

WEATHER  
IS THE  
NATION'S BUSINESS



*The report of the*  
DEPARTMENT OF COMMERCE ADVISORY COMMITTEE  
ON  
WEATHER SERVICES

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ADVISORY COMMITTEE ON WEATHER SERVICES  
of the  
Department of Commerce

Joseph J. George, B/Gen. AFRES  
Superintendent of Meteorology  
Eastern Air Lines, Inc.  
Municipal Airport  
Atlanta, Georgia

Robert D. Elliott, Vice President  
North American Weather Consultants  
2420 No. Lake Street  
Altadena, California

A. F. Merewether, Col. AF (Ret)  
Supervisor of Meteorology  
American Airlines, Inc.  
New York Airport Station  
Flushing, New York

Howard T. Orville, Capt. USN (Ret)  
Technical Consultant  
Friez Instrument Division  
Bendix Aviation Corporation  
Baltimore, Maryland

Richard J. Roth  
Assistant Secretary and Manager  
Crop-Hail Insurance Actuarial Assn.  
209 West Jackson Boulevard  
Chicago, Illinois

Charles Pennypacker Smith  
Chief Gas Dispatcher and Meteorologist  
Pacific Gas and Electric Company  
245 Market Street  
San Francisco, California

Kenneth C. Spengler  
Executive Secretary  
American Meteorological Society  
3 Joy Street  
Boston, Massachusetts

Athelstan F. Spilhaus, Dean  
Institute of Technology  
University of Minnesota  
Minneapolis, Minnesota

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U.S. Dept. of Commerce. Advisory Committee on Weather Services.

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# WEATHER IS THE NATION'S BUSINESS

*A report of the*  
Advisory Committee on Weather Services  
to  
The Honorable Secretary of Commerce



December 1, 1953

Washington

84690





DEPARTMENT OF COMMERCE  
WASHINGTON 25

December 1, 1953

The Honorable

Secretary of Commerce

We have the honor to submit herewith our report and recommendations on the organization, operations and functions of the United States Weather Bureau.

We have spent a large part of the past half year in consulting with a wide variety of people all over the nation who have a common interest in the field of meteorology. Included are principal users of weather information, scientists, representatives of the Weather Bureau and other government agencies, and meteorologists engaged in private practice.

From our investigations, the representative opinions of all these people, and from the store of experience of our individual members, we have drawn these conclusions.

We take pleasure in expressing our sincere thanks for the opportunity to be of service to the Nation and ask that the Committee be discharged.

ADVISORY COMMITTEE ON WEATHER SERVICES

*Joseph J. George*  
Joseph J. George, Chairman

*Robert D. Elliott*  
Robert D. Elliott

*Arthur F. Merewether*  
Arthur F. Merewether

*Howard T. Orville*  
Howard T. Orville

*Richard J. Roth*  
Richard J. Roth

*Charles Pennypacker Smith*  
Charles Pennypacker Smith

*Kenneth C. Spengler*  
Kenneth C. Spengler

*Athelstan Spilhaus*  
Athelstan Spilhaus



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## Weather Is the Nation's Business

The recent disastrous droughts in the southwest, midwest and eastern parts of our country have clearly emphasized again the vital importance of weather in our national life. No segment of a nation's economy escapes the impact of severe or unusual weather. While the public is forcefully reminded of man's necessity to bend his activities to the vagaries of the elements by the great convulsions of nature such as hurricanes, tornadoes, floods, and blizzards, they sometimes forget that even in the less spectacular changes great stakes are involved. Each year hundreds of lives are lost and millions of dollars are lost in property damage in spite of highly organized warning services which the nation has set up. These spectacular losses do not go unnoticed, but far more important to the nation's business are the less spectacular, day-by-day changes of weather and the manner in which they affect agriculture, business, and industry.

A pilot takes advantage of weather information to use a tail wind to save gasoline or to pick a flight level comfortable to his passengers. A department store changes its window displays from swim suits to tweeds to raincoats as the forecast veers from hot to cold to rainy! A farmer hires extra labor to harvest his crop just ahead of a predicted cold wave. A great city marshals an army of men and equipment to combat an impending snowfall. The aggregate of all these adjustments of agriculture, commerce, and industry is equivalent each day to a tremendous economic decision based on weather predictions. Even the rate of births and deaths rises and falls with weather changes.

The Weather Bureau was originated and remains until today essentially a service function of government. Nine-tenths of its funds and manpower are employed in taking weather observations, plotting maps and charts, preparing and issuing forecasts and processing information on the weather in various ways. This nine-tenths of its activity is essentially a production-line job being done repetitively day after day, and to organize for this kind of a production job requires the same kind of plant layout and management study as the repetitive production of any other commodity. Advances in the last twenty years have made it possible to apply the latest discoveries in the science of meteorology to all of this material produced by the Weather Bureau for the specialized uses of agriculture, industry, and business. Thus it is that in this last twenty years there has been the birth of a new profession—the profession of meteorology—in private practice, in the Armed Services, and in other civilian agencies of the government, such as Soil Conservation, Reclamation, Flood Control, etc. This new profession provides opportunity for scientifically trained men and women who in the traditional pattern of American competition are pushing ahead with new ways of using the data and fundamental discoveries of meteorology to benefit our national life.



The organic act of 1890 under which the Weather Bureau still functions was written at a time long before the present developments and applications of the science to business and industry could have been envisioned. It is necessary, therefore, that a redefinition of functions be made to recognize the changes since that time. In 1953 we find professional meteorologists working in many areas outside of the Weather Bureau. In the chemical industry they assist in plant design, air pollution, production and marketing problems. In aviation leading airlines have large meteorological staffs to promote safety, efficiency, and passenger comfort in their operations. In the petroleum industry meteorologists are necessary if offshore drilling is to be successful and for other types of plant protection. Specialized meteorology must be utilized if hydroelectric plants are to be operated efficiently. In the gas industry meteorologists aid in planning the production of wells and in the regulation of supplies. And in many, many other industries and businesses where the meteorological interest may not be sufficient for full-time staff meteorologists, the consulting meteorologist aids by being called in on specific problems. Business and industry are beginning to recognize that substantial savings, increased profits, and therefore lower prices to the public can be effected by considering the weather in their day-to-day operations. In this era of a complex industrial society, and concentration of population in large cities, weather vitally affects us all. Today, "Weather Is the Nation's Business."

The Weather Bureau, still operating under the organic act of 1890 and subsequent amendments, has attempted to meet the changing needs indicated, not always with desirable results. In a highly commendable effort to do all things for all men, the Weather Bureau sometimes loses sight of the point where government should stop in providing specialized service. We think of the Weather Bureau and its relation to the new profession of private meteorology in the same way as we think of the United States Public Health Service in its relation to medical practitioners. We would admit that epidemics are a concern of the government health service but individual illnesses are the province of the private practitioner. Similarly, the issuance of severe storm warnings endangering life or widespread damage to property are, and should remain, the function of government but special services to industries to effect economies in their operation must be the province of the private practitioner.

It is for these reasons and because of the change of our life in the past sixty years from a rural agricultural economy to a highly integrated technical society that a redefinition of the functions of the national Weather Service must be made. While all of the recommendations of this report can be implemented under the existing organic act, we feel it is desirable that a study be made to determine whether the basic law should be revised. The following are the Committee's recommendations as to the functions of the Weather Bureau under such a revision of the law.



## Functions of the National Weather Service

1. To observe, measure, record, collect, and disseminate reports of the weather in the United States, its territories and possessions and to make these data available to all users.

2. To participate in the development of an international basic meteorological network including the establishment and operation of reporting stations on the high seas, in polar regions, and in foreign countries in cooperation with other governmental agencies of the United States and the meteorological services of such foreign nations.

3. To issue severe storm warnings, cold wave warnings, and flood warnings to the general public where extensive danger to life or property is involved, and to other governmental agencies, and to ships at sea and in the coastal and inland waters.

4. To prepare a simple, high quality general forecast of the probable weather for the general public and to encourage the widest dissemination of this forecast.

5. To encourage and assist the unrestricted development of the profession of meteorology to meet the special needs of industry, business, and agricultural groups.

6. To make such special weather observations, reports, and forecasts as are required for safety of aerial and marine navigation in the United States, its territories and possessions and to provide such special weather information as is required by individual farmers.

7. To promote and foster research in meteorology by the use of private and governmental research facilities and to support and encourage the dissemination of the results of such research.

8. To coordinate the meteorological requirements of the United States in order to maintain standards of quality in observations, promote efficient use of facilities, and avoid duplication in services unless such duplication is in the public interest.

9. To collect and store foreign weather reports.

## Principal Recommendations and Conclusions

1. The Weather Bureau at present is highly centralized and should be reorganized with a delegation of both administrative and technical responsibility downwards. |||

2. Several of the high level assistants of the Bureau have reached, or are approaching, retirement age. Adequate replacements should be selected, trained and given necessary authority and responsibility as rapidly as it is possible to do so.

3. The headquarters in Washington should be a small policy-making staff with all operating functions outside of the Washington area. |||



4. The personnel policies of the Bureau should provide for a continued influx of young professional meteorologists.

5. The Weather Bureau should assume certain basic duties which are presently being performed by other agencies, notably the military. (In order to assume these duties it will be necessary to increase the budget of the Weather Bureau. However, this will be more than offset by the decrease in the military budget effected thereby.)

6. An aggressive, imaginative "can-do" research program should be set up and undertaken with a budget adequate for its performance.

7. The attitude of the Weather Bureau toward the development of the new profession of private meteorology should be to assist actively the free growth and development of this profession.

8. The forecasting organization should be strengthened by the addition of capable experienced forecasters at both the staff and regional levels. The actual forecasts should be decentralized.

9. The climatological program of the Weather Bureau should be vigorously renewed. ||

With these functions and attitudes as the basis of operation of the Weather Bureau, the Department of Commerce should strongly support the Bureau in its representations for the necessary funds to carry them through.

#### How Can Savings Be Effected?

We have been aware of the need for effecting budget savings when compatible with acceptable efficiency. This has been difficult because as will be seen this is one government organization which has been frugal to the point of diminishing returns. Despite this situation and our belief that this service should be increased in efficiency as the first requirement, it is believed that implementation of the following recommendations will result in an over-all decrease in budget for the nation's weather service although that of the Weather Bureau must be increased.

1. The return of certain research, climatological and observing functions from the Armed Forces to the Weather Bureau.

2. Arrangements should be made to utilize any appropriate semi-permanent Army GMD-1A installations to replace current observation stations. There is no reason why both functions cannot be served.

3. Fewer major forecast centers. (Reduction from 15 to 5.)

4. Increased efficiency due to decentralization.

5. The continued combination of certain CAA INSAC stations with Weather Bureau observing stations. The utilization of certain low density towers as observing stations when equipped with remote reading instruments.



6. As the growth of private meteorology is encouraged and replaces certain specialized Weather Bureau services to industry, some saving of personnel can be effected. (Reduction and eventual elimination of special services.)

7. Development of a cheaper means of obtaining upper air data over the oceans.

8. The encouragement of state and local governments to participate in programs such as hydrologic observations and the preparation of local climatological summaries.

9. Adequate charges for publications, especially climatological bulletins.



## Organization and Procedures of the Committee

The Department of Commerce Advisory Committee for Weather Services was appointed in May, 1953, by Honorable Robert B. Murray, Jr., Under Secretary of Commerce for Transportation. It was charged with a general review and evaluation of civil weather matters, especially those concerning the Weather Bureau. A list of the Committee members is given on the inside front cover. At the initial meeting of the Committee in June, it was decided that, wherever possible, the Committee would act in concert throughout its history. Each member of the Committee is a professional meteorologist, with an average experience in the field of over twenty years.

The Committee has held six meetings between June and November, each one lasting from two days to two weeks. The first step was to obtain a general review from the Chief of the Weather Bureau and his staff of their entire operations. Requests were then made by the Committee for detailed information covering all phases of administrative and technical work of the Bureau. This material was promptly and completely supplied and the Committee has had excellent cooperation from all levels of the Weather Bureau.

The Committee has interviewed many prominent users of weather service, such as farmers, public utilities, scientists, private meteorologists, and representatives of the Armed Forces, and other government agencies.

Weather Bureau personnel and principal users of weather information were interviewed either by the entire Committee or by task forces at Los Angeles, Santa Barbara, San Francisco, Portland, Medford, Chicago, Kansas City, Fort Worth, New Orleans, Atlanta, Miami, New York, Washington, D. C., Salt Lake City, Baltimore, St. Louis, and Boston. All regional offices were visited with the exception of Alaska, and all regional directors, with the same exception, have been interviewed as well as many line employees, including observers and forecasters.

The Committee is keenly aware of the many difficulties and problems which have beset the Weather Bureau during the last two decades. Over and above the routine difficulties experienced in the administration of Civil Service procedures by all government agencies, the Weather Bureau has had to adjust its course to conform to an extremely rapid growth in the science of meteorology, as well as the emergence of a private practice in meteorology. Due to these unusually rapid developments the Weather Bureau has had to do its best to train the existing personnel and at the same time recruit new personnel which had received formal training in the universities. This change has created a certain amount of personnel difficulties and has made it hard for them to develop the scientific stature which the organization should have.



Throughout the activities of this Committee, budget difficulties of the Weather Bureau have been encountered at every turn. It is only fair to state that part of the recommendations contained in this report cover deficiencies recognized by Bureau officials and could have been remedied if sufficient appropriations had been available.

We should like to make it clear that we believe the present Chief of the Bureau has served with a devotion to duty, and conscientious effort, seldom found in any organization.

It is inevitable in a report of this kind that deficiencies of the organization will be emphasized, while the adequacies, of which the Weather Bureau has many, are likely to be subordinated. This report should be read with this in mind.

We believe that this report reflects the general opinion of the profession. The conclusions and recommendations are our own however, and have the unanimous concurrence of the Committee.



## Introduction and Background

The national weather service was created by a joint Congressional resolution approved February 9, 1870. This resolution established the Signal Service (later the Signal Corps) of the Army as the agency responsible for taking meteorological observations at military stations in the interior of the continent and in the states and territories, and for giving notice on the Great Lakes and at the sea coast by magnetic telegraph and marine signals of the approach and force of storms. The service was subsequently expanded to include preparation of warnings for the benefit of farmers, merchants, shippers, etc.

As the value of the service gained recognition it became apparent that a civilian bureau was necessary. The Organic Act was passed in October, 1890, establishing the Weather Bureau under the Department of Agriculture. Under this act the Chief of the Bureau was charged with the forecasting of weather, the issuing of storm warnings, the display of weather and flood signals for the benefit of agriculture, commerce, and navigation. Other duties were also specified, such as the collection and transmission of marine intelligence for the benefit of commerce and navigation, the reporting of temperatures and rainfall conditions for the cotton states, the display of cold wave signals, the distribution of meteorological information in the interest of agriculture and commerce, and the taking of such meteorological observations as might be necessary to establish and record the climatic conditions in the United States. During the ensuing 30 years the Weather Bureau underwent a slow expansion, mainly in the field of increased observations and compilation of climatic information.

The advent of commercial aviation was the great stimulus to the development of the modern Weather Bureau. With the passage of the Air Commerce Act of 1926 and the later Civil Aeronautics Act of 1938, the Weather Bureau was charged with additional responsibilities with regard to taking observations, making studies of meteorological phenomena, and with furnishing of such reports, forecasts, warnings and advices as are needed in air commerce. Those acts also charged the Weather Bureau with the establishment and coordination of the international exchange of meteorological information and with the participation in the development of an international basic meteorological reporting network. It is significant that the Weather Bureau was required to detail annually members of the Weather Bureau staff for training at government expense either at civilian institutions or otherwise in advanced methods of meteorological science, within the limits of available appropriations.

The 1920 to 1930 period is important because a new scientific method of meteorological analysis known as air mass analysis was being adopted by meteorologists around the world. The Weather Bureau



initially failed to adopt this new technique, and little real advance in meteorology appeared in the Bureau's procedures until the late 1930's. As a result, the quality of the Weather Bureau's services lagged behind the requirements of civil aviation. This deficiency was met by the progressive policies of the Armed Services and the major airlines, which soon created their own meteorological departments making use of graduates of the schools wherein the new methods of meteorology were being taught. Under the stimulus provided by this competitive force, which was entirely new to meteorology, the Weather Bureau began to use the air mass analysis techniques in the late 1930's. This was due in a large part to the vigorous efforts of a new Chief (the present one).

In the course of the subsequent rapid expansion of aviation forecasting services and of the greatly augmented weather reporting network required to service aviation, it was recognized that the role of the Weather Bureau in the general economic life of the nation required greater emphasis in non-agricultural fields. Accordingly, the Bureau was transferred from the Department of Agriculture to the Department of Commerce as a part of the Reorganization Plan No. IV in 1940.

During the war years, the Weather Bureau rendered many essential services to the Armed Forces. A close liaison with the military services during and after the war led to the development of an expedient arrangement whereby funds were transferred to the Weather Bureau to perform certain meteorological services which the Armed Forces felt were required for the performance of their own missions. Some of these services should have been provided for in the Weather Bureau's budget.

During the war years, many lessons were learned about the possibilities of applying meteorological knowledge to the solution of specific problems in the conduct of the war. During and after the war there was a rapid expansion of the Weather Bureau services in the field of specialized forecasting services to industry. Private meteorologists had been able to demonstrate numerous ways in which specialized weather forecasts, tailor made for particular needs, could produce dollar savings and improved efficiency in many operations. The Weather Bureau frequently adopted these methods, and offered free competing services. This resulted in enlarging the Bureau's forecasting staff.



# Organization

## Present Practices

The Chief of the Weather Bureau is responsible by law for all the Bureau's activities, both domestic and international. He is also responsible for coordination of the civilian weather service with the Armed Forces.

At the second level there are three Assistant Chief positions, only two of which are filled. The Assistant Chief for Administration is responsible for leadership in planning, management and administration. The Assistant Chief for Operations is responsible for the technical operations and services of the Bureau. The Assistant Chief for Research and Scientific Services position is vacant.

A Plans and Program Management Office assists the Chief in coordinating the administrative and operative functions, in the analysis of existing and proposed programs, and in establishing performance standards. A Budget Office provides the necessary budgeting and fiscal control.

There are nine Division Chiefs in the Central Office:

<i>Division</i>	<i>Functions</i>
Administrative Services	Fiscal matters, procurement, supply, etc.
Personnel Service	Personnel appointments, classifications, records and training.
Station Facilities and Operations	Responsible for the basic observation program.
Synoptic Reports and Forecasts	Responsible for the forecasting services except for extended forecasts.
Instrument Division	Designs and develops instruments, establishes standards for procurement and maintenance and inspection.
Scientific Services	Responsible for basic studies to improve methods of forecasting, and for liaison and for the extended forecast service.
Climatological Services	Collection, processing, publication and storage of observations and summaries.
Hydrologic Services	Responsible for forecasting floods and river stages, and the conduct of hydrologic investigations.
Physical Research	Responsible for the Bureau's basic research activities.

At the present time, the Assistant Chief of the Bureau (Administration) is also the Chief of the Climatological Services Division.

The United States and Alaska are divided into five regions, each under the titular leadership of a Regional Director, but concerned



mainly with housekeeping functions in his region. Hawaii and Puerto Rica report directly to the Central Office.

The principal working level of the Weather Bureau, and its main point of contact with the public occurs at the field stations. As of November 1, 1953 there were 332 first-order stations manned by full-time employees, and 108 second-order stations on a part-time basis.

Cooperating with the Weather Bureau there are 10,400 cooperative stations in the Climatological network, manned by observers serving without pay, approximately 2,000 ocean vessels, 247 CAA stations, and 238 supplementary airways reporting stations.

The Weather Bureau's organization chart appears in the Appendix.

### Findings

The Weather Bureau's organization, as presently constituted, is rigidly controlled by a Central Office in Washington. The regional organization is concerned primarily with housekeeping functions, and has no technical responsibility.

The field stations, for the most part, report directly to Washington, and their technical activities are directed by Central Office personnel. Most decisions, even of minor character, must be made in Washington.

This state of affairs leads to numerous delays, to misunderstandings in the conduct of operations in the field and to an unhealthy dependence on the Central Office in all matters, large and small. Headquarters personnel are so occupied with routine matters that they have little time for direct contact with the field personnel or for overall planning. The fruitful exchange of ideas which would result from frequent personal contact with the field personnel seems to be lacking. Over the years, this has resulted in an in-breeding of ideas, philosophy, outlook, and program, to a lack of initiative in the field, and to a lack of experienced executives in the organization.

### The Committee Recommends--

1. That the Central Office be confined, as far as possible, to executive and staff functions, furnishing overall policy direction, liaison, and coordination, free of administrative detail.

2. That the operations be conducted by a line organization on a regional basis.

3. That purely operational functions now being performed in Washington be moved completely out of the Central Office.

The recommended organization and lines of responsibility are as follows:

- a. The Chief of the Weather Bureau should be its principal executive.



b. Directly under the Chief there should be two Deputy-Chiefs, one for Operations, and one for Research and Development.

c. Under the Deputy Chief for Operations, the Regional Directors should be responsible for all technical and administrative matters within their regions.

d. In each regional organization there should be an adequate number of competent staff specialists in each of the Bureau's principal fields of activity.

e. Under the Deputy Chief for Research and Development there should be three Directors, in charge of three major laboratories. These should be:

1. The National Climatological Laboratory at Asheville, N.C.
2. A National Weather Research Laboratory.
3. A Weather Instruments Development Laboratory.

f. Administrative assistance to the Chief should be provided by an Assistant Chief for Administration, at a lower level than the two Deputy Chiefs. He should have line authority over his own staff, but should have a staff relationship with the Regional Directors.

g. Specific recommendations concerning changes in the forecasting organization are contained in the section "Forecasting Services."



# Budget and Fiscal

## Present Practices

The Committee has reviewed budget estimates and fiscal matters of the U. S. Weather Bureau dating back to 1938 to obtain background information on the development of the weather service incident to the rapid expansion of aviation, agriculture, business and industry. A review of the history of the Weather Bureau budget has impressed the Committee with the frugality of this Bureau's operations and its management is to be commended in the manner which they have administered public funds. ~~\*\*\*~~ ~~\*\*\*~~ We know of no other governmental agency that has been so economical in the expenditure of its funds. The Committee obtained a rough comparison of the per capita cost of weather services of other countries which is given below:

### Approximate Cost of Weather Services Per Capita

Iceland.....	\$1.00	England.....	\$.20
Canada.....	.50	Ireland.....	.19
USSR (10 yrs. old)..	.47	United States.....	.18
Norway.....	.24		

A review of the above per capita costs shows how extremely economical the budget has been for the provision of a national weather service to a nation whose annual gross income is approaching \$370,000,000,000. As we have pointed out before, while the United States estimate does not include military or other department expenditures for weather service, this same problem also exists in greater or less degree with most other countries.

A brief review of the increases proposed in the original Weather Bureau request for the fiscal 1954 budget is set forth below:

In July 1952, Weather Bureau budget estimates for the Fiscal Year 1954 were requested in the amount of \$42,000,000. This represented an increase over Fiscal Year 1953 of approximately \$14,000,000. Included in this estimate were requests for increases in funds for:

a. The automatic dissemination of aviation weather information, an essential service to private and non-commercial operators. This plan proposes to disseminate aviation weather information by means of self-repeating radio broadcasts and automatic telephone facilities. This service would be provided to communities having several airports and a high rate of aviation activity. An experimental facility established in the New York metropolitan area during Fiscal Year 1952 serves 16 outlying airports plus a number of aircraft owner offices. The test was so successful here and more recently in Chicago, that the Weather Bureau planned to install similar equipment at 60 stations during the next few



years. The addition of this facility would eliminate many of the present complaints from private and non-commercial pilots.

b. The provision of facsimile weather maps at field stations so that each station will receive pre-analyzed maps and charts from the WBAN Analysis Center. This will eliminate plotting and preparing of these charts by individual field stations and thereby reduce duplication of effort.

c. Extension of improved River and Flood Forecasting Service to prevent flood damage. The Weather Bureau River and Flood Forecasting Service has been of great value during the past few years. Under this item, additional funds were requested to cover many river areas presently without an adequate flood warning service.

d. Increase the staff at Weather Bureau airport stations. The additional personnel are required at stations where air traffic is particularly heavy. The Weather Bureau pointed out that rapidly increasing civil aviation activities and public interest in weather had overtaxed the existing facilities. This is explained by the rapid increase in air transport activity for the period 1938-1950 when the number of miles flown by the airline fleet in scheduled airline operations increased 519%; the number of passengers carried increased 13 times; airmail 6 times; air cargo and express skyrocketed 70 times over the 1938 figure while the Weather Bureau appropriations have lagged far behind in the expansion of weather services compatible with these increases.

e. Preparation of a National Atlas of Climatology. In requesting this increase, the Weather Bureau appropriately pointed out that as now constituted it is essentially a data collecting and filing activity. With the introduction of mechanical processes, the Weather Bureau is now in a position to prepare a National Atlas of Climatology which would contain basic information required for pressing problems confronting regional flood control and area development groups, the building industry and active projects in the development of long range plans for high level jet aircraft operations. Such an atlas would include information of great value to agriculture interests, industry, public works, commerce and transportation. This project would last several years and funds in the amount necessary to complete the project would be required.

f. State Service Centers. To provide improved weather service to aviation, agriculture, business and the general public, the Weather Bureau proposed to set up State Service Centers which would give improved weather service to cities and communities off the federal airways. The plan proposed to establish this service in eight states during 1954. This would be a continuing program.

g. Severe storm forecast and warning service. This program proposed to greatly augment the existing tornado and severe storm warning service by adding additional facilities, severe storm warning networks, and radar storm detection equipment which would permit the detection and tracking of severe storms and tornadoes.

h. Radar Storm Detection Network. Radar has proven to be invaluable in the detection and tracking of destructive storms. Analysis of



radar photographs of storms in progress has contributed much to the knowledge of the physics of these phenomena. The large effective range of radar permits the detection and tracking of precipitation areas associated with severe storms before they are detected by local storm reporting observers. Radar permits continuous 24-hour observations. This is a distinct advantage during the night hours. This radar network would also be available for general weather forecasting, aviation briefing and research purposes.

i. Modernization of upper air program. Since 1950 the Joint Meteorological Committee (JMC) has recommended that the continental upper air network obtain regular observations to 50,000 feet at 6-hourly intervals. In 1952 this same committee completed a comprehensive study representing the coordinated requirements of both civil and military interests and the Weather Bureau portion of this overall program requires the installation of new GMD-1 radio wind equipment at 74 locations and an increase in the frequency of observations from two to four daily. This would be a multiple-year program requiring three years for the conversion of the network.

j. Rehabilitation and modernization of facilities. The Weather Bureau requested funds to provide weather briefing units, instrument consoles and instrumental equipment at selected weather observing stations throughout the country. It pointed out that existing facilities were shabby and inefficient, and have been since before World War II. The equipment they requested was office, professional or scientific which, according to the Bureau of Internal Revenue, has an average useful life of 15 years. Much of this equipment has been used continuously for 20 to 40 years on a 24-hour round-the-clock, 7 days per week, basis. The Weather Bureau appropriately points out that obsolescence had been reached and that replacement with more modern equipment is long overdue at these offices. The Committee considers that this was an extremely important program and should have been approved for the full amount requested. In addition to the use of modern instruments featuring instantaneous reading in-doors from remotely located equipment, the purchase of latest type ceilometers for measuring cloud ceiling, telepsychrometers to obtain instantaneous in-door readings of temperatures, wind equipment for wind conditions, and finally the development of an "automatic weather observer" to mechanically measure certain weather elements and transmit the weather information automatically replacing observers at these stations, they comprise a most progressive and urgently needed program.

k. Research. Finally, the Weather Bureau recognizes the need for a marked increase in research on tornado forecasting and weather modification. It also recognizes the possibilities of electronic computers for forecasting projects and continued its efforts to obtain funds for carrying on the publication of analyzed Northern Hemisphere weather charts. This latter proposal was presented in 1951, 1952, and 1953. It would permit the Weather Bureau to carry out its responsibilities as authorized by basic law. The Research and Development Board of the Department of Defense, the Joint Meteorological Committee and the Committee on Geophysics and Geography all recommended that the above research is the responsibility of the Weather Bureau and strongly recommended



that the Bureau obtain appropriations for the publication of the hemisphere maps as a basic civil responsibility. The Air Force which has largely supported this project, by transfer of funds, indicated that funds would no longer be available for the support of the Northern Hemisphere project.

### Findings

The Committee has reviewed the new estimates for fiscal 1955 and notes that there is a further substantial reduction for the coming year. The failure to get the necessary funds to carry out its basic responsibilities has caused criticism of the Weather Bureau from the Army, Navy and Air Force as well as the public. When the Weather Bureau fails to obtain funds for a project such as the Northern Hemisphere Map Project, the Air Force and Navy are forced to transfer funds, do the job themselves, or permit the project to be dropped. There are other projects which are primarily of a civilian nature which are supported by the military on a transfer of funds. The transfer of funds is necessary because the Weather Bureau has been unable to obtain sufficient funds to carry out its basic responsibilities.

### The Committee Recommends --

That the Weather Bureau receive the strongest possible support in budgetary matters at department level for the next few years when adequate funds will be absolutely essential. To correct some of the present deficiencies of the Weather Bureau, the Committee recommends that favorable consideration be given to authorizing an increase in funds to support the following projects:

- a. Authorization for the gradual implementation of the Weather Bureau program for the automatic dissemination of aviation weather information to private and industrial pilots.
- b. Funds for the development of a national radar storm detection network to be developed during the next three years.
- c. Furnishing facsimile equipment to additional field stations.
- d. Necessary funds for modernization of the upper air program to provide latest type ground station equipment to obtain regular 6-hourly observations to 100,000 feet. A phased program to spread over three years has been recommended by the Weather Bureau.
- e. Rehabilitation and modernization of facilities, including modern instrumental equipment as proposed by the Weather Bureau in 1952. A survey should be made to establish priorities on space, office equipment, air conditioning and lighting. At some places working conditions are highly undesirable.
- f. An increase in funds for research to include research in tornado and severe storm investigation, use of electronic computers in weather forecasts and publication of the analyzed Northern Hemisphere weather charts.



We believe that until adequate support is given to the above programs the Weather Bureau will be forced to operate on standards 20 to 40 years behind the times. Furthermore, as discussed in other sections, the over-all savings to be gained by these and other recommendations should cover these increases or even provide a favorable balance. Once more, however, we stress two points:

1. The savings will come from the over-all government budget but that dealing with the Weather Bureau only should be increased.

2. The transfer of functions can be accomplished only if the agencies now performing them can be assured that the Weather Bureau will actually perform them on a routine basis in an adequate manner.

Many other of the Weather Bureau requests are desirable but can be phased in at later times. It is highly desirable that a long range plan, year by year, be drawn up, investigated, and approved which would incorporate such improvements. In this way all concerned should be able to obtain a better grasp of what and when budget increases would be needed, and if necessary, what items could be deferred.



# Observations

## Present Practices

In the early days of the Weather Bureau observations were of a comparatively simple and elementary nature required to meet the needs of the farmer, the sailor and the general public. Surface observations of temperature pressure, precipitation and winds constituted the basic elements and were made at rather infrequent intervals. As the country grew, military and industrial requirements for weather information increased. Floods caused loss of life and property and had to be controlled by dams. This pointed up the need for more intensive observation networks of precipitation. With the development of aviation, observations aloft as well as at the earth's surface became a requirement. Furthermore, observations of additional elements such as sky cover, visibility, and humidity became necessary. Observations of all elements were needed much more frequently and from an ever-expanding network of stations.

At the present time surface observations are taken and transmitted every hour or even more frequently under rapidly changing conditions. Upper wind observations are made every six hours and upper air observations of temperature, pressure and humidity are made twice daily. The quality of the Weather Bureau observations is very good. Surface observations are taken at:

- 332 first order Weather Bureau stations;
- 247 CAA stations;
- 108 second order Weather Bureau stations (part-time reporting);
- 10,400 cooperating climatological substations in the U. S. and possessions;
- 238 supplementary airway reporting stations;
- 2,000 cooperating ships in ocean transport (approximately 2/3 U.S. flag).

These cooperative programs are to be commended and their continuation is most desirable.

Upper air observations are taken at:

- 195 pilot balloon stations in the U. S.;
- 80 upper air sounding stations by the Weather Bureau;
- 50 upper air sounding stations maintained by Cuba, Mexico, the military forces of the U. S. and the joint effort of the United States and Canada in the Canadian Arctic.

## Findings

The Bureau should continue to encourage other government agencies or private organizations to support or take specialized observations,



such as the observations for hydroclimatic network, river and rainfall network, etc., when such observations are not a duplication of effort. However, the Bureau should continue to be charged with the responsibility for establishing observing standards, for storing the records of these observations, and publishing them if of sufficient general interest.

We view with considerable concern the steady whittling away of the observation network in this country and urge that all alternate means of saving funds be carefully considered before further reductions are made.

Although by statute the Weather Bureau is charged with responsibility for maintaining within the United States and its territories the basic observational network, both surface and upper air, we feel that the Bureau has failed in some instances to assume this responsibility. Consequently, the Air Force and Navy have been forced to do so, particularly with regard to upper air observations. Because of the high turnover of personnel in the military services, and for other reasons, the quality and regularity of their observations suffer. In addition, due to communication difficulties, observations by military personnel, when taken, are frequently not available for civil use.

With military jet aircraft already operating at higher altitudes and with jet transports soon coming into the picture, upper air observations of wind, temperature, pressure and humidity to at least 100,000 feet are already a requirement for current operations and for research. Latest type equipment, such as the GMD-1A developed by the military services, is necessary for obtaining wind data at high altitudes. The Weather Bureau has very little of this equipment and in this connection the Committee deplores the gift of such expensive equipment to foreign countries, before equipping our own stations. In addition, the U. S. Army has obtained or is in the process of procuring a large number of these expensive GMD sets. Yet no coordinated program to make maximum use of this equipment has been established.

A very important new tool for observing weather, aerial targets, etc., has been developed, namely radar. The United States is already fairly well blanketed with radar equipment including Air Defense, Air Force Weather Service, U. S. Navy, Weather Bureau, and CAA radar, each performing a specialized service, but all suitable in varying degrees for weather observation purposes. A coordinated system for general use of this radar, particularly for severe storm detection and in-flight assistance to pilots is highly desirable to prevent unnecessary and costly duplication. Direct communication between pilot and radar observer is important. Some expansion of the Weather Bureau radar network and replacement of obsolete equipment is essential.

In the field of aviation, weather observations are vital to safety. They must be accurate and timely. In the interest of accuracy, end of the runway observations of cloud height and visibility are highly desirable. The program already underway at Washington and New York airports should be rapidly expanded to other airports throughout the country.



At some locations in the United States where aviation activity is relatively light, CAA and Weather Bureau functions have been combined with a resultant reduction in personnel. It is believed that there are many more places where CAA INSAC (Interstate Air Communications Station), airport control tower and Weather Bureau observing duties may be combined with further economies in personnel without adversely affecting either the CAA functions or the Weather observations. A careful examination of all such possibilities is urged. Replacement of personnel by automatic observing gear at many non-airport stations is a distinct possibility. In the interest of economy this program should be pushed.

Pilot reports of weather provide information not available by any other means. The Weather Bureau has sponsored and encouraged a pilot reporting program. Nevertheless, there is room for much improvement. Basically it appears to be a local communications problem involving the exchange of pilot report information between the airlines, the Air Force, the Navy, the Weather Bureau and CAA at key airport areas throughout the country.

The present method of observing weather over ocean areas is excessively expensive. On the other hand, from the point of view of current operations and of research, continuation of these observations is highly desirable. Therefore, every economically feasible means of continuing these observations should be explored, including the possibility of contracting this operation to private companies, use of observers stationed on the regular ships of Military Sea Transport Service, etc. In this connection we applaud the efforts of the Weather Bureau in exploring both the possibilities of utilizing privately operated vessels as stationary observing platforms, and ships of the Military Sea Transport Service as moving platforms. We have been informed that either method afforded good observation service at far less cost than the present ocean vessel program.

A long range plan for improving the observational equipment and network is desirable. Equipment for observing cloud bases and tops through several cloud layers, now in the development stage, should eventually be standard equipment at all airport stations. Similarly, modern wind equipment recording instantaneous gusts should replace the obsolete equipment now used at most stations.

An observational network to be effective must be provided with a fast and efficient communications network. The present systems have long been inadequate. Although plans are under way to speed up weather circuits to 75 words per minute, this must be considered as only in interim measure. Better definition in maps and charts transmitted via facsimile and considerably increased speeds of such transmissions are very desirable. These matters are further discussed under the section on Communications.

#### The Committee Recommends—

1. The Weather Bureau should budget for and operate the basic observation network. This includes many stations, particularly upper air now operated by the Air Force and Navy.



2. A long range plan for obtaining the necessary equipment for upper air stations (GMD type) should be established. This should include arrangements wherever possible of coordinating the use of GMD type equipment of the U. S. Army.

3. Arrangements should be made to coordinate for severe storm warning use, the radar units of the Air Defense Command, Air Weather Service, U. S. Navy, Weather Bureau, and CAA. Where necessary the Weather Bureau radar program should be expanded to fill in the gaps in radar coverage.

4. Expand as rapidly as possible the end of the runway observation program.

5. Maximum use be made of CAA INSAC stations for taking hourly observations where net savings of Weather Bureau and CAA personnel can be effected.

6. Maximum use be made of CAA tower personnel for taking hourly observations. Remote reading observation equipment so that tower operators need not leave the cab should be provided, as well as equipment (SECO) for automatically transmitting the reports over the teletype circuits.

7. Install automatic observing gear at non-airport stations.

8. Continue to push the pilot reporting program.

9. Explore all possibilities of obtaining upper air observations over ocean areas in a manner less costly than the present Coast Guard ship program. It is important that some means of obtaining these observations be continuous after the present methods are abridged or terminated.

10. Establish a long range program for improving observational equipment.

11. Establish a long range program for improving the methods and speeds of transmitting weather reports, and maps and charts. One specific suggestion is made in the chapter on Communications.



# Instrumentation

## Present Practices

In the past the Weather Bureau's instrumentation program has been extremely conservative, in fact so much so, that present and future requirements have been largely neglected. We recognize that the reason for this inadequacy may be due to shortage of funds. The following paragraphs outline the trend of instrumentation which we believe is required.

## Findings

Recent advances in electronics have uncovered the possibility of developing automatic weather stations which will be capable of recording all essential surface weather elements at predetermined intervals. These automatic weather stations will effect a great saving in manpower and will provide extremely important information in isolated areas. The cost of the equipment can be amortized in a few years. We are of the opinion that the development of automatic weather stations should receive high priority in the Weather Bureau's instrumentation program.

Voluminous information is available on the great importance of radar in detecting severe storm conditions, destructive thunderstorms, tornadoes, severe ice storms, blizzards and rapid changes in these conditions can be observed continuously with radar. Radar photographs of the PPI and RHI scopes permit exhaustive studies of the development, intensification and dissipation of all of these destructive storm conditions. Modern radar equipment is already installed or can be made available within the next two or three years to permit radar coverage of the entire United States. Such a radar network will make it possible for the Weather Bureau observers to spot most destructive storm conditions; track them continuously, and with the establishment of an effective warning network for each area it will be possible to issue timely and adequate warnings to the public, aviation, industry, agriculture and business interests. The present program to modify and install the APS-2 radar equipment recently obtained from surplus military stocks should be assigned urgent priority.

We are pleased to note the progress which is being made by the Weather Bureau in the development of remote indicating and recording instruments which may be installed at some distance from the meteorological office or control tower. The telepsychrometer, rotating beam ceilometer, transmissometer and the infrared humidity indicator appear to be in advanced stages of development. These instruments will provide the much needed observations of essential weather elements at the end of the instrument runways during marginal or instrument flight conditions. This program should be greatly accelerated.



We are of the opinion that the present instrumentation program for obtaining upper air observations to altitudes of 100,000 feet or greater is inadequate. The use of SCR-658 equipment in a "tight network" to track balloons when strong winds aloft are encountered is a partial solution to the problem. However, modern rawinsonde equipment such as the GMD-1A even though expensive is the only equipment presently available for obtaining consistently reliable data to high altitudes at all seasons of the year.

At Tyler, Texas, we observed the need for a weather instrument panel where the CAA control tower observers may get all weather observations without leaving the tower. The tower has wind equipment and the indicators all mounted between the two control tower operators' positions. To obtain observations of temperature, dewpoint, humidity, maximum and minimum temperatures, it is necessary for the control tower operator to leave the tower and refer to an instrument shelter mounted on the balcony of the next floor below. The control tower operator should have a weather panel located near the wind speed and direction indicators where all weather observations may readily be obtained. The control tower operator expressed the opinion that there are more than 100 CAA stations in the United States where such an instrument panel may be used.

Modern wind equipment for recording wind speed and direction is urgently needed at many large Weather Bureau Airport Stations. The old triple-register is not satisfactory for current day requirements.

#### The Committee Recommends—

The Weather Bureau instrumentation program is in need of improvement. Specifically, the Weather Bureau needs improved equipment in the following categories:

1. Ground stations and transmitters to obtain reliable upper air soundings to 100,000 feet. (GMD-1A)
2. Ground radar equipment for locating and tracking severe storms, fronts, thunderstorms, and other destructive storms.
3. Remote indicating and recording instruments, especially visibility and cloud height for end of runway observations. Runway wind direction and velocity and temperature are also desirable.
4. The development of suitable automatic weather stations (including ocean locations) should be given highest priority by the Bureau.
5. Improved wind equipment for recording gusts.
6. Weather panel for tower operators and other similar installations which will permit remote reading of all basic elements of an observation, including temperature, dewpoint, wind direction and velocity, and altimeter setting.



# Climatology

## Present Practices

We are quite concerned with the slow, almost lingering, death of real climatology in the Weather Bureau. Some thirty years ago the Weather Bureau had a fine reputation for its climatological work and some of that stands up as classical even now. During the last twenty years there has been a very slow but progressive deterioration and it seems that climatology in the Weather Bureau has become exclusively a data collecting and tabulation business. In the last decade the only work of a technical nature has been essentially statistical. We do not say that statistical work in climatology is not needed but it does seem that the primary purpose of a climatological laboratory is to take data and analyze it for purposes of practical application by the general public. This would improve public relations immeasurably.

## Findings

Climatological analysis should be on the same par as day-to-day weather forecasting efforts. However, we do not advocate that the climatological laboratory should do individual jobs for private industry which can be done by private meteorological consultants, but instead, should devote itself to the broader problems of a more basic nature which concern not large industries or groups but large segments of the population such as problems dealing with land utilization on a large scale, water supplies, climatic changes, etc. Practically no scientific and analytical work has been done by the Weather Bureau on these problems in the last ten or fifteen years.

While it is hard to assess in its entirety the reason for this decline it is quite clear that the Climatological Services Division of the Weather Bureau has been treated somewhat as a stepchild and has had only nominal leadership in recent years. In addition, it has been unable to attract meteorologists with a genuine and primary interest in climatology. It is quite indispensable to have some people working primarily in this field whose background and training is climatological meteorology and not just statistics or machine methods. It is essential that the head of the National Climatological Laboratory be familiar with both climatological and synoptic meteorology.

The new National Climatological Laboratory should have the following functions:

1. Collection and maintenance of all weather records including those of other agencies or organizations.
2. Preparation of statistical summaries by modern machine methods.



3. Publication of historical weather data.
4. Analysis of data and publication of studies when such analysis and publication is for general public use.
5. Preparation and publication of historical Northern Hemisphere weather maps.

The present horizontal organization should be replaced with one which establishes the proper line of authority and liaison as between the climatological section centers, the weather record processing centers, the regional offices and the National Climatological Laboratory.

The laboratory should be located at Asheville, North Carolina, the site of the present National Weather Records Center.

The larger percentage of the personnel and equipment are supported by transferred funds from other agencies, particularly the Air Force and Navy, and consequently the work is specifically being performed for those agencies. This work is essential, but relatively little effort can be expended by the Bureau on its own projects because of its own scant budget.

#### **The Committee Recommends—**

That the National Weather Records Center be part of the National Climatological Laboratory. Specifically the following recommendations are made concerning the present National Weather Records Center:

1. Since the present National Weather Records Center is the official repository of all government records (as designated by the National Archives), extreme care must be exercised to prevent destruction of the stored documents. Possibly, duplicate microfilms of the records should be stored at a location away from Asheville.

2. To prevent the punched card file (approximately two hundred million cards at present) from expanding at a prohibitive rate, a qualified committee should pass on implementation of the following steps:

- a. Store some of the observations without punching.
- b. Destroy some of the present punched cards for which future use is improbable.
- c. Put some of the present punched cards on magnetic tape to be reconverted at a later date as required.

3. Investigation of the newest types of tabulation machines should be continued.

4. A catalog of available material should be published.

At present the Air Force maintains a large machine tabulation unit at Asheville. They have indicated that they would like the Weather Bureau to take over the functions of this unit pertaining to the processing of Air Force weather records, as this would allow the Air Force



machine tabulation unit to concentrate on its own proper specialized activities.

Sufficient funds should be obtained for the laboratory to collect, process, and maintain all government weather records.

Adequate personnel should be obtained probably from outside of the Weather Bureau, to revitalize this division of the organization.



# Forecasting Service

## Present Practices

The forecasts of the Weather Bureau are of two main types:

- a. Generalized forecasts for broad public distribution by newspapers, radio, and television.
- b. Forecasts for the aviation industry.

The generalized public or district forecast is made by a senior forecaster and is generally valid for 24 to 48 hours. There are 14 district forecast centers covering the 48 states.

The airways forecast is of shorter range and more specialized. It is usually valid for periods of 12 to 24 hours, and is issued from 26 airway centers.

Both district and airways forecasts are issued at standard intervals, four times daily.

In addition to these two main types of forecasts, specialized predictions are made by the district forecast centers of severe conditions such as tornadoes, hurricanes, frost conditions, fire weather advisories, river and flood stages.

A long range or extended forecast unit is stationed in Washington, D. C. Five-day forecasts are issued at frequent intervals, and twice monthly a thirty-day forecast of temperature and precipitation departures from normal is published. The thirty-day forecast covers the entire United States.

A master weather analysis unit, known as WBAN (Weather Bureau, Air Force, Navy) is maintained in Washington. Its duty is to disseminate weather charts to all parts of the nation via facsimile and coded transmissions. The charts serve to coordinate any analyses prepared in the field and they relieve many weather stations of duplicate plotting and analyses of maps and charts. Another important function is to prepare and issue prognoses of pressure distribution, both at the surface and aloft, for periods up to 54 hours in advance. These prognostic charts are utilized by field forecasters in the preparation of their specific area forecasts.

There also exists in the WBAN center a unit whose duty is to forecast severe storms and tornadoes over the mid-eastern and eastern parts of the United States.

The forecasts produced by these units are transmitted to their users in a variety of ways. Airways forecasts are usually distributed via teletype and, in a few cases, by continuous radio broadcast. District



forecasts are disseminated by means of public automatic telephone systems, commercial radio, commercial television, newspapers, and individual telephone calls.

During certain occasions, when cold waves or storms of specified intensity are approaching, some of the district forecast centers also issue advisories by collect telegrams to industrial concerns and other organizations who have requested this service.

In many cities there are local teletype loops paid for by the consumers, over which the district forecasts are transmitted at regular times, together with various types of weather observations of special interest to the recipients.

At the present time, the Bureau has a verification system for both district and airways forecasts, but the profession feels that it is inadequate and of little value.

Two experiments are presently underway to determine whether district forecasts can be made more efficiently if decentralized into smaller forecast districts.

### Findings

We believe that aeronautical forecasts should be designed to meet the needs of the private and itinerant pilot, as well as general commercial aviation. It is noted that changes were recently made in these forecasts for this specific purpose. The quality of the aeronautical forecasts is not as good as desirable, particularly from the standpoint of the itinerant pilot. We believe that they could be improved by procedures which will be discussed under the general subject of district forecasts.

Fruit frost forecasts are issued in both Florida and California, and are extremely well received by the farmers who use them. The reliance placed upon these forecasts is a testimonial to the people who are responsible for this system.

The quality of the district forecasts, on which the public judges the Weather Bureau, is very spotty. Forecasts differ in quality between district forecast centers, and vary with the individuals who make them. There are a number of problems in this connection which are difficult to solve.

From our interviews with people in all levels of the Weather Bureau, we have concluded that only about one-half of the forecasters, both district and airways, are really well qualified for this type of work taking into account training, temperament, ability and desire. At the present time, the technical training required for this job is by no means the paramount criterion for judging proficiency. This situation is unlikely to change radically within the next few years. Specifically, there is need for a more rigorous quality control of the product, that is, the forecasts, and for methods to ensure that the best qualified forecasters will be assigned the responsibility for making the most important public forecasts. Many localities on the periphery of forecast



districts are not satisfied with service received. In some places the forecasts appeared to be adequate for the large centers in which they were made, but adequate consideration is not given to the outlying locations. Furthermore, in many localities, local effects are present which require an entirely different forecast under certain weather conditions for places only a few miles apart. This is particularly noticeable around the Great Lakes and near the sea coasts. The forecasters apparently do not give the proper attention to differences of geography, space, and time.

The problem of frequent interruptions to the forecasters' routine, due to the answering of telephone inquiries, is a very real one, particularly during bad weather. Much of the forecaster's time is taken up answering telephone inquiries about weather conditions, many of which relate to minor affairs. This detracts from their ability to devote the proper attention to the quality of his product, and to their primary responsibility to serve the public as a whole.

The personnel policies in forecasting are far from satisfactory. There appears to be little or no system to recruit talent into the bottom of the organization. In some cases, transfers to forecasting are made simply because a man has been in grade long enough for a promotion and this provides a convenient mechanism. The avenues of advancement for the forecasters are very restricted. They may go from airways forecasting into district forecasting, and finally into supervision of forecasting, but this channel is not open enough at the top to maintain the interest of the best people. The combination of the prospect of shift work as long as they stay in forecasting, together with limited opportunities for advancement, has led many promising people to transfer out of forecasting at the time when their talents were reaching a peak and they were needed most as forecasters. There has been little success in recent years in attracting promising graduates of recognized meteorological institutions into this field—partly because of the objections which have been already discussed and are plainly apparent to the applicant, partly because other more attractive lines of endeavor in the field have been available, and probably also because there has been no intensive effort to recruit such people.

It appears that the number and variety of forecasts add unduly to the complication of work at forecast centers. In addition, the need for multiple notifications in some places by individual telephone calls is undesirable. In general, the policy should be to distribute forecasts only through mass distribution media by methods which will not entail individual handling. The use of public automatic telephone systems is a very good one and should be encouraged by whatever means are possible.

Radio distribution of weather forecasts is still basic and this should be continued as a fundamental distribution medium.

In New York and Chicago continuous aviation forecasts on FM channels have been very successful in getting the forecasts to the users and in cutting down individual telephone calls to the forecast office. Expansion of this program is highly desirable.



Radio broadcasts of a limited number of observations over CAA channels are made every half hour. The Committee has heard some complaints that these broadcast schedules are not maintained as rigidly as they should be. On some occasions, the broadcasts are omitted altogether. We recognize the difficulties, but, in view of the widespread use of these broadcasts by all sectors of the aviation industry, we suggest that a greater effort be made to adhere to the broadcast schedules, and to include a reasonable number of reports in each broadcast.

In many places, local teletype circuits to radio, newspaper, television, and wire service offices are available for the purpose of rapid dissemination of forecasts and special announcements. This is undoubtedly the best method available at present and minimizes the work load in the forecast offices. Its use should be encouraged wherever possible.

Television provides an excellent medium for the public dissemination of weather information and forecasts. While there are at present many weather programs on television which are somewhat objectionable to professional meteorologists, to the Weather Bureau, and even to intelligent laymen, these programs should not be restricted by regulation. We believe that providing weather information freely for television dissemination will result ultimately in the better type of weather program coming into the ascendancy. Perhaps this process could be speeded by professional association awards to the best television weather shows.

We believe that any means of distributing weather information forecasts is to be encouraged, even the simple visual displays of the weather ball or illuminated sign type.

There are many problems connected with the newspaper distribution of forecasts which the Weather Bureau recognizes and should continue to solve on a local basis. These consist mostly of newspapers failing to print the time and dates of the forecasts along with the period covered. In some cases, out-of-date forecasts are printed. The same is true of the newspaper weather maps which, in many cases, should be more recent than they are.

The regional staffs responsible for forecasting should be provided with sufficient experienced and vigorous talent to cope with these problems in an aggressive fashion. Prospects of sufficient caliber, while few, do exist and they should be utilized to full advantage.

#### The Committee Recommends—

1. Forecasting should be reorganized on the following basis:

a. The WBAN Center should function as the National Weather Analysis Center. It should be budgeted for by the Weather Bureau and operated by Weather Bureau personnel. It should be provided with suitable quarters, adequate equipment, and the most competent analysts in the Weather Bureau. (The present quarters and equipment are abysmally poor.)

b. In each of the Bureau's five regions there should be set up a Regional Weather Central, whose analyses and prognoses would be



coordinated with those of WBAN. The Regional Weather Centrals should be staffed with the most able forecasters in the service. Each regional center should be supervised by an Assistant Regional Director for Forecasting. Each region should have a fire-weather forecasting unit, and Regions 1, 2, and 3 should each have a severe weather forecasting unit devoted particularly to hurricane, tornado, and severe thunderstorm forecasting.

c. The existing district forecast centers and the present severe weather unit in WBAN should be abolished. Personnel not required in the regional centers should be re-assigned to other duties, particularly to augment the staffs assigned to first order stations.

d. The Regional Weather Centrals should issue forecasts, for professional consumption only, in the form of pictures, words, or both, to the first order stations in their regions. Within the framework of the region's master forecast, but with appropriate modification to meet local conditions, the first order stations should be responsible for the issuance of the public forecasts for their area.

e. The present airways forecast centers should remain as they are now, except that wherever possible they should be combined with a local first order station, and the same forecasters charged with issuing both the local public forecasts and the airways forecasts. The timing of the forecasts should be adjusted so that time conflicts will not ensue.

f. The number of forecasts issued regularly to the public should be reduced to two a day, subject to amendment when a revision is necessary.

This program has several advantages:

1. It permits the infusion of new talent in the first order stations, where experience can be gained and screening accomplished. Promotion would be from first order stations through airways forecast centers, then regional weather centrals, to WBAN or staff positions in the regions.

2. It permits the most efficient use of the available talent.

3. It distributes the forecast responsibilities in such fashion that the master forecasts are made by the most capable forecasters.

4. It allows full consideration of local effects, and permits smaller forecast areas yet retains a desirable degree of coordination.

5. It places the responsibility of meeting the public's demands on the local officials who are closest to the customers.

2. Public telephone access into forecast centers should be restricted to normal office hours, and as far as possible, the forecasters should be protected against interruptions while on duty.

3. Sufficient personnel should be provided at each principal forecast center so that each forecaster can be rotated through research



periods, just as he is rotated from shift to shift. In this way, he will be relieved from time to time from the strain of forecasting, and will be stimulated to improve his forecasting techniques.

4. A simple and effective verification system should be developed for all forecasters similar to the practice forecasts formerly issued. It is more important that the system be simple and workable than that it meet stringent statistical tests. The Committee believes, and many of the field forecasters have indicated, that this would introduce a healthy competition and stimulus, and would permit more objective appraisal of individual forecasting skills than the present methods.

5. A systematic program should be developed to encourage the infusion of new talent into the forecasting organization at the lower levels. This requires a two-fold effort, first to discover and screen suitable talent in the Bureau's present personnel, and second, to secure promising graduates from the technical schools. It may require a higher starting salary than is currently offered.

6. As a general rule, public forecasts should be fewer in number and variety and better in quality than at present. They should be framed in simple non-technical language for mass distribution.

7. Individual telegram forecasts and specialized forecasts for companies or industries should be eliminated as quickly as possible. Weather Bureau forecasts should be confined to mass distribution media, with some minor exceptions, such as pilot briefings and special forecasts for farmers and other government agencies. The principle should be followed that the Weather Bureau forecasts are for general public use and in addition, forecasts where the protection of life or severe property damage is involved. Examples of this are the aeronautical forecasts and the fruit-frost forecasts.

8. Research in local forecasting problems should be encouraged and its content published and adequately catalogued.

9. Special forecast warnings should be issued for coastal areas where life and property is endangered by unusual sea, surf, and tide conditions, even when the storm causing them is remote from the area. This should be done in coordination with the other agencies of government involved.

10. In order to establish a satisfactory basis for cost and efficiency comparisons, it is desirable that one or two Weather Bureau stations be contracted to competent private agencies under a bidding procedure. The private contractor would perform all the specified Weather Bureau functions at the location, subject to inspection of the Bureau. In addition to furnishing a satisfactory yardstick to judge the Bureau's costs, it may be possible to make substantial dollar savings. It is recognized that real difficulties may be encountered in implementing this suggestion, but we believe it is worthy of serious investigation.



## Communications

### Present Practices

Synoptic meteorology became possible when the electric telegraph was invented. For the first time it became practicable to collect reports of the current weather over a wide area, and thus to see that weather is more than a local phenomenon.

Weather and communications have been related ever since. For the past twenty-five years the Weather Bureau has relied on other agencies to perform the communication function, both in the collection of observations and in the dissemination of information to the public. Since the early 1930's the basic communication system used to transmit observations to the forecast centers has been a nation-wide network of teletypewriter circuits, operated by the Civil Aeronautics Administration. These circuits are also used to transmit forecasts from the forecast centers to the local offices of the Weather Bureau and the Civil Aeronautics Administration.

In addition to the Weather Bureau, the military services, many air transport companies, certain educational institutions, and some privately practicing meteorologists are allowed to maintain teletype connections on these circuits, to receive the basic observational and forecast material. This is done under a restrictive licensing arrangement which permits the Weather Bureau to determine who shall and who shall not be authorized access to this basic material and thus control its use.

During World War II the process used commercially to send news photographs by wire facsimile was adapted for the transmission of weather maps by the military services. At present, a nation-wide facsimile network is operated by the United States Air Force and is used to transmit weather charts from the WBAN master analysis center in Washington to military stations throughout the United States. The Weather Bureau has installed facsimile receivers at seventy-six of its stations to permit a reduction in the number of maps and charts which would otherwise be plotted by hand, at most of these stations. The Navy, airlines and others also have drops on this circuit.

### Findings

Although considerable improvements have been made, the present methods of facsimile have not been entirely satisfactory because of technical considerations. The speed of transmission is much too slow, the quality is marginal, and the process is insufficiently mechanized.

Teletypewriter circuits also suffer from certain technical limitations. In the past the existing circuits have been operated at sixty words per minute, and the only means of handling additional volume was



to add more circuits. The Civil Aeronautics Administration is now planning to increase the speed of these circuits by twenty-five percent in 1954, which will result in a temporary improvement.

In this connection it should be noted that the Weather Bureau is responsible for the initiation of the JONSEC project to develop high speed point-to-point communication methods by means of which six hundred words per minute may ultimately be obtainable between two or more major centers. The intelligence will be entered on revolving drums at the receiving end and distributed selectively. This offers promise for higher speeds than are feasible with existing teletypewriters and the order of magnitude more nearly approaches what is required to meet present and future needs.

The weather observation is useless until it is communicated. Furthermore, a weather observation is one of the most perishable pieces of intelligence from the standpoint of forecasts and warnings.

The proper fulfillment of the Weather Bureau's mission involves consideration of every step from the raw observation, collection, filtering, analysis, and storage down to the dissemination of advices and warnings. Each step involves one or more communication techniques and the proper integration of the function requires that the process be considered as a whole. Only in this manner can a balanced and compatible system be developed using the best available techniques.

### The Committee Recommends—

1. The national weather service should devote a greater effort towards investigating new communication techniques. The Committee does not recommend that the national weather service engage directly in large scale development and research, but rather that it take steps to make its needs known to the industry and to initiate and expedite the development of advanced techniques. Specific areas which offer promise are:

#### Short Term

- a. Expansion of automatic telephone forecast service to all major cities;
- b. Automatic dissemination of forecasts to radio and television stations and to the press;
- c. Remote briefing facilities to satellite airports from a single center by local video wires;
- d. Expansion of automatic aviation broadcasts (such as is done by the Weather Bureau in Chicago) to other areas;

#### Long Term

- e. The use of commercial television facilities for nation-wide transmission of weather maps and charts at high speed during the station break periods and/or the retrace cycle;



f. The development of communications system compatible with the technical requirements of automatic observation stations, automatic data collection and filtering, objective machine analysis and advanced storage methods.

2. The responsibility for the present facsimile network now operated by the Air Force should be transferred to the Weather Bureau.

3. The Weather Bureau effectively controls private meteorology by controlling the issuance of licenses for obtaining access to weather teletype and facsimile circuits which carry weather information across the nation. We believe this control should cease. Any taxpayer willing to bear the cost of the special equipment needed should have unrestricted access to the communication channels over which weather observations and advices are disseminated. We recognize that abuses may arise from this preference, but the present license system fails entirely to accomplish its objective and we believe that if such abuses develop, they are still preferable to rigid government control. We also believe that if such abuses become serious, suitable corrective steps can be taken at that time. This matter is further discussed in the section on private meteorology.



# Research and Development

## Present Practices

Research and development has not received adequate attention in the Weather Bureau on an organized basis in the past. Rather than forging ahead and developing new ideas to the stage where they can be applied to increase effectiveness of routine procedures, the Bureau has passively accepted or frequently been forced into adopting new developments from outside of the Bureau. Prior to the war, Bureau research was confined to the activities of a handful of individuals, some of outstanding caliber. Before the war the position of Assistant Chief for Scientific Services was created as a step designed to rectify this deficiency. This position became vacant at the end of the war and has never since been filled. There now exists a Division of Scientific Services and a Division of Physical Research, both of relatively recent origin and both concerned primarily with research of one kind or another. However, the continued neglect of research is attested by the fact that allocation of funds for research have constituted only a minor part of recent budgets, currently about two and one-half percent.

## Findings

In addition to there being an inadequate financial provision for research, the work has seemingly been conducted in isolated areas not connected with one another within the structure of a comprehensive plan. There is little research in the fields of modern instrumentation, modern communications and the systems approach to weather. In recent years the Bureau has displayed an arbitrary and sometimes negative attitude toward new developments in meteorology originating outside the Bureau, especially in the fields of long range weather forecasting and weather modification. This recalls the attitude of the Bureau with respect to air mass analysis methods prevalent during the 1920's and 1930's. On the other hand, commendable work is now being done in the development of objective forecasting techniques and in the Bureau's own long range forecasting unit. The initiation of the JONSEC project is commendable, and is further discussed under the section entitled, "Communications."

## The Committee Recommends—

We are inescapably drawn to the conclusion that research is given too little attention in the Bureau. In the modern world operational changes tend to occur swiftly in response to gains in fundamental knowledge. Even yielding the pursuit of fundamentals to others, the Weather Bureau should more aggressively pursue the adaptation of new fundamental knowledge to the needs of the national weather service. Instead of actively pursuing this policy the Bureau waits until forced into new



methods and techniques by outside agencies, especially the military services. It is therefore recommended that the research budget be materially increased.

We realize that the Weather Bureau may have difficulty in attracting to its staff the competent scientists needed to carry out an enlarged program. It is desirable that much of the research be contracted to universities and other research organizations. The expanded research program should be directed toward the development of automatic observing stations with compatible communications, automatic data collecting and filtering systems, objective machine analysis and forecasting techniques, and improved high-speed communications.

It is clear that developments along these lines will lead eventually to the replacement of men by machines in the performance of routine and exacting tasks. Professional personnel thus relieved will be free to devote more time to duties involving high-grade thinking which is in keeping with the level of professional competence desirable in the Bureau.

It is contemplated that synoptic or engineering research efforts, which probably offer the most immediate benefits to forecasting, will be carried out primarily at the forecasting station level as provided in Section IX. There is much of this type research, however, which is applicable to national problems rather than regional or local. Examples are severe storm investigations and prognostic chart research. These problems properly should be handled by the National Weather Research Laboratory. This organization should also guide and coordinate regional and local research.

This same Laboratory should also contain the principal physical research facilities of the Weather Bureau as well as provide a mechanism for testing basic research ideas from both the field and other organizations and converting them into practical engineering applications to forecasting.



## Personnel and Training

### Present Practices

Prior to the introduction of air mass analysis methods into the Weather Bureau (during the 30's), the Bureau's educational level was extremely low for an organization supposedly engaged in scientific tasks. During the 30's an increasing number of recruits joined who possessed college degrees in meteorology, physics or mathematics. In addition, a considerable number of Bureau personnel received masters degrees in meteorology while on leave of absence from the Weather Bureau, or at the Weather Bureau's expense in connection with the Bureau's training program.

Simultaneous with this trend, older personnel possessing much less technical education, had, through seniority, risen to higher positions of responsibility. These were often capable people possessing a zeal for public service, and in some cases, self-educated in the more modern technical methods. However, in spite of these qualifications, these individuals did not all have the proper background to respond to the potentialities provided by the new scientific methods and were unable to insure effective use of the special capabilities of the highly trained younger personnel. Neither were they ready to meet the forecast problems of the new and expanding aviation industry.

During the early 40's, the Armed Forces trained a large number of meteorologists at the graduate level. Where meteorologists numbered in the hundreds before the war, there were thousands by the end of the war. Many of these persons had as prerequisites to meteorology, degrees in physics, mathematics, chemistry, and engineering. After the war most returned to the field of their original training but a number joined the Weather Bureau staff or entered the field of private meteorology.

In the past, salaries of Weather Bureau personnel have been notoriously low. However, late in the war and since, the level has been raised until it is roughly in line with that of industry and other government agencies. This has had a considerable influence in raising morale, which was generally low before the war. Dissemination of house organs, "Weather Topics" and "Forecaster's Forum", have also served to raise morale.

At present there is a small Bureau training program in which selected Bureau personnel are sent to certain universities to study for advanced degrees in meteorology.

### Findings

Many of the senior officials of the Weather Bureau are now nearing retirement age. It is urgent that replacements be found for these



individuals in order to increase the general efficiency of Bureau administration. This replacement becomes a necessity if the recommended organizational changes are to be carried out.

In general, the personnel situation reflects the long enduring regime of close control of details by the Central Office. This has resulted in a progressively growing dearth of administrative experience on the part of the younger people in the Weather Bureau. Under more normal circumstances, these personnel would acquire necessary administrative experience as they climbed the ladder to higher posts. This situation would be rectified in time if the recommended changes in organization are made. However, there will exist for some time a dearth of qualified administrators in the Weather Bureau structure unless some replacements are obtained from outside the Bureau.

At many of the forecast centers it was found that the forecasters felt overburdened with the demands of the public. There appears to be considerable interference with the performance of technical duties because the forecaster is required to answer the telephone and feels obliged to serve the public no matter how trivial the request. In many centers, a telephone receptionist was able to relieve the situation during the working hours.

There is evidence that forecasting has trended perhaps too strongly toward specialization with the result that specialists such as fire weather, fruit frost, and river and flood forecasters were not fully occupied in their specialties during off-seasons. There even exists sentiments in favor of eliminating the distinction between Airways and District Forecasters in major centers where a rearrangement or a staggering of the respective forecast schedules would permit them to be issued by one man.

There is evidence that a decline in the present high standards of education of personnel is threatened because of lack of proper recruitments at the bottom of the ladder. Current graduating classes of meteorologists are not finding the prospects of working for the Weather Bureau acceptable and are seeking employment elsewhere. Part of this seems to be due to the existence of a confused and inadequate advancement policy in the lower grades of the Weather Bureau. A second factor is the low salary scale at the bottom of the Weather Bureau ladder. A third factor which undoubtedly plays a major role in this situation is the fact that the sphere of activity of the meteorologist within the Weather Bureau is now largely restricted to forecasting. With the recommended changes a much broader field of activity will be open to the new meteorologist. Night shift work has been mentioned as a factor. However, where an office is well organized and provided with adequate facilities, this is a factor of minor significance.

#### The Committee Recommends--

The following changes should be made within the framework of the proposed organization:



1. Several of the high level assistants of the Bureau have reached, or are approaching, retirement age. Adequate replacements should be selected, trained and given necessary authority and responsibility as rapidly as it is possible to do so.

2. Staff the regional offices with a sufficient and aggressive organization to accomplish the needed shift in operational emphasis to this level. This might well involve transfer of some of the younger people in Washington to the field organizations.

3. Rearrange forecast procedures and schedules in the field offices so as to secure for the forecaster freedom from continual interruption of technical routines by elimination of specialized and unscheduled forecasts via telephone. Scheduling should be aimed at improvement of mass distribution of forecasts.

4. Make what changes are necessary to attract college meteorology graduates to the Weather Bureau. This would probably involve higher starting salaries and a well defined and well publicized program of career development.



## Publications

### Present Practices

Prior to World War II, the Weather Bureau was a leader in the field of meteorological publications. Its "Monthly Weather Review" is the oldest American meteorological journal, now in its 81st year. Many supplements to the "Monthly Weather Review" were of great value.

Many first-order stations duplicated on weekdays a local weather bulletin which included a synoptic map, local forecasts and climatological data. The daily weather map published in Washington included the surface map for the United States and forecasts for the states in the Washington forecast district area.

At the outbreak of World War II, the printing of local weather bulletin was discontinued and the publishing of weather and climatological data nationally was greatly curtailed or delayed. However, up to this time, there was a complete absence of published past synoptic maps. Early in the war, at the insistence of the Air Force and Navy and with their financial support a much needed historical series of synoptic weather maps was prepared for the period 1899 to 1939.

The present publication program of the Weather Bureau includes the following:

1. Teaching aids.
2. The Daily Weather Map.
3. Station reports and bulletins.
4. Observational aids and instructions.
5. Synoptic weather charts, bulletins and codes.
6. Forecasts and forecasting methods.
7. Climatological data.
8. Periodicals.
9. Serials including both research and technical papers.
10. Monthly Weather Review.
11. Climatological summaries.
12. Weather Bureau Motion Picture Films.
13. Photographs.
14. Miscellaneous papers.

### Findings

The present publication program of the Weather Bureau is adequate in many respects. The Daily Weather Map issued from Washington was improved considerably several years ago by the addition of the map showing barometric and frontal pattern over North America as it existed 12 hours previously and the 700-millibar constant pressure chart. Another worthwhile additional feature has been the occasional articles explaining



climatic features and weather services to the public which appear on the reverse of the map.

The daily weather bulletins issued locally such as the one in New York City are both timely and useful.

The publication of the series of daily synoptic weather maps for the Northern Hemisphere sea level and the 500 millibar levels is supported mostly by the Air Force and Navy although it is definitely a logical function of the civilian national weather service.

The inauguration of an average monthly weather resume and outlook, commonly referred to as the 30-day forecast, several years ago was a noteworthy event particularly in light of the Bureau's attitude toward long range forecasts prepared by others. Considerable interest in these outlooks has been evidenced, and many newspapers and periodicals reproduce parts of them.

The printing of climatological data and summaries is probably the largest publishing problem of the Bureau. Considerable efforts have been expended to streamline the printing work in the view of efficiency and economy. Apparently as a result of this reorganization an additional time lag has developed in the distribution of the monthly climatological summaries.

Although the Monthly Weather Review has never regained the stature it enjoyed before 1940, it is a well-edited, high quality type of publication on the subject for which it is named. With the increase in the number of periodicals and journals outside the Weather Bureau, it is apparent that articles of a scientific and technical nature by Weather Bureau personnel should be submitted to existing journals of scientific societies and organizations.

Many excellent research and technical papers have been published in the last decade. However, there is little evidence of encouragement of the field personnel to submit such papers. In fact, the Committee feels that considerable unnecessary censorship is exercised in the Central Office in the reviewing and editing of their research efforts.

The weekly Weather and Crop Bulletin, National Summary, is a timely and useful release and the weekly Corn and Wheat Weather Bulletin and the Weekly Cotton Weather Bulletin seem to enjoy a similar reputation in a regional and seasonal way.

The Weather Bureau motion picture film library should be expanded as it is noted that the films now advertised are few and these produced in the 1930's. The maintenance of a large collection of photographs of various weather phenomena from which contact prints can be ordered is an excellent service.

The miscellaneous publications of the Weather Bureau include many worthwhile items, such as the report on "The Thunderstorm", but the printing of the reports on subjects outside the domain of the Weather Bureau at times seems unwarranted.



### The Committee Recommends—

1. The "Monthly Weather Review" should be devoted to a full discussion of the month's weather, including a description of general circulation patterns and analyses of the meteorological situations which were accompanied by extreme weather conditions during that month.

2. In order to relieve the Weather Bureau of inquiries for special studies, a statement should be placed in the "Monthly Weather Review" to the effect that detailed special studies can be obtained from private practicing meteorologists.

3. Personnel of the Weather Bureau should be encouraged to submit papers to the regular scientific and technical journals directly as private individuals. A popular publication on weather should be distributed to all cooperative observers. This publication should be so written that the cooperative observers could use it in schools and lay groups of their community.

4. Consideration should be given to the utilization of the back of the Daily Weather Map for the publication of daily aerological data having a suitable time lag to enable proper checking for accuracy.



# Private Meteorology

## Present Practices

Except for the meteorological services set up by the airlines in 1929 and 1930, there were very few persons engaged in private meteorology, prior to World War II, and they were employed by universities or industrial organizations. Even though this number was small there developed a need for clarification of the relationship between the Weather Bureau and the private meteorologist. A special committee, known as the Compton Committee, was appointed in 1940 to study this problem. The Compton report recommended, among other things, that the Weather Bureau control the release of teletype information to organizations outside the government. However, it was not until 1946, and then largely as a result of the efforts of the American Meteorological Society, that teletype weather information was released to private meteorologists. This was accomplished by a formal agreement between the Weather Bureau and the private meteorologist and was subject to revocation, if in the opinion of the Bureau the latter violated the restrictions contained in the agreement.

## Findings

Immediately after World War II there was a rapid expansion of the practice of private meteorology as many Air Force and Navy personnel were released to civilian life. After a short time a few of the private meteorologists were forced to seek other employment when, for various reasons, their efforts were unsuccessful. However, the others have prospered and expanded their services, though many problems still existed. In an effort to clarify the relationship between the Weather Bureau and the private meteorologists the American Meteorological Society arranged for a conference to discuss the problems. As a result of this conference the following agreement, known as the Six-Point Program, was adopted:

Statement of Relationships Between the United States Weather Bureau and Industrial Weather Consulting Services as a result of Discussions Held in Washington, D. C., March 30 and 31, 1948, with the Chief of the United States Weather Bureau, Representatives of Industrial Weather Consulting Services, and the American Meteorological Society.

1. Advise all field offices that industrial meteorology is a legitimate field of endeavor and should be encouraged and aided by the Weather Bureau in the interest of national economy and defense.

2. Advise all organizations now served by the Weather Bureau that they are not getting an individualized and specialized service (i.e., added information and/or more service than is normally given the general public) and furnish them with a list of consulting firms approved for teletype service.



3. Advise individuals or organizations seeking specialized services that it is not a Weather Bureau function and with their consent refer the matter to the Central Office of the Weather Bureau for transmittal to the American Meteorological Society and the meteorological consultants.

4. Advise all Weather Bureau personnel that they should be alert to point out and develop cases in business where the employment of a consulting meteorologist would aid in developing applied meteorology.

5. Accept grants from individuals or organizations for research and statistical surveys only when they cannot be accomplished by or with private consulting meteorologists.

6. The service of looking after interest of private concerns and the initiating of special advices for commercial uses is the field of consulting meteorology and the Weather Bureau will make it a practice to refer to the field of consulting meteorologists requests for services of this kind.

The above agreement was never issued as such to the Weather Bureau field stations for their guidance.

Weather Bureau Circular Letter 22-48, issued about two weeks before the Six-Point Program was agreed to, does not clearly establish the relationship between the Weather Bureau and private meteorologists. The opinion expressed by private meteorologists in the field is that the Six-Points should be issued and Circular Letter 22-48 cancelled. In view of this uncertainty, Weather Bureau personnel in the field often express doubt as to the existing policy between the Weather Bureau and the private meteorologist. In most instances the Central Office in Washington decides each case individually.

The operation of the Special or Public Service Units of the Weather Bureau was observed at a number of field stations and we received reports of instances where these units are providing service to individuals in direct competition with the private meteorologist. Cases of actual proselyting of private clients by misguided but enthusiastic Weather Bureau people are by no means rare.

In reviewing the operations of the Weather Bureau, it was noted on several occasions that a very liberal interpretation of the term "industry-wide" was used by the officials. These instances lead us to the opinion that this type of service should not be rendered by the Weather Bureau.

There is a feeling among many Weather Bureau employees that encouragement of private meteorology is incompatible with growth of the national weather service (Weather Bureau). This is not in accordance with the American philosophy of private enterprise and competition. We believe the progress of one is indissolubly bound to that of the other. This concept should be stressed at all levels.

World War II caused a great expansion in Weather Services to meet military requirements. The Air Force and Navy expanded into large organizations in order to meet the essential requirements of wartime operations of the military forces. At the same time it was necessary for the Weather Bureau to expand its activities to meet the supporting



requirements of the military services, with the result that many persons became weather conscious and weather services are used much more extensively today than ever before. We believe that the development of industrial meteorology would result in even greater efficiency of the Weather Bureau.

### The Committee Recommends—

1. That the Weather Bureau actively encourage the development of private meteorology.

2. Cancel present teletype restrictions.

(a) Encourage the American Meteorological Society, ultimately working with state organizations, to work out a registration program for professional meteorologists similar to the long-established registration procedures of engineers, lawyers, doctors, and other professional men.

3. A special committee should be set up in the Department of Commerce to review all complaints and to develop new leads for the private meteorologist. This committee should be composed of non-government members who can work actively with the private meteorologist and with the Weather Bureau.

4. The special committee should also review each case of "industry-wide" service rendered and, where compatible with the general recommendations of this report, such services should be terminated as soon as practicable. The availability of private service should be made known to the present recipients.

5. Cancel Weather Bureau Circular Letter 22-48 and issue a new directive clearly defining the policy between the Weather Bureau and private meteorologists. This new directive should include all of the six points agreed upon in 1948 but with the following amendments:

Point No. 2 should read: Advise all organizations now served by the Weather Bureau that they are not getting individualized and specialized weather information and refer them to the American Meteorological Society for a listing of consulting meteorologists. (In the earlier point 2 the wording was, "firms approved for teletype service." There should be no approval for teletype service under the setup that we suggest.)

Point No. 3 should be re-written. "Advise individuals or organizations seeking specialized services that it is not a Weather Bureau function and refer these individuals directly to the American Meteorological Society for a list of meteorological consultants." (This rewording is in line with the delegation of functions downwards and eliminates the funnelling of such matters through the bottleneck of the Central Office.)

6. Draw up regulations governing teletype service to private meteorologists in time of war.

7. Encourage professional meteorologists to set up radio and television weather programs without censorship of any kind.



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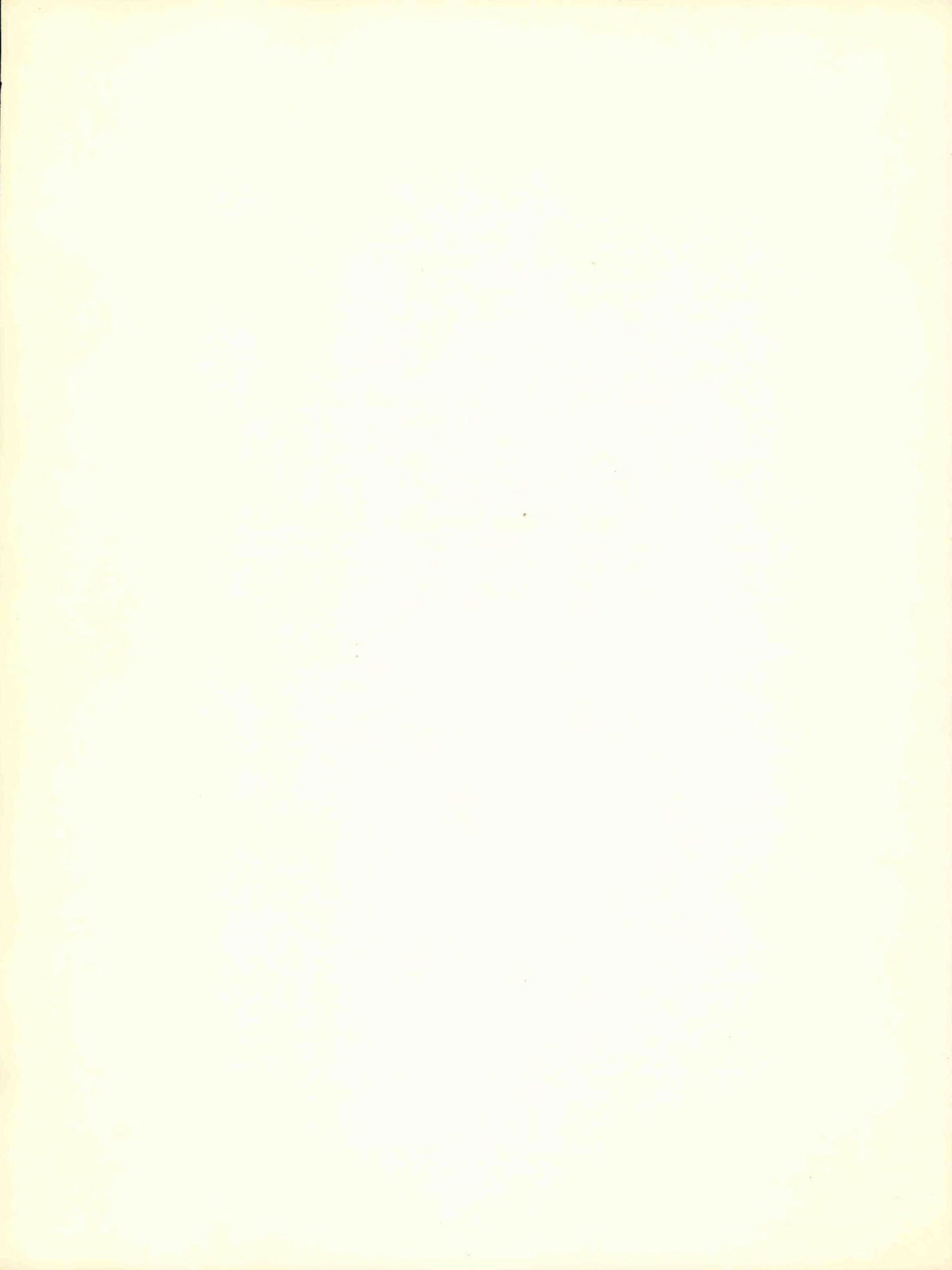
## Appendix

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## STATUTORY AND EXECUTIVE AUTHORITIES

Prior to October 1, 1890, the functions of the Weather Bureau were exercised by the Signal Corps of the Army under authority of a joint Congressional resolution approved February 9, 1870.

15 U.S.C. 311 (Act of Congress, approved October 1, 1890), transferred activities to Department of Agriculture, effective July 1, 1891.

15 U.S.C. (Act of Congress, approved October 1, 1890), provided for position of Chief of Bureau and civilian employees.

15 U.S.C. 313 (Act of Congress, approved October 1, 1890) specified the duties of the Chief of the Bureau. The pertinent text is:

That the Chief of the Weather Bureau, under the direction of the Secretary of Agriculture, on and after July first, Eighteen hundred and ninety-one, shall be charged with the forecasting of weather, the issue of storm warnings, the display of weather and flood signals for the benefit of agriculture, commerce, and navigation, the gauging and reporting of rivers, the maintenance and operation of sea-coast telegraph lines and the collection and transmission of marine intelligence for the benefit of commerce and navigation, the reporting of temperature and rainfall conditions for the cotton states, the display of frost and cold wave signals, distribution of meteorological information in the interest of agriculture and commerce, and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States, or as are essential for the proper execution of the foregoing duties.

15 U.S.C. 313a provided for the establishment, operation and maintenance of an international basic meteorological reporting network in the Arctic Region of the Western Hemisphere.

15 U.S.C. 325 (Enabling Act of 1948, P.L. 573), all legislative language was deleted from Weather Bureau Appropriation Act and contained in permanent legislation.

15 U.S.C. 326 authorized the maintenance of a printing office in Washington, D.C., for the printing of weather maps, bulletins, circulars, forms and other publications.

33 U.S.C. 706 (Flood Control Act of 1938) authorized the establishment, operation and maintenance of a current information service on precipitation, flood forecasts and flood warnings.

49 U.S.C. 603 (Air Commerce Act of 1926, U.S.C. 171, as amended by Civil Aeronautics Act of 1938) made specific provisions for a special weather service to be rendered to civil aviation.

49 U.S.C. 803 (Civil Aeronautics Act of 1938) specified functions and duties of the Weather Bureau in order to promote safety and efficiency in air navigation to the highest possible degree. The pertinent text is:

In order to promote safety and efficiency in air navigation to the highest possible degree, the Chief of the Weather Bureau, under the direction of the Secretary of Commerce, shall, in addition to any other functions or duties pertaining to weather information for other purposes,



- 1) make such observations, measurements, investigations, and studies of atmospheric phenomena, as are necessary or best suited for ascertaining, in advance, information concerning probable weather conditions;
- 2) furnish such reports, forecasts, warnings, and advices to the Administrator, and to such persons engaged in civil aeronautics as may be designated by the Administrator, and to such other persons as the Chief of the Weather Bureau may determine, and such reports shall be made in such manner and with such frequency as will best result in safety in and in facilitating air navigation;
- 3) cooperate with persons engaged in air commerce, or employees thereof, in meteorological service, establish and maintain reciprocal arrangements under which this provision is to be carried out and collect and disseminate weather reports available from aircraft in flight;
- 4) establish and coordinate the international exchanges of meteorological information required for the safety and efficiency of air navigation;
- 5) participate in the development of an international basic meteorological reporting network, including the establishment, operation, and maintenance of reporting stations on the high seas, in polar regions, and in foreign countries in cooperation with other governmental services of foreign countries and with persons engaged in air commerce;
- 6) coordinate meteorological requirements in the United States in order to maintain standard observations, promote efficient use of facilities and avoid duplication of services unless such duplication tends to promote the safety and efficiency of air navigation;
- 7) promote and develop meteorological science and foster and support research projects in meteorology through the utilization of private and governmental research facilities and provide for the publication of the results of such research projects unless such publication would be contrary to the public interest; and,
- 8) detail annually, within the limits of available appropriations made by Congress, members of the Weather Bureau personnel for training at Government expense, either at civilian institutions or otherwise, in advanced methods of meteorological science: Provided, that no such member shall lose his individual status or seniority rating in the Bureau merely by reason of his absence due to such training.

P.L. 657 (80th Congress, approved June 16, 1948) authorized the study of the internal structure of thunderstorms, hurricanes, cyclones, and other severe atmospheric disturbances.

Reorganization Plan No. IV, transferred activities from Department of Agriculture to Department of Commerce, effective June 30, 1940.

Reorganization Plan No. V, pursuant to the provisions of the Reorganization Act of 1949, approved June 20, 1949, vested the Secretary of Commerce with broad powers of administration and control of all functions of the Weather Bureau.

Department Order No. 115, dated May 23, 1950, temporarily delegated authority to all offices and employees of the Department who prior to the effective date of Organization Plan No. V had been vested with certain functions to continue administration thereof until otherwise directed.

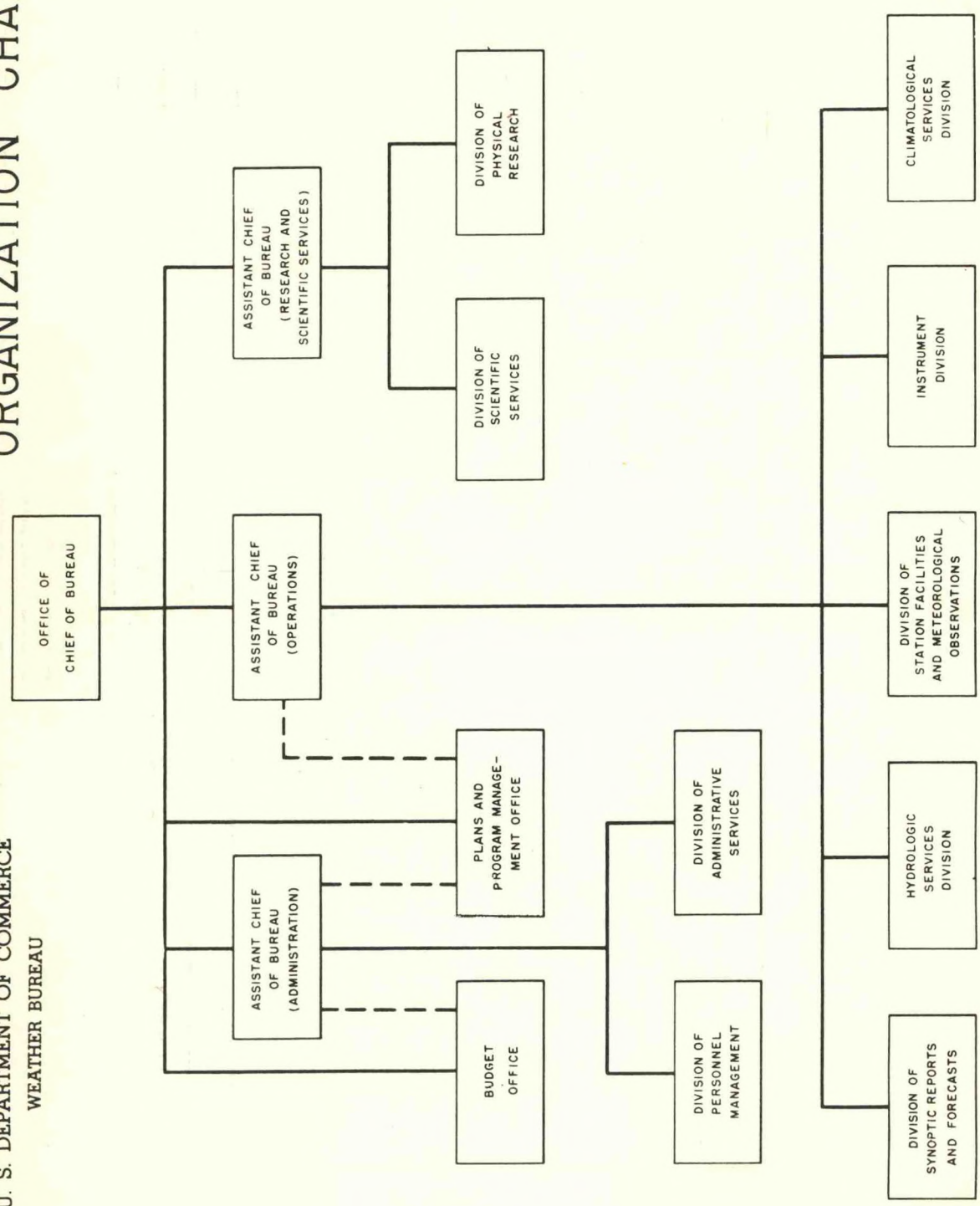


E. O. No. 8991 (dated December 26, 1941), designated Chief of Weather Bureau to serve as liaison officer between Secretary of Commerce and the Secretary of National Defense to coordinate Civil Meteorological Facilities and Services.



# ORGANIZATION CHART

U. S. DEPARTMENT OF COMMERCE  
WEATHER BUREAU

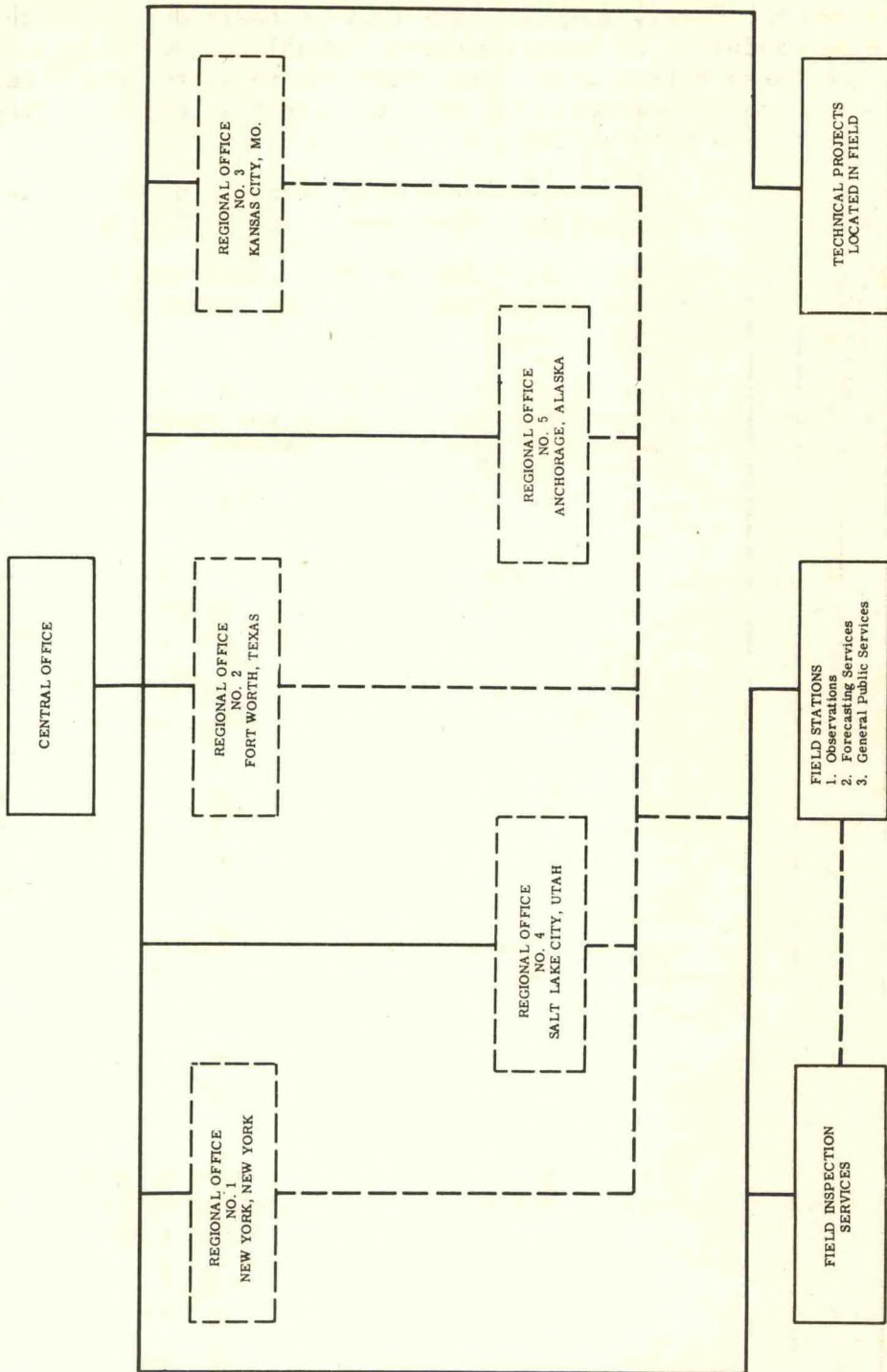




U. S. DEPARTMENT OF COMMERCE  
WEATHER BUREAU

PRESENT

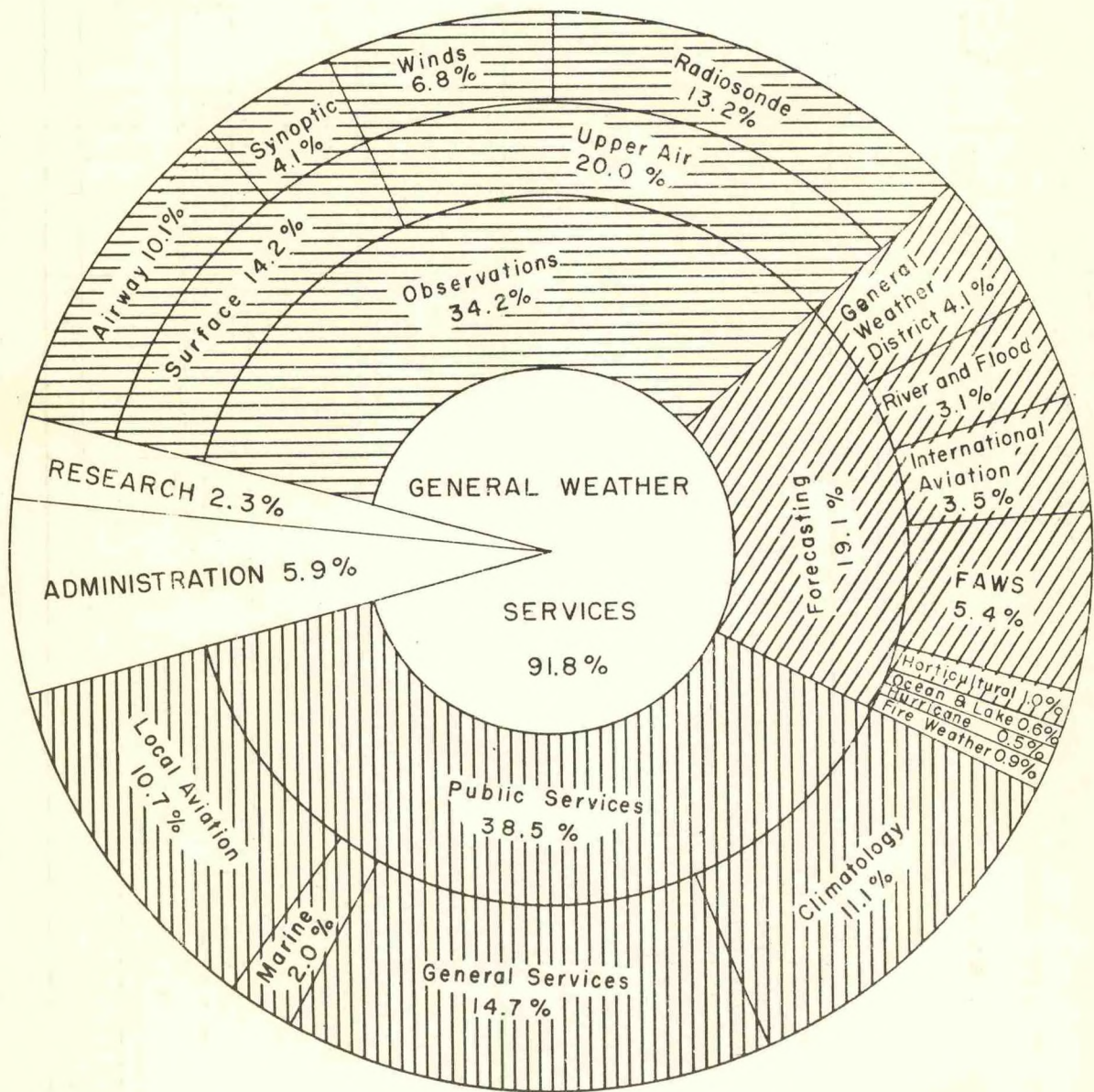
RELATIONSHIP OF FIELD ORGANIZATIONS



— Direction  
- - - Working Relationship



# DISTRIBUTION OF DIRECT OBLIGATIONS FISCAL YEAR 1954 BY ACTIVITIES AND FUNCTIONS



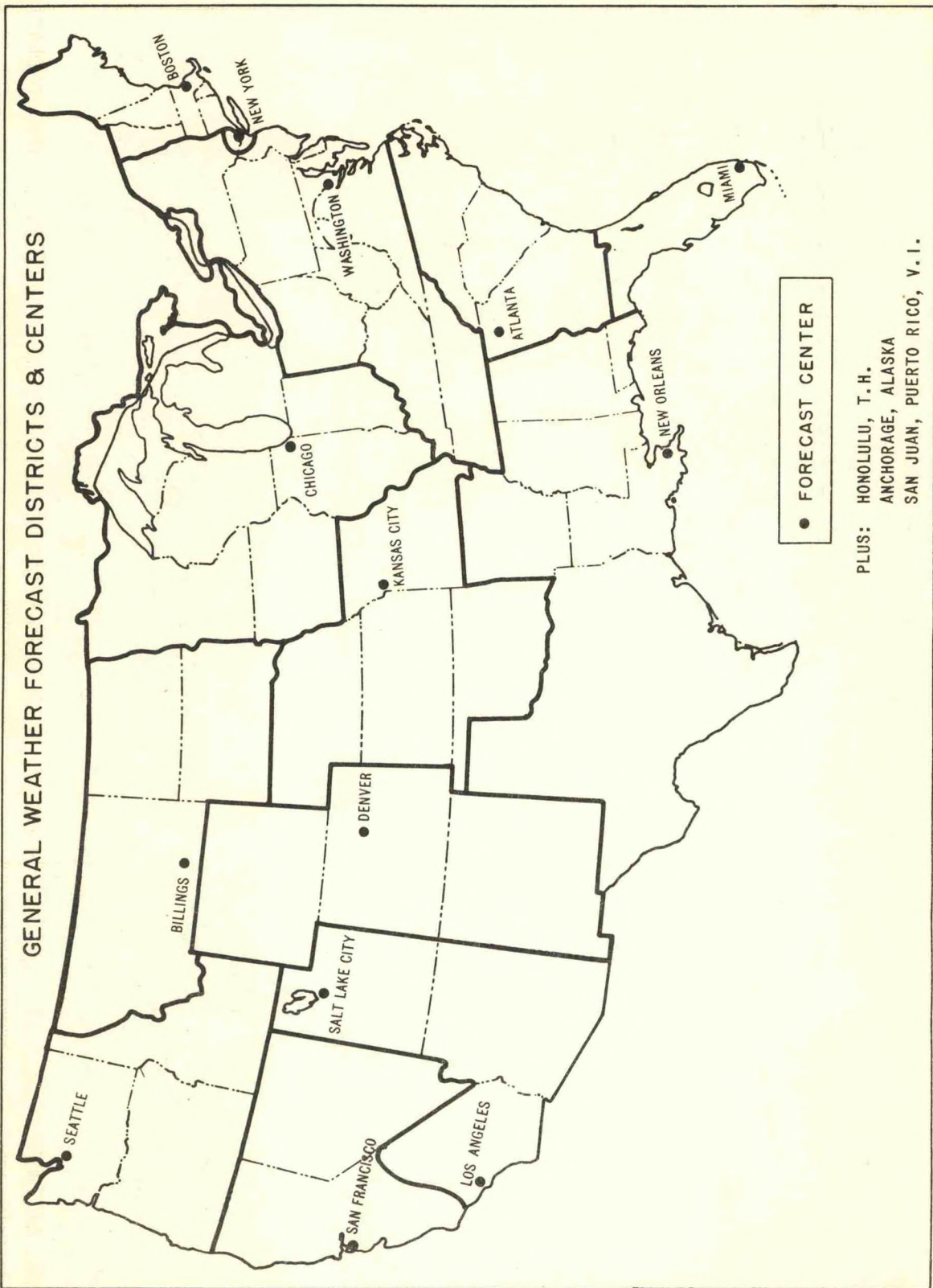


ANALYSIS OF MAN-YEARS AND COSTS BY ACTIVITIES AND FUNCTIONS

Activity or function	Fiscal year 1953 (actual)				Total cost
	Full-time personal services		Other objects cost	Total cost	
	Man-years	Cost			
I. General weather services:					
A. Forecasting:					
1. General weather district.....	164.6	\$941,141	\$138,404	\$1,079,545	
2. Flight advisory weather service.....	210.1	1,233,831	169,973	1,403,804	
3. International aviation.....	142.9	801,508	113,792	915,300	
4. Ocean and lake forecast and storm warning service.....	22.5	128,807	17,874	146,681	
5. River and flood forecast and warning service.....	129.0	715,928	100,377	816,305	
6. Hurricane forecast and warning service.....	14.9	83,572	44,932	128,504	
7. Horticultural and agricultural forecast service.....	37.4	221,965	33,788	255,753	
8. Fire-weather forecast and warning service.....	35.5	201,760	41,407	243,167	
Subtotal, forecasting.....	756.9	4,328,512	660,547	4,989,059	
B. Observing:					
1. Hourly aviation.....	409.0	1,932,718	426,176	2,358,894	
2. 3- and 6-hourly surface synoptic.....	158.7	746,978	198,065	945,043	
3. Winds aloft (Pibal and Rawin).....	280.0	1,291,411	574,821	1,866,232	
4. Upper-air temperature, pressure and humidity (radiosonde).....	335.9	1,541,990	2,278,459	3,820,449	
5. Solar radiation, radar and evaporation.....	38.6	190,504	29,329	219,833	
Subtotal, observing.....	1,222.2	5,703,601	3,506,850	9,210,451	
C. Local aviation service.....	498.3	2,580,315	342,362	2,922,677	
D. General weather service.....	699.2	3,540,584	488,955	4,029,539	
E. Climatological service.....	485.5	2,270,504	621,878	2,892,382	
F. Marine service.....	56.8	292,939	231,566	524,505	
Subtotal, full-time employment.....	3,718.9	18,716,455	5,852,158	24,568,613	
Part-time and temporary employment.....	178.0	321,000	.....	321,000	
Total, general weather service.....	3,896.9	19,037,455	5,852,158	24,889,613	
II. Research.....	82.0	457,257	167,419	624,676	
III. Administration.....	343.4	1,479,366	114,059	1,593,425	
Subtotal, full-time, all activities.....	4,144.3	20,653,078	6,133,636	26,786,714	
Total direct obligations.....	4,322.3	20,974,078	6,133,636	27,107,714	
Add:					
1. Charges for quarters and subsistence.....	.....	40,576	.....	40,576	
2. Reimbursements from other accounts.....	1.9	9,931	22,205	32,136	
3. Reimbursements from non-federal sources.....	5.8	38,779	47,810	86,589	
Total obligations incurred.....	4,330.0	21,063,364	6,203,651	27,267,015	



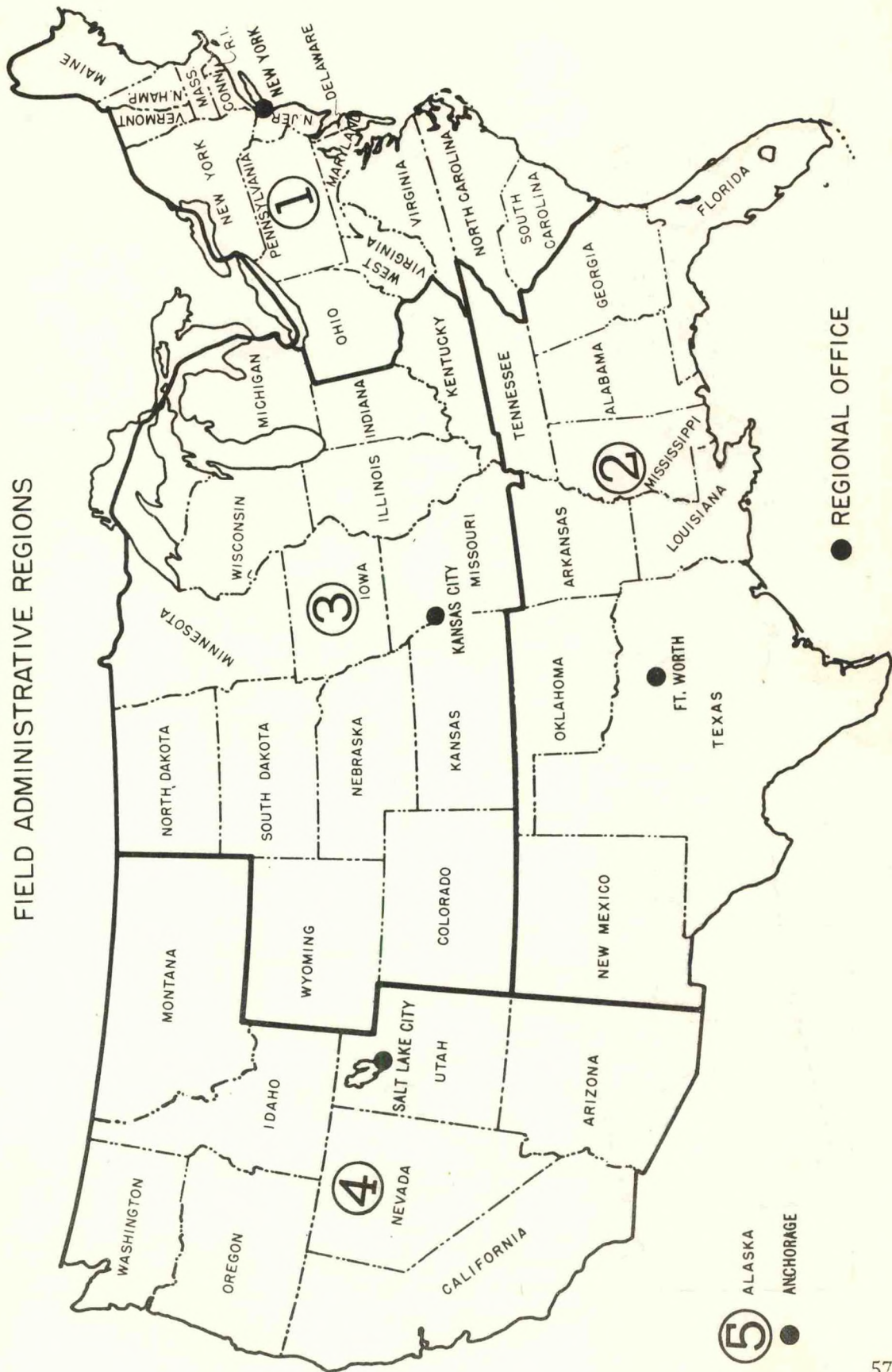
GENERAL WEATHER FORECAST DISTRICTS & CENTERS



PLUS: HONOLULU, T. H.  
ANCHORAGE, ALASKA  
SAN JUAN, PUERTO RICO, V. I.



**U. S. DEPARTMENT OF COMMERCE  
WEATHER BUREAU  
FIELD ADMINISTRATIVE REGIONS**





UNITED STATES DEPARTMENT OF COMMERCE  
WEATHER BUREAU  
WASHINGTON, D. C.

Office of Chief/Oc.  
(File No. 070.2, 000,  
420.3, 620.8, 622.1)

March 9, 1948

CIRCULAR LETTER NO. 22-48  
(TO ALL STATIONS)

Subject: Policy With Respect to Private Practice of Meteorology and Instructions Regarding Cooperation With Private Meteorologists.

All employees should be familiar with the policy on extension of applied meteorology and development of private meteorological services to meet commercial and industrial requirements beyond the scope of Government services. This policy has been stated from time to time during the past several years in public announcements and bureau correspondence. It is based not only on the Government's general policy of fostering private enterprise but also on the fact that applied meteorology in general will benefit through a competent and vigorous body of private practitioners. Advantages will accrue also to the Bureau and its meteorological services as result of broader development of applied meteorology. There will be problems and individual difficulties that arise from competition, duplication and questions of professional ethics but these will not outweigh the general advantages. To assist in carrying out this policy, the following specific instructions are issued summarizing the provisions now in effect in the interest of good, coordination and cooperation:

1. Weather Bureau facilities should be directed primarily towards--  
(a) adequate and accurate observations, reports and records of weather and climate; (b) superior service in storm, cold wave, etc., warnings and advisories, and in regular forecasts for public dissemination by radio, television, press, automatic transcription telephone, etc., and (c) authorized research and development projects for the general good. The Bureau has an excellent tradition of courteous and helpful service to individuals who call at its offices or telephone for weather information, and this form of service will be continued wherever possible. But with the increasing interest in and applications of meteorology, the Bureau cannot serve all individuals and business concerns who request information. Individual calls should not be allowed to interfere with prompt and efficient services to the general public by radio and press, and other broad responsibilities of the Bureau.

2. Weather Bureau offices are authorized to give special advices on an industry-wide basis for general fields of application, such as agriculture, transportation, shipping, etc., but these services should not be individualized to an extent of becoming private consultant advices like those referred to in paragraph 4, below.

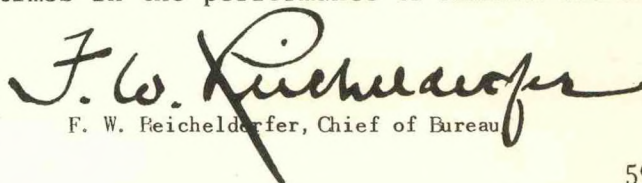
3. Field offices of the Bureau are authorized and urged to cooperate with private meteorologists engaged in ethical and legitimate practice of the profession in accordance with the terms of our teletype service agreements. The Weather Bureau must not permit an impression



that it has "exclusive rights" in the science and practice of meteorology. In public statements and contacts with private meteorologists, employees of the Bureau may not question the rights of any agency or person to employ the services of a private meteorologist. Public controversies over the relative values of services or the accuracy of forecasts should be avoided. It is the general policy of the Federal Government not to express opinions on the merits of private enterprises except when the statutes place on a Government agency this specific authority. Suspected violations of ethical practices, or activities believed to be contrary to the public interest should be reported to the Central Office and not made the subject of local action or statement unless authorized by the Central Office. In most cases private meteorologists have shown the desire and ability to cooperate well with Weather Bureau offices with mutual benefit to their services and the public services of the Bureau.

4. Weather Bureau offices are not authorized to give individualized services to private agencies which call for special study or prolonged attention. Persons who request services of a private nature should be courteously referred to commercial sources of weather information or to the American Meteorological Society which endeavors to put private inquiries in touch with consultant sources. As a guide it may be stated that the general rule is for field offices of the Bureau not to furnish regular daily services to any individual or business when they require special studies or lengthy interviews each day. The time limitation would not apply as strictly to single (i.e. not daily) interviews on meteorological problems of a new or non-recurring nature not large enough to require the services of a private meteorologist. In general, the field of private practice in meteorology will supplement and individualize the services of the Weather Bureau, not directly duplicate them. Usually, a question on whether a private request is within the province of a government service or should be referred to private sources can be decided by comparison with similar cases in other professions, such as engineering or law. If in analogous cases the matter is one for a private engineer or a lawyer, it probably falls within the province of the private meteorologist. The Bureau must refrain from giving at public expense services that are definitely outside the sphere of government functions and in such cases, we have a public obligation to cooperate in the advancement of applied meteorology by referring such inquiries to reliable sources of private consulting services, if known. When in doubt, such cases should be referred to the Central Office.

Nothing in these instructions is to be construed as prohibiting issue of information, forecasts and warnings to any person or organization in times of emergency when such action is in the public interest and required for safety of life and property. Further, these instructions do not modify the long standing policy throughout the Bureau of being alert to opportunities for greater public service and encouraging a helpful and progressive outlook at all times in the performance of official duties.

  
F. W. Reichelderfer, Chief of Bureau