BY THE COMPTROLLER GENERAL

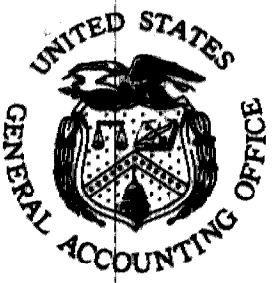
Report To The Congress

OF THE UNITED STATES

The Federal Weather Program Must Have Stronger Central Direction

Weather programs operated by seven Federal agencies are expected to cost $650 million in fiscal year 1979 and larger expenditures are planned for the future.

The Department of Commerce should provide stronger central management of the programs in order to eliminate duplication of services by the agencies.



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COMPTROLLER GENERAL OF THE UNITED STATES
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To the President of the Senate and the
Speaker of the House of Representatives

Although some progress in coordinating weather programs has been made, there appears to be potential for improved service at lower cost. This report points out the need for better coordination and resource allocation by the Department of Commerce to eliminate duplication of services by the agencies.

We are sending copies of this report to the Director, Office of Management and Budget, and to the Secretaries of Commerce, Defense, the Navy, and the Air Force.

Comptroller General
of the United States

COMPTROLLER GENERAL'S REPORT TO THE CONGRESS

THE FEDERAL WEATHER PROGRAM MUST HAVE STRONGER CENTRAL DIRECTION

D I G E S T

The Federal weather program is fragmented and costly. The operational weather programs of seven agencies are estimated to cost $650 million in fiscal year 1979 and larger expenditures to improve current capabilities are planned. (See pp. 6 and 7.)

To reduce these costs and to more effectively meet civil and military weather requirements, the agencies involved must have strong central coordination and direction.

The Bureau of the Budget (now the Office of Management and Budget (OMB)) attempted to provide such coordination by issuing Circular A-62 in 1963. The circular gave the Department of Commerce a central role in meeting and coordinating the Government's weather information needs and responsibility for curtailing redundant operations by planning and reviewing weather services.

Since the circular was issued, Commerce has made progress in coordinating weather programs; it has furthered the exchange of information among agencies and has arranged some multiagency efforts, such as the development of an advanced radar system. But much stronger central direction is needed to establish the optimum configuration of weather services, staff, and support capabilities and to prevent the establishment of redundant capabilities.

Needed improvements include:

--Firm leadership.

--More comprehensive short- and long-range planning.

--More indepth, systematic program reviews.

--An independent, full-time staff to make such plans and reviews.

The proposed National Weather Act of 1978 attempted to provide remedies for current deficiencies in coordinating weather programs, but the act was not enacted.

BETTER PLANNING AND REVIEWING NEEDED

The three major weather organizations--the National Weather Service, Air Weather Service, and Naval Oceanography Command--often provide similar types of services covering the same geographical and atmospheric areas. (See p. 6.) Such redundancies can be eliminated by sharing and/or consolidating resources and responsibilities.

To take advantage of such opportunities a long-range Federal weather plan must set forth current and future requirements and how the requirements can best be met. Further detailed program reviews must monitor the plan's implementation. Good planning and reviewing are of particular benefit in assessing the need for future acquisitions and improvements of weather capabilities, because they can prevent unnecessary expenditures. (See pp. 9 and 26.)

Commerce's review system is too informal and too limited to ensure that Federal agencies use the best service arrangement. Agencies' proposals to change their programs, for example, are not required to be formally submitted to Commerce for review. As a result, Commerce has little opportunity to determine the relative costs and benefits of proposals. (See pp. 15 and 28.)

Rather than actively planning and reviewing weather programs to improve their efficiency and effectiveness, Commerce officials prefer to wait until opportunities conducive to

integration arise. This passive role is partly because of Commerce's lack of authority as a lead agency.

Because Circular A-62 does not contain enforcement provisions enabling Commerce to carry out its coordinating efforts, Commerce officials must rely on their own persuasive ability and other agencies' goodwill. And because Commerce does not have any budgetary authority over other agencies, its ability to prevent unnecessary costs by recommending joint development or procurement efforts has been very limited. (See p. 10.)

Commerce, in an advisory role to OMB, should be granted authority to assess agencies' weather budgets and programs in relation to other agencies' programs or to a national plan.

Another reason for Commerce's ineffective leadership is that its weather coordination office does not have sufficient full-time staff nor the independence to assess agency requirements. (See p. 13.)

POTENTIALLY PARALLEL OR REDUNDANT CAPABILITIES

Because centralized planning and reviewing are inadequate, agencies generally maintain or develop capabilities to satisfy their own needs without considering the others' capabilities and requirements. Justifications for parallel capabilities, however, should be evaluated before being accepted. (See p. 28.)

Examples of questionable capabilities are summarized below.

--Each of the three major weather organizations operates its own primary computer center using a similar forecasting process. All three centers plan to increase their

computer capabilities but did not fully consider the others' requirements or capabilities in making their plans. Commerce also has not made an indepth study of the need for three centers. (See pp. 8 and 29.)

--Both the National Weather Service and the Air Force provide severe weather warning services through separate organizational structures. (See p. 32.)

--The National Weather Service, Navy, and Air Force provide common aviation services but use different operating methods. (See p. 33.)

In each of these cases, the potential exists for one organization to meet the other's requirements or for operations to be consolidated for more efficient service arrangements.

RECOMMENDATIONS

Since the Congress has never prescribed in a single document national policies, responsibilities and programs regarding weather services and supporting research, Commerce draws its basic authority and responsibility from Circular A-62. While the circular generally provides the policy and procedural guidelines, certain ambiguities exist, and GAO believes the authority given is not sufficient to achieve effective central direction.

Therefore the Congress should enact legislation which would:

--Reaffirm the central agency role for weather and specifically define its authority and responsibilities concerning civil and military weather organizations.

--Strengthen the central agency's role by requiring it to assist OMB in its annual

review of agencies' budget submissions by providing comments and recommendations on budgeted activities and on their consistency with the central agency's overall Federal plan or plans.

GAO wil provide specific legislative language to the Congress upon request.

Other recommendations for improving plans and operations are contained on pages 22 and 34.

AGENCY COMMENTS AND GAO'S EVALUATION

OMB and the Departments of Commerce and Defense basically agreed with the main thrust of the report. Although some progress in coordinating weather programs has been made, there appears to be potential for improved service at lower cost through better coordination and resource allocation. This is true, particularly as new and expensive technologies are introduced along with the potential requirement for major system changes in the near future.

The other key comments were:

--Difficulties pointed out in the report center on problems of implementation of A-62, not a lack of clarity in authority and responsibility for coordinating weather services. Therefore, while not opposed to legislation which would reaffirm the provisions of Circular A-62, they do not consider it necessary.

--Renewed interest and concern is needed at the highest levels; it is now being generated and several actions are underway to improve coordination and isolate potential areas for improved services at less cost.

--Emphasis should be on coordination, informing one another of weather activities and waiting for targets of opportunity to surface for integrated support.

--GAO's primary proposal appears to be that one agency should have direct control, including management and budgetary authority, over other Federal agencies.

GAO recognizes that there are alternatives available to provide the central direction which it believes necessary. One alternative would be to develop a weather service agency similar to the recently established Federal Emergency Management Agency, which is responsible for emergency preparedness. Another would be establishing an oversight organization within OMB.

GAO believes that a "national" weather service may be the most effective organization for providing central direction. At this time, however, the lead agency type organization can provide for effective and efficient services if it is given sufficient authority to develop national plans, analyze customer requirements, review capabilities to provide services, and make recommendations on how best to provide the weather services.

GAO applauds current actions to improve coordination and isolate potential areas for improved services at less cost. However, more needs to be done to assure that these actions are of a continuing nature--ambiguities need to be removed from current directives, weather services need to be clearly defined, and the authority and responsibilities should be specifically spelled out. GAO suggests that the best approach to reaffirm the intent of the Congress, plus remove the ambiguities, etc., is through legislation.

The Department of the Defense provided oral comments to the report. OMB comments are in appendix V and Department of Commerce comments are in appendix VI.

Contents

ABBREVIATIONS

GAO	General Accounting Office
OMB	Office of Management and Budget
NWS	National Weather Service
NOAA	National Oceanic and Atmospheric Administration
MIPS	million instruction per second

GLOSSARY

Basic weather services	All activities required to produce or complete a description in time and space of the atmosphere. In general, the products of this process are meteorological in nature and are not necessarily useful for users' operational needs.
Service agency	An agency that provides user agencies with the weather services.
Specialized weather services	Those activities, generally derived from output of basic services, which produce products needed to serve the operational needs of particular user groups, such as aviation, agriculture, business, commerce, and industry and military.
User agency	An agency whose mission requires meteorological services either for its internal operations or as part of its direct services to a clientele group.
Weather	Includes both meteorological and oceanographic functions such as marine weather. The term will be used interchangeably with "atmospheric" in this report.
Weather functions	The functions performed by Federal agencies in weather observations, analyses and forecasts, communications, dissemination of data, and general support groups.

CHAPTER 1

INTRODUCTION

The objectives of the Federal weather program are to

--reduce the economic and social impact of natural disasters,

--promote the Nation's welfare and economy,

--preserve and enhance the quality of the environment, and

--strengthen national security.

To meet these objectives, seven Federal agencies (shown in the chart below) are involved in basic and/or specialized weather services. Basic services, which constitute the analysis and forecast process, meet public needs and fulfill requirements common to two or more agencies. Specialized services are developed by tailoring this basic data to specific purposes, such as aviation, marine, agriculture, or military applications. For example, a specialized aviation service may be an enroute weather report identifying visibility, icing, turbulence, or thunderstorm activity.

Planned expenditures for basic and specialized programs and supporting research to be conducted by the seven agencies total $763 million during fiscal year 1979, as shown below. (See app. I for further details.)

	Operational programs		Research programs	Total
	Basic	Specialized		
	(000,000 omitted)			
Commerce	$271	$ 31	$ 18	$320
Defense	43	226	40	309
Other (note a)	11	67	56	134
Total	$325	$324	$114	$763

a/The other agencies are the Departments of Agriculture, Energy, and Transportation; the National Aeronautics and Space Administration; and the Environmental Protection Agency.

As can be seen, the Departments of Commerce and Defense have the most extensive operational programs. They operate the Nation's three major weather organizations: the National Weather Service (NWS), under Commerce, and the Air Weather Service and the Naval Oceanography Command (~~formerly the~~ Naval Weather Service Command), under Defense. (See app. II for background information on these organizations.)

Operational weather forecasts are made by each organization's primary center, specialized centers, and local and regional forecast service offices. Because these three organizations provide both basic and specialized services, they can be considered the heart of weather operations. The specialized centers provide such services as severe storm or hurricane forecasts, and the forecast offices primarily translate basic services received from the primary and specialized centers into specialized forecasts. (See app. IV for an explanation of the operational forecast process.)

REDUNDANT PROGRAMS-- A LONGSTANDING CONCERN

Overlapping Federal weather programs have concerned both the Congress and the Office of Management and Budget (OMB) for more than a decade. In 1962, after studying overlapping or redundant facilities and services, the Bureau of the Budget (now OMB) reported 1/ that existing divisions in weather operations were the result of historical events and adjustments made to meet changing needs, rather than careful planning. The report also noted the need for "strengthening of existing arrangements for planning and coordinating meteorological programs."

Recognizing the need for policy guidance in weather activities, the Congress enacted section 304 of Public Law 87-843 in 1962, which stated:

> "The Bureau of the Budget shall provide the Congress in connection with the budget presentation for fiscal year 1964 and each succeeding year thereafter, a

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1/"Survey of Federal Meteorological Activities," dated March 1962.

horizontal budget showing (a) the totality of the programs for meteorology, (b) the specific aspects of the programs and funding assigned to each agency, and (c) the estimated goals and financial requirements."

In November 1963 the Bureau issued Circular A-62 to provide agencies with needed policy guidelines governing weather services. The circular established a Federal policy for assessing agency roles in weather activities and for setting goals to be achieved by effective coordination. Most noteworthy, the circular gave Commerce a central role in meeting and coordinating the Government's weather information needs.

The proposed National Weather Act of 1978 (H.R. 13715) reflected more recent congressional interest in weather programs. The bill, considered but not enacted by the 95th Congress, attempted to provide remedies for deficiencies in the present coordination of the programs.

CURRENT FEDERAL COORDINATION MECHANISM

Although Circular A-62 did not designate Commerce as the single central manager of weather services, it made Commerce responsible for identifying inefficient and uneconomical operations through systematic reviews and integrated planning of basic and specialized services. To carry out its review and planning responsibilities, Commerce established the Office of the Federal Coordinator for Meteorological Service and Supporting Research. Two interdepartmental committees, one for services and the other for applied research, were also established to assist the Office of the Federal Coordinator in its reviewing and planning responsibilities.

Commerce also established the Federal Committee for Meteorological Services and Supporting Research to provide policy guidance to the Office of the Federal Coordinator and to review proposed Federal plans and resolve interagency differences. If major differences among agencies could not be resolved through the Federal Committee, they were to be referred to the Executive Office of the President.

PREVIOUS GAO STUDIES

Previous GAO reports which have addressed the need for better planning and coordination of the three weather organizations' programs and capabilities follow:

--In March 1977, we reported (B-133202) on the feasibility of consolidating weather briefings for general aviation pilots because both NWS and the Federal Aviation Administration provided such briefings. (The Aviation Administration and NWS are coordinating aviation services under an interagency agreement, dated January 24, 1977.)

--Also in March 1977, we reported (LCD-76-445) on the feasibility of consolidating certain aviation weather services. We suggested that NWS, the Air Force, and the Navy had not actively fostered the integration of common military and civilian aviation requirements and functions. Instead, the three services operated weather stations which appeared to have overlapping functions.

--In March 1978 (CED-78-77), we pointed out that the effectiveness of specialized services for aviation, agriculture, air pollution, and marine activities had been hampered by the lack of specific and up-to-date plans.

During this review, we isolated two additional issues which were separately reported to the Secretary of Defense. The first issue paralleled the lack of coordination theme in this report but was isolated to coordination between the Navy and the Air Force in developing their computer flight plans. We brought this to the attention of Defense on October 10, 1978 (LCD-78-437), because independent Air Force and Navy actions which would lead to duplicative effort were at that time imminent.

The second issue was that the Air Force had not sufficiently explored the availability and use of host nation support for weather services in Europe as part of Defense's overall program to rely more on host nation support services (LCD-79-413 dated May 11, 1979).

SCOPE OF REVIEW

We made this review to assess the adequacy of existing Federal coordination mechanisms for ensuring the effective use of civilian and military operational weather capabilities and fully integrated national weather programs.

We examined the three weather organizations' basic and specialized services, including their plans to coordinate these services among agencies.

We held discussions with officials from OMB; the Departments of Defense, including Air Force, Navy, and Army; the National Weather Service; and private users of weather services.

We also reviewed the legislative history of weather programs and OMB circulars and implementing guidelines.

CHAPTER 2

ISSUES AND PROBLEMS IN ESTABLISHING EFFECTIVE CENTRAL DIRECTION OF THE FEDERAL WEATHER PROGRAM

The organizational structure of the Federal weather activities is fragmented and costly. Operational weather programs are planned to cost almost $650 million in fiscal year 1979, and large expenditures to improve current capabilities are planned over the next several years.

To reduce these costs and to more effectively meet weather information requirements, the agencies involved must have strong central direction based on a comprehensive weather plan and continuing program reviews. As the designated lead agency, the Department of Commerce should provide such direction with a view toward the full integration of weather services. At issue are two basic questions.

--Do the current weather organizations provide the most cost- and mission-effective weather services to the Federal Government?

--What is the Government's optimum configuration of weather services, staff, observation stations, satellites, primary centers, and forecasting offices?

WHY IS CENTRAL DIRECTION NEEDED?

The National Weather Service, Air Weather Service, and Naval Oceanography Command have missions to meet the weather information needs of the general public, special users, and the military. While NWS primarily serves civilian users in the United States, the Air Force and Navy organizations serve military users throughout the world. However, the three weather organizations share interest in common geographic and atmospheric areas.

To meet the various user information needs, the three organizations operate extensive weather networks. As described in appendix II, the networks are comprised of primary centers and a large number of regional and local or base weather offices. The following table shows staff and expenditures for fiscal year 1978.

	Cost	Personnel (note a)
	(000,000 omitted)	
National Weather Service	$194	5,089
Air Weather Service	84	3,916
Naval Oceanography Command	41	1,602
Total	$319	10,607

a/Assigned as of September 30, 1978.

Thus, at a substantial cost, the weather organizations operate from similar types of offices, and their basic analysis and forecast often cover the same geographical and atmospheric areas. As demonstrated in chapter 3, the organizations sometimes provide similar types of weather services. Sharing and/or consolidating parallel capabilities could offer opportunities for savings. Effective central coordination and direction of weather programs would be necessary to identify and to take advantage of such opportunities.

Furthermore, demands for a fiscally responsible Government emphasize the need for coordination in planning future capabilities and expenditures. Commerce and Defense, for example, are planning to extend forecast periods and increase forecast accuracy by developing improved mathematical models. Since more sophisticated models require more computation, Federal agencies also plan to spend substantial funds to replace and/or upgrade their computer capabilities. The 1975 Federal Computer Plan for Operational Forecasting and Atmospheric Modeling Research projected expenditures of about $64 million for seven Federal agencies in fiscal years 1978 and 1979 alone. Both Commerce and Defense also plan to upgrade primary weather facilities with more powerful computer systems as shown below.

--NWS' primary center uses the National Oceanic and Atmospheric Administration's (NOAA's) computer service center for basic computational support. The center's computer system is basically composed of three IBM 360/195s for major computer power and several smaller systems for processing weather data. Each IBM 360/195 has a total computing power of 10 to 15 million instructions per second (MIPS). Plans are to upgrade and/or replace the system in the 1980s. In addition,

NWS' primary center operates several smaller computers, used for communications, which are continually upgraded.

--The Air Force's primary center operates a computer system composed of three UNIVAC 1110 computers of 2.5 MIPS each and several small supporting computers. Plans are being made to increase the computing power to 12 MIPS in 1979 and 45 to 50 MIPS by 1985.

--The Air Force recently requested procurement authority to upgrade two large-scale computers and to support its center's operation. As discussed on page 32, the House Committee on Government Operations asked us to analyze this procurement. The Committee believes that this acquisition is but a small part of a large Air Force plan to replace, at a total cost of over $100 million, its entire complement of computer equipment.

--The Navy's primary center operates a computer system comprised of three CDC 6500 computers of 1.8 MIPS each and one Control Data Corporation Cyber 175 computer of about 6 MIPS. The Navy is in the process of increasing its computing power to about 67 MIPS by 1980.

Development efforts and plans are not confined to improved models and larger computers. All three weather organizations have ongoing efforts to improve observation and forecast capabilities through the introduction of automatic sensors and the increased use of visual forecaster aids and minicomputer systems. These and other developments require substantial funds. For instance, subject to funding approval, the Air Weather Service's fiscal year 1978 master plan shows estimated funding requirements of $362 million for the 8-year period ending 1985.

WHAT IS EFFECTIVE CENTRAL DIRECTION?

To effectively coordinate extensive civil and military weather capabilities, Commerce must exercise leadership in developing future plans to meet requirements and in making sure that current service arrangements are as effective as possible. In such a leadership role, Commerce must have sufficient authority to oversee other agencies' programs, as

well as a firm commitment, adequate resources, and the objectivity to evaluate weather services and identify opportunities for better service arrangements.

In commenting on our report, OMB, Commerce, and Defense were concerned that we were proposing that one agency should have direct control, including budgeting and management authority over other executive departments and agencies. This is not our intent--we recognize that OMB has this authority.

In the content of this report, centralized direction does not mean line management or budgetary authority over the operations of the various Federal agencies involved in weather activities nor that Commerce can direct them to adjust their programs. Rather, it means establishing the combined Federal peacetime and wartime weather requirements as computed and justified by the agencies, analyzing these requirements in relation to capabilities, controlling planning for the most effective and economical way to meet these requirements, and recommending/advising OMB as to the best approaches for providing weather services at less cost.

Firm leadership authority

The Congress has not prescribed in a single document the national policies, responsibilities, and programs regarding weather services and supporting research. Consequently, Commerce draws its basic authority and responsibility as lead agency from Circular A-62. While the circular generally provides clear policy and procedural guidelines, certain ambiguities exist and the authority given Commerce is not adequate to allow effective central direction.

Ambiguities in policy guidelines

The circular directs Commerce to meet the basic weather service requirements of the public and those common to more than one Federal agency and to arrange for other parties to provide such services when doing so would be effective and economical. Recognizing that certain weather requirements cannot be met through basic services, the circular also gives Commerce some control over the procedures agencies should follow in obtaining special services.

In spite of the circular's apparent intent to put Commerce in a lead position, a number of ambiguities exist.

For example, the just-mentioned provisions of the circular do not apply to weather activities involving special security considerations. What constitutes these considerations or who decides when they are present is not clear.

Furthermore, the circular does not provide Commerce with sufficient authority to lead and effectively implement its procedural and coordinating efforts. Commerce officials told us that, because the circular provides limited authority, the Office of the Federal Coordinator must rely heavily on its own persuasive ability and Federal agencies' goodwill to get positive action. According to the Federal Coordinator, his office looks out for opportunities offering potential for improved service arrangements and relies heavily on coaxing Federal agencies into action. Although the Federal Coordinator considered this management approach effective, he agreed that the approach was partly influenced by the Office's limited authority and staffing. Similar views were voiced by a former Federal Coordinator who said the Office can plan, coordinate, and advise; however, the Office cannot implement needed actions without OMB or agency backing.

Such limited authority does not appear to be sufficient for effective central direction. We are not implying that Commerce should determine and validate all peacetime and wartime weather requirements or even provide all the necessary weather services. But, it must have the authority and responsibility to plan, review, and propose how, when, and where these services can be provided most effectively and economically, and, in turn, recommend appropriate actions to OMB. Although the Congress started to address this issue in a bill that would have become the National Weather Act of 1978, the bill was not enacted into law.

The current central agency concept needs to be strengthened

Besides clarifying Commerce's role, there also exists a need to reexamine the central agency's adequacy to direct weather activities. Although Circular A-62 required Commerce to develop an integrated weather program, the circular provided Commerce with little or no authority to influence budgetary or other decisions involving individual agencies' weather services.

Circular A-62 endorsed the central agency concept by assigning a single agency, Commerce, the responsibility for overall coordination of the Government's weather program.

Operating authority and funding channels, however, continued to rest entirely with the agencies involved in weather activities. Nor did the circular stipulate that Commerce should have an advisory role to the Congress or OMB in budgetary matters involving other agencies' weather activities.

In our view, this type of central or "lead" agency approach may not be an adequate solution to the problem of fragmentation in weather service. In discussing similar problems--several Federal agencies are involved in weather modification--the Weather Modification Advisory Board stated that the lead agency solution is inadequate and a single program manager is needed to resolve existing fragmentation. The Board reasoned that:

> "Responsibility without authority is a prescription for administrative frustration, and in none of the earlier proposals was it contemplated that any authority to require action or control of fiscal resources would be vested in the 'lead agency.' By now, bureaucratic behavior patterns and constituencies and Congressional relations are so ingrained that, in our view, not even a modified 'lead agency' approach, in which the 'lead agency' might be given some budgetary screening authority, would be effective. In any case, such authority is inevitably weakened, and especially as the initial impetus gradually settles down to the pace of the long pull, by erosive effects of the forces that impel peer Agencies to avoid controversies and maintain their 'sovereignty.'"

We recognize that OMB has final budget review authority over executive departments and agencies. We believe, however, that Commerce's authority as lead agency should be broadened because without some role in funding matters, Commerce has limited ability to affect individual agencies' proposals.

In the early 1970s, NWS began to develop a system to automate the transmission and display of weather charts and forecasts. Shortly thereafter, the Navy began to develop a similar system. According to Commerce officials, the two systems are different in some respects, but a joint development effort might have been possible with proper planning and coordinated funding. The Federal Coordinator stated that initially only NWS had the necessary development funds. By the time Navy

funds were available, development of the NWS system was well underway and it was too late to modify the design to meet both agencies' requirements. As a result, the coordinator's role was reduced to merely insuring that the two systems were capable of exchanging information.

With a greater funding role, even if only advisory, Commerce could have at least alerted OMB to the cost savings possible through joint development and procurement efforts. To avoid such problems in the future, we believe that Commerce's authority as central agency should be broadened to include a budgetary screening authority. In an advisory role to OMB, Commerce should be required to comment on agencies' budgets and programs in relation to a Federal weather program.

Independent, full-time staff

Having more authority will not by itself result in effective central leadership; comprehensive planning reviews by an independent office are also needed. The office should have full-time staff members who can devote their time to objectively evaluating and planning weather services.

As mentioned in chapter 1, Commerce established the Office of the Federal Coordinator to plan and review Federal weather services. Commerce intended to provide for the Office's independence by placing it as a staff office in Commerce rather than in NWS. It also assigned 10 permanent full-time professional staff members, plus the coordinator. The importance of a full-time and independently placed staff was mentioned in a 1963 progress report, 1/ as follows:

> "The experienced personnel who make up the * * * staff have, as their specific charge, the review of agency meteorological programs for the express purpose of achieving the maximum integration of current and future meteorological services and supporting research. The staff members are able to be completely objective in their analysis and recommendations since they do not represent any agency meteorological service or research and development activity."

1/Progress report on the Bureau of the Budget Circular A-62, Nov. 13, 1963, U.S. Department of Commerce, July 1, 1965.

However, the Office no longer reflects that kind of independence; it is now placed in an operating division of NOAA, and its permanent staff consists of two part-time and one full-time professional. The Federal Coordinator who saw nothing wrong with this arrangement said that the Office's work can be more effectively done and additional part-time staff can be obtained on an as-needed basis from NOAA and other agencies participating in the interagency committees. In contrast, a former Federal Coordinator stated that the staff reduction has placed more responsibility on the part-time staff, who often lack the time and interest to devote much effort on areas outside their normal duties and who have difficulty in remaining totally objective in matters concerning their respective agencies.

We believe that the sizable reduction in full-time staff must be partly responsible for the Office's passive role and that the increased objectivity of an independent, full-time staff would outweigh the savings from using other agencies' part-time staff. We also believe that the committees established by Commerce are an excellent forum for exchanging information and discussing issues and problems; however, the committees do not offer sufficient independence from everday pressures to carry out effective program reviews and planning.

Federal weather plan

Once an independent central management mechanism has been established, a Federal weather plan should be prepared. To do so, current and future requirements must be established and validated by user organizations and current weather services, equipment, and other support capabilities must be assessed by service organizations. Only then can the Federal Coordinator merge the combined peacetime and wartime requirements and capabilities into an integrated, long-range plan that sets forth how and where the requirements can best be satisfied and what weather activities should consist of in the future.

Circular A-62 requires the development of a comprehensive Federal plan to assess and direct weather services and supporting research and to achieve the maximum integration of current and future services and research consistent with the effective and economical accomplishment of mission requirements. As discussed in chapter 3, Commerce has not developed a comprehensive plan, and published plans lack the

detail needed to adequately review agencies' programs. Without a comprehensive plan, Commerce has little basis for evaluating, and taking advantage of opportunities to integrate, weather services. In addition to dollar savings, such opportunities could offer other benefits. For example, in the computer area:

--Economies of scale are the savings attainable when a larger, more accurate computer is used to make computations faster and at a lower cost. Weather forecasting could benefit if such economies were planned. For instance, NWS and the Air Force's primary centers run primitive equation models to forecast weather in the Northern Hemisphere, but NWS cannot provide the forecast for the Air Force because of the Air Force's time constraints. A faster computer might allow NWS to do so.

--Economies of specialization are available from certain computers that are especially efficient for scientific computing purposes. Large and complex mathematical computations, such as those used in weather modeling and some other scientific applications, could benefit from such economies.

--Standardization means that two or more components or systems are interchangeable or compatible. In the case of broad scale weather forecasting, planned standardization of computer hardware may allow the primary centers to meet each other's requirements. However, each primary center used different mainframe computer hardware, so the computer programs for models and applications are not written in a completely compatible format. In part, the lack of computer compatibility is reflected in the weather organizations' limited backup capabilities, as discussed on page 20.

Detailed program reviews

Detailed program reviews, which should monitor implementation of a Federal weather plan, are another important element of effective central direction. The reviews should question weather services, functions, and capabilities to identify opportunities for better service arrangements or development efforts.

Circular A-62 requires systematic and continuing reviews of basic and specialized weather requirements and services. These reviews are to promptly identify the need for new or revised services, to develop those basic or specialized services that most efficiently meet the need, and to arrange for the conduct of such services by those Federal or non-Federal organizations offering the most effective and economical arrangement. Again, however, Commerce has not met the review requirements and objectives established by the circular. Without detailed and ongoing program reviews, opportunities for improvements can be missed, instead of being recognized early and aggressively pursued.

For instance, all three primary centers use their own Northern Hemisphere atmospheric prediction models for broad-scale operational forecasts. Both NWS and the Navy also use models to forecast wave and swell height and direction, although the Navy's more sophisticated model can forecast more facets of waves and swells than the NWS model. Officials of all three weather services told us that the models had not been formally studied to determine their relative value (cost and benefit analyses) in order to identify the best one for operational use. Their failures to make formal comparisons underlines the need for Commerce to make detailed reviews.

WHAT ARE THE POTENTIAL BARRIERS TO INTEGRATING WEATHER SERVICES?

In planning and reviewing weather services with a view to their full integration, Commerce must consider certain issues which have been raised as potential barriers. Although many of the issues have merit, they generally need to be studied further before accepting them as justification for continued redundancy in weather capabilities. The major issues are:

--Different agency requirements for basic and special service.

--Stateside position requirements for military staff returning from ship or overseas duties.

--Backup requirements.

Different agency requirements

The military consider their basic and specialized weather requirements to be the chief barriers to integrating weather services. To justify separate weather capabilities, they contend that such capabilities are needed to meet their users needs in terms of security response time, level of detail, and worldwide coverage. The military believe that the civilian sector lacks the responsibility and capability to meet such extensive requirements, thereby, concluding that separate capabilities must be maintained.

We agree that the civilian sector currently lacks the responsibility and capability to satisfy the military and others' total requirements. We also agree that it is not necessary or always practical for one organization to satisfy all user needs. But, does each weather service need comparable capabilities? Isn't there potential for interservice/interagency servicing? If all requirements were isolated, and, where necessary, uniqueness well defined and justified, couldn't appropriate capabilities be developed and responsibilities assigned to not only achieve economies but also improve services?

We did not evaluate user requirements to determine their essentiality. Nor should the lead agency, as we envision its future role. As entitled, weather services are service organizations--they do not establish weather service requirements. They determine what is needed to satisfy customer requirements--how to provide the service.

The lead agency would generally decide how best to provide the service without jeopardizing user agency's mission effectiveness. While obvious differences do exist in specific user agencies' weather information requirements, uniqueness in certain areas should not form the basis for self-sufficiency.

Does the need for basic services justify separate basic capabilities? We think not. Does the need for common specialized requirements justify separate capabilities? We think not. Does the need for unique specialized requirements justify separate capabilities? This depends on what makes them unique.

Basic weather services

Although Circular A-62 established Commerce as the prime provider of basic weather services, both the Air Force and the Navy also provide basic analyses and forecast services. Military officials justify this situation by saying that Commerce does not have the capability to meet their basic requirements. However, we were told that all three weather organizations could provide the others with required services if the requirements were well defined and if the needed staff and financial resources were provided. Since resources can be provided through direct appropriations and/or transfer of staff, personnel ceiling points, funds, or facilities and since services can be defined through interagency agreements, there appears to be questionable support for basic service capabilities at all three weather organizations.

Special weather services

In contrast to basic services, the issue of specialized services is more clouded. Circular A-62 defines "specialized meteorological services" as those derived from basic services and used by special users, such as agriculture and aviation groups, but does not differentiate among the services.

In our view, specialized services can be divided into two categories: those unique to military and civil users and those common to both. For instance, both civil and military aviation users require such common specialized services as terminal aviation forecasts, area and route forecasts, computer flight plan services, and severe weather warnings. In contrast, special mission support, command and control, and intelligence weather services are unique to military users, and crop forecasts are unique to agricultural users.

Such a distinction is important because, in the past, the Bureau of the Budget maintained that no one central agency can meet all user organizations' service requirements. In commenting on this, the Bureau reported in 1962:

> "The internal meteorological requirements of some agencies are so highly specialized and enmeshed with their basic missions that they cannot be effectively met by a central agency. Concentration of responsibility for specialized

meteorological activities in such agencies facilitates effective programming responsive to agency needs. Finally, the value of some meteorological programs can often be more readily recognized when closely identified with the mission they support."

This suggests that Defense and other mission-oriented agencies can translate weather needs to operational requirements because they have weather service as well as mission responsibilities, while Commerce cannot make such translations because it has only weather responsibilities.

While we agree with this rationale in regard to some unique specialized services as discussed below, we question it with regard to more common services and believe potential does exist for interagency arrangements. Looking at the issue first from a functional point of view, the work steps necessary to arrive at a terminal aviation forecast, for example, appear to be the same for both military and civil weather organizations. What is different is the format, frequency, and the detail of the forecast elements which are more a function of user requirements and forecast preparation rather than association with the mission. If these requirements are known in total, the best service arrangements can be centrally planned for and integrated if appropriate. In addition to aviation, marine and severe weather services represent common specialized services where additional potential exists. (See pp. 32 and 33.)

Next, looking at the issue from a service point of view, there appears to be no major reasons why, for example, NWS personnel could not provide some specialized services to military users as long as the expertise exists and the requirements were defined. In some respects, such a provider-user relationship already exists between NWS and the Federal Aviation Administration. NWS forecasters provide the Aviation Administration with aviation forecasts for 48 terminals and 328 routes on a scheduled basis. Further, staff of the two agencies work together at several flight service stations to provide time-critical weather assistance to enroute pilots; thus, in a sense, NWS is providing mission support.

A similar provider-user relationship exists between the Army and the Air Force. Under joint regulations, 1/ the Air Force provides the Army with most weather information. In the operational decisionmaking process, however, the Army, as the mission-responsible organization appears to be expected to make the needed operational translations. Except for combat field support and other unique services, the Air Force's services to the Army therefore appear to be similar to NWS' services to the Aviation Administration. Accordingly, the need for military self-sufficiency can be selectively questioned.

Unique military specialized weather services includes special mission support, command and control, and intelligence weather services. Should these requirements automatically be satisfied by the military services? We believe uniqueness should be well defined and supported. Many of these specialized services may and possibly should be best serviced by a Defense organization, especially war zone requirements.

But what makes them unique? Is it where the service is provided? On ship? On land in the front lines? If it is out of the battle zone, is it essential that the U.S. military provide the service? Could host nation support in overseas locations or NWS within the continental United States provide the services?

Is it because of security considerations? As discussed earlier, Circular A-62 does not apply to weather activities involving special security considerations. Considering the current and projected state of the art in providing for secure transmission and data protection, we believe that security considerations should not automatically be excluded from intergrated servicing. In the past, there may have been very valid reasons for their exclusion, but do the same conditions exist now?

We believe that similar "changing times" rationale should be considered in evaluating all so-called mission, command, wartime, etc., related user agency requirements. Again, there may be many valid reasons for unique specialized services being satisfied by a Defense organization.

1/ Army Regulation No. 115-10 and Air Force Regulation No. 105-3, dated June 9, 1970.

But, we do not believe that they should automatically be excluded from interagency/interservicing consideration. Further, the last 15 years have brought about new technologies--such as more secure or faster communications and computer systems--which may alleviate barriers to integrating military and civilian weather services.

Stateside position requirements

Also of concern to the military are stateside position requirements for military staff returning from ship or overseas duties. That is, military positions must be kept in U.S. military weather organizations so that personnel can maintain proficiency in weather operations when they are not aboard ship or overseas.

This barrier to integrating civilian and military weather services is questionable, in our opinion. We see no reason why military personnel could not maintain their skills by working with civilians at civil weather organizations or at joint civil-military offices. For example, NWS and the military weather organizations could jointly staff centers and reduce staff shortages and military staff returning from overseas assignments could retain their positions.

Backup requirements

The need to have redundancy in certain weather capabilities in case of an emergency or backup requirements is a valid concern of several agencies. If one weather organization's computer, for example, were put out of order during a national disaster, another organization's computer should be available to produce the downed computer's forecasts.

Although the three primary centers have backup arrangements for certain basic services, one center merely runs its own model to produce forecasts for use by the downed center. This arrangement is limited, because the forecast is not based on the downed center's computer model. Furthermore, backup for special services is virtually nonexistent. Despite their limited backup, Commerce and Defense have not quantified the full nature and impact of the potential threats against their operations versus the required protection mechanisms and associated costs. Such a risk assessment is essential in evaluating the need for backup capabilities

for major investments--such as the primary centers' computers--because services are often highly dependent on accurate weather forecasts.

NOAA recently made a security study on its computers (those NWS uses). The study recommended, in part, that NOAA (1) make a risk assessment of the specialized products and (2) use the "Federal Plan for Back-up" to make a comprehensive analysis of process and product criticality to develop a backup priority scheme. At the time of our review, NOAA officials said they were working on external backup and planning to contract for a complete risk assessment.

CONCLUSIONS

The fragmentation of civil and military weather operations through several weather organizations continue to emphasize the need for strong goal-oriented central direction. This need is reenforced by planned expansions and improvements and by the general need to pool available resources to make the Federal Government more effective, efficient, and economical. In our view, effective central direction should, to the extent possible, establish joint centers or seek other arrangements that will most economically meet basic and common specialized requirements. These actions should be taken, however, only after a long-range detailed plan has been developed on the basis of current and future requirements and current capabilities. And such a plan should be monitored through systematic program reviews.

Commerce has been designated as the central agency to coordinate and provide weather services. Although some progress has been made, much more should be done. What is needed are revisions to the planning and review efforts and clarifications of the mandate establishing the central agency role. Also needed is a reaffirmation and possibly broadening of the central agency's role in weather.

As discussed earlier in this chapter, Commerce's authority as central agency appears limited. One alternative is a central or lead agency concept which grants the budget screening authority. Such authority would strengthen Commerce's role and help the Congress and OMB to assess individual agencies weather requirements in relation to overall weather requirements and capabilities. We do not propose a role which has been historically considered a

line agency function but, rather, an independent advisory role in reviewing individual agencies' programs.

RECOMMENDATIONS

Since the Congress has never prescribed in a single document national policies regarding weather services and supporting research, we recommend that the Congress enact legislation that would:

--Reaffirm the central agency role for weather and specifically define its authority and responsibilities concerning civil and military weather organizations.

--Strengthen the central agency's role by requiring it to assist OMB in its annual review of agencies' budget submissions by providing comments and recommendations on budgeted activities and on their consistency with the central agency's overall Federal weather plan or plans.

GAO will provide specific legislative language to the Congress upon request.

Assuming that the lead agency-type organization is selected as the mechanism for assuming the central direction role for OMB and that an office similar to the existing Office of the Federal Coordinator is used as the lead agency agent, we recommend that OMB provide that this organization have sufficient staffing, funds, and independence from operating matters to assure that desired goals can be achieved.

AGENCY COMMENTS

OMB and the Departments of Commerce and Defense basically agreed with our primary message that, although some progress in coordinating weather programs has been made, there appears to be potential for improved service at lower cost through better coordination and resource allocation.

For example, the Department of Commerce stated that it is true that aspects of the OMB Circular A-62 have not been actively followed in the coordination of Federal meteorological activities. However, they believe the mechanisms have been established to seek out cases of unwarranted, redundant, or overlapping services and supporting research.

They added that although the policy level concern and coordination has decreased over the past decade, working level coordination has been active and effective. And they cite examples such as hurricane warnings, severe local storm warnings, storm reconnaissance, and working group activities in the area of automated observing systems, weather radar, and tropical cyclone research. Plus, in February 1979 a senior study group was established to identify areas for increased cooperation--marine prediction.

They also agreed that there is some overlap of weather services in the three major processing centers. They, as well as OMB, believe it timely to consider formal review of these centers now that upgrading and expansion of the computer systems will soon be necessary. Commerce has begun work in this direction in the Federal Committee for Meteorological Services and Supporting Research.

OMB also summarized additional actions which have been initiated to address the concerns they had independently identified and which are similar to those contained in our report. They have:

--Initiated cross-cut budget reviews of civilian and military meteorological satellites.

--Been meeting with Defense and Commerce officials to identify program issues which the Federal Coordinator should address.

--Begun to develop information for a possible special fiscal year 1981 budget review to provide an overview of Federal weather programs and policies.

--Asked Commerce to study alternatives for the future structure and management of its National Weather Service.

We applaud these actions and believe they not only demonstrate renewed interest but also significantly increases the coordination of weather services. However, similar activities and resolutions were present in the early days of the Federal Coordinator, but it deteriorated over time. To assure this interest does not wane as it has in the past, we believe that specific and definitive authority and responsibility has to be developed and assigned.

The commenting agencies emphasized that greater coordination is needed. They believe the difficulties pointed out center on problems of implementation of Circular A-62, not on a lack of clarity in authority and responsibility for coordinating weather services. Therefore, while not opposed to legislation reaffirming the provisions of Circular A-62, they do not consider it necessary.

In emphasizing coordination and commenting on our recommendations, OMB assumed that a single national weather program does not exist, and that agency weather programs have been developed to support the particular mission requirements of the agency involved.

We agree--there is no single Federal weather program. But, there should be, and we believe that its development is in line with the intent of the Congress both in Public Law 87-843 enacted in 1962, as well as the proposed National Weather Act.

The agencies were strongly opposed to what appeared to them to be the GAO proposal--that Commerce should have direct control, including management and budgetary authority, over other Federal departments/agencies. This is not our intent, and we have attempted to change the wording which could lead to this impression.

We recognize that OMB has the central direction responsibility, including final budget review authority. We also recognize that there are several alternatives available for providing central direction. One alternative would be a weather service agency directly responsible to OMB--similar to the Federal Emergency Management Agency which is responsible for emergency preparedness--and which combined both civilian and military responsibilities within the new organization. Another alternative would be to establish an oversight organization within OMB.

We believe that a national weather service may be the most effective organization. However, it may not be necessary at this time. We believe a lead agency organization can provide OMB both effective and efficient services and, if given sufficient authority, can develop a national plan, analyze customer requirements, review capabilities of organizations to provide services, and make recommendations to OMB on the best means of providing services.

We support current actions to improve coordination and to isolate potential areas for improved services at less cost. However, more needs to be done to assure that these actions continue. Ambiguities need to be removed from current directives, weather services need to be clearly defined, and authority and responsibilities should be specifically spelled out. We suggest that the best approach to reaffirm the intent of the Congress, plus remove the ambiguities, etc., is through legislation.

The Departments of Commerce and Defense agreed with our recommendation that the Office of the Federal Coordinator should have sufficient staff, funds, and independence from operating matters to be effective. They also suggested that the other agency personnel be assigned to this Office. This is an excellent proposal, and we wholeheartedly support a jointly staffed organization.

CHAPTER 3

CURRENT DEFICIENCIES IN WEATHER PROGRAM MANAGEMENT AND POTENTIAL SYSTEM REDUNDANCIES

In the 15 years since Circular A-62 was issued, some progress has been made in coordinating Federal weather programs. The Department of Commerce has furthered the exchange of weather information among agencies and has arranged multiagency efforts in such areas as the development of an advanced weather radar detection system. But much more systematic planning and reviewing are needed to establish the optimum configuration of weather services and staff, and support capabilities to meet the circular's requirements. The sizable weather capabilities which we found, as well as the planned and costly improvements to existing capabilities, demonstrate the need for a comprehensive framework to manage weather programs.

NEED FOR MORE COMPREHENSIVE PLANNING

To meet the planning requirements of Circular A-62, Commerce prepared implementation guidelines for a comprehensive, detailed Federal weather plan in 1964. Under the proposed guidelines, the plan would be organized by major service programs, such as basic services, aviation, and agriculture. Each program would be divided into a description of the requirements--a 5-year operating plan, including equipment and facilities, and supporting research. These sections would be further divided into major functions, such as observations and communications.

However, Commerce has not published a comprehensive Federal plan nor a series of plans covering major weather service programs or functions. Furthermore, published plans do not contain the detail proposed by Commerce's own guidelines. The Office of the Federal Coordinator publishes annually, a Federal Plan for Meteorological Service and Supporting Research. The plan is essentially a compilation of budget and some program data which presents an overview of Federal agencies' weather activities and expenditures over 2 budget years. The plan lacks the specificity necessary for reviewing agencies' weather programs. For instance, it provides status information on five basic service functions but does not clearly link this information to operational and research programs. Similarly, the cost cannot be tied to each function and individual agency.

In addition to the annual plan, the Office of the Federal Coordinator publishes individual plans covering selected basic and special services. In 1978 we reported (CED-78-77) that specialized plans were outdated due to changing user needs. Similarly, basic service plans were inadequate because they did not integrate individual agency requirements into a cohesive Federal plan nor did they address all weather functions. Two examples follow.

--Weather observation, a major activity of basic services, is divided into six functions; however, only two of the functions, rocket and weather radar, are covered by a published plan. We could not identify any plans covering upper air balloon or land and marine surface observation functions, even though Commerce and Defense programs alone included some 723 stations and 2,081 ships in fiscal year 1979.

--The Federal Computer Plan for Operational Forecasting and Atmospheric Modeling Research, dated November 1974, does not adequately discuss common agency capabilities and requirements or attempts to integrate these requirements into a cohesive plan. For the most part, the plan is a general list of Federal agencies' existing capabilities and projected program expenditures for fiscal years 1973-78.

The Federal Coordinator questioned the expenditure of staff resources to develop a long-range comprehensive plan. In his view, the development of plans should wait until opportunities for integration are ripe. In our view, waiting is not warranted because a primary purpose of planning is to create integration opportunities within the context of an overall plan.

Because centralized planning is inadequate, the three weather organizations generally develop programs to satisfy their own needs without considering the others' capabilities and requirements. As discussed later in this chapter, several parallel weather capabilities have developed as a result.

NEED FOR MORE SYSTEMATIC PROGRAM REVIEWS

While centralized planning is essential to charting the development of weather capabilities, program reviews are essential to insuring that the charted course is followed

and that redundant weather capabilities are not established or maintained. Circular A-62 requires that Commerce make systematic and continuing reviews of requirements and services, but its review system is too informal and too limited to ensure that Federal agencies use the best service arrangement.

For instance, the Commerce-Defense agreement on the circular's implementation states:

> "Department of Defense program submissions shall be transmitted directly to the Federal Coordinator for Meteorological Services and Supporting Research by the Department of Defense. Normally, only one major submission will be made annually under the provisions of Paragraph 3c. In the case of operational programs this should occur at least 30 days in advance of the final deadline for making changes to the meteorological programs in the annual budget submission of each military service."

We attempted to examine Defense's program submissions for the last 5 years and the Federal Coordinator's decisions on them, but were unable to locate any. According to Commerce officials, the interagency agreement is not enforced to the extent of requiring formal submissions, reviews, and documentation of the decisionmaking process. Instead, committee members informally discuss problems as they arise and, if necessary, establish ad hoc working groups to study the problems. The established practice was considered sufficient because committee members were usually aware of the issues involved. Commerce officials questioned the need for continuing reviews and said they preferred to wait until opportunities conducive to change arise. Again we disagree. Without detailed and ongoing program reviews, opportunities for improvements cannot be promptly recognized and aggressively pursued.

PARALLEL WEATHER CAPABILITIES

In our view, formal reviews based on a comprehensive plan are warranted because of existing parallel weather capabilities. As demonstrated in the following cases, NWS and the military weather organizations have established their own primary centers and other capabilities to independently meet severe weather warning, aviation, and marine weather requirements. Although requirements may differ, the potential exists for one weather organization to meet the

others' requirements or for operations to be consolidated. In each case, detailed analysis is needed to determine the best service arrangements.

Primary centers

In 1954 numerical weather forecasting began in the United States with the establishment of the Joint Numerical Weather Prediction Unit in Suitland, Maryland, composed of the Navy, Air Force, and Weather Bureau. Due to conflicts over the use of limited computer resources, the joint operation broke up in the late 1950s and each of the three weather organizations established its own center. The following table shows the centers' estimated fiscal year 1978 expenditures.

	Budget cost (millions)
NWS Center	$14.7
Navy Center	12.7
Air Force Center	14.3

Today, each primary center provides basic and, to a varying extent, specialized weather services. Each organization maintains that its center's capabilities are needed to meet its own unique requirements. As discussed in chapter 2, this position may be supportable for unique specialized services, such as mission forecasts, intelligence products, and command and control, but is questionable for basic services and more common specialized services, such as severe storm forecasts.

All the centers, as explained in appendix IV, use a similar forecasting process which relies heavily on mathematical models and computer capacity. Further, all the centers plan to increase their computer capacity to handle expanded data input and advanced mathematical models, as discussed on page 8. According to Commerce and Defense officials, however, none of the centers considered the others' service requirements in estimating future computer needs. Furthermore, they were not planning to change this practice.

Considering the anticipated growth in computer requirements and the related provisions of the Brooks Act, 1/ the question must be raised if a joint center or some other arrangement could provide a more efficient and economical way to meet basic analysis and forecasting needs. Commerce has not made an indepth study of this question, even though it is responsible for identifying the most efficient service arrangements. Defense, however, studied the question as it applies to the two military primary centers.

Consolidation study and concerns

In June 1971 the Institute for Defense Analyses reported that about 10 percent of the computer capacity was duplicated and that current and projected military needs could be met by either separate or consolidated centers. While the Institute concluded that consolidation would not be cost effective, it showed that a planned consolidation (phased over 10 years) could save computer acquisition and operating costs. However, the Institute concluded that these savings were not sufficient reasons to consolidate because Defense may decide not to fill all projected future weather requirements considered in the study. Since consolidation could also lead to organizational problems, the Institute recommended that the decision to consolidate be based on management, rather than cost, considerations. The Department of Defense decided to accept the computer duplication and not to consolidate.

Commerce and Defense officials agreed that, as in 1971, it would not be effective nor economical to consolidate two or three primary centers as presently constituted. However, views on a phased consolidation, similar to that considered by the Institute, differed among the agencies. For instance, Navy officials stated that consolidation or different service arrangements should not even be considered until an operational computer with computing speed as high as 1,000 MIPS was on the market. Commerce officials said the time for a different arrangement may well be due for consideration with the next one or two generations of computer systems.

1/The Congress enacted Public Law 89-306 (the Brooks Act) in October 1965 to result in more economical acquisition and optimum utilization of computer equipment by considering Government-wide, rather than merely agencywide, computer requirements in such similar functional areas as weather or science.

Nonetheless, most officials voiced concern over any new service arrangement even though they viewed potential management and operational problems (such as security, backup, and priority) as not unsurmountable under proper central leadership and priority computer use arrangements.

Potential benefits from other arrangements/management

One way to reduce management concerns would be to have the unique mission-oriented applications done at each center, and future, large-scale computer requirements which are relatively common to all agencies done at one of the three centers or at a fourth location with a computer capable of performing the required services. Under such an arrangement, all basic analysis and all basic and specialized modeling or analytical processes requiring vast amounts of computer speed and capacity would be done at the one center, and the products would be transferred to the other centers as needed. By having direct access to the basic data base, each primary center would have the capability, including limited built-in backup, to meet its customers' requirements.

The concept of a single computer center serving the large computational needs of several groups is not new. For example, the concept is currently used in the thermonuclear research field. The National Magnetic Fusion Energy Computer Center provides large-scale computational support, through high-speed communication lines, to about 1,000 large and small research centers throughout the country. Research priorities, anticipated computer demand, and various orders of need were considered before the center was established.

Officials of the energy center consider the center very successful in that it has lowered computer acquisition and operating costs while increasing operating efficiency. They expect the center to grow in proportion to meet future computational needs and to eventually make greater use of satellites as the conventional high-speed communication lines become saturated. While acknowledging unfamiliarity with weather information needs, the officials believed that the service center concept should be considered as an alternative to upgrading each weather organization's primary computer systems. Besides offering lower operating cost, such a service center offers opportunities to improve standardization and to take advantage of economies of scale and specialization through the acquisition of scientific-type computers. (See p. 14.)

In their official comment, Commerce agreed that there is some overlap of weather services in the three major processing centers. Some redundance is required to assure immediate backup capability and has been so planned. (As discussed on p. 20, this backing is limited.) However, Commerce believes it is time to consider a formal review of these centers now that upgrading and expansion will be necessary soon, and it has begun to work in this direction. OMB has this under consideration for a cross-cut review.

In addition, the Chairman, House Committee on Government Operations, has asked us to evaluate the Air Force's recent request for procurement authority to upgrade two large-scale computers to support its Global Weather Central System. Apparently this is but a small part of a larger Air Force plan to replace its entire complement of computer equipment at an estimated cost of over $100 million.

The Committee's concern is that the request is for a sole-source noncompetitive procurement and that the Air Force has not properly defined its requirements.

Severe weather warning services

Both NWS and the Air Force have the responsibility of providing severe weather warning services. NWS' severe storm center, which has 12 forecasters and a support staff, identifies severe thunderstorms and tornadoes over the continental United States and issues bulletins to local NWS offices. These offices, in turn, issue severe weather warnings over local communication systems, such as radio and television.

Similarly, the Air Force severe storm unit, having 27 forecasters, identifies severe storms and issues general area weather advisories every 6 hours to military base weather detachments. Additionally, the Air Force issues point warnings, as required, to about 500 locations, such as ammunition arsenals, radar sites, and selected Defense contractor plants. Similar to NWS' local offices, the detachments and other users issue the actual warnings.

NWS officials stated that they could provide the services now provided by the Air Force with 15 additional staff positions. The estimated cost was about $270,000 annually plus a $375,000 one-time equipment cost. However, the officials also stated that, under the total NWS warning system, severe weather warnings are already issued within each locality for periods up to 24 hours before the anticipated event. Further, under existing support agreements, several NWS

weather offices currently notify about 42 military installations whenever their military weather detachments are not manned or are otherwise inoperative.

Marine weather services

Both NWS and the Navy have the responsibility of providing marine weather services. NWS provides various coastal and high seas marine services through 19 forecast offices, and the Navy provides marine services from four fleet weather centrals and a fleet weather facility. The services are provided routinely or can be tailored to a special need.

Although these weather services have similarities, they are different in forecasts and geographic coverage.

NWS issues warnings and prepares forecasts in a general format. Unless safety of life and property is concerned, the more individualized and tailored products are generally prepared by private meteorologists using guidance products available from NWS and the Navy. In contrast, the Navy prepares general and specialized products to meet individual ship, fleet, or other operational requirements, such as acoustic range prediction amphibious operations. NWS generally covers parts of the Pacific and North Atlantic Oceans, the Caribbean, the Gulf of Mexico, and Alaska. In contrast, the Navy covers all areas of the world.

Aviation services

NWS, the Navy, and the Air Force have the responsibility of providing several aviation services. NWS services include terminal aviation, in-flight route, significant meteorological, area, and wind and temperature forecasts. The Air Force and Navy provide such common aviation services to about 146 military airfields. Other military aviation services include computerized flight plans, pilot briefings, and special mission forecasts. All three weather services issue amended forecasts as required.

With some exceptions, the common aviation forecasting functions are very similar. For instance, NWS provides terminal aviation forecasts three times a day, with information on wind speed and direction, cloud ceilings, visibility, and temperature. The military prepares similar forecasts, only those forecasts are issued four times a day.

The three weather organizations use different operating methods to provide aviation forecasts to airfields. The Navy serves its airfields from base weather detachments, and NWS serves several civil airfields in a specified geographic area from one weather service forecast office. In contrast, the Air Force's primary center prepares forecasts covering the 6- to 24-hour period. Base weather detachments serve airfields with locally prepared forecasts covering a 6-hour period, even though the primary center provides backup for those detachments with limited operating hours and for airfields without detachments.

It appears to us, therefore, that one organization may be able to provide aviation forecasts for the others. Commerce should determine which operating method provides the most effective forecasts.

CONCLUSIONS

Although progress has been made in coordinating Federal weather activities, the objectives of Circular A-62 have not been fully met. The Department of Commerce has not adequately (1) developed a comprehensive Federal weather plan and (2) made program reviews. As a consequence, Federal weather services have not received the central direction necessary for their integration and little basis exists for evaluating agencies' current and future responsibilities, capabilities, and services in relation to a Federal plan.

In times of limited resources and technological advances, the Government must constantly look at existing and proposed service arrangements with a view toward seeking more efficiency and economy. By improving its weather program management through plans and reviews, Commerce can be expected to find service arrangements that could be operated more efficiently, as well as actual or proposed systems that result in redundancy.

RECOMMENDATIONS

We recommend that the Secretary of Commerce direct the Federal Coordinator to:

--Develop a comprehensive Federal weather plan designed to fully streamline and integrate weather responsibilities, capabilities, and services. Such a plan

should be in sufficient detail to be a road map for action and should cover all major basic and specialized weather services.

--Develop a formal review system that would require Federal agencies to submit revised or new weather service requirements and require formal justification why the requirements cannot be met through existing services.

Further, we recommend that the Director, Office of Management and Budget, sponsor an independent study to evaluate the computer needs of the three primary centers and any related centers in research to identify the best service arrangements. The purpose of the study would be to reduce overall computer requirements in the future and to take advantage of benefits obtainable through lower capital and operating costs, standardization, greater backup capability, and economies of scale and specialization. Such a study should consider all available options, including upgrading all three centers and using the service center concept we described.

AGENCY COMMENTS

Commerce and OMB are not confident that the preparation of detailed, comprehensive plans or a formal review system for new or revised requirements is necessary to assure that Federal weather programs are effectively coordinated. Commerce also believes it would be extremely difficult and costly to develop and keep the plans current.

OMB stated that they are sensitive to new technology development and plans, and will assess the impact on weather programs throughout the agencies. This will be accomplished by means of cross-cut reviews or by special studies, when required.

We do not support the "when required" target of opportunity approach which Commerce and OMB voiced. We believe that it is evident based on this report that the staffing levels at OMB and Commerce are not sufficient to effectively isolate targets on a consistent basis.

We also believe that Commerce's proposal for the conceptual plans which show agency roles, mission, and programs would result in a plan too general for analysis of opportunities for integrated weather services support. As previously

stated, Commerce prepared implementation guidelines for a comprehensive, detailed Federal weather plan in 1964 in order to meet planning requirements. We believe this approach is as valid now as it was then--actually more so considering new technologies and constrained budgets.

In our opinion, goal planning and reviewing are of paramount importance in assessing the need for future acquisitions and improvements of weather capabilities. We believe economies achieved would more than offset the cost of developing and updating the plans.

The current renewed interest and cross-cut reviews, plus special coordination activities underway, are excellent actions which hopefully will resolve some of the concerns raised in our report. But how can we be assured that continued high-level attention will be available. We believe the "coordination" will return to the status quo without the high-level attention and the delegation of authority and responsibility to an organization with sufficient staff and funds to do an effective job. The job should be an active one, the staff should be consistently involved and have expertise in weather support services, and we believe continuous planning, review, and analysis is required.

In response to our recommendation that an independent study be conducted to evaluate the computer needs of the three primary centers and any related centers, OMB stated that they do not, as a matter of general policy, sponsor independent in-house projects with such a narrow focus. We believe, however, that OMB should take the initiative in ensuring that the study is conducted in order to prevent unnecessary computer capabilities for weather services.

APPENDIX I

FISCAL YEAR 1979 PLANNED EXPENDITURES BY AGENCY AND WEATHER SERVICES

Table 1
Meteorological Operations and Supporting Research by Agency

Agency	Operations	Supporting research	Total
	(000 omitted)		
Agriculture	$ 1,107	$ 2,713	$ 3,820
Commerce	301,777	17,889	319,666
Defense	269,386	40,441	309,827
Energy	2,758	212	2,970
Environmental Protection Agency	500	6,450	6,950
National Aeronautics and Space Administration	2,011	32,630	34,641
Transportation:			
Coast Guard	3,230	-	3,320
Federal Aviation Administration	68,719	13,627	82,346
Total	$649,488	$113,962	$763,450

Table 2

Meteorological Operations and Supporting Research by Service

	Operations	Supporting research	Total
	(000 omitted)		
Basic (See table 3)	$324,864	$ 49,879	$374,743
Aviation (See table 4)	a/223,591	16,280	239,871
Marine (See table 5)	13,922	3,781	17,703
Agriculture and Forestry (See table 6)	5,821	2,753	8,574
General military (See table 7)	47,392	34,607	81,999
Other (See table 8)	33,898	6,662	40,560
Total	$649,488	$113,962	$763,450

a/Incomplete.

Table 3

Basic Meteorological Service Costs

Agency	Operations	Supporting research	Total
	(000 omitted)		
Commerce	$271,255	$17,249	$288,504
Defense:			
Air Force	34,469	-	34,469
Navy	8,559	-	8,559
National Aeronautics and Space Administration	-	32,630	32,630
Transportation:			
Coast Guard	2,349	-	2,349
Federal Aviation Administration	8,232	-	8,232
Total	$324,864	$49,879	$374,743

Table 4

Aviation Meteorological Service Costs

Agency	Operations	Supporting research	Total
	(000 omitted)		
Commerce	$ 21,586	$ 35	$ 21,621
Defense:			
Air Force	131,415	-	131,415
Navy	10,103	2,618	12,721
Transportation:			
Federal Aviation Administration	a/60,487	13,627	74,114
Total	$223,591	$16,280	$239,871

a/Incomplete.

Table 5

Marine Meteorological Service Costs

Agency	Operations	Supporting research	Total
	(000 omitted)		
Commerce	$ 3,107	$ 565	$ 3,672
Defense:			
Navy	9,934	3,216	13,150
Transportation:			
Coast Guard	881	-	881
Total	$13,922	$3,781	$17,703

Table 6

Agriculture and Forestry Meteorological Services Costs

Agency	Operations	Supporting research	Total
	(000 omitted)		
Agriculture	$ 1,107	$ 2,713	$ 3,820
Commerce	4,714	40	4,754
Total	$ 5,821	$ 2,753	$ 8,574

Table 7

General Military Meteorological Service Costs

Agency	Operations	Supporting research	Total
	(000 omitted)		
Defense:			
Air Force	$30,161	$ 7,250	$37,411
Army	6,102	21,107	27,209
Navy	11,129	6,250	17,379
Total	$47,392	$34,607	$81,999

APPENDIX I

Table 8

Other Specialized Meteorological Services Costs

Agency	Operations	Supporting research	Total
	----------(000 omitted)----------		
Commerce	$ 1,115	$ -	$ 1,115
Defense:			
Air Force	19,389	-	19,389
Army	1,727	-	1,727
Navy	6,398	-	6,398
Energy	2,758	212	2,970
Environmental Protection Agency	500	6,450	6,950
National Aeronautic and Space Administration	2,011	-	2,011
Total	$33,898	$6,662	$40,560

APPENDIX II

HISTORY AND BACKGROUND

ON THE NATIONAL WEATHER SERVICE,

AIR WEATHER SERVICE, AND NAVAL OCEANOGRAPHY COMMAND

A central meteorological agency providing common services to varied public interests has continued since 1870 when the Congress created a Weather Bureau, under the Secretary of War, for certain weather functions. These functions prevailed through reorganizations transferring the general meteorological work of the Army Signal Office to the Department of Agriculture in 1891 and the Weather Bureau to the Department of Commerce in 1940.

Following the transfer of meteorological work in 1891, the Signal Corps continued to furnish the Army with certain specialized weather information. By 1937 the weather requirements of the Army Air Corps had grown to such an extent that the Army weather service was transferred to the Air Corps. During World War II, the deployment of air and ground forces required a vast expansion of this service. After the war, this service was reorganized into the Air Weather Service, functioning as part of the Air Force. Under a joint Department of Defense regulation, the Air Weather Service furnished weather support to the Army. However, for certain Army activities, notably research and development and artillery and missile trajectories, the Army provides its own service.

Naval activity in weather programs dating back to the 1830s evolved gradually into the Marine Meteorological Service, which the Navy maintained until 1904. At that time, the Weather Bureau assumed the functions of the Marine Meteorological Service, with the exception of pilot charts. During World War I, the expanded fleet operations, including naval aviation, led to the establishment of the Naval Aerological Organization. In 1921 Naval Aerology was transferred to the newly organized Bureau of Aeronautics. Later, the Naval Weather Service was established which, in turn, became the Naval Oceanography Command.

With some exceptions, weather organizations have evolved to where each maintain sizable capabilities in both basic and specialized services. The major exceptions are observation and communication functions. Following is a brief description of each weather organization.

APPENDIX II

NATIONAL WEATHER SERVICE

The National Weather Service (NWS) is to contribute to the safety, health, welfare, comfort, and convenience of the general public with respect to weather conditions, including conditions involving natural disasters, and to meet the weather information needs of various segments of the national economy. NWS provides both basic and specialized services.

The basic services, designed to meet either public or other agencies' needs, constitute the foundation for disaster warnings and specialized services. Basic services include

--acquiring raw data by observing current weather conditions;

--communicating weather data and information;

--preparing basic analyses and forecasts;

--issuing and disseminating products, including warnings and forecasts, to users; and

--achieving weather information for ready retrieval.

NWS also provides specialized services, including the facilities, products, and distribution system for servicing the needs of specialized users. Such services, provided to support the basic missions of other Federal agencies, include:

--Agricultural weather, including soil moisture and temperature, leaf wetness, evaporation, drying conditions, and other factors affecting farming and ranching.

--Aviation weather, including terminal and enroute weather advisories principally detailing types of precipitation, cloud amounts and heights, visibility, wind factors, and other significant enroute aviation hazards, such as aircraft icing, turbulence, and thunderstorm activity.

--Marine weather, including coastal storm tides, hazards to navigation on the high seas, conditions for pleasure boating, and lake ice and other factors affecting inland marine navigation.

APPENDIX II

--Forestry weather, including weather conditions needed for forestry and range measurement and conditions affecting wildfire control.

--Environmental air quality, including air stagnation conditions and expressions of the atmosphere's ability to dilute and dispense pollutants.

--Weather conditions affecting special activities, such as space flight operations and energy development, including atomic testing.

NWS is basically composed of the headquarters office in Silver Spring, Maryland, plus three operational levels. The National Meteorological Center, NWS' primary center in Suitland, Maryland, is the backbone of weather operations. The National Severe Storms Forecast Center in Kansas City, Missouri; the National Hurricane Center in Miami, Flordia; and the Hurricane Warning Centers in San Francisco, California, and Honolulu, Hawaii, may also be considered at this level. The primary center is generally responsible for preparing large-scale guidance material and long-range forecasts for use by the forecasting offices as it provides a single source for hemispheric analyses and prognoses. The National Severe Storms Forecast Center provides a single source for severe local storm watches. The National Hurricane Center serves the same function for hurricane forecasts in the Atlantic, Caribbean, and Gulf of Mexico, whereas the San Francisco Hurricane Center provides this service for the eastern and central Pacific and Honolulu.

Fifty-two weather service forecasting offices represent the second operational level. Located throughout the United States and San Juan, Puerto Rico, the offices are responsible for warnings and forecasts covering areas about the size of an average State. Their forecasts, issued twice daily, cover expected weather conditions for 48 hours. An extended outlook is issued once daily for up to 5 days for the same area. These offices also issue critical weather warnings to the public, as well as various special forecasts and warnings, and provide the mainfield forecast support for the marine aviation, agricultural, and fire weather programs.

About 243 weather service offices represent the third organizational level. They issue local forecasts, which are adaptations of the area forecasts, and have important county weather warning and distribution responsibilities.

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AIR WEATHER SERVICE

The Air Weather Service is responsible for operational environmental services for all Air Force command levels, for the commands specified by the Air Force Chief of Staff, and for the Department of the Army. Support to other Federal agencies may also be directed by the Air Force Chief of Staff.

In addition to supporting Air Force and Army commands, the Air Weather Service develops operational techniques for forecasting weather and its effects; supports military weather research, development, and evaluation for weapon systems; and provides representatives to national and international meteorological organizations. These responsibilities, we were told, include some basic functions similar to those performed by NWS. Specialized services include severe weather warnings, tailored probability forecasts, and computer flight plans.

At the time of our review, the Assistant for Weather, Deputy Chief of Staff/Programs and Resources, had primary responsibility within Air Force headquarters for all meteorological matters, except research and development, which were handled by the Deputy Chief of Staff/Research and Development. The Military Airlift Command at Scott Air Force Base, Illinois, is responsible for the operational and command jurisdiction of the Air Weather Service.

The service is comprised of its headquarters at Scott Air Force Base, five weather wings, and its primary analysis and forecast center--the Air Force Global Weather Central at Offutt Air Force Base, Nebraska. The weather wings provide weather support services to military users on a worldwide basis through 16 weather squadrons, 160 weather detachments, and 105 operating units.

NAVAL OCEANOGRAPHY COMMAND

The Naval Oceanography Command is to meet the Department of the Navy meteorological requirements and the Department of Defense oceanographic requirements.

The Navy meteorological and related oceanographic programs are worldwide in scope. This scope includes environmental conditions on and under the sea and in the atmosphere. Navy programs use not only the capabilities of the oceanography command but also the environmental observation and

APPENDIX II

collection efforts of the Marine Corps, Army, Air Force, other U.S. agencies, and foreign countries. The Navy uses remote sensor platforms, such as meteorological satellites and ocean buoys, as practicable.

Basic Navy services include most of the basic services provided by the National Weather Service and the Air Force. However, the Navy concentrates its efforts over the oceans. Specialized services include optimum track ship routing, search and rescue, and acoustic sensor range prediction.

The Naval Oceanography Command, directly under the Chief of Naval Operations, includes all Navy, Marine Corps, and other activities which provide meteorological or associated oceanographic observations or services. The command includes (1) the Fleet Numerical Weather Central in Monterey, California, which is the operational hub of the naval weather system, (2) four fleet weather centrals--Guam, Pearl Harbor, Norfolk, and Rota Spain--which use the basic numerical guidance products to provide specific fleet environmental support on a global basis, (3) one major fleet weather facility which specializes in localized or functional direct support, (4) fleet weather service facilities oriented primarily to management functions, and (5) 54 weather detachments which provide local support to air stations and specific technical support. In addition, the command provides personnel trained in weather forecasting to ships.

APPENDIX III

BACKGROUND AND HISTORY OF THE PRIMARY WEATHER PROCESSING CENTER

Numerical weather forecasting began in the United States in 1954 with the establishment of the Joint Numerical Weather Prediction Unit in Suitland, Maryland, which was composed of the Navy, Air Force, and Weather Bureau. This joint operation continued until the late 1950s, when the Navy moved its numerical operations to Monterey, California, and the Air Force started moving to Offutt Air Force Base, Nebraska. Breakup of the joint operations resulted from a conflict in prioritizing the use of limited computer resources and model applications. According to a Commerce and a military official, neither the Weather Bureau nor the military agencies could meet the needs of the others with the resources available at that time.

Today, each of the agencies operates a primary computer processing center which provides both basic and specialized services. Following is a brief description of each center.

NATIONAL METEOROLOGICAL CENTER

NWS' National Meteorological Center has four sections with the following functions.

--The forecast division applies a combination of numerical and manual techniques to produce anaylses and prognoses up to 120 hours into the future, emphasizing the period 2 to 72 hours. It also serves as a high altitude forecast office for supporting most commercial aviation flights in the United States.

--The automation division operates the computers and their communication links to NWS communication division and investigates various techniques for automating center operations.

--The development division conducts research and development of numerical weather prediction and adapts it to the center's products. It also conducts stratospheric research and investigates the problem of four-dimensional data simulation.

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--The long-range prediction group prepares forecasts for 1-month periods and experiments with seasonal predictions. It also develops techniques for improving these forecasts, including extending forecast periods.

During a single day, the center receives thousands observations from around the world through both civil and defense communications systems. The data generally goes through the Air Force's automated weather network to Carswell Air Force Base in Texas where it is examined, sorted, edited, compiled into specific weather messages, and sent to the National Center and the other two primary centers. These daily observations include

--14,000 synoptic and 25,000 hourly surface reports,

--2,500 synoptic ship reports,

--2,500 atmospheric soundings,

--3,500 aircraft reports, and

--available cloud and temperature data from weather satellites.

Using this information as a starting point, the center employs a combination of manual and automated numerical means to predict future weather conditions for periods up to 5 days.

Each day the center provides to field forecasters and overseas users over 785 facsimile and 819 teletypewriter data transmissions, including a large number of graphic products describing both current and forecast conditions throughout the Northern Hemisphere. The graphic products provide forecasters with a generalized three-dimensional concept of the current weather condition. The center also provides an increasing number of meteorological end products, such as wind forecasts for domestic and international aviation and precipitation forecasts for hydrologic and public services.

AIR FORCE GLOBAL WEATHER CENTRAL

The Air Force Global Weather Central provides meteorological support, on a global basis, to aerospace and ground operations for Air Force, Army, and other Federal agencies

APPENDIX III

as directed by the Air Force Chief of Staff. Its operational concept is to build a comprehensive data base and tailor the data to support the specific military requirements on a direct, real-time basis.

To carry out its responsibilities, the center's core operation at Offutt is comprised of six major divisions and some administrative support services with the following functions.

--The operating division advises the commander on operations, plans, and communications; develops policies and procedures for providing weather services; standards and records; and monitors priority allocation of resources.

--The data automation division operates and manages automated data processing systems, receives and processes conventional and satellite weather data, and prepares and displays automated analyses and forecasts for its customers.

--The forecast services division prepares global analyses and prognoses, terminal aviation forecasts, medium-range forecasts, severe weather advisories, point warnings, and other products to meet Defense operational requirements. It also monitors, controls, and amends the automated data base and provides emergency backup to NWS' National Facsimile Network.

--The technical services division manages the scientific and technical activities; develops and evaluates new data processing, analyses, and environmental forecasting programs; and tailors and displays numerical model outputs for support applications of the forecast services division, the special support division, and the external customers.

--The special support division provides specialized analyses, forecasts, and meteorological watch of environmental conditions, develops and maintains computer programs used in supporting classified requirements, and coordinates and standardizes operational procedures in support of special Government projects.

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--The executive support division advises the commander on all administrative, personnel, budget, and supply matters.

The Air Force center receives about 85,000 weather reports a day from conventional meteorological sources throughout the world--essentially the same observations the NWS center receives. Satellite data and reports from classified Air Force operations are sent directly to the Air Force center.

The center's basic operation is similar to that of the NWS center in that it also employs a combination of manual and automated numerical means to predict future weather conditions. However, its geographic coverage is more extensive, and it concentrates its efforts on short-term forecasts and is primarily concerned with the upper atmosphere. The Air Force center provides support to strategic programs, command and control systems, and military meteorologists at various remote facilities, such as base weather stations. Examples of its products are point weather warnings, solar event alerts, tailored probability forecasts, and automated flight planning.

The Air Force center exchanges products and data with NWS and Naval Oceanography Command facilities. It also provides backup services to the NWS center and the National Severe Storms Forecast Center. The forecasts and specialized products are disseminated to Air Force, Army, Navy, and other users through facsimile and automated communication systems.

FLEET NUMERICAL WEATHER CENTRAL

The Navy's Fleet Numerical Weather Central provides meteorologists and oceanographers around the globe with products that can be used to make specific forecasts for localized naval operations.

The center comprised of six operating departments with the following functions.

--The data integration department manages the receiving, processing, and archiving of all incoming data and production of all meteorological and oceanographical analyses and prognoses.

APPENDIX III

--The fleet applications department provides tailored products and services to customers and develops and maintains applications software.

--The computer systems department operates computer centers and develops and maintains systems software.

--The field support department coordinates and manages support to the field, including communications and validation and development of field requirements.

--The logistics department provides logistic support, such as developing and supporting specialized computer equipment, maintaining existing facilities and equipment, and stocking and distributing various products.

--The administrative department assists in the centers routine administration.

The Navy center receives thousands of observations daily from around the world. The number of Navy satellite reports will increase significantly after the SEASAT satellite program becomes operational. The Navy's observations, with the exception of the new satellite information and classified reports, are essentially the same as those received by NWS and the Air Force.

The Navy center's basic operation is similar to NWS' and the Air Force's in that it also employs automated numerical means to predict future weather conditions. However, its geographic and atmospheric coverage is more extensive, and the Navy concentrates its efforts on weather conditions at sea. The processed basic data is disseminated to the four fleet weather centrals for further refinement or sent directly to meet specific users' needs. Some of the specialized products are search and rescue drift computations, acoustic propogation forecasts in both the atmosphere and the oceans, and optimum track ship routing. The major means of communicating this information are the Air Force's Air Weather Network, AUTODIN (Automatic Digital Network), and the Naval Environmental Data Network.

APPENDIX IV

DESCRIPTION OF THE OPERATIONAL FORECASTING PROCESS

The Nation's three primary weather organizations generally go through the same forecasting process in developing weather products. This process can be divided into three functions: (1) collecting weather observations, (2) communicating weather data, and (3) preparing basic and specialized forecasts.

OBSERVATIONS

The basic element of an environmental forecast is the weather observation. Observations which include information on wind condition, humidity levels, and temperature levels are obtained through aircraft reconnaissance, radar, satellite, surface, and upper air observations. All five methods are vital to operational forecasting; however, air reconnaissance and radar observations, which are primarily used to detect storms, are the major elements of the Nation's natural disaster warning system. While upper air and surface observations have been taken for years, satellite observations are a fairly recent addition to the observation network and have greatly expanded global observing capabilities.

Satellite observations from both polar orbiting and geostationary satellites provide an almost continuous flow of weather data and pictures of cloud covers on a global basis to ground stations. In addition, pilots routinely report weather conditions they encounter. Observing programs and systems are organized into various network configurations. While some provide data almost continuously, others provide data on a monthly, or even seasonal, basis.

COMMUNICATING WEATHER DATA

Weather observations are distributed nationally by communication systems operated by civil and defense agencies. Data is exchanged across national borders over international and Defense weather communication circuits linking the United States with overseas data sources. Most global data 1/ is transmitted through the Air Force's Automated Weather Network to Carswell Air Force Base in

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1/Satellite data is sent directly to the primary centers.

APPENDIX IV

Texas, where it is examined, sorted, edited, compiled into specific weather messages, and sent to user agencies, including the three primary centers.

The basic system is complemented by communications systems operated by NWS and the Navy. NWS communicates directly with major weather centers, such as London and Tokyo. Although the speed of these communication lines vary, they all can provide primary centers with the basic data necessary to analyze the information and prepare operational forecasts.

PREPARING ANALYSES AND FORECASTS

Each organization analyzes the observations it receives to determine the current state of the atmosphere. By using computers and numerical models, the condition is then used as a basis to predict future weather conditions. Basically, the physical laws govern the atmosphere. Because an equation may require up to 25 billion computations to forecast 24 hours into the future, each organization uses large computers that can perform many computations in a minimum amount of time.

Because atmospheric conditions change rapidly and predictions become less reliable as they extend further into the future, forecasts must be updated frequently by new data and computer processing. The results of this modeling process are weather conditions in digital or grapic form provide forecasters with a generalized concept of current and future weather conditions. The forecasters may then take this generalized forecast and tailor it to a specialized application.

APPENDIX V

GAO-NSIAD-79-53697

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

JUN 18 1979

Mr. Voss
Mr. Stanton
Mr. Stankosky
Mr. Rhile
Mr. Callison
Editing
Report Control
Corres. Control
JUN 21 1979
2812 to
Dirs & OICD
cc: M. Fuller

Mr. Allen R. Voss
Director
General Government Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Voss:

This is in response to your letter of April 24, 1979, requesting our comments on your draft report entitled, "Federal Weather Activities, Strong Central Direction is Needed."

We appreciate the opportunity to review and comment on your draft report. I believe that it has raised some issues which are timely and important, and has provided useful and relevant information. Although we cannot assess the accuracy of all the findings or fully accept all of the recommendations at this time, there does appear to be a potential for improved service at lower cost, by better coordination and resource allocation, particularly as new and expensive technologies are introduced along with the potential for major system changes. (See p. v1.)

As discussed with members of your staff, the Office of Management and Budget (OMB) has independently identified concerns similar to those contained in your report and has begun to work with the Departments of Commerce and Defense to address them. Our actions to date are summarized as follows for your information.

Last fall, we initiated a cross-cut budget review of civilian and military meteorological satellites in order to assess the savings potential associated with the deployment of the next generation of polar orbiting meteorological satellites. We will continue this analysis as part of the 1981 budget review. OMB staff has also been meeting with officials from the Departments of Defense and Commerce to identify program issues which the Federal Coordinator for Meteorology should address. In addition, we are developing information for a possible special FY 1981 budget review to provide an overview of Federal weather programs and policies. Finally, we have asked the Department of Commerce to conduct a study to outline alternatives for the future structure and management of its National Weather Service (NWS). (See pp. v1 and 23.)

APPENDIX V

Recommendations in your draft report are made in two broad areas. The first relates to the conclusion that there should be more central direction for Federal weather programs. The second area relates to the conclusion that there should be centralized comprehensive planning for Federal weather programs, as well as central direction.

A basic assumption which is implicit in the conclusions and recommendations of the draft report is that the several agencies having involvement in weather services are parts of a single Federal program which is fragmented and costly. Attention must be focussed on the fact that agency weather programs have been developed to support the particular mission requirements of the agency involved. The area of concern then becomes what similar activities or support systems do they rely on where savings could be achieved through the use of common designs and consolidated procurements. (See p. 24.)

Our specific comments on the recommendations in your draft report, provided below, are based on the assumption that a single national weather program does not exist at present, and that existing weather programs outside of Commerce are in response to particular agency missions. We do not assume, however, that greater coordination is not needed. (See pp. vi and 2

GAO Recommendation

"... that Congress enact legislation that would:

Reaffirm Commerce's central agency role for weather and specifically define its authority and responsibilities concerning civil and military weather organizations.

Strengthen the central agency's role by requiring it to assist the Office of Management and Budget in their annual review of agencies budget submissions by providing comments and recommendations on budgeted activities and on their consistency with the control agency's overall Federal plan or plans."

OMB Comment

This Office is strongly opposed to the enactment of legislation that would mandate a Department of Commerce (or other lead agency) role in validating requirements, or providing authority over budget submissions of other agencies. Final review of agency budget requests as part of the overall President's budget has been and should remain the responsibility of the OMB as a staff arm of the President. It is awkward for an operating agency to review budget requests of other agencies, especially where there may be adversarial situations. (See pp. vi, 9, and 24.)

We believe that the role of the Department of Commerce in coordinating the basic meteorological services is adequately defined in Circular A-62. We recognize some of the difficulties that you have pointed out in the draft report. Most of these are problems of implementation of Circular A-62 provisions, rather than a lack of clarity in authority and responsibility for the coordination of Federal meteorological services. While we would not oppose legislation to place the provisions of Circular A-62 in the statutes, we do not believe that such a step is necessary or particularly useful. (See pp. v and 23.)

GAO Recommendation

"... that the Secretary of Commerce direct the Federal Coordinator to:

Develop one or more comprehensive Federal weather plans designed to fully streamline and integrate weather responsibilities, capabilities and services. Such a plan or plans should be in sufficient detail to be a road map for action and should cover all major basic and specialized weather services.

Develop a formal review system that would require Federal agencies to submit revised or new weather service requirements and require formal justification why the requirements cannot be met through existing services."

OMB Comment

We are not confident that the preparation of detailed, comprehensive plans by the Federal Coordinator or a formal review system for new or revised requirements is necessary to assure that Federal weather programs are effectively coordinated. We do, however, share the objective of the prevention of unnecessary expenditures and the elimination of unnecessary duplication and/or redundancy. It is for this reason that we have instituted the steps summarized earlier. (See p. 35.)

New technology is opening the door to many new capabilities in observing, forecasting and disseminating weather information. New communications technology is being employed by the National Weather Service in modernizing their weather communications network. New regional observing and forecasting systems are under consideration. We are sensitive to these new developments and plans, and will assess the impact on weather programs throughout the agencies. This will be accomplished by means of cross-cut reviews or by special studies, when required. (See pp. 23 and 35.)

GAO Recommendation

"Further, we recommend that the Director, Office of Management and Budget, sponsor an independent study to evaluate the computer needs of the three primary centers and any related centers in research, to identify the best service arrangements. The purpose of the study would be to reduce overall

computer requirements in the future and to take advantage of benefits obtainable through lower capital and operating costs, standardization, greater backup capability, and economics of scale and specialization. Such a study should consider all available options, including upgrading all three centers and using the service center concept we described."

OMB Comment

As the time approaches for consideration of the installation of the next generation of large-scale digital computers at the weather analysis and forecast centers, there is need to evaluate the overall requirements for weather computational capability in the Nation. This is one of the issues that is under consideration for the cross-cut review. This Office however, does not, as a matter of general policy, sponsor independent in-house projects with such a narrow focus. We rely on the agencies to undertake such studies; our role usually involves review of the study outlines, proposed analyses, and conclusions. (See p. 23.) (See p. 30.)

Thank you again for the opportunity to comment on your draft report. We will be pleased to cooperate with GAO further as you prepare the final report and as we work with the agencies in the manner described above.

Sincerely,

John P. White
Deputy Director

cc: Secretary Juanita M. Kreps
Secretary Harold Brown

APPENDIX VI

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Administration
Washington, D.C. 20230

21 JUN 1979

Mr. R. W. Gutmann
Director, Logistics and
Communications Division
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Gutmann:

This is in reply to Mr. Eschwege's letter of April 30, 1979 requesting comments on the draft report entitled "Federal Weather Activities: Stronger Central Direction is Needed."

We have reviewed the enclosed comments of the Associate Administrator, National Oceanic and Atmospheric Administration, and believe they are responsive to the matters discussed in the report.

Sincerely,

Elsa A. Porter
Assistant Secretary
for Administration

Enclosure

APPENDIX VI

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230
OA22/SP

OFFICE OF THE ADMINISTRATOR

JUN 15 1979

Mr. R. W. Gutmann
Director, Logistics and
Communications Division
U. S. General Accounting Office
Room 5800
441 G Street, N. W.
Washington, D. C. 20548

Dear Mr. Gutmann:

We have reviewed the draft of the proposed General Accounting Office (GAO) report on "Federal Weather Activities, Stronger Central Direction Is Needed." Our comments will address the general concepts developed in the draft report and the specific recommendations made.

The main thrust of the report is that coordination activities for Federal weather services and supporting research have been inadequate and that there is a potential duplication of weather activities. It is true that aspects of the Office of Management and Budget (OMB) Circular A-62 have not been actively followed in the coordination of Federal meteorological activities. However, the Office of the Federal Coordinator for Meteorological Services and Supporting Research has established mechanisms to seek out cases of unwarranted redundant or overlapping meteorological services and supporting research. Although the policy-level concern and coordination has decreased over the past decade, as discussed below, the working level coordination has been active and effective. This working level coordination is exemplified by the following:

(See pp. v and 22.)

(See p. 23.)

a. In February of this year NOAA and the U. S. Navy established a senior study group to identify areas for increased cooperation. The group determined that, among others, marine prediction was such an area and the Director, National Weather Service, and Commanding Officer, Fleet Numerical Weather Central, were instructed to proceed. Task groups are presently reviewing atmospheric/oceanographic observing and numerical modeling activities to establish specific steps for increased program coordination.

(See pp. vi and 23.)

b. Joint working groups are established and functioning concerning interagency efforts and plans for automated observing systems, weather radar, and tropical cyclone research.

c. Directors of the three major processing centers (National Meteorological Center, Air Force Global Weather Central and Fleet Numerical Weather Central) meet semi-annually to discuss their operations and mutual support.

d. New Federal plans are being finalized for Agricultural Weather Service and Forest Fire Meteorological Service.

e. Detailed multi-agency plans are in effect for operations such as Hurricane Warnings, Severe Local Storm Warning and East Coast Winter Storms.

Outside of the Federal Coordinator structure, the National Oceanic and Atmospheric Administration (NOAA) continues routinely to coordinate other activities that minimize possible redundance:

a. Two committees involving the National Aeronautics and Space Administration (NASA), Department of Defense (DOD), and Department of Commerce (DOC) coordinate plans, design, procurement, and operation of meteorological satellites.

b. NOAA and the Federal Aviation Administration (FAA) have in effect a memorandum of agreement on aviation weather service and meteorological communications. The agreement covers facilities, installation, maintenance, observations, dissemination, training, communications, research, and budget matters. Provisions of this agreement are actively followed. Currently, the two agencies are jointly procuring a radar remote weather display system for wide use in NOAA and FAA. In addition, there is close coordination between NOAA and FAA in R&D on aviation weather prediction and on development of automated aviation weather observations.

c. NOAA and the U.S. Air Force coordinate closely and effectively in storm reconnaissance and, under the terms of an interagency agreement, NOAA reimburses the USAF for reconnaissance done to meet civil needs. NOAA aircraft fill in as needed for both NOAA and DOD support.

d. NOAA and NASA consult on budget submissions for meteorological research funding.

We agree that there is some overlap of weather services in certain areas such as the three major processing centers. Some redundance is required to assure immediate backup capability and has been so planned. However, it is timely to consider a formal review of these centers now that upgrading and expansion of the computer systems will soon be necessary, and we have begun to work in this direction in the Federal Committee for Meteorological Services and Supporting Research (FCMSSR). (See p. 23.)

The report develops the position that the Department of Commerce should be the manager of a total Federal weather system. We do not agree that individual agency weather services should be planned, managed, budget justified, and inspected by the Department of Commerce to verify that the agencies are providing weather service in agreement (See p. 9.)

with an overall Federal weather program. These are agency responsibilities which, in the interest of good management, operational control and user responsiveness, cannot appropriately be delegated to the Department of Commerce. The report overstates the responsibility assigned the Department of Commerce by OMB Circular A-62 for assuring the efficiency of Federal Weather services and the curtailment of redundant operations. The responsibility to coordinate agency weather programs is clear in OMB Circular A-62 but there is no authority to direct changes or curtailment of other agencies' operations. (See p. v.)

The report concludes that stronger central direction is needed and that such centralized direction should include:

a. overseeing agency weather programs;
b. evaluating weather services;
c. identifying better service arrangements;
d. establishing combined agency requirements - peace and war;
e. planning effective and economical ways to meet these requirements;
f. achieving fully implemented programs;
g. assisting OMB in annual budget reviews;
h. proposing to OMB implementation actions;
i. maintaining a Federal weather plan for integrated weather services;
j. preparing and maintaining special plans; and
k. monitoring implementation of the Federal weather plan and special plans. (See pp. 9 and vi.)

This concept is not consistent with Congressional mandates for agency missions in the terms of legislative authorizations for programs, organic acts, and appropriations. The report recognizes that the Department of Commerce should be the lead agency. However, the Department of Commerce can only provide central coordination -- not centralized direction of agency programs. OMB Circular A-62 should not be modified to contain enforcement provisions enabling Commerce to direct rather than coordinate agency efforts. (See pp. 9, v, and 23.) (See pp. vi and 23.)

Improved direction of Federal weather service is best provided through the normal decision-making processes available to the affected agencies. Substantive involvement of the Federal Coordinator is appropriate in the context of these processes. The various concerned agencies must evidence their interest and willingness to participate in joint decision-making through active, policy-level participation in the FCMSSR, which is charged with providing guidance and inter-agency support to the Federal Coordinator. The Federal Coordinator, and through him the FCMSSR, should be involved in crosscut program evaluations designed to input to the budget process.

Unfortunately, in recent years there has been some decrease in agency policy-level interest in meteorological problems due in part perhaps from a lack of significant issues. This decrease is illustrated by the almost total absence of policy-level representatives of participating agencies at recent meetings of the Federal Committee for Meteorological Services and Supporting Research. This problem has been recognized (See p. 22.)

by the Federal Committee and the Federal Coordinator, and actions are being taken to revitalize the committee. If effective policy-level interest and concern is exhibited by the Federal Committee, consideration of means to provide the Federal Coordinator with adequate support to conduct meaningful analyses of outstanding problems, reviews of proposed programs and coordination of agency plans in the development of an integrated Federal weather program is needed.

Rejuvenation of the FCMSSR will be encouraged if the Federal Coordinator is routinely asked to carry out analyses and reviews of inter-agency programs in meteorology for timely input into the agency and OMB budget processes. In NOAA's opinion, part of the deterioration of the effectiveness of OMB Circular A-62 has been a decline in reliance (See p. 23.) on the Federal Coordinator. This is not a recent development. The decline has occurred over an entire decade, and it is encouraging to note that the present Administration has indicated its understanding of the need for corrective action. Preparation of crosscut reviews for OMB and the agencies of selected weather programs of Federal agencies is underway at the present time.

Our comments on the concluding recommendations in the report are as follows:

a. Reference recommendation that Congress enact legislation that would:

(1) Reaffirm Commerce's central agency role for weather and specifically define its authority and responsibilities concerning civil and military weather organizations.

Legislation proposed by this report goes much further than a simple reaffirmation of Commerce's existing role. The appropriate role of the Department of Commerce in coordinating Federal meteorological activities is already adequately authorized in OMB Circular A-62. We do not (See p. v.) believe legislation is needed for this purpose. Such legislation might be incompatible with the assignment of mission responsibilities already given to other agencies by Congress, e.g., DOD, NASA, Department of Transportation (DOT), National Science Foundation (NSF), etc. It would not be appropriate to give to the Department of Commerce the authority and responsibility, as lead agency, to direct Federal weather programs through the Federal Coordinator. This would give authority but little or no responsibility for program performance. Such an arrangement would be bad management practice. We believe it would be inappropriate for the Department of Commerce to be given budgetary screening authority over other agencies, or to evaluate their budgets and program implementation, except in carrying out analytical or review assignments from the Federal Committee or OMB.

In our zeal to eliminate duplication and to develop an integrated weather service, we must be careful not to encroach on the Department of Defense's operational mission support responsibilities both overseas and in the continental United States. While security consideration should not automatically exclude mutual support of basic weather services, the ability to respond and to direct military operations cannot be compromised.

(2) Strengthen the central agency's role by requiring it to assist OMB in their annual review of agencies' budget submissions by providing comments and recommendations on budgeted activities and on their consistency with the central agency's overall Federal weather plan or plans.

We have no objection to Congress reaffirming the Department of (See pp. v and vi.) Commerce's central agency role for coordinating both requirements for weather services and the best way to meet them. OMB Circular A-62 is sufficient basis for these roles. We believe it inappropriate for one agency to be assigned in legislation the responsibility and authority to review other agencies' budgets. It is appropriate to have the Federal Coordinator provide analysis for OMB with the full knowledge and cooperation of the agencies involved, through their policy-level participation in the FCMSSR.

b. Reference recommendation that OMB provide Commerce necessary personnel ceiling and funds for a permanent full-time staff for the Office of the Federal Coordinator.

We are in agreement that there is an important role for the Office of Federal Coordinator and will review the level and potential sources of staff and other resources for the Office. We will also consult with other agencies for the detailing of their personnel to assist us.

c. Reference recommendation that the Secretary of Commerce reestablish the Office of the Federal Coordinator as a staff office to reaffirm the Office's independence from operating matters.

We agree in principle that the Office of the Federal Coordinator should be a staff office independent from operating matters. What changes, if any, are necessary will require further study to determine the optimum location of such a function.

d. Reference recommendation that the Federal Coordinator be directed to:

(1) Develop one or more comprehensive Federal weather plans designed to fully streamline and integrate weather responsibilities, capabilities and services. Such a plan or plans should be in sufficient detail to be a road map for action and cover all major basic and specialized weather services.

A very significant increase in the Federal Coordinator's level of effort would be needed to develop a plan or plans as envisioned by the report. We seriously question whether such a plan would be worth the (See p. 35.) large effort required. The preparation of such a complex overall plan in sufficient detail to be a road map for action would be extremely difficult and costly to develop and keep current. It may be more useful and less costly to prepare a conceptual plan presenting a national weather system which would show agency roles, missions and programs. This would be less of a program requirements plan and more of a "where are we going in the next five to seven years" that could be very useful to OMB, the agencies involved, and the Congress. The conceptual plan would be supplemented by service plans for such activities as Agriculture Weather Services and functional plans such as Weather Radar.

(2) Develop a formal review system that would require Federal agencies to submit revised or new weather service requirements and require formal justification why the requirements cannot be met through existing services.

The original implementation plan for Circular A-62 called for scheduled submission and formal review of agency requirements and programs. This is no longer done on a formal basis for all programs. The recommended formal review system by the Federal Coordinator can produce useful results where the agencies, through the FCMSSR, and OMB, provide guidance and support. The Federal Coordinator should not, however, oversee agency programs or weather services to evaluate the weather programs and monitor implementation of Federal plans. It would be appropriate for the Federal Coordinator to request periodic reports from agencies on the status of implementation of Federal plans.

Going beyond the review and recommendation to the Federal Committee and OMB was not the intent of Circular A-62 nor is it the most effective means for coordinating weather activities in the Federal Government. An adequate review of agency programs can be accomplished by performing detailed analyses for use by OMB and the agencies as input to the budget review process. Such reviews of Federal weather programs are being undertaken for the FY 1981 budget for selected programs. Plans are to expand these reviews for the FY 1982 budget cycle.

In summary, the proposal for central direction and management of Federal meteorological programs is, in our estimation, an overreaction to the problem of some cases of inadequate or poorly documented coordination. The report's recommendations in many respects propose solutions that amount to a Federal weather services czar, who would have considerable authority over very senior officials. This is not the proper solution to the problem. The root problem is one of decreased policy-level interest and concern. To correct this problem does not require a major

re-structuring of the Federal Government. OMB Circular A-62 is an adequate basis for necessary reviewing, coordinating and planning (See pp. v and 23.) Federal weather activities. The interest and concern of agencies involved needs to be renewed and that action is underway at this time. With the advent of new technologies and potential capabilities, agencies are focusing their attention on how the weather programs of the next decade should be structured.

Sincerely yours,

George S. Benton
Associate Administrator

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