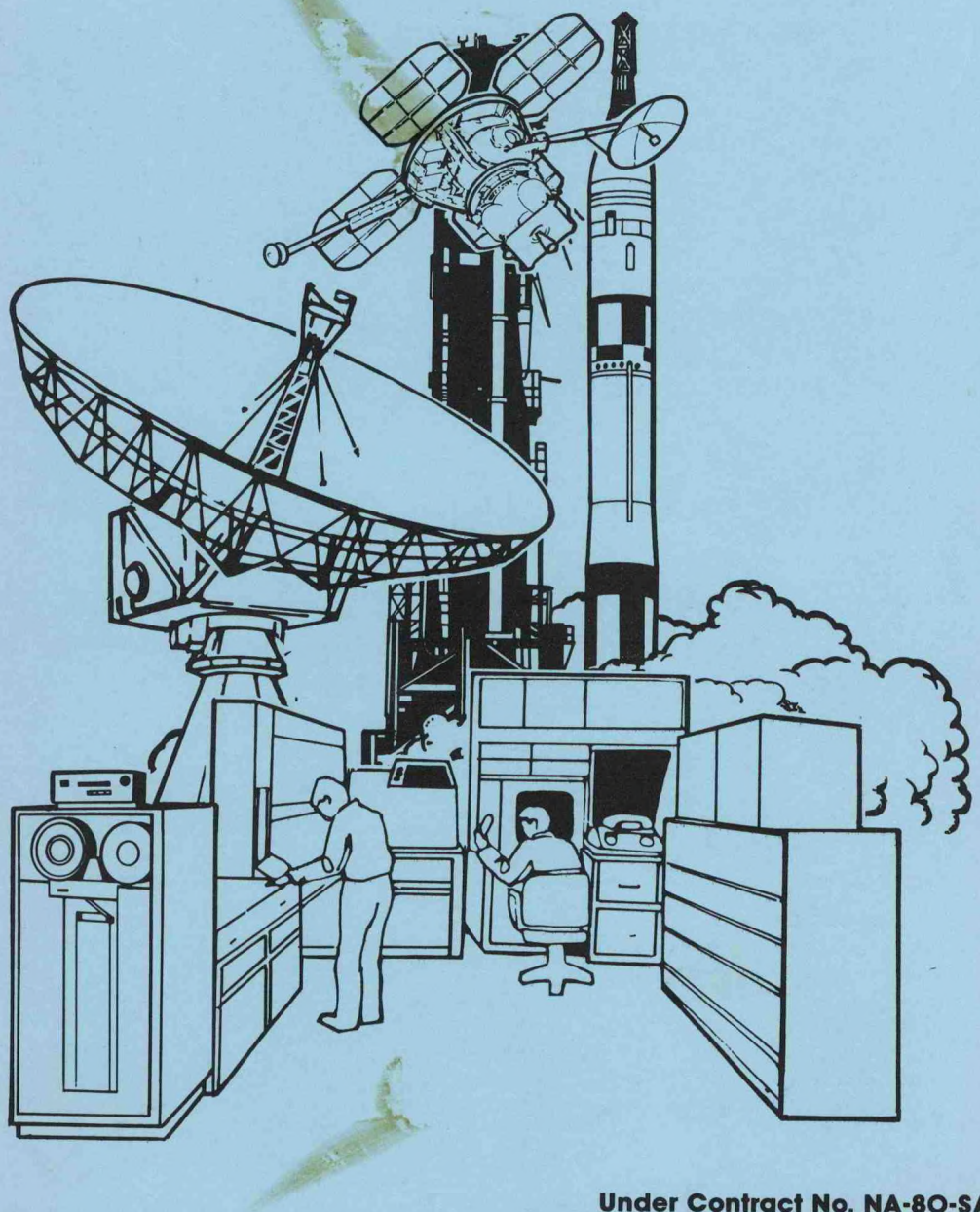
D. Sargent

CROSS CUT REVIEW OF FEDERAL WEATHER PROGRAMS

AGENCY ROLES, MISSIONS AND PROGRAMS SUB TASK

FINAL REPORT—SEPTEMBER 1980



Prepared By:
Economics Technology Associates, Inc.

Under Contract No. NA-80-SAC-00645
for the
Office of the Federal Coordinator for Meteorological Services and Supporting Research
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

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National Oceanic and Atmospheric Administration
U.S. Department of Commerce
Washington, D.C. 20230

September 1980

FOREWORD

At the request of the Office of Management and Budget, the Office of the Federal Coordinator for Meteorological Services and Supporting Research, NOAA, in cooperation with other Federal Agencies, has arranged for the preparation of a series of cross-cut reviews of Federal Weather Programs. Two of the reviews - Agency Roles, Missions and Programs, and Numerical Meteorological Processing Centers - are being prepared concurrently under a contract arrangement with Economics Technology Associates, Inc. (ETA), Los Angeles, CA. ETA has in turn entered into a sub-contract with the System Development Corporation, Santa Monica, CA, to acquire additional expertise.

The two studies have been conducted under the direction of Mr. Arthur W. Johnson, Project Manager. Team members are Messrs. Charles L. Bristor, Frank W. Burnett, Marc Cotnoir, Willard S. Houston, Richard A. Johnston, Donald F. Moore, Clarence E. Roache, Silvio G. Simplicio, and Booker T. Thomas. The leaders of the sub tasks were Mr. Moore - Agency Roles and Missions, and Mr. Bristor - Numerical Meteorological Processing Centers. All team members have had extensive experience in large scale programs, both operations and planning. Because of their past experience, some experts contributed to both studies.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SECTION 1 - INTRODUCTION

1.1 BACKGROUND

In the early 1960s there was a growing concern on the part of the Executive Branch and the Congress over the proliferation of meteorological programs throughout the Federal Government. This concern was manifested in two significant ways. First, the Bureau of the Budget (now the Office of Management and Budget) in the Executive Office of the President undertook a survey of Federal meteorological activities as a result of a request by the House Committee on Appropriations of the Congress. The survey was published in March of 1962 and found that 15 Federal agencies were engaged in significant meteorological programs in support of their missions. Among other things the survey concluded:

"a. A central meteorological service cannot feasibly perform all meteorological activities for all agencies.

b. With the exception of the U.S. Weather Bureau (now the National Weather Service), the organization of meteorological services resulted from historical development based on ad hoc accommodation to needs and to scientific and technological advances.

c. Pressures being exerted by scientific and technical advances within and upon the field of meteorology and the accelerating growth of expenditures required strengthening of existing arrangements for planning and coordinating meteorological programs."

This concern over proliferation of Federal meteorological programs was again expressed through inclusion by the Congress of the following language in Section 304 of the Department of Commerce Appropriation Act of 1963:
"The Bureau of the Budget shall provide the Congress in connection with the budget presentation of fiscal year 1964 and each succeeding year thereafter, a horizontal budget showing (a) the totality of the programs for meteorology, (b) specific aspects of the program and funding assigned to each agency, and (c) the estimated goals and financial requirements."

In response to these concerns the Bureau of the Budget issued Circular A-62 on November 13, 1963 (Appendix A) setting forth policies and procedures for the coordination of Federal meteorological services. In brief, the Circular called on the Department of Commerce to "establish procedures designed to facilitate a systematic and continuing review of basic and specialized meteorological requirements, services and closely related supporting research" and to "prepare and keep current a plan and obtain periodic information on its implementation for the efficient utilization of meteorological services and supporting research."

The Department of Commerce implementation plan (Appendix B) was issued on January 23, 1964, and provided for a Federal Coordinator for Meteorological Services and Supporting Research together with an appropriate interdepartmental committee structure.

Shortly after the plan was implemented the Office of the Federal Coordinator was at its planned strength of 15 personnel (including personnel detailed from other agencies).

For the initial years the organization, staffing, and activities of the Office of the Federal Coordinator remained reasonably stable. However in recent years, staffing has been significantly reduced and coordinating activity slowed.

On October 16, 1979 the Comptroller General of the United States submitted a report to the Congress entitled "The Federal Weather Program Must Have Stronger Central Direction" (LCD-80-10). The purpose of this report was 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."

This General Accounting Office (GAO) report acknowledged that Commerce has made progress in coordinating weather programs, has furthered the exchange of information among agencies and has arranged some multi-agency

efforts. However the GAO felt that much stronger central direction is needed to establish the optimal configuration of weather services, and to prevent establishment of redundant capabilities. Improvements were considered necessary in the following areas:

- Leadership
- Comprehensive short and long range planning
- In-depth systematic program reviews
- An independent fulltime staff to make such plans and reviews.

The GAO was also of the opinion that "the Department of Commerce's role should be strengthened by requiring it to assist the Office of Management and Budget (OMB) in its annual review of agency budgets by providing comments and recommendations on budgeted activities and on their consistency with the central agency's overall Federal plan or plans."

Agency comments on the GAO report appear to support its main thrust. However there was opposition to the suggestion that the Department of Commerce have a role in advising the Office of Management and Budget on budget submissions of other Federal agencies.

Finally the GAO report applauded the current actions of the Administration to improve coordination and isolate potential areas for improved services at less cost.

During its hearing of the FY 1980 Department of Defense budget request, the House Committee on Appropriations apparently had access to a draft of the GAO report. The Committee's report listed a number of studies of meteorological programs which have been conducted in recent years. The report stated:

> "The Committee believes that there is significant duplication in the Federal Government meteorological programs which require an estimated one billion dollars and eleven thousand people annually for operational and research and development programs. This duplication appears between the Department of Defense and other Federal agencies, between the various

military services, and even between certain elements within each service. Examples of these redundancies would be the use of civilian commercial airports by certain elements of the Department of Defense that retain their own meteorological prediction capability; the colocation of both Naval and Air Force units at a single base sharing the same runway but each service maintaining independent meteorological operations; and Air Force retention of three separate operating meteorological centers in San Antonio, Texas, with two of the three being located on a single Air Force installation.

The Committee is therefore declaring Defense meteorological programs to be an item of special attention and directing that there be no major expansion over the FY 1979 program level pending completion of a special committee investigative report and a hearing in conjunction with the fiscal year 1981 budget review."

The study referenced above has recently been concluded but the specific findings are not known to this study team.

In its FY 1980 guidance letter to DOC the OMB called for government-wide cross cut analyses of future needs and direction of Federal weather programs and activities. At the request of OMB, The National Oceanic and Atmospheric Administration (NOAA) proceeded, in cooperation with the Departments of Defense and Transportation with two cross cut analyses (Agency Proposals for Next Generation Weather Radar and Agency Proposals for Surface Weather Observation Automation). On February 4, 1980, contract NA-80-SAC-00645 was issued to Economics Technology Associates, Inc. (ETA) to conduct cross cut reviews of two additional areas. ETA has teamed with the System Development Corporation (SDC) to establish task study teams for each of the reviews.

The work statement calls for ETA to undertake comprehensive reviews and assessments of the Federal meteorological establishment. ETA is to develop observations and options for use in further defining the weather service roles of NOAA and other Federal agencies and to provide analytical support to the Federal Coordinator for Meteorological Service and Supporting Research.

Recognizing the relatively long term required for an in-depth review, ETA, by agreement with NOAA, is to address two individual sub-tasks and prepare reports on each. These cover numerical meteorological processing centers and agencies' roles and missions. This report deals solely with the agency roles and mission sub-task. A separate ETA report with regard to the numerical meteorological processing centers sub-task has been prepared concurrently.

The following is an extract from the work statement of the Agency Roles, Missions, and Programs subtask:

"The present structure for coordination of Federal meteorological programs was established by Bureau of the Budget Circular A-62 issued in 1963. The contractor will examine Circular A-62, all statutory and regulatory documents, and interagency agreements for the conduct of meteorological programs. He will document findings on these authorities related to agency roles, missions and weather service programs.

In addition, the contractor will collect agency views and positions on:

a. Present and future requirements and plans for weather services in the 1980s.

b. Developing technology, including communications and display, and its effect on the capability to provide needed weather services in the 1980s or to create demands for such services.

c. The present and future role of the private sector in providing these services.

d. Contributions of the academic community in meeting needs for weather services and supporting research.

e. Coordinating mechanisms for weather services and supporting research.

Following this collection effort, the contractor will make an assessment of the material in terms of applicability to agency missions and responsibilities, overlapping programs and degree of interagency coordination. Finally, the contactor will make recommendations, as appropriate, regarding carrying out the responsibilities of Circular A-62.

The contractor will provide a progress report on the collection and assessment aspect of this study by March 15, 1980, a draft final report by June 15, 1980, and following a 30-day review by NOAA, 300 copies of the final report by August 15, 1980. The final report will contain findings, assessments and recommendations in each of the foregoing areas (a through e)."

1.2 PROCEDURES FOLLOWED

In an initial meeting with the Federal Coordinator for Meteorological Services and Supporting Research, certain boundaries to the study were agreed upon. These included:

- The study should not attempt to analyze user requirements nor the ability of any of the meteorological services to meet the needs of its users. The study is concerned only with the activities of the suppliers of meteorological services and those directly involved in other meteorological activities.

- The study will identify areas of apparent and potential duplication but will not have the resources to conduct in-depth studies in any of these areas.

- The study excludes consideration of the coordination of meteorological satellite programs, but will consider the impact that satellite technology will have on meteorological services in the 1980s.

- If priorities of study effort needed to be established, questions concerning private sector, research, and academia would be deemphasized.

The initial phase of the study involved a concentrated schedule of visits to obtain the views of all Federal agencies who are either conducting or supporting meteorological programs. The agencies were requested to provide their views and positions with respect to items a through e above. In addition, meetings were held with the following:

- Legislative Branch of the U.S. Congress:
  - The General Accounting Office
  - House Committee on Appropriations Investigating Staff
- Executive Office of the President:
  - Office of Management and Budget
  - Office of Science and Technology Policy, Staff of the Committee on the Atmosphere and the Oceans
- Federal Emergency Management Agency
- National Advisory Committee on the Atmosphere and the Oceans
- National Academy of Sciences
- The American Meteorological Society
- Academic Institutions
- Private Meteorological Organizations.

For a complete list of all of the contacts made by the study group, see Appendix C.

SECTION 2 - AGENCY VIEWS AND POSITIONS

2.1 Developing Technology

Opportunities for improving weather services and delivery of weather information to users become possible as advances in technology are made. These advances create pressures for change in two ways: first, by arrangements which reduce personnel requirements through automation of labor-intensive tasks; and second, by suggesting systems which make possible the issuance of new or improved products. Any plans to restructure the Federal weather services should consider both aspects, even under conditions of budgetary constraints. Although forecasting of improvements in technology has uncertainties, one must be aware of present trends and likely developments to make realistic projections concerning alternatives for the future Federal weather establishment. Accordingly, the following brief assessment of technological developments relevant to meteorological and oceanic services is provided as possible ingredients to the design of future organizational or operational arrangements.

Observations and Data Acquisition

Remote sensing of weather was first introduced to meteorology by radar, whereby precipitation patterns could be detected at distances of one hundred miles or more from a radar station. Measurement of surface and atmospheric temperatures and detailed cloud pictures from orbiting satellites have already become standard parts of the observational data base. Large increases in the number of temperature/humidity soundings (vertical profiles) from polar orbiting satellites are projected, and developments point to increasing accuracy of these soundings. The Prototype Regional Observing and Forecasting Services (PROFS) experiments indicate that ground based remote sensing may further increase the number of vertical soundings. A soundings capability from geostationary satellites (GOES) is scheduled to be tested in the near future and added to subsequent GOES satellites if test results warrant. Routine operational production of temperature/humidity soundings from these several sources can be anticipated by the end of the decade. Projecting this capability to the GOES-type satellites to be operated around the globe by other nations equates to a sounding data

base which could be updated frequently, which would be densely spaced in the horizontal coordinates, and which would extend around the globe from about 50°N to 50°S latitude. Since resolving power of these sounding techniques diminishes with increasing atmospheric depth, it has been suggested that the data be combined with the surface-based PROFS data to produce higher quality atmospheric soundings.

Developments to improve the coverage of atmospheric winds are underway. Tracking cloud displacements from the GOES type satellites now provides several hundred wind observations per day. Developing improved night-time IR imagery, experiments using the water vapor sensors to track humidity patterns in cloud free areas, and using LIDAR developments for direct wind calculations are efforts aimed at increasing the number of wind observations in the free atmosphere.

Aircraft have been a valuable source of wind and temperature data for a long time. During the First GARP Global Experiment (FGGE) an automated system for collection of these data by satellite interrogation and relay proved successful. Following up on this development, including obtaining data on aircraft ascent and descent, will further augment the upper air data base.

Developments for remote sensing of clouds, ceiling, visibility and precipitation from ground-based systems are underway. Such systems would pave the way to partially automate some additional elements of the surface observations, and would automate nearly all of the elements included in conventional surface observations used for aviation operations. Many of the surface weather parameters are currently being measured automatically and have been packaged into automatic weather stations both at fixed land stations and as fixed and drifting buoys. Many of these are equipped so that the data can be acquired directly and relayed by satellite. Placing these automatic devices on ships would lead to improvements of observational coverage over the oceans. These developments pave the way for a greatly expanded coverage of specialized reporting networks such as required by hydrological, forestry and many other interests.

State of the sea and wind conditions at the surface of the oceans are important to all maritime interests. Instrumentation developments were tested on the SEASAT experimental satellite to describe the state of the seas, and from these observations to obtain surface winds. This promising development, if carried out on the proposed National Oceanic Satellite System (NOSS) satellites, would provide important oceanic data and could result in improved services for all maritime activities.

Finally, developments have shown that weather radar information can be evaluated more quantitatively by digitizing the output signals, and such a program is underway. Downstream from these efforts is the measurement of radial wind velocities using the Doppler principle. Plans are underway to replace the existing weather radars with a Doppler-type. When completed, the new radars should lead to improvements in specifying the intensity and location of severe local storms, heavy rainfall and other convective weather phenomena.

Computers

Continuing developments toward miniaturization of electronic circuitry and work toward Very Large Scale Integration (VLSI) point the way to new generation computers, probably at no more cost than today's large scale so-called Class 6 computers. The study of the three major processing centers being prepared concurrently with this review found that the three numerical processing centers were projecting downstream needs for computers near the 1000 MIPS (Millions of Instructions Per Second) capabilities by the end of the decade. On-going developments in the computer industry suggest that such capabilities represent a realistic achievement. Apart from inflation, the price/performance ratios for past computer advancements have shown a five-fold throughput increase for the same dollar investment. With this trend continuing, one can expect new super computers with reasonable prices.

This same technology is expected to provide powerful minicomputers for peripheral and decentralized functions for local users at reasonable cost. Developments indicate that the related computer data storage capabilities will provide vast data bases that can be readily accessed on a selective basis by multiple users. These developments open another pathway for users to obtain the kinds of information required to meet their particular needs.

Communications

Communication satellite developments will clearly provide new opportunities for weather services. Wide band availabilities at reducing costs can be used by the services for both the data acquisition and product dissemination functions. For example, one vendor has suggested the leasing of an entire satellite transponder with 60 million bits per second capacity to be channelized at the option of the user for a total satellite cost of $1.3M per year. Thus it does not appear that pure communications would result as a bottle neck in the flow of data or products to users. High volume, high speed communications are already on the scene, providing a mechanism for exchange of information between non-collocated activities.

Analysis and Prediction

Research and Development in both the Federal establishment and university community continues on problems of data assimilation and analysis and on improved prediction models. With the availability of each new class of computer, a more sophisticated analysis-prediction model has been introduced operationally that increased the accuracy of forecasts over the previous model. Continuing this trend depends upon some of the other developments discussed in this section such as increasing the data base, improved communications and faster computers. The projected increase in the observational data base provides the opportunity for finer scale description of the atmosphere and the atmosphere-ocean interface, communications appear capable of delivering data to processing centers and computers are projected that can improve the weather analysis and forecast process.

Research into both the mathematical and physical aspects of numerical weather prediction suggests that models with finer scale weather patterns are possible and that improved accuracy for longer range forecasts can be achieved. Past developments which combine the pure model outputs with statistical comparisons of the actual weather (Model Output Statistics - MOS) have shown skill, and further efforts indicate that this approach will continue to show positive results and can be expanded toward the prediction of other parameters required by the users.

Dissemination of Products and Applications

The U.S. Navy has implemented a computer-to-computer interactive display system that provides their internal users with alpha-numeric and graphical results from their central computer. The NOAA Automation of Field Operations and Services (AFOS) provides for communications and display of data and graphics. Development is underway toward further advances in these systems. The FAA and the USAF also have communications and display systems under development to meet their needs. Technology suggests that slow speed teletypewriter-facsimile presentations will be replaced by high speed video presentation of data, intermediate products, end result forecasts or other applications. Experiments are on-going to show that information can be obtained directly on unused capabilities of home TVs. Developing technology suggests that it will be possible for home computers to have access to weather services data bases with capabilities to extract the information one needs. Such a capability seems quite likely for at least a group arrangement of specialized users such as aviation or farmers.

Other developments relate to the presentation of weather information. Computer generated worded public and aviation forecasts are now available and can be expected to expand to other forecasts for specialized interests. Experiments have been successful to convert computer information into human voice outputs and the quality of such outputs may improve to the point of being generally acceptable to the user.

Summary

The projections could be expanded in several ways by detailed reference to many on-going experimental, research and development programs. However, it is felt that useful summary statements can be made based upon the above technological developments:

- The three dimensional state of the atmosphere and the state of the underlying surface will be determined with improved quantitative resolution and at more frequent time intervals. Important weather events will become exposed to almost continuous surveillance.

- o Increasing volumes of data will be sensed, collected, validated and made available in user data base form on a more timely basis and with decreasing need for direct human interaction.
- o Improved analyses and predictions using advances in numerical and statistical model developments will provide users with more accurate specialized application products.
- o Automatic generation of weather information both in written and spoken form will continue to develop and will result in more timely dissemination of information without the need for human interface.
- o Home TV may permit optimum presentation of weather information to the user through selective access to the weather services product data base.

This summary projects technological developments that should be considered in planning the activities of the Federal Weather establishment during this decade.

2.2 Plans For Providing Weather Services In The 1980s

This section reports on existing plans of the Federal agencies for improved and expanded weather service during the 1980s. Items now in development and those which the task team felt could be operational by the end of the 1980s are reported. Current programs of the agencies are not reported. Should the reader desire information about on-going programs it is suggested he read the current Federal Plan for Meteorological Services and Supporting Research (FY81).

2.2.1 Major Development and Procurement Programs for the 1980s

Three major programs for the 1980's are receiving the attention of the Federal Coordinator. These are the development and procurement of (1) the next generation radar (NEXRAD), (2) automated surface weather observations, and (3) automated weather collection and distribution systems.

2.2.1.1 NEXRAD

NEXRAD is the furthest along in that agreement has been reached for proceeding with a system to meet the common requirement of DOC/NOAA, DOD, and DOT/FAA. NEXRAD has capability beyond conventional weather radars, with the addition of Doppler capability that permits measuring the radial velocities of raindrops in a storm. This increased detection capability provides increased warning lead times and reduced false alarm rates for warnings of tornadoes and severe thunderstorms over present conventional weather radars. A Joint Systems Program Office (JSPO), responsible for the planning, development, and procurement of a network of the new radar and related data processors, has been established and manned for the NEXRAD system.

2.2.1.2 Automated Surface Weather Observation

The Federal Coordinator for Meteorological Services and Supporting Research completed a Crosscut Analysis of Agency Proposals for Surface Weather Observation Automation on October 3, 1979. In this crosscut analysis, the Federal Coordinator recommends (1) that a mechanism be established to determine convergence of requirements and joint procurement of common equipment for DOD, DOC, and FAA, and (2) that until such a mechanism is operating, all agencies should hold the procurement of new sensors and processors in abeyance. The OMB response to these recommendations was reflected in the FY81 budget guidance to DOC:

> "The 1981 budget allowance supports the accelerated development and field testing of the technology. Automation should be deployed at sites (as soon as technology permits) where actual staff reduction or elimination is possible with hard savings. Under your Department's lead, agencies should establish appropriate administrative procedures that will assure full coordination of efforts (common R&D and equipment) and lead to joint procurement of common equipment. This coordination mechansim must be operating before procurement actions are initiated by any agency. Furthermore, the Departments of Commerce and Defense should assess the possibility of using state of the art equipment (i.e., without present weather) to automate fully those observations where the discrimination between rain, snow and mixed rain and snow is not critical because of infrequent occurrence."

An agreement has been reached by the three agencies on the formation of a Joint Automated Weather Observation System (JAWOS) Program Office to coordinate their activities on automated surface observation systems. The JAWOS Program Office will be responsible for:

(a) Establishment of system requirements
(b) Development and procurement plans
(c) Systems specification;
(d) Systems procurement; and
(e) Coordination of system implementation.

It was announced at the June 26, 1980, Interdepartmental Committee for Meteorological Services and Supporting Research (ICMSSR) meeting that the FAA would be the lead agency and would be responsible for forming the JAWOS Program Office.

In the interim, the Panel on Automated Meteorological Observing Systems (PAMOS) of ICMSSR is doing a portion of the job that ultimately will be assigned to the JAWOS Program Office. A PAMOS working group is developing a requirements document for a Joint Automated Weather Observing System.

There have been informal agreements with respect to the research and development effort on three critical sensors. The FAA has proceeded with laser ceilometer development for measuring cloud heights; and the NWS is working on a laser weather sensor (fog vs rain vs snow). Visibility sensor development strategy has not been determined; however the Air Force has done work on visibility sensors and it is plausable that they lead this effort.

The Department of Agriculture (Forest Service) and the Department of Interior (Bureau of Land Management) are jointly planning a multi-year purchase of some 600 to 800 Remote Automatic Weather Stations (RAWS) that measure temperature, humidity, wind, pressure, solar radiation, precipitation amount, and cloud cover. The stations are being procured from current program funds as replacements for existing manned locations in the BLM and Forest Service programs. Use of these stations will increase the observational frequency from one per day to

24 per day; six of these daily observations will be archived. These programs will be coordinated with the JAWOS Program Office activities through the Federal Coordinator structure.

2.2.1.3 Automated Weather Collection and Distribution Systems

The third major program for the 1980s is automated weather collection and distribution systems. During the 1980s, four major automated systems in support of weather service programs are to be installed or are being planned for. The three Federal Agencies involved and the systems planned are:

1. The Department of Transportation's Flight Service Automated system and the National Airspace Data Interchange Network (FSAS/NADIN) are expected to emerge in the middle to late eighties as a fully operational system.
2. The United States Navy's Naval Environmental Display Station (NEDS) is in place at the Fleet Numerical Oceanography Center and at the four Naval Oceanography Centers. Installation at fifty bases world-wide is planned during the first half of the eighties.
3. The United States Air Force Automated Weather Distribution System (AWDS) is currently under development.
4. The NOAA Automation of Field Operations and Services (AFOS) is nearing completion insofar as equipment installation is concerned.

All of the systems, AFOS, NEDS, AWDS and FSAS/NADIN, although differing in degree of sophistication and capability, involve the display and dissemination of alpha-numeric and graphic weather information, information storage and retrieval, and message composition. These data handling systems are designed to maximize the capability of the forecasters and briefers in daily weather activity by eliminating many of the labor-intensive tasks of the job. AFOS and AWDS will also have some capability for simple local computations.

The Federal Coordinator in a December 23, 1979, memo to the chairman, ICMSSR, asked the committee to undertake a study to determine the opportunities for savings through development and procurement of common systems. The memo reads in part:

"The National Weather Service is well along on the road to an operating capability for its Automation of Field Operations and Services (AFOS) system.

The U.S. Navy has an initial operating capability for its Naval Environmental Distribution System (NEDS). Both the U.S. Air Force and the FAA are in advanced planning stages for systems that will collect, disseminate and display alphanumeric and graphic weather data and products. The requirements for these systems appear to be sufficiently similar to warrant an examination from the aspect of the opportunities for savings through development and procurement of common systems. If the ICMSSR concludes that there is sufficient justification for continuing the four separate paths, the rationale for such a conclusion should be stated clearly and include a definition of interfaces among the systems and their costs. If, on the other hand, ICMSSR concludes that some or complete convergence of requirements and programs is feasible and cost effective, a plan for this should be developed."

The ICMSSR meeting on April 10, 1980, addressed this request and agreed to:

"(1) Refer the automation issue to the SC/SD [Subcommittee on Systems Development] to:

--Examine the agency requirements and plans,

--Prepare a report plus recommendations if needed, for the Federal Coordinator."

Section 6.2.2 discusses this matter in considerable detail and elaborates on the capabilities of the existing and planned systems.

2.2.2 Automation and Modernization of Existing Sensors or Observation Systems

Several developments are likely in the area of upper air measurements. The Army is developing the Automated Atmospheric Sounding set AN/TMQ-31 as the replacement for the AN/GMD-1 for artillery support. The NWS is developing an Automatic Radio Theodolite to replace AN/GMD-1 and WBRT-57 equipment. The Air Force is upgrading the AN/AMQ-29 dropsonde recording system and is working with NOAA to develop an operational dropwindsonde capability for hurricane hunter aircraft. Current research and development by NOAA's Environmental Research Laboratories shows promise of eventually replacing the conventional upper air equipment with ground-based remote sensing equipment that could be fully automated.

The Navy plans to field test remote sensors in order to validate sensor algorithms for converting sensor output to geophysical parameters, such as sea surface winds and waves, surface and subsurface temperatures, ice, bathymetry, trafficability and atmospheric moisture.

The US Coast Guard has a program to automate its light house stations to permit withdrawal of personnel. This action will further reduce weather-related costs. In addition, conversion of NOAA data buoy communications from HF radio to satellite data links will reduce USCG support costs.

FAA plans to install automated surface weather observing and reporting systems at some general aviation and satellite airports. These systems will give the pilot, via radio, the wind direction, wind speed and altimeter setting. Equipment will be installed at airports that currently have an approved instrument approach from navigational aids but do not have weather observing service. The automated information will permit a pilot to make an instrument approach to the airport more efficiently and safely and will permit the FAA to lower minimum approach requirements.

The Air Force is modernizing much of its equipment. For example, it is modifying the AN-FPS-77 weather radars by replacing components to ensure a continuing operational capability until the NEXRAD program is implemented. Airfield meteorological equipment is being modified by replacing obsolete vacuum tube components with solid state electronics to reduce logistics and maintenance costs and mercurial barometers are being replaced by solid state barometers for the same reasons.

2.2.3 Proposals for Expansion of Satellite Technology and Applications

There are also several proposed developments related to new satellites and additional applications of satellite technology to meteorological services and related problems.

2.2.3.1 National Oceanic Satellite System

The National Oceanic Satellite System, (NOSS), is proposed jointly by NOAA, NASA, and the DOD, all of whom will participate in the program. Distribution of costs will be DOD (Navy) 50%; NASA 25%, and NOAA 25%. The ground system includes the primary processing facility, data dissemination by commercial communications satellites, and interface terminals to the user's data processing facilities. NOSS data will be used to meet increasing demands from marine areas such as commercial fishing and shipping, off-shore drilling operations, military operations, and recreation. Plans presently envision launching of the first NOSS spacecraft in 1986.

2.2.3.2 Satellite Data-Handling Systems

The Air Force plans to acquire an interactive processing and display system (IPADS) for use at the AFGWC to improve the interaction between man and machine to provide accurate and comprehensive meteorological forecasts. In March 1979, a contract awarded for the acquisition of a Satellite Data Handling System (SDHS) included an option for the acquisition of IPADS. These complementary systems will provide 35 computer consoles (29 IPADS, 6 SDHS) that AFGWC weather technicians will use to interact directly with the AFGWC computers. This automation will eliminate physical handling of hardcopy information (plotting, overlaying, tracing, posting, sorting, etc.). Meteorological satellite imagery will be integrated electronically with conventional meteorological data to construct a data base for use in analysis and prediction models.

The Navy has operational capability to receive and process data from Defense and National satellite systems to alleviate global maritime data scarcity. During FY81, the emphasis will be on developing applications models to use derived sea surface temperature, ice prediction models, and to refine the atmospheric temperature profiles calculated from satellite data. Also, wind data from remote ocean areas obtained from satellite images will be used in the upper air analysis program. The Navy will continue development of systems software for new or improved sensors and development of display and dissemination procedures for fleet users.

2.2.3.3 TIROS-N Instrumentation

The TIROS-N system, the third version of U.S polar-orbiting environmental satellites, became fully operational on June 16, 1979, when NOAA 5, the last satellite of the preceeding system, was deactivated. TIROS-N satellites are expected to increase the accuracy of weather forecasting by providing quantitative data required for improved numerical models. They carry advanced instruments to provide more reliable temperature soundings and microwave channels to facilitate sounding retrieval in cloudy areas. They also will provide greatly improved multi-channel images and carry a new data collection and platform location system. During the lifetime of the TIROS-N system, new instruments may be added or substituted for present instrumentation. Therefore, the spacecraft were designed for a 25 percent growth capability in terms of weight, volume, power, command, and telemetry. For example, NASA plans to develop an ozone sensor as part of its operational satellite improvement program. This new sensor is intended to furnish NOAA spacecraft with the capability to monitor atmospheric ozone levels in response to Congressional directives.

2.2.3.4 AgRISTARS

Satellite technology is also the basis for AgRISTARS (Agriculture and Resource Inventory Surveys Through Aerospace Remote Sensing). This is a broad-based, six year (FY80-85) research and development program led by the Department of Agriculture (USDA) with cooperation of NOAA, NASA, and other agencies to determine how satellite technology can be used as an information source by agriculture and renewable resources interests. AgRISTARS is one of the more innovative applications of meteorology to new national concerns, but meteorology is not the principal driving factor in the program.

The specific objectives of AgRISTARS include the development, testing, and evaluation of procedures for adapting aerospace remote sensing technology to:

(a) Improve the capabilities of the USDA to make timely and reliable assessments of changes in crop production;

(b) Provide more objective and reliable crop production forecasts;

(c) Assist in inventory and assessment of the condition of land, water, and renewable resources; and,

(d) Develop a cost base so that USDA can assess the feasibility and desirability of integrating remote sensing technology with existing data sources and systems.

The participating agencies are linked by a formal memorandum of understanding outlining cooperation in this program.

2.2.4 Other Development Areas

2.2.4.1 Computer Technology

The technology of computerized weather forecasting can be expected to progress in an evolutionary fashion. New analysis and forecasting models will create new demands for larger and faster computers. DOC and DOD are in the process of replacing and upgrading their large weather computers. The future direction and configuration of major weather processing computer systems is the subject of another cross-cut review currently being carried out at the direction of OMB. Therefore, this aspect of computer technology will not be addressed in this review.

Computer technology is moving rapidly and is providing new opportunities for improving weather services. The Green Thumb system under consideration by the Department of Agriculture is an excellent example. The objective of this system is to provide farmers with a means for receiving up-to-the-minute agricultural information in their homes at their own convenience. This will be done by means of a "Green Thumb Box" connected to the user's television set and linked by telephone lines to a county computer where the latest information on local weather, agricultural markets, pests, spray information, 4-H meetings, and home economics is available. To use the Green Thumb Box, the user simply turns on the television set, sets the dial to an unused channel, and telephones a local county extension computer. A "table of contents" for the computer will be displayed on the user's television screen, listing, by number, the types of information available. The farmer can then view the desired information on this television screen by pressing a correspondingly numbered button on the Green Thumb Box. A "talking" computer, such as the FAA Voice Response System

(VRS) now being tested in the Washington, DC, and Cleveland area, is another example of a system that makes a large amount of weather information available to users at low cost.

2.2.4.2 Programs for Service Improvements

2.2.4.2.1 Joint Agency Development Programs

a. PROFS System

The new Prototype Regional Observing and Forecasting Services (PROFS) program has begun its four-year development phase in the Boulder/Denver area. PROFS is an interagency program with participation by NOAA, FAA, DOD and NASA. The mission is to create a cost effective, improved local weather service capability that will be directly responsive to society's present and future service requirements. The main objectives of Phase I of PROFS are (1) to design an overall prototype local weather service system using the identified requirements for local services and current technology and (2) to create an Exploratory Development Facility (EDF) to test and integrate into the PROFS system various candidate technological solutions. The program is now at the beginning of a four year experimental phase.

b. Severe Storms Forecasting

The joint NASA/NOAA Centralized Storm Information System at the National Severe Storm Forecast Center at Kansas City, Missouri is an example of direct coordination. It is a cooperative effort of NASA and NOAA to assist NOAA in its severe storms forecast and warning mission.

c. FAA-NWS Center Weather Service Units, Low Level Wind Shear, and Clear Air Turbulence Programs.

Center Weather Service Units have been placed in some of FAA's air route traffic control centers, and will be in all 20 centers within the contiguous 48 states and one in Alaska by the end of FY80. Three National Weather

Service meteorologists in each unit provide service to the air traffic controllers and to other FAA facilities for two 8-hour shifts per day. In FY81 the number of meteorologists per unit is to be increased to four. FAA reimburses the National Weather Service for the program costs as well as providing staffing authorizations.

To assist the meteorologists in the Center Weather Service Units, remote weather radar display systems are being installed by the FAA. This system displays on a television screen six levels of radar detected precipitation intensity in six different colors. The system will provide a display of this information for the controller manning the air route traffic control sector as well as the center meteorologist. Installation of equipment will be completed by mid-FY81.

Installation of a low level wind shear alerting system is continuing and will be completed at approximtely 60 airports by FY81. This system uses wind sensors (anemometers) at peripheral locations around the airport and compares the readings from these sensors with a center field wind sensor. When a wind shear is apparent from this comparison, the tower controller is alerted and the information is passed from the controller to pilots approaching the airport or preparing for takeoff.

Under the FAA's Wind Shear Program, airborne solutions to low level wind shear detection have been developed. As a result of the extensive manned simulation and flight test effort, a Notice of Proposed Rule Making requiring airborne wind shear detection and avoidance equipment for air carrier aircraft was issued in FY80. In FY81, improvements in the algorithms to drive the flight director will be expanded to include automatic flight controls for possible wind shear encounters.

A radiometer device that shows great promise for warning airline pilots of clear-air turbulence (CAT) during flight was developed and tested by NOAA scientists on NASA research aircraft during 1977-79. Operational tests of

the radiometer were being made on commercial airliners and NASA aircraft during FY80.

NOAA also plans a coordinated new and improved marine weather service for coastal and offshore areas in cooperation with the U.S. Navy. Ocean Service Units will be established and operated as elements of existing Weather Service Forecast Offices.

2.2.4.2.2 NOAA Public Services

NOAA is planning to expand its Weather Wire Service,a teletypewriter system that delivers weather information and warnings to the media and state and local governments, to all of the 48 contiguous states.

2.2.4.2.3 Military Weather Services Development Programs

The military Weather Services are actively developing techniques for determining atmospheric effects on electro-optical and near millimeter wave length weapons systems. Typical systems are influenced by natural and man made, (clouds, fog, precipitation, smoke, dust, etc.) obstructions to propagation; microwave detectors are helpful for this problem.

The Navy's Automated Environmental Prediction System (AEPS) program will be developed to achieve a 1985 automated capability to meet essential environmental support requirements of Navy Command and Control. The system will be used to process and analyze meteorological and oceanographic data that describe air-ocean interactions affecting naval operating areas around the globe; to predict atmospheric and oceanographic conditions with the timeliness, accuracy, and scale of prediction necessary to meet command and control and weapons-sensor system requirements; and formulate, disseminate and display weapons-sensor systems performance predictions based on predicted environmental conditions. Emphasis is on improvements in analyses and predictions.

2.2.4.3 Support for Emergency Management

Demands for emergency services are expected to expand and become more formal in structure. Although support during emergency situations such as floods, tornadoes and hurricanes has long been an intensive part of National Weather Service

activities, directly related to its mission of protection of the lives and private property of the nation, the formation of the Federal Emergency Management Agency (FEMA) will start a new support phase. Although extensive means have been developed for distributing emergency information and warnings, a new set of specific requirements for emergency support should be anticipated. The new requirements will include environmental support for dealing with incidents of public concern such as the Three Mile Island incident as well as flood, hurricane and tornado disasters. Public demand for protection increases with the numbers of planned facilities. Agencies such as the Nuclear Regulatory Commission are concerned with quick reaction monitoring resources. This will undoubtedly require multi-agency involvement and coordination; State and local facilities will be involved; and significant change from a rather passive to an active role in demands and needs for support probably will evolve.

2.2.4.4 Needs for the Future

In the future, new agencies with expanding needs will undoubtedly require another detailed look at facility planning, particularly with regard to communications. Population growth and movement involves concern and demands for adequate weather services as potential flood plains and coastal inundation areas are developed. Cities and communities in areas vulnerable to severe storms, tornadoes, and hurricanes require protection. Evacuation problems become more complicated and the need for services increases with the population growth. And as the needs grow, so will the demand for facilities to meet these needs.

2.3 Present and Future Role of the Private Sector

Federal agency views were solicited on the present and future role of the private meteorological sector in providing weather services to the public. Other than the NWS, very few agencies had any comments to offer. It became clear that the NWS is the major interface with the private sector. One exception is the DOD Naval Oceanography Command which indicated that at least two private companies had access to its computer data base. These companies were involved in the prediction of optimum ship routing for commercial interests.

Aside from the comments received from the NWS on this subject, the major portion of this discussion is derived from a summary of three workshops held in Boston, MA, (Oct 12-13, 1978), Boulder, CO (Nov 15-16, 1978) and Washington, D.C. (Feb 14, 1979). These workshops were sponsored by the Subcommittee on Natural Resources and the Environment of the Committee on Science and Technology, U.S. House of Representatives, to obtain the views of Federal agencies, private sector and academia on the proposed NOAA Organic Act [1]. These workshops discussed the full spectrum of inter-relationships between Federal agencies, academia, and the private sector in the provision of weather services and research. They were well attended by knowledgeable individuals and the results of the sessions are incorporated in a rough draft, dated May 9, 1979. Only that portion of the draft dealing with agency views of the present and future role of the private sector are dealt with here.

2.3.1 National Weather Service Comments

The most current policy statement on industrial meteorology was issued by the Director NWS and issued in the fall of 1978 as a revision to Chapter A-55 of the NWS Operations Manual. In part it states:

> "Private Meteorologists serve specific businesses and individuals who depend on specialized meteorological advice which cannot be satisfied by authorized government products or dissemination methods.
>
> "NWS will provide support...to non-Government meteorologists whenever such support can be given within available resources without partiality, and without compromise of its mission or of regulations covering release of information. NWS supports the concept of private sector meteorology which is responsible, competent and service oriented."

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1 H.R.9708 - "NOAA Organization Organic Act of 1977".
H.R.13715 - "National Weather Services Act of 1978".

The NWS policy statement also notes that NWS products, regularly prepared for the general public, are available to business and industry or that, where the general welfare is served, products for specific industries such as aviation, agriculture, forestry and marine are routinely prepared, but that "NWS will not provide specialized services for business and industry when the services are currently offered or can be offered by a commercial enterprise."

Within the NWS structure, there appears to be some difference of opinion with respect to the relative roles of the private sector and the NWS. In general the NWS headquarters holds to its policy quoted earlier; but some lower echelons in the field services tend to have a less liberal attitude toward full cooperation with the private meteorologists. This varies from viewing them as competitors, to concern over private metorologists using NWS forecasts in such a way as to bring unwarranted criticism on the NWS.

Within the next decade the NWS leadership does not see any significant changes in the current relative roles, although it does think that perhaps more industries will be making more and more use of private meteorologists.

When asked about the NWS fruit-frost forecast program, it was agreed that this is a grey area of responsibility between the two sectors. However, while there has been some questioning by the private sector on this specific program, there has not been an overwhelming objection to the provision of this service by the Government.

Information from the private sector regarding on-going or potential problem areas usually comes through the Special Assistant for Industrial Meteorology in NOAA. Only 10-15% of that individual's time is available for this portion of his duties and responsibilities. At one time, a full time positon was available in NWS headquarters for public sector contacts but the position was abolished. The NWS Regional Headquarters also had a User's Service Representative for a similar purpose and the function still exists at this level.

The Special Assistant for Industrial Meteorology meets annually with members of the AMS Board of Industrial Meteorology and the National Council of Industrial

assistance and or complaints from the private sector. Frequently, these are referred to the appropriate Branch or Division Chief in NWS to obtain assistance. Many meteorologists in the private sector have developed a rapport with these headquarters people and deal directly with them when problems arise.

2.3.2 Summary of Workshop Comments

The Boston workshop, attended mostly by executive branch agencies, reviewed agency atmospheric programs and held general discussions on atmospheric services and research.

The Boulder workshop was attended by a more broadly-based group of the private sector, user groups, university atmospheric scientists, and representatives of government agencies.

The final workshop meeting in Washington was attended mostly by Government and private meteorologists.

With respect to the relative roles of the private sector and the Federal government, the question posed was:

What should the responsibility of the Federal Government be in providing weather services in the following categories:

- severe weather warnings
- public weather services, and
- specialized weather services (e.g., agriculture, aviation, weather service inputs to water resources planning and management, marine, forestry, etc.)

In addressing this issue the following pertinent questions were also considered:

- What should the Federal Government's policy be towards the issuance of severe weather warnings?
- What should the Federal Government's responsibility be to provide data to the private sector?

The basic issue was, what should be the respective roles of the Federal Government and the private meteorological sector in providing weather services?

Nearly all of the participants at all the workshops supported a stronger role for the private meteorological sector and agreed that this sector should be able to operate in whatever area the market leads it. It was agreed that the Government, through encouragement by NOAA or other agencies and perhaps even through legislation, should attempt to encourage, stimulate, and support the private meteorological sector.

In view of the Government's function to provide for the national defense and for the protection of life and property, the need for military weather services and for the severe weather warnings by the Federal Government were universally agreed upon. Further, because certain basic data are needed to perform these functions and because of the high costs of acquiring these basic data it was agreed that this task was also a Federal responsibility.

There was a strong consensus among the Federal agencies that the provision of general public weather services is the responsibility of the Federal Government. Some of the specialized services now being provided by the Government came under scrutiny as candidates for possible private sector responsibilty (other than the military and possibly, the marine area which is assumed to be an extension of the general public service).

Most agreed that there were also some specialized services the government could properly provide except, perhaps, specialized services for particular user(s). In this regard, if the weather service in question related to public health, welfare, safety, or defense and there were economic consequences of national significance (e.g., aviation, agriculture) then it was properly the responsibility of the Federal Government. Specialized weather services such as the fruit-frost warning service did not seem to meet the above requirements and were considered appropriate for private sector responsibility.

2.3.3 Views of the Private Sector

A recent study prepared by Walter F. Zeltmann, of International Weather Corporation ("The Projected Image of Industrial Meteorologists," Bulletin of the AMS, VOl. 61, Number 1, January 1980) deals with the types of services being offered by the private sector. The information was listed in a matrix and is shown in Table 2.1. It is a good indicator of the types of services being marketed by the private sector. Also of interest is the relatively uniform growth of the private sector (except for the five year period ending in 1974) over the past 25 years. The data were derived from the Professional Directory of the Bulletin but do not reflect the total number of firms in the private sector since not all advertise in the Bulletin. Because there has been a significant growth in the private meteorological sector, their views with respect to the relative role of the Government and the private sector should be of concern.

The discussion here is based on the workshops referred to in the previous section and on a very limited sample of visits to two major private services, a major TV network, and on a previous SDC study "Comprehensive Review of the Functions, Activities and Operations of the NWS Weather Service Offices."

At the workshops with representation from the private sector and academia there were some significant comments. One view, expressed by a few of the academic community and supported by some of the private sector with respect to the relative roles of Government and private sector, was presented:

1. The collection and processing of weather data, both in real time and for retrospective use, should be carried out by Federal personnel and at public expense.
2. Public safety justifies governmental responsibility for preparing severe weather warnings.
3. The Federal Government should have responsibility for general public forecasts.
4. All other weather services should be delivered by the private sector, which should have the products of the Federal weather service made available by the Government at only the incremental cost of tapping into the system used for Federal purposes. The full cost of special observational or processing needs should be borne by those having the need.

Table 2.1

Frequency Distribution of Services

Offered by the Private Meteorological Sector

	1954	1959	1964	1969	1974	1979
Service categories						
General research	7	14	22	32	31	48
Equipment	1	3	12	15	21	37
Environmental Research	0	2	6	8	23	35
Forecasts	5	11	11	18	17	23
Forensic	1	1	1	5	11	20
Marine	1	3	5	10	10	15
Aviation	0	0	3	6	11	11
Agriculture	0	0	0	0	2	11
Media	0	0	1	3	6	10
Modification	4	6	6	8	5	9
Geographic	0	0	1	4	1	4
Construction	0	0	0	0	0	4
Undifferentiated	4	6	6	6	8	3
Hydrology	0	0	1	5	2	1
Total	23	46	75	120	148	231
Number of firms listed	15	25	35	49	57	81
Average number of categories per firm	1.53	1.84	2.14	2.45	2.60	2.85

Under this division of responsibility between NWS and the private sector, the so-called "specialized services" would not be a Federal responsiblity. Presumably the coastal, off-shore and open ocean general forecasts now issued by the NWS as part of its Marine Meteorological Service would be considered an extension of the general public services.

There was not a consensus to support these views at the workshops. There was, however, general agreement at the workshops and among the limited sample of the private sector interviewed on the respective roles of the Government and private meteorological sector as outlined below.

It was agreed that the Federal Government is, and should be, responsible for the collection and processing of data, public weather forecasts, warning services and the provision of specialized services where the general welfare of the public was concerned (e.g., agriculture, aviation, etc). The private sector should be responsible for the provision of specialized forecasts for private organizations, industry, and commerce and state, local and county government interests (highway patrols, fire departments, state officials, etc). Forecasts of a specific nature, tailored for a specific client are not a Federal responsibility.

The private sector was concerned that, although there is a NWS policy statement that attempts to clarify the respective roles of each, the NWS field offices do not always adhere to this policy and some do provide "specialized services" to private individuals, and/or to industry. A feeling was expressed that the NWS field offices look upon private meteorologists as competition. This feeling was also indicated to a certain extent in the previously cited SDC study.

The SDC report noted "there is substantial evidence that the WSOs are providing specialized services to private (and individually owned) concerns". Several examples were then cited of specialized services being provided, by some WSOs, that should properly have been provided by the private meteorological sector.

Concern was expressed, by the private sector sampled on the AFOS system, that it may result in a loss of data currently being received from NWS. While it is agreed that the NWS responsibility is to make the data available and it is their (the private sector) responsibility to pay for the line charges and equipment to obtain the data, nevertheless, concern was expressed about the high costs of obtaining data when AFOS is implemented, and its impact on small or marginally profitable companies.

A few private sector meteorological organizations (rather large ones) were of the opinion that there would be a marked increase in services being offered by the private sector. This increase would be at the expense, perhaps, of smaller, marginally profitable organizations. The cost of technology (communications, computer capability, access to radar and satellite data, etc.) will continue to increase and thus only those organizations with the necessary resources will survive.

In this regard, the AMS, in cooperation with University Corporation for Atmospheric Research has taken the initiative to form an Ad Hoc committee to study the impact of AFOS on users outside the NWS. The committee is composed of non-government users of government data including representatives from the private sector, meteorologists, TV, academia, aviation, etc. A meeting was held at AMS headquarters in Boston; the Deputy Director of NWS and some NWS staff members also attended. The problem was discussed and, while no solution evolved, a first step was taken. A consolidated list of requirements is being prepared by the private sector and will be sent to the NWS. It is to be hoped that the initiative taken by the private sector will eventually result in a coordinated effort and solution equitable to all.

The private sector deals through the Special Assistant for Industrial Meteorology, NOAA, when problems or requirements arise. While there was no strong feeling about the adequacy of this approach, one of the corporations visited felt that the views of the private sector were not always adequately represented in NWS decisions (e.g., AFOS) that impacted on its operation. It was suggested that since the private sector is growing rapidly, it should get the same type of full time representative afforded academia (e.g., a full time Director of

University Affairs, NOAA). Those interviewed believe that the staff of the Special Assistant for Industrial Meteorology should be expanded to interact directly with this community on a continuing basis rather than on an Ad hoc or "complaint" basis.

The Executive Director, AMS, is of the opinion that the private sector will continue to expand during the eighties both in numbers of concerns and in volume of business. He expressed concern that because of the competitive nature of the business, a single voice to speak for the private sector in its dealings with NOAA/NWS has not emerged. This creates a problem with respect to coordination of requirements among the private sector for input to NOAA/NWS. He feels that in the absence of a formal private sector presence, Ad Hoc committee procedures may fill the void. He suggests a strengthening of the Office of Special Assistant for Industrial Meteorology, NOAA, as a means of improving coordination with the private sector.

A paper by the Special Assistant for Industrial Meteorology, NOAA, was recently published in the AMS Bulletin, (May 1980), "Prospects for Industrial Meteorology in the 1980's" which addresses the subject of the projected private sector growth in this decade. He says, in part:

> "It seems very clear that the next five to ten years will bring substantial change to the private practice of meteorology. We will see increases in the sophistication of data handling, of data processing and forecast techniques. The acceptance of private services is likely to increase commensurately. It is uncertain at this point whether operations will remain viable for the many new firms now coming into existence. Since many of them are now being established with relatively small amounts of capital, it seems probable that they will need new sources of capital within the next five years in order to stay in business. Some will find support through alliances with large businesses. Some may be able to merge in order to create larger and better capitalized firms. It does seem likely that during the early 1980's we will see a number of failures of small consulting firms established in the late 1970's. The final outcome, however,

should be a smaller number of larger, more prosperous firms in the late 80's probably doing a sharply increased amount of consulting business over what is now common."

2.4 Contributions of the Academic Community

There are two major contributions to the Federal meteorological effort by academia. The first is in the area of education. University graduate and undergraduate programs in Atmospheric Sciences are the major source of meteorologists for the Federal Services. Additionally, the universities provide post graduate work for federal employees on federal scholarships, on a course by course basis and or specialized 2 to 3 month programs (e.g., agricultural meteorology). In general, there is satisfaction with the calibre of meteorologists being graduated, and with the course programs, although these vary from university to university. There is some concern over whether or not the university curricula are keeping abreast of the "changing role" of the meteorologist. The rapidly changing technology (radar, satellite, numerical weather prediction) suggests that some changes in curricula more attuned to the realities of the meteorologist's emerging role are in order. While there is sympathy among the University faculties to the idea, and many universities do make use of the technology in their educational program, there is a feeling that this portion of the educational process (e.g., use of new technology) is best accomplished in the field, after graduation.

The other major contribution is in atmospheric research. It is this area in which there is a large interest by the university group. The FY78 distribution of federal funding in Atmospheric Sciences, by agency, is shown in Table 2.2. That portion of research accomplished by the university group is indicated in the third column and represented about 23% of the total expenditure. This compares with "in-house" expenditures of 38% and "industry" and "other" allocations of 25% and 15% respectively. The data for this table were derived from sources indicated on the table itself.

In recognition of its relatively low allocation to university research, and in an attempt to increase its relationship with the academic and research community, NOAA has recently issued a memorandum, dated June 18, 1979, to all of its MLCs (Major Line Components) titled "Increased Relations Between NOAA and the Academic

Table 2.2 Distribution of Federal Atmospheric Science Funding, FY 1978, by Agency, in Accordance With Where Funded Research is Performed a/

(in thousands of dollars)

	In-house Research		Industry Research		University Research		Other Research b/		Total Research	
	Funds	%	Funds	%	Funds	%	Funds	%	Funds	%
Agriculture	1,777	77.36	50	2.18	470	20.46	-	-	2,297	100
Commerce	46,349	80.96	6,666	11.64	3,697	6.46	539	0.94	57,251	100
Defense	46,443	65.03	15,675	21.95	8,530	11.94	770	1.08	71,418	100
Energy	3,731	19.87	130	0.69	2,512	13.38	12,408	66.07	18,781	100
Interior	1,463	19.22	2,100	27.58	2,000	26.27	2,050	26.93	7,613	100
Transportation	3,939	50.12	3,920	49.88	-	-	-	-	7,859	100
EPA	3,000	22.56	7,800	58.65	2,500	18.80	-	-	13,300	100
NASA	4,141	7.80	34,748	65.44	14,213	26.76	-	-	53,102	100
NSF	1,200	1.90	1,400	2.22	32,870	52.02	27,715	43.86	63,185	100
TOTALS	112,043	38.01	72,439	24.58	66,792	22.66	43,482	14.75	294,756	100

a/ Data obtained from Natonal Atmospheric Sciences Program: Fiscal Year 1978. ICAS 21-FY78. September 1977. p. 4.

b/ The category "other" represents funds expended in non-profit or not-for-profit organizations (other than universities) as well as miscellaneous expenditures.

and Research Community." This memo encourages increasing substantially the university funds allocated to research, relocation of NOAA research facilities with academic institutions (under certain conditions), cooperative agreements with academic institutions, more use of consultants, informal consultation and short term appointments to NOAA from the academic community. A Director of University Affairs is established in NOAA to oversee the relations with the academic community.

A similar NASA memo aimed at the continuation of a strong academic involvement in the NASA R&D program was issued in 1979. This memo, "NASA/University Relations," was sent to all Associate Administrators in NASA and in very strong terms encourages the use of academia in the basic research programs of NASA, which already allocates all but 7.8% of its research funds to industry and academia. NASA has in the past made computer facilities available to academia at no cost. However, because of increasing computer costs, this policy is now undergoing changes and all users will be charged for computer-time.

NASA depends upon the academic community for major support in its research activity. This is especially true in the development of global models and analyses of data in support of its studies on climatic processes and in understanding the physical and chemical processes of the atmosphere.

NASA uses the "workshop" technique to develop plans, ideas, etc. and includes representatives at these workshops covering a wide spectrum of governmental and academic institutions.

Currently, the Naval Oceanography Command of the DOD, relies heavily on the university community and on the Navy Post Graduate School for development of its prediction models and expects to continue to do so at nominal cost when working on projects of mutual interest. The Fleet Numerical Oceanography Center (FNOC) makes their operational computer facilities available to university researchers free of charge. No change in this arrangement is anticipated at present.

The University Group felt that of all the agencies involved in meteorological research, NOAA could distribute more of its resources to university

research and made this feeling known at the workshops discussed in 2.3.2 (specifically, the Boulder workshop). The NOAA Administrator responded to this with the policy referred to earlier.

A former President of the AMS made these comments with respect to the relationship between the Federal agencies and academia. He stated that the major role of the universities in meteorology is to provide students with a well rounded education that will enable them to meet the challenges of field forecasting and research. Each university has its own areas of expertise and the thrust for research should, therefore, be an individual one for each university, dependent upon this expertise. He would like to see this area of contribution further exploited by the Federal agencies. Finally, he suggests that the exchange program between the universities and federal agency field meteorologists be re-vitalized and expanded. Thus, field meteorologists and hydrologists could be assigned to universities for short periods of time (1-3 months) to teach applied forecast techniques, and university staff could be assigned to forecast offices to obtain first hand knowledge of forecast problems and to impart their own theoretical knowledge to field forecast personnel. This cross-fertilization would have beneficial effects on both communities.

2.5 Coordinating Mechanisms For Weather Services And Supporting Research

None of the agencies interviewed expressed any strong views with regard to the existing Department of Commerce mechanism for carrying out its responsibilities under Circular A-62. There was general agreement that the level of activity within the Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM) had deteriorated in recent years and the current effort on the part of the Department of Commerce to strengthen the OFCM was needed. Still several agencies felt that the essential day-to-day coordination of interrelated agency programs had not suffered.

One agency member pointed out that the individuals responsible for the largest operational meteorological programs have been so submerged organizationally through the years that it is very difficult for them to coordinate

their programs. None of them is on the Federal Committee for Meteorological Services and Supporting Research and only the Director of the National Weather Service has been on the Interdepartmental Committee for Meteorological Service in recent years. Some interagency coordination takes place on a bilateral basis because of the difficulty of getting the material up through agency channels and before the appropriate OFCM committee. In the present circumstances the bilateral approach is effective.

It was commented that the OFCM structure serves a useful purpose in allowing individuals to meet and know their counterparts in other agencies and their programs and that this greatly facilitates informal day-to-day phone contact and coordination.

One agency representative at the Federal Committee level felt that the Circular A-62 and the OFCM mechanism are more effective than people realize. He was strongly of the opinion that his agency would probably have gone its own way with many of its meteorological programs had it not been for the constraints imposed by Circular A-62.

Another agency member felt that the Interdepartmental Committees for Meteorological Services (ICMS) and Supporting Research (ICAMR) had failed to do their job in identifying areas of overlap or duplication and that if they had, some hard decisions would have been passed to the Federal Committee for resolution.

Still another agency representative was of the opinion that the Federal Coordinator is in need of greater authority if he is to achieve the intent of Circular A-62. This same agency member raised an interesting interpretation of Circular A-62. It was his view that the Circular does not confer on the Department of Commerce any responsibility or authority for coordinating meteorological programs that are solely within a single department. For example, he did not feel that the Federal Coordinator had any responsibility with respect to duplication between meteorological programs of the Air Force and the Navy or between the Coast Guard and the FAA.

Several agency members stated that the Federal Coordinator should focus on issues, program development plans and program overlap and place much less emphasis on the annual plan. Several agency members expressed doubt as to the value of comprehensive plans. (The GAO in its study also encountered this same view.)

There was a general view from the agencies that no purpose would be served by seeking legislation reaffirming the provisions of Circular A-62; any desired change in the Circular could be satisfactorily accomplished by an amendment.

One agency member expressed an old concern, namely that the Office of the Federal Coordinator for Meteorological Services and Supporting Research should be an independent entity and at a high policy level within DOC.

As reflected in the GAO report, Federal agencies were uniformly in opposition to the Department of Commerce having direct control, including management and budgetary authority, over meteorological programs of other Federal departments and agencies.

One agency member felt that overall coordination among agencies was good. The problem is in a few areas of duplication which can and should be addressed by the Federal Coordinator. He suggests that another problem is the many boards, committees, advisory groups, commissions, etc. in the meteorological area, many of which duplicate each other's work.

In discussions with OMB personnel, they make the point that the size and mission of their office is changing and they do not have the capability to follow programs as closely as they once did. They are looking ahead more and more and are less aware of what is happening on a day by day basis unless a specific problem is brought to their attention. Only the Federal Coordinator has the time and the staff to surface issues and bring together interagency programs. For that reason, OMB continues to support a strong Federal coordinating mechanism.

Opposing views were encountered within one organization with regard to the organizational level of the Office of the Federal Coordinator. One view suggested that the role needed to be strengthened and given more independence; the other being that the office should remain in its present location where the meteorological program activity of NOAA takes place.

SECTION 3 - STATUTORY AND REGULATORY AUTHORITIES OF THE AGENCIES

With the exception of the National Weather Service and the Federal Aviation Administration, statutory authorities of the agencies as they relate directly to meteorology either are non-existent or are derived from authorities such as the Clean Air Act or from support of general mission responsibilities.

Most of the authorities stem from the budgetary process which serves the purposes of most agencies. Programs are proposed and funded, and the success of funding usually relates to program priorities rather than to any specific authority. The Federal Coordination mechanism does serve to keep the agencies apprised of activities of the other agencies. Relatively new and evolving agencies such as the Federal Emergency Management Agency and the Nuclear Regulatory Commission are developing requirements and relationships in the meteorological area with no apparent problem with basic authorities.

Most agency activities in meteorology are described in the Federal Plan for Meteorological Services and Supporting Research. The authorities as reported by the agencies relating to these activities are shown in Appendix D.

Weather plays an important role in the activities of the Federal Government. Therefore, several agencies of the Federal Government engage in or make significant use of weather services and supporting research. These agencies collectively have the following broad program goals for their weather activities:

- Promote the economic and social well-being of the nation.
- Enhance the national security.
- Minimize the financial and social disruptions caused by weather-induced disasters.
- Preserve and enhance the environment.

A generalized statement of activities of each of the principal Federal agencies, and the related authorities are presented below:

Department of Agriculture (USDA)

The Nation's food and forest resources are becoming increasingly important to our domestic and international economic situation. Food has recently taken on new dimensions in foreign affairs and national security. Weather, and its effect on crop yields, is one of the most important factors in the Nation's agricultural production. The USDA conducts supporting research that focuses on understanding the interactions of weather and climate with plants and animals. USDA also assists the Department of Commerce in determining farmers' needs for weather information and in disseminating such information to them. The nation's forest resource must be managed for multiple use and must be protected from adverse impacts of fire, insects, disease, and pollution.

USDA conducts research that focuses on better management of the forest resource and the role weather plays in achieving those goals pursuant to its mission. USDA takes special fire weather observations and cooperates with the National Weather Service in providing fire and land management weather information to help manage the almost 181 million acres of National Forest land.

Department of Commerce (DOC)

DOC's National Oceanic and Atmospheric Administration (NOAA) is the principal meteorological agency of the Federal Government. By law, NOAA is responsible for reporting the weather of the United States and providing weather and flood forecasts and warnings to the general public, developing and furnishing specialized weather services for specific user groups, and recording the climate of the United States. This mission is carried out within NOAA by the National Weather Service (NWS), the National Environmental Satellite Service (NESS), the Environmetal Research Laboratories (ERL), and the Environmental Data and Information Service (EDIS). DOC is charged by statute authority to prepare an annual plan presenting a horizontal view of meteorology to be submitted with the President's budget. This requirement has been

implemented by OMB (BOB) Circular A-62, and a DOC implementation plan establishing within DOC the Office of the Federal Coordinator for Meteorological Services and Supporting Research.

NWS carries out data acquisition, preparation of forecasts and warnings, communications, product dissemination, and applied research and development functions. Public weather services focus on information needed by the general public in its daily activities. Warnings are aimed at reducing loss of life and property caused by weather events. Special meteorological services provide information to enhance the efficiency and safety of agriculture, forestry and transportation industries.

NESS provides images and quantitative data on the earth and its environment to meet civil and military needs. NESS operates a national environmental satellite system of polar-orbiting and geostationary satellites.

Research and development activities within NESS are directed toward improved sensors and observing techniques and new applications for environmental satellite data. NESS specifies the performance of the spacecraft and NASA acts as their agent to build, procure, and launch them.

ERL research programs are oriented toward providing understanding of the atmosphere and oceans and developing the new technologies that will form the basis for future improvements in the Nation's weather services.

EDIS disseminates global meteorological and climatological information to commerce, industry, agriculture, the scientific and engineering community, the general public, and Federal, state and local governments and conducts mutual data exchanges with foreign countries.

Department of Defense (DOD)

DOD operates a military environmental service system to provide specialized worldwide meteorological and oceanographic prediction services in support of military forces. This service directly supports all phases of military operations, from strategic planning to tactical operations. The U.S. Navy's Naval Oceanography Command and the U.S. Air Force's Air Weather Service are the primary military performing agencies. The Army and the Marine Corps each have a small generic weather support capability, but depend upon the primary weather services for most support. The military weather services contribute to the national and international weather observing capability by making conventional observations on land and at sea where there is no other conventional weather observing capability and where the observations are most needed to meet military requirements. In addition, DOD maintains special observing capabilities such as the Defense Meteorological Satellite Program and aerial weather reconnaissance to meet unique military requirements. The reconnaissance program also serves national needs for data from tropical and coastal winter storms. Observational data are sent by military communications networks to military and civil facilities in the United States and overseas.

Department of Energy (DOE)

The DOE supports meteorological services at nine of its National Laboratories under DOE cognizance, and at the Nevada Test Site. Services include climatological summaries, daily weather forecasts and products specifically in support of laboratory operations such as environmental monitoring, atmospheric sciences research, and hazardous material release assessments. The Weather Service Nuclear Support Office at the Nuclear Test Site provides continuing meteorological services required for the safety and technical programs associated with nuclear and non-nuclear experiments conducted by the DOE at the Test site and other locations.

Department of Interior (DOI)

The principal meteorological activity of DOI is the weather modification research program called Project Skywater, administered by the Water and Power Resources

Service, dedicated to augmenting water resources in critical water problem areas of the West through the development and demonstration of a practical precipitation management technology. Other Water and Power activities, including runoff forecasting, flood hydrology, irrigation projects, and reservoir operations, as well as projects related to the development of wind and solar energy resources, also require the collection and use of meteorological data.

The Water Resources Division of the Geological Survey in DOI collects and uses meteorological data in its runoff forecasting and flood hydrology activities and in studies of the effects of atmospheric deposition.

The Bureau of Land Management in DoI collects meteorological data from a system of remote automatic weather stations and operates a Lightning Detection System, containing wideband direction-finders that respond primarily to cloud-to-ground lightning, in its fire-management program.

Department of Transportation (DOT)

Federal Aviation Administration:

The Federal Aviation Administration (FAA) is responsible for the safety and separation of aircraft and the efficiency of flight operations. The adequacy of aviation weather information contributes significantly toward the fulfilling of these responsibilities. FAA makes recommendations to the U.S. Department of Commerce on civil aviation meteorological services, provides specialized equipment and surface observations at certain airfields, distributes weather data over civil communications systems and provides the principal means for disseminating weather information to pilots.

Weather information for pilots is made available through Flight Service Stations, recorded messages broadcast over navigational aids, special weather broadcasts, and telephone answering systems. Air Route Traffic Control Centers now have weather service units manned by NWS meteorologists to assure that vital

FAA maintains a continuing research program to improve aviation weather service to the National Airspace System and its users. FAA also engages in engineering efforts to improve weather observations and communications related to aviation.

U.S. Coast Guard:

The U.S Coast Guard cooperates with the NWS in observing, forwarding, and disseminating weather information. Observations taken by Coast Guard units and those from coastal and high seas commercial shipping are sent to NWS offices. Some NWS automated observing systems are located at Coast Guard stations and on navigational buoys. NWS forecasts and warnings for coastal and high seas areas are included in the scheduled Coast Guard Marine Information Broadcasts.

Coast Guard personnel stationed at the NOAA Data Buoy Office at Bay St. Louis, Mississippi, furnish technical support and liaison for NOAA Data Buoy operations. Coast Guard vessels are used to deploy and maintain NOAA data buoys.

Environmental Protection Agency (EPA).

The Environmental Protection Agency is responsible for working with State and local government agencies to ensure adequate meteorological support for air quality programs. Applied research and meteorological support to EPA are provided by NOAA's Environmental Research Laboratories. Support to the Office of Air, Noise and Radiation, the EPA regional offices and other EPA components includes review of environmental impact statements development and state implementation plans, application of dispersion models to establishment of air pollution standards, regulations and control actions, preparation of dispersion studies and evaluations, and meteorological support for air pollution emergencies and episodes.

National Aeronautics and Space Administration (NASA).

The NASA weather and climate program is an integrated effort to develop new technology for use in improving the quality of meteorological information to meet national needs. A central assumption to all of NASA's efforts is that by use of satellite remote sensing systems, much of the needed data can be collected

and processed in a more cost-effective manner than by any other means. The NASA program may be divided into three components:

- o Developing coordinated space and ground systems for severe storm detection, prediction, and warning.
- o Applying space technology to improve forecasting for periods up to two to three weeks.
- o Investigating the potential for monitoring and predicting climate changes.

National Science Foundation (NSF).

The National Science Foundation supports meteorological research primarily at universities and non-profit institutions through its Atmospheric Sciences Division. Although the research is largely basic in character, there are portions of three programs that could ultimately improve either basic or specialized meteorological services. The three programs are (1) Meteorology, (2) Experimental Meteorology and Weather Modification, and (3) The Global Atmospheric Research Program (GARP). The Meteorology Program supports the development and improvement of limited area numerical models of the atmosphere that could ultimately improve operational numerical forecast models. The Experimental Meteorology and Weather Modification Program, together with NASA, DoD, FAA, NOAA, and DoI supports university scientist participation in activities such as the Severe Environmental Storms and Mesoscale Experiment (SESAME) which is aimed at improving the predictions of severe weather.

GARP is an international effort to obtain basic knowledge that should ultimately improve weather forecasting. NSF supports research on methods of accounting for smaller scale processes in large scale numerical models of the atmosphere that could directly improve operational weather prediction.

Federal Emergency Management Agency (FEMA)

FEMA was established in 1979. It merged into FEMA the closely allied Federal programs involved with preparedness, mitigation and response to national emergencies ranging from natural and manmade disasters to nuclear attack. It replaces five former agencies, consolidating into a single structure a dozen different

Federal emergency related activities, including such functions as community-awareness programs for weather emergencies and coordination of all emergency warnings.

The Department of State.

The Department of State interests in meteorology are general but touch a number of areas. They involve the international aspects of food and feeding the world, disaster warnings and assistance, long range concern with the socio-economic effects of climate change, World Meteorological Organization activities and international programs such as the GARP Atmospheric Tropical Experiment (GATE), and concern with some programs which start as operating programs but develop international interest and concern such as the possibility of seeding of storms in the Pacific.

SECTION 4 - INTERAGENCY AGREEMENTS AND COOPERATION

Even before the publication of Circular A-62 (and in the intervening years since its publication) various studies and reports have expressed concern over the duplication that allegedly existed among the Federal agencies engaged in meteorological activities. Very little was ever said about the extensive cooperation that did exist among these agencies - a degree of cooperation which far overshadows the relatively few cases of parallel efforts.

There are numerous current interagency agreements and memoranda of understanding covering cooperation in meteorological programs among Federal agencies. Some of the more significant agreements have been listed in Appendix E. The majority of the activities carried out under these agreements is accomplished on a reimbursable basis. A few specific examples of cooperation in meteorology among Federal agencies are presented below:

- As a result of a Department of Defense in-house study, Navy enlisted forecasters and observers are now trained at the Air Force facility at Chanute Air Force Base, Illinois.

- The Navy Postgraduate School at Monterey, California, provides graduate meteorological training to its officers and to some Air Force weather officers and NOAA meteorologists as well.

- During the period from 1969 to 1973 the Navy transferred title and operation of AN/FPS-41 weather radars at Naval air stations at Pensacola, Florida; Patuxent River, Maryland; Memphis, Tennessee; Brunswick, Maine; and Quonset Point, Rhode Island to NOAA.

- Air Force liaison officers are assigned to the Fleet Numerical Oceanography Center, Monterey, and Navy personnel are stationed at Offutt and Carswell Air Force Bases to facilitate cooperation.

- Air Force weather reconnaissance missions are carried out on a reimbursable basis on tropical storms, hurricanes and winter storms in support of NOAA forecast and warning responsibilities.

- FAA provides weather communications circuitry for NOAA and other users of meteorological data.

- NOAA acquires and archives meteorological data from Department of Defense installations.

- NOAA and Air Force archival units are collocated in Asheville, NC, and operate a joint computer system for processing, storing and retrieving historical weather data.

- NOAA provides weather support to the Nevada test site on behalf of the Department of Energy.

- The Air Force and the Navy operate a Joint Typhoon Warning Center on Guam and provide typhoon warning services to all civil and military users in the Center's area of responsibility in the western Pacific.

- The Navy and Coast Guard provide broadcast facilities for certain NOAA marine weather products.

- The next generation weather radar (NEXRAD) is being jointly developed and procured by DOC, DOD, and DOT through a Joint Systems Project Office in the National Weather Service.

- The FAA is developing a low altitude wind warning system for use in the terminal area of military as well as civilian airports.

- The FAA sponsors, in coordination with the National Weather Service, Public Television, and user organizations, an outstanding aviation weather broadcast (AM-Weather) over public TV stations in the contiguous 48 states.

- The Air Weather Service, U.S. Air Force, for many years has made mobile units of its 6th Weather Squadron available to other Federal agencies. The most recent example was assistance rendered to NOAA and the Nuclear Regulatory Commission in support of the Three Mile Island incident.

- The National Weather Service provides training meteorologists (12) on the staff of the FAA Academy at Oklahoma City.

- The National Weather Service provides meteorological staff (5) at the FAA System Command Center in Washington, DC.

- The Foreign Agricultural Service, U.S. Department of Agriculture, is an operational user of weather data as input to analysis of agricultural commodities for high risk areas of the world. The data needed for these analyses are obtained through cooperative arrangements with Federal weather agencies.

- In a number of cases the military weather services and the Federal Aviation Administration contribute to the basic radar network of the National Weather Service and in other cases make use of data from nearby NOAA weather radars to avoid establishing additional radar installations.

- Many Federal agencies have contributed to the success of a recent series of large scale meteorological research experiments. These include:

    a. The Barbados Oceanographic and Meteorological Experiment (BOMEX)
    b. The Global Atmospheric Research Program (GARP)
    c. The GARP Atlantic Tropical Experiment (GATE)
    d. The First GARP Global Experiment (FGGE)

- The USAF Air Weather Service Automated Weather Network obtains weather observations from overseas areas and makes them available over high speed circuitry to the U.S. Navy's Fleet Numerical Oceanography Center and NOAA's National Meteorological Center.

- Data derived from DoD's Defense Meteorological Satellite Program and NOAA's National Environmental Satellite Service are exchanged fully between these agencies.

- The Air Force Global Weather Central (AFGWC), the Navy Fleet Numerical Oceanography Center (FNOC) and NOAA's National Meteorological Center have detailed arrangements and procedures to provide backup support to one another in the event of computer, power or communications outages.

- Under the terms of a long-standing agreement, NOAA provides comprehensive meteorological research and support services related to EPA's air pollution and environmental problems. This work involves about 50 people and between $2 and $3 million annually.

- DoD, NASA and NOAA cooperate with each other and foreign agencies in maintaining a world-wide solar observing network.

- The U.S. Navy has developed a guide to assist Navy meteorologists in interpreting Defense Meteorological Satellite Program satellite imagery for the marine environment. It is now in use by NOAA marine meteorologists.

The above cooperative arrangements are in addition to the normal activities of the National Weather Service in providing basic meteorological services to all users, Federal and non-Federal alike. The National Weather Service also provides certain specialized weather services to other Federal agencies. The Navy and the Air Force make basic weather observations in the U.S. and overseas and provide these to the National Weather Service.

SECTION 5 - OMB CIRCULAR A-62 AND OTHER COORDINATING MECHANISMS

5.1 OMB Circular A-62

On November 13, 1963 the Office of Management and Budget (then the Bureau of the Budget) issued Circular A-62 setting forth guidelines and procedures for planning and conducting Federal meteorological services, and applied research and development to improve such services. The Circular reaffirmed the central role of the Department of Commerce with respect to basic meteorological services, clarified respective responsibilities of the Department of Commerce and the user agencies for basic and specialized meteorological services, established procedures for facilitating coordination and the timely resolution of outstanding issues, provided for evaluating user requirements within the context of a balanced and integrated Federal plan, and fixed responsibilities for a continuing and systematic review of meteorological services and supporting research.

The Circular specifically excluded basic research in meteorology. It also did not apply to (1) "the division of responsibility between the Department of Commerce and the National Aeronautics and Space Administration for development of meteorological satellites and (2) meteorological activities involving special military security considerations."

Circular A-62 called on the Department of Commerce to "prepare and keep current a plan and obtain periodic information on its implementation, for the efficient utilization of meteorological services and supporting research." The plan, relating proposed programs to fiscal year and longer range objectives, was to be available for the annual review of the various agencies' budgets.

Finally the circular required the Department of Commerce to "establish procedures designed to facilitate a systematic and continuing review of basic and specialized meteorological requirements, services and closely related supporting research." The Department was to obtain the advice and assistance of the principal agencies providing or utilizing meteorological services and was to establish appropriate arrangements for obtaining continuing advice from the principal agencies concerned.

On January 23, 1964 the Department of Commerce issued an implementation plan which provided for a Federal Coordinator for Meteorological Services and Supporting Research to carry out its responsibilities under the Circular. The plan also outlined a committee structure consisting of the Federal Committee for Meteorological Services and Supporting Research and Interdepartmental Committees for Meteorological Services (ICMS) and Applied Meteorological Research (ICAMR).

The Assistant Secretary of Commerce for Science and Technology was named Chairman of the Federal Committee. The Chief of the U.S. Weather Bureau was named Federal Coordinator and was assisted by a fulltime Deputy Federal Coordinator. The Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM) was physically and organizationally removed from the U.S. Weather Bureau and was assigned directly to the Assistant Secretary of Commerce for Science and Technology.

The Federal Committee for Meteorological Services and Supporting Research provided high level policy guidance for the Federal Coordinator, reviewed and validated proposed Federal meteorological plans, and resolved differences which arose in connection with the preparation, monitoring, and coordination of Federal meteorological activities. All agencies having need for meteorological services either for their internal operations or a part of the direct service to a clientele group were represented on the Federal Committee.

Interdepartmental committees were to do the principal work of coordination of meteorological activities, the systematic and continuing review of basic and specialized meteorological requirements, services and supporting research and the preparation and maintenance of a Federal meteorological plan. Membership on the ICMS consisted of the commanders of the military weather services, Director of the National Weather Service and representatives of equivalent status in user departments and agencies. Membership on the ICAMR consisted of senior managers and directors of department and agency programs of applied meteorological research. The ICMS established subcommittees along service lines (basic and specialized), while the ICAMR established subcommittees along functional lines (observation, data processing, etc.)

Issues that could not be resolved at the Federal Committee level were to be referred to the heads of agencies concerned. If an issue still could not be resolved in this manner it would then be referred to the Executive Office of the President for resolution.

The OFCM was established and staffed in the first half of 1964. By the end of 1964 the fulltime staff consisted of ten professionals and five subprofessionals, including four senior personnel on detail from other agencies.

The record of actions of the initial meeting of the Federal Committee reflected the following views of the Chairman:

- The need for better coordination in program planning to identify overlaps between one or more programs or over emphasis on certain programs.

- The basis of agency requirements should be examined when two agencies have very similar requirements to see if a single facility, item of equipment, etc. can do the job of more than one agency by small modification of the requirements of one or both agencies.

- Consolidation of facilities should be considered when they are either functionally the same or geographically co-located and similar.

- That efforts will be in the direction of the basic services meeting more of the common needs.

- That by virtue of their weather programs being an accepted part of an overall plan, individual bureaus and agencies will be in a better position to support their needed funding at the Department, Bureau of the Budget, and Congressional levels.

In addition, the chairman recognized that there would be a definite problem in obtaining agreement between agencies on program emphasis, where an agency might feel its interests might be adversely affected. He also recognized the problem of obtaining needed funds through the budgetary process to implement agreements.

The preceding discussion describes the manner in which the Department of Commerce chose to implement Circular A-62 in 1964. It is useful to review briefly how the Office of the Federal Coordinator for Meteorological Services and Supporting Research evolved from that time forward.

The Environmental Science Services Administration (ESSA) was established on July 13, 1965. At this point the Chief, U.S. Weather Bureau became Administrator of ESSA and his interests and responsibilities were expanded to include the activities of the United States Coast and Geodetic Survey. Attention to the OFCM and emphasis on its activities began to diminish as ESSA took on broader responsibilities.

The Interdepartmental Committees each averaged a little more than seven meetings a year through 1967. On August 8, 1967 a significant change was made in the military membership on the Interdepartmental Committee for Meteorological Services with the establishment of the Office of the Special Assistant for Environmental Services in the Office of the Joint Chiefs of Staff, Department of Defense. At that time a General Officer was named to head that office and to represent the military weather services on the Committee. The original agency membership on the Interdepartmental Committee for Applied Meteorological Research held up well with the exception of one or two agencies that had named members who were organizationally too far above the program level being coordinated.

After 1967 the permanent staff of the OFCM was systematically reduced until it reached a low of one fulltime person plus one other who worked on OFCM matters part-time. No one was assigned the duty of Deputy Federal Coordinator from 1974 through 1976.

Perhaps the most significant change occurred in October 1970 when ESSA was

the same individual who, as Chief of the U.S. Weather Bureau, had a great deal to do with the establishment of the OFCM, now became Administrator of a much larger organization which included the National Marine Fisheries Service and Sea Grant in addition to the former ESSA organizations. More importantly, increasing activity in the marine area placed heavy demands on the administrator's and the organization's time.

At this same time, NOAA became an agency within Commerce which no longer reported to the Assistant Secretary for Science and Technology. As a result, the Administrator of NOAA, for a short time, served both as Federal Coordinator and Chairman of the Federal Committee. He relinquished his duties as Federal Coordinator in 1972. The functions first resided in the Associate Administrator for Environmental Monitoring and Prediction, NOAA, and then in the Assistant Administrator for Oceanic and the Atmospheric Services. For a very brief period the Director, National Weather Service served as Federal Coordinator.

Another important phase was entered into when the Deputy Federal Coordinator for Meteorological Services and Supporting Research, who was the director of the Office of the Federal Coordinator for Meteorology and Supporting Research, ceased to be a fulltime employee in 1967. In addition, where the OFCM staff had provided direction and continuity to the two primary subcommittees by providing the chairman, these functions passed to NOAA staff personnel whose primary duties were elsewhere. See Table 5.1 for the history of the staffing of the positions of Chairman, Federal Committee, Federal Coordinator and Deputy Federal Coordinator.

The following figures summarize what has occurred in the level of Meteorological activities since 1964. Figure 5.1 shows the total funding of the Federal program in meteorological services by year since 1965 by function. Figure 5-2 graphs the Federal program in meteorological services by selected agencies for the same period. Figure 5.3 shows what happened to the number of personnel working in meteorological services. Figure 5.4 shows the funding of basic versus specialized meteorological services since 1965.

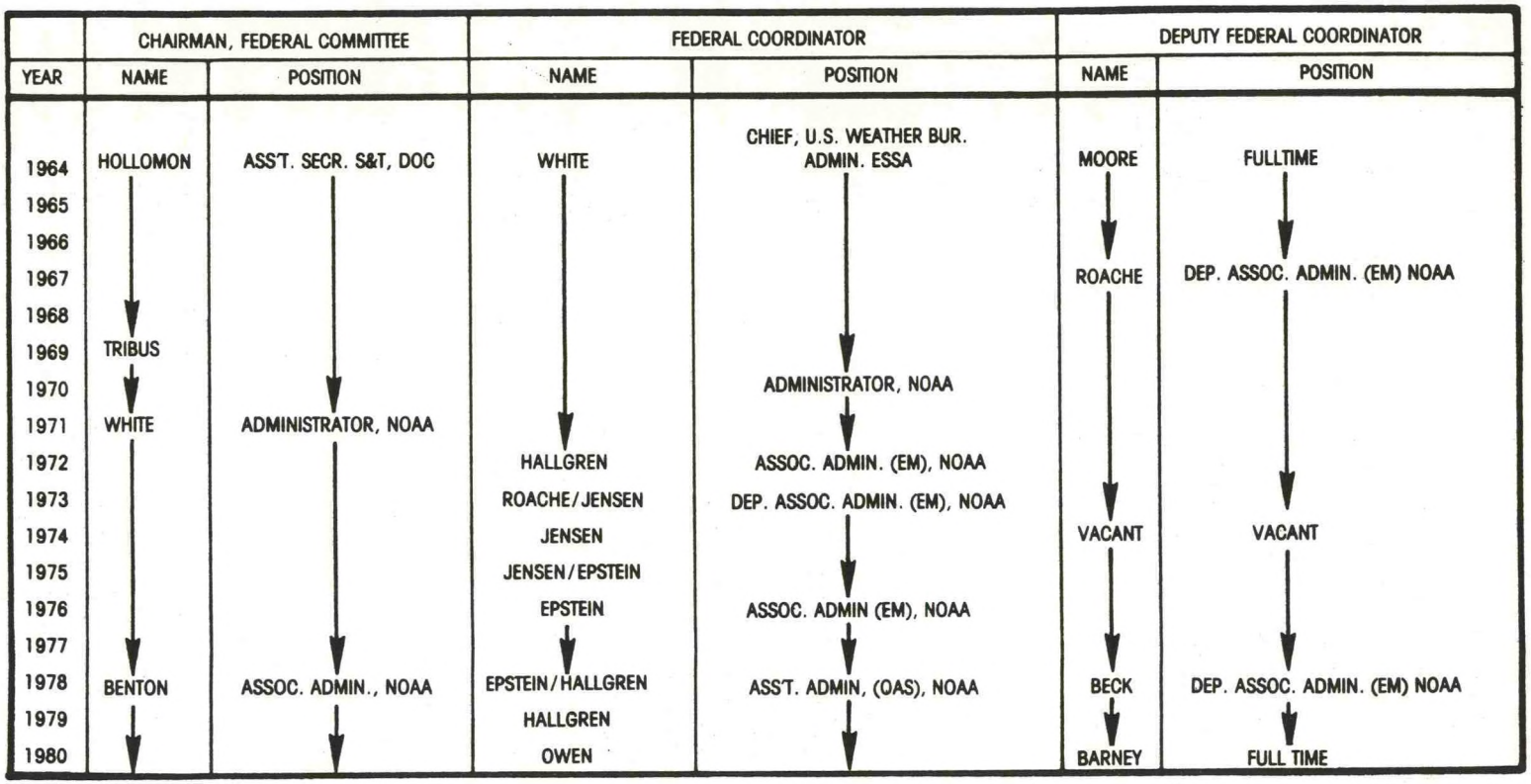

Table 5.1. History of Staffing of the Positions of Chairman, Federal Committee and Federal and Deputy Federal Coordinator

FISCAL YEAR	OBSERVING	COMMUNI-CATIONS	ANALYSIS & FORECASTING	DISSEMI-NATION	SATELLITE OPERATIONS
1965	114,675	40,837	32,594	39,136	22,486
1966	104,980	37,086	38,454	49,442	26,862
1967	104,091	38,078	53,369	46,045	33,289
1968	119,796	36,710	54,098	60,359	31,228
1969	116,168	39,484	53,966	63,034	20,939
1970	134,857	54,280	53,502	51,120	18,830
1971	147,776	59,021	53,763	63,471	28,102
1972	137,143	47,588	60,466	59,773	35,051
1973	142,800	44,781	66,128	66,027	37,749
1974	192,731	46,562	84,286	70,251	83,012
1975	188,131	52,708	99,641	80,763	96,050
1976	207,820	52,468	101,543	105,262	119,659
1977	← NOT REPORTED →				164,134
1978	← NOT REPORTED →				167,774
1979	257,918	50,293	118,930	111,613	NOT REPORTED
1980	213,773	70,406	123,642	114,548	NOT REPORTED
1981	253,820	70,114	137,948	115,843	NOT REPORTED

NOTES:

1981 FIGURES ARE BUDGET FIGURES – NOT FUNDED PROGRAMS

THE SATELLITE OPERATIONS FUNDS ARE ALSO INCLUDED WITHIN THE FIRST FOUR CATEGORIES.

THE ABOVE FIGURES HAVE NOT BEEN ADJUSTED FOR INFLATION.

Figure 5.1 Funding for Meteorological Services By Function Since 1965
(Dollars are Actual - Not Adjusted)
(in Thousands of Dollars)

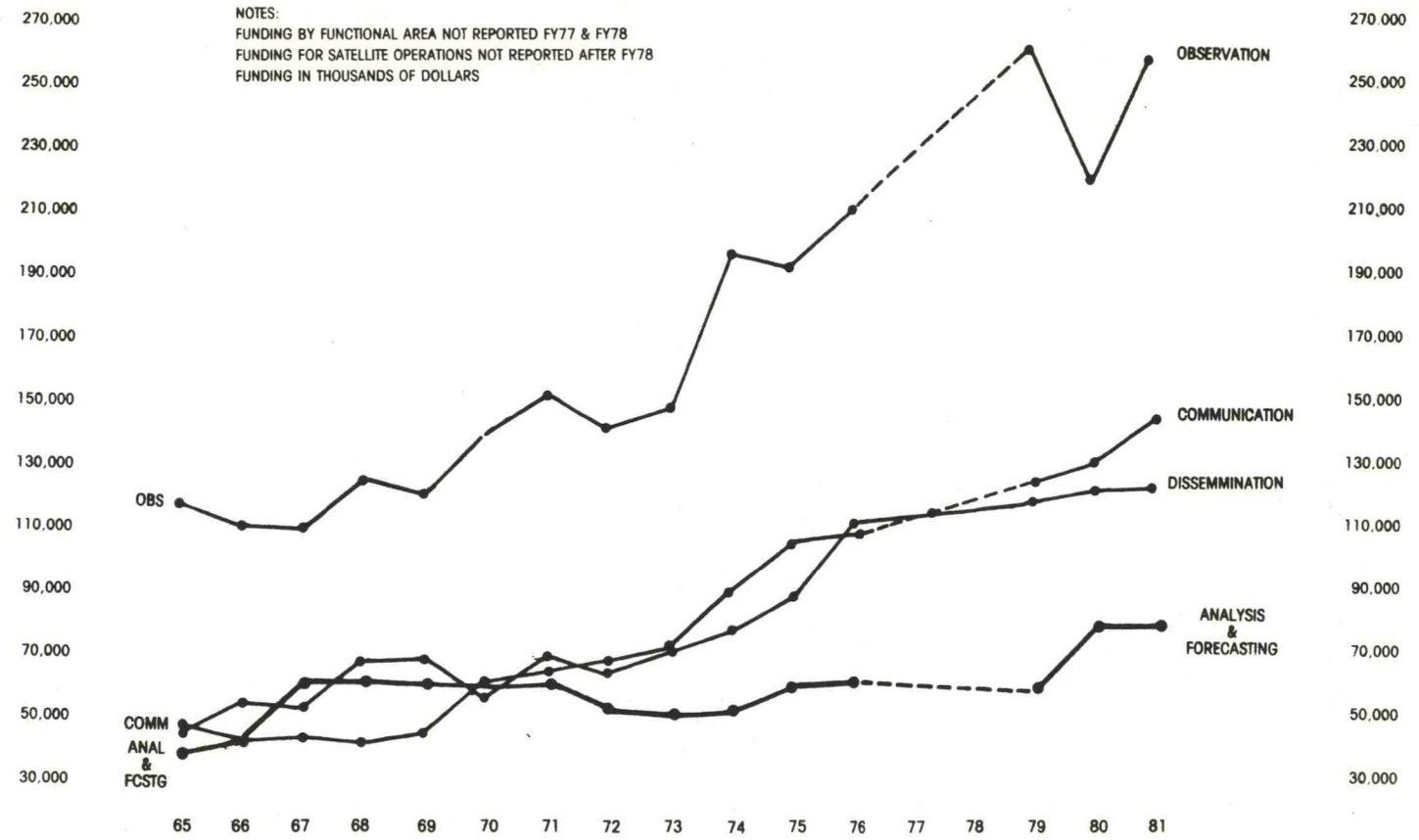

Figure 5.1 (a) Funding for Meteorological Services By Function Since 1965
(Dollars Are Actual - Not Adjusted)

YEAR	DOD	USAF	USN	DOC
1965	110,472	82,416	25,675	98,929
1966	147,279	112,561	30,988	95,057
1967	165,953	121,453	38,546	102,167
1968	183,315	141,411	32,960	110,591
1969	184,723	138,649	37,253	105,749
1970	209,864	157,340	44,206	114,107
1971	218,348	167,089	40,284	135,731
1972	192,033	148,449	34,839	134,174
1973	184,359	NOT REPORTED		168,253
1974	210,624	NOT REPORTED		219,398
1975	213,524	NOT REPORTED		243,361
1976	234,104	NOT REPORTED		268,407
1977	263,744	NOT REPORTED		297,269
1978	262,602	NOT REPORTED		283,656
1979	267,420	NOT REPORTED		327,498
1980	249,069	NOT REPORTED		312,061
1981	281,708	NOT REPORTED		330,028

NOTES:

USAF AND USN FIGURES ARE INCLUDED IN THE DOD FIGURES. DOD FIGURES ALSO INCLUDE SMALL ARMY PROGRAMS.
THE ABOVE FIGURES HAVE NOT BEEN ADJUSTED FOR INFLATION.
DOD DID NOT BREAK OUT USN AND USAF COSTS AFTER 1973.

Figure 5.2 Programs in Meteorological Services
By Selected Agencies Since 1965
(Thousands of Dollars)

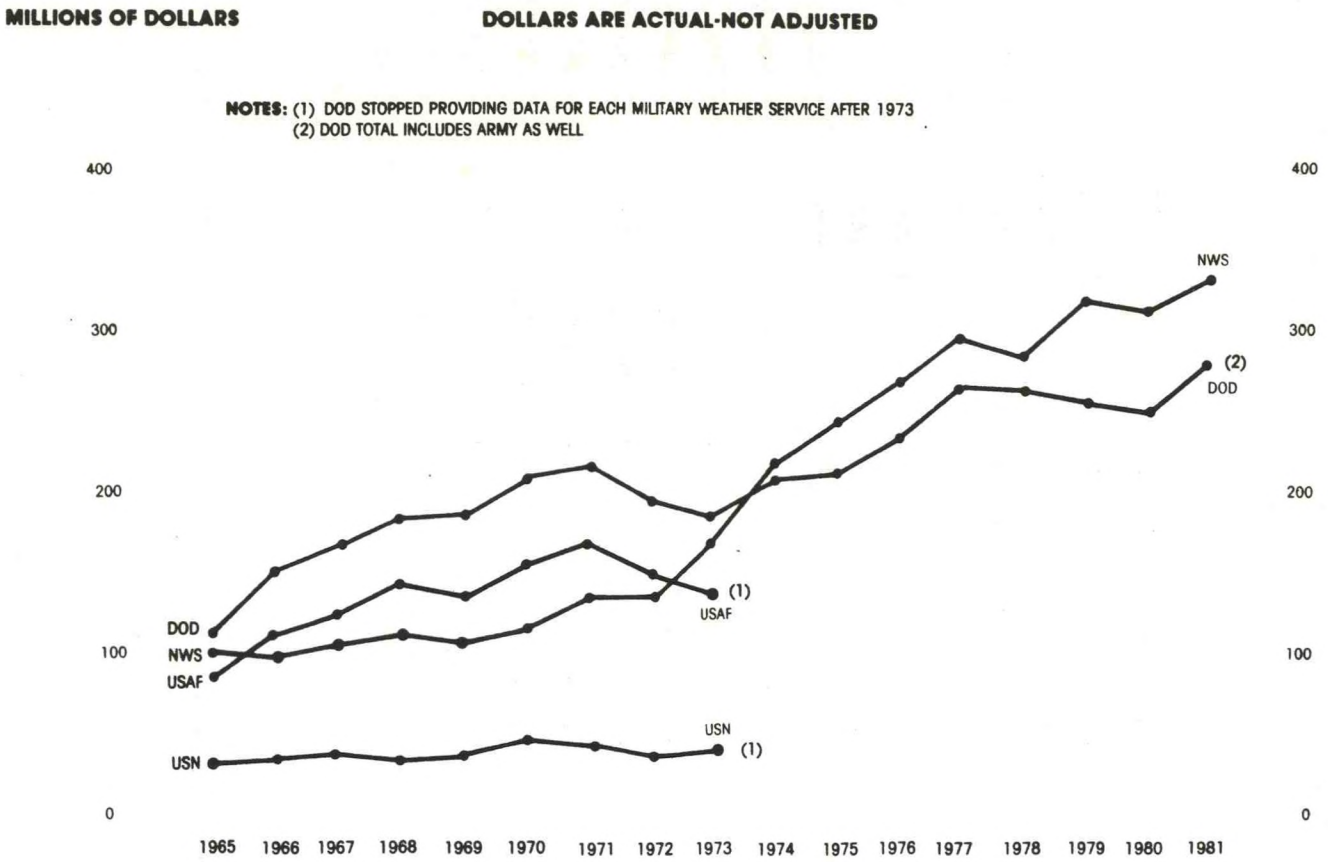

Figure 5.2 (a) Program in Meteorological Services By Selected Agencies Since 1965
(Dollars Are Actual - Not Adjusted)

FISCAL YEAR	DOD	DOC	FAA
1965	13,188	4550	1734
1966	16,761	5510	2027
1967	16,829	5716	2115
1968	17,756	5646	2317
1969	17,402	5868	2209
1970	14,916	5592	2381
1971	14,920	5847	2444
1972	15,460	5573	2290
1973	13,395	6091	2250
1974	11,639	6346	2310
1975	11,107	6536	2460
1976	10,257	6577	2535
1977	11,030	6498	2183
1978	10,173	5982	2242
1979	9,291	6022	2229
1980	9,695	5899	2875
1981	10,608	5906	2923

NOTES:

FIGURES ARE FOR MAN YEARS IN THE CASE OF PART-TIME PERSONNEL

INCLUDES MANPOWER FUNDED BY ANOTHER AGENCY

Figure 5.3 Personnel Staffing By Agency Engaged In Weather Services - Since 1965

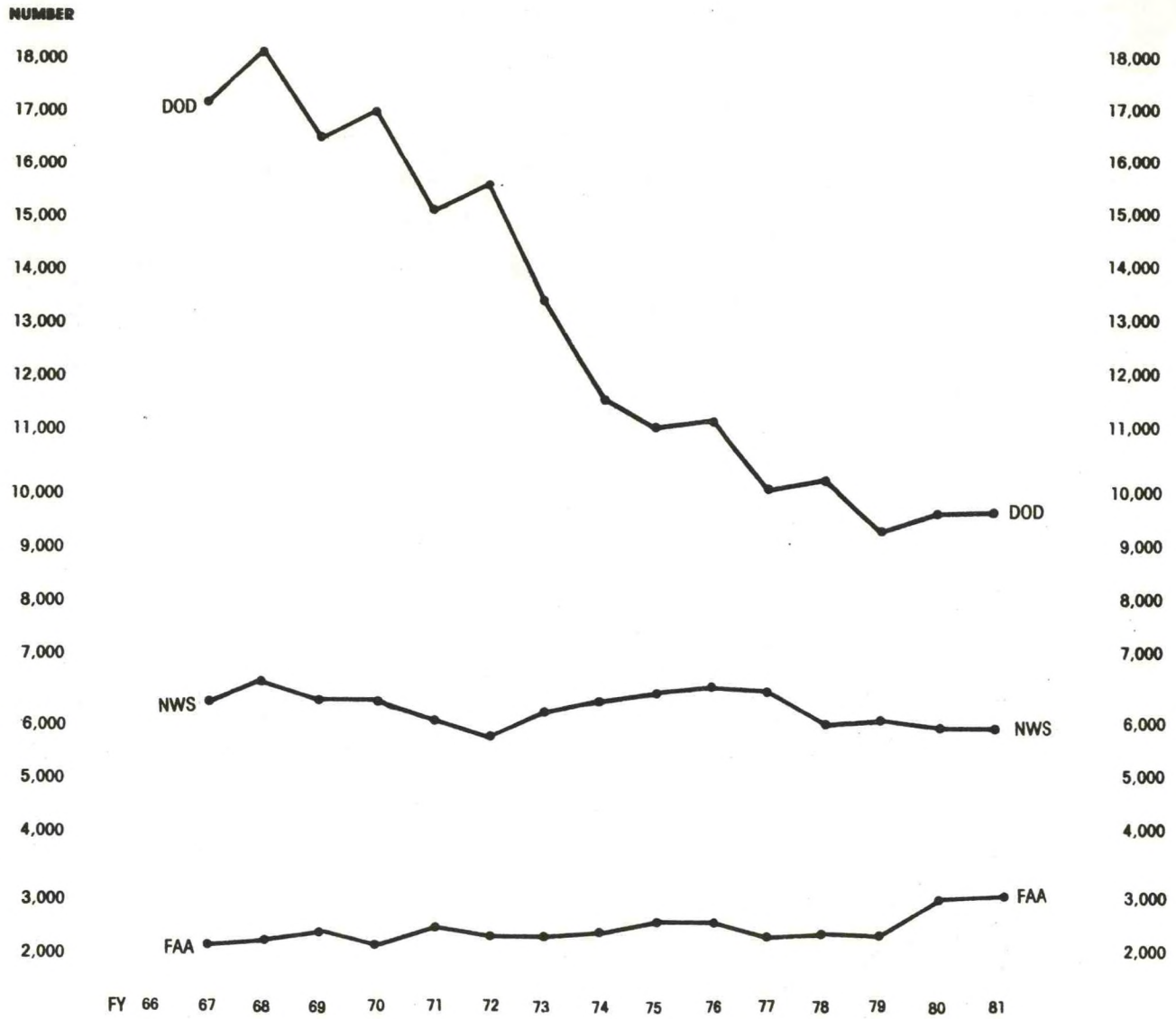

Figure 5.3 (a) Personnel Staffing By Agencies Engaged in Weather Services Since 1966

FISCAL YEAR	BASIC SERVICES	SPECIALIZED SERVICES
1965	86,379	147,464
1966	88,694	179,863
1967	123,502	179,121
1968	139,329	202,463
1969	132,511	203,631
1970	150,718	223,251
1971	171,891	238,058
1972	166,528	218,026
1973	197,443	214,365
1974	247,600	244,955
1975	269,527	255,783
1976	289,522	287,979
1977	321,244	314,679
1978	308,238	312,698
1979	NO PROGRAM FIGURES WERE PRESENTED	
1980	340,437	338,072
1981	344,975	390,298

NOTES:
FIGURES ARE NOT ADJUSTED FOR INFLATION.
ACTUAL PROGRAM WAS NOT REPORTED AFTER 1978.
FIGURES FOR 1980 AND 1981 REPRESENT BUDGET REQUESTS.
FIGURES ARE IN THOUSANDS OF DOLLARS.

Figure 5.4 Funding For Basic Versus Specialized Meteorological Services Since 1965

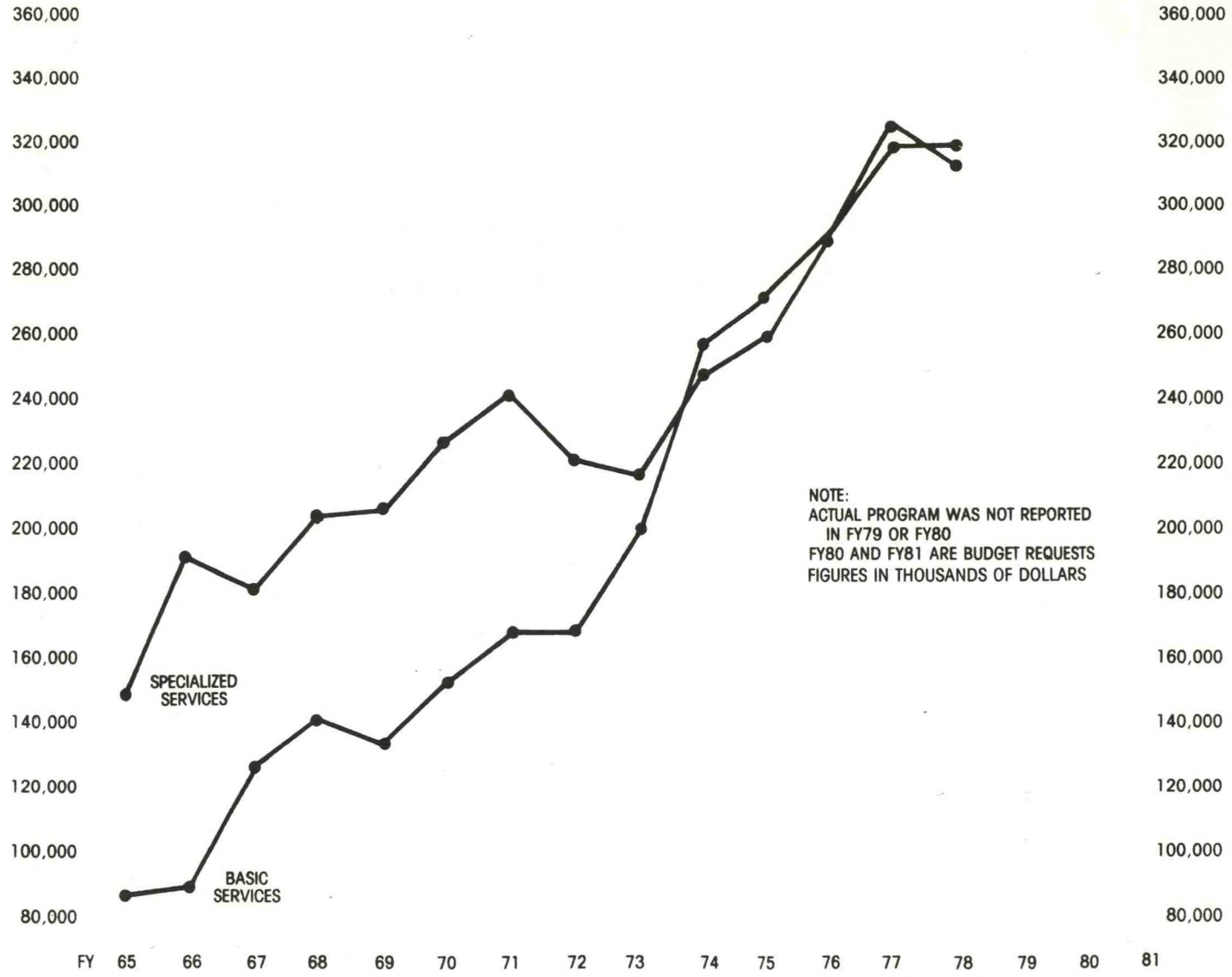

Figure 5.4(a) Funding For Basic Versus Specialized Meteorological Services Since 1965
(Dollars Are Actual - Not Adjusted)

The data for figures 5.1 through 5.4 were obtained from the Federal Plans for Fiscal Years 1966-1981. It is hazardous to draw too many conclusions from these figures because of programs moving in and out of agencies, changes in reporting procedures, shifting of funds from personnel to non-personnel costs, and the effects of inflation. However, it is possible to make some generalizations:

a. A significant amount of the new funds made available for meteorological services from FY 1974 through FY 1978 was devoted to the meteorological satellite program. (The satellite program was not reported separately in the Federal Plan after 1978.)

b. The Department of Defense meteorological services were funded at a higher level than the Department of Commerce until FY 1974. The DOC funding exceeded that of DOD thereafter.

c. There has been a marked reduction in the number of personnel devoted to meteorological services since FY 1975. However, the reduction has taken place almost entirely within the DOD.

d. The specialized meteorological services enjoyed substantially greater funding than the basic meteorological services during the 1960s. In the 1970s, however, the specialized meteorological services were overtaken by the basic services.

An attempt was made to determine what effect inflation has had on the Federal program for meteorological services since 1965. The Department of Commerce recommended use of the "Implicit Price Deflator for Federal Government Expenditures." This factor incorporates all costs, including salaries. The Consumer Price Index was not used since it appeared likely to overstate the effect of inflation. Using 1970 as a base year, the deflator was 67.0 for 1965 and 167.6 for 1979. This means that the Federal program for Meteorological Services which was $233,843,000 in 1965 would have to be $584,956,000 in 1979 just to maintain the 1965 level. The actual figure for 1979, $672,486,000, shows that there has been some real growth in funds for meteorological services.

The funds available for non-personnel costs have become substantially greater, and there was a marked decrease in personnel during the period. (See Figure 5.3)

The Federal Committee in its first meeting in 1978 agreed to review the Federal coordinating mechanism and to recommend ways the system might be improved and made more efficient. During its first meeting in 1979, the Deputy Federal Coordinator summarized the history of the Office of the Federal Coordinator and pointed up some of the problems inherent in the Circular A-62 guidelines. The Deputy Federal Coordinator also advised the committee on the preliminary findings of a GAO study (subsequently issued as LCD-80-10, October 16, 1979 and entitled "The Federal Weather Program Must Have Stronger Central Direction"). The study indicated that in some areas the A-62 mandate was not being accomplished.

At the direction of the Federal Committee, the Deputy Federal Coordinator presented, during the second meeting in 1979, his recommendations for a realignment of the OFCM. The OFCM would be expanded with a permanent staff headed by a fulltime Deputy Federal Coordinator. The expanded staff would include the Deputy Federal Coordinator, three NOAA professionals, two DOD Officers (O-6), one FAA professional and two secretaries for a total of seven full-time professional and two clerical personnel. The NOAA Assistant Administrator for Oceanic and Atmospheric Services would continue to serve as Federal Coordinator. The former Interdepartmental Committee for Meteorological Services and Interdepartmental Committee for Applied Meteorological Research would be combined into a single committee, the Interdepartmental Committee for Meteorological Services and Supporting Research (ICMSSR). The Deputy Federal Coordinator would chair the combined committee.

The DOD member, in commenting on the Deputy Federal Coordinator's recommendations, suggested that the OFCM either be at the policy level of NOAA to insure there would be no conflict of purpose, or outside of the agency. The Committee approved the Deputy Federal Coordinator's recommendations for the realignment of the OFCM structure and the expansion and staffing of the Federal Coordinator's office. They requested the chairman to report on the status of the OFCM at the next meeting and to reply to DOD's concern about its location within NOAA.

During the first meeting in 1980, the Chairman of the Federal Committee stated that the OFCM would be located in the Office of the Assistant Administrator for Oceanic and Atmospheric Services (OAS). He stated that this arrangement separated the OFCM organizationally from the OAS staff and the operational units of NOAA and that it would be physically separated as well. He went on to say that the new arrangements for the OFCM were to essentially return it to a mode of operation that it had when it was formed in 1964.

The primary differences in the new organization as compared to the one implemented in 1964 are:

a. The Federal Coordinator for Meteorological Services and Supporting Research is no longer the head of the agency. He is the senior agency manager to whom some of the units involved report.

b. The Chairman of the Federal Committee is no longer organizationally above the agency.

c. The Office of the Federal Coordinator for Meteorological Services and Supporting Research has been submerged organizationally within the agency rather than being outside of it.

d. There is no longer a single committee devoted to the coordination of applied meteorological research.

e. No provisions have been made for the planning and coordination of a number of specialized meteorological services.

The present agency representation on the Federal Committee for Meteorological Services and Supporting Research is shown in Table 5.2 together with the meteorological functions each is engaged in.

AGENCY	OBSERVATIONS	COMMUNICATIONS	ANALYSES AND FORECASTS	DISSEMINATION TO USERS	SUPPORTING RESEARCH
AGRICULTURE	X	X		X	X
COMMERCE	X	X	X	X	X
DEFENSE:					
AIR FORCE	X	X	X	X	X
ARMY	X	X		X	X
MARINE	X	X	X	X	X
NAVY	X	X	X	X	X
ENERGY					X
EPA	X (2)		X(1)	X	X
FEMA				X	X
INTERIOR	X	X			X
NASA					X
NSF					X
STATE					
TRANSPORTATION:					
COAST GUARD	X	X		X	X
FAA	X	X	X(1)	X	X

(1) No analyses or forecasts are performed by the agency, however, special analyses and applications are funded under reimbursable agreements with the National Weather Serice.

(2) For research only.

Table 5.2. Meteorological Activities of Federal Committee Agencies

5.2 Other Coordinating Mechanisms

In looking at the coordination of meteorology one must look beyond the Department of Commerce's implementation of Circular A-62. There are many committees and boards which have an impact on the future course of meteorological programs. Some of these are discussed below.

1. The meteorological satellite program is coordinated through the following two boards:

   a. The Polar Orbiting Operational Meteorological Satellite Coordinating Board (POOMSCOB) with membership from Commerce, Defense and NASA, provides for the coordination of polar operational meteorological satellite systems operated by Commerce and Defense.

   b. The Department of Commerce-NASA Satellite Program Review Board (DNSPRB) coordinates the functions performed by the Department of Commerce and NASA (1) in the conduct of operational environmental satellite programs of the DOC and (2) in the development of the supporting technology required for these operational satellite programs.

2. The Weather Modification Advisory Board established by the Secretary of Commerce provides independent advice on a wide range of weather modification issues.

3. The National Advisory Committee on Oceans and Atmosphere was established by Public Law 95-63 to undertake a continuing review of the progress of the marine and atmospheric sciences and services program in the United States. The Committee reports to the President and to the Congress and provides advice to the Secretary of Commerce with respect to the carrying out of the purposes of NOAA.

4. The National Climate Program Advisory Committee established by the Department of Commerce in accordance with Public Law 95-367 advises the Secretary and the Congress on the conduct of the Climate Program.

5. The Climate Program Policy Board which is the principal source of guidance to the Director, National Climate Program Office. It also approves programs developed by the National Climate Program Office and participating agencies.

6. The Federal Coordinating Council for Science, Engineering and Technology's Committee on Atmosphere and Oceans in the Executive Office of the President. Its function is to develop plans and coordinate programs and policies in the atmospheric and marine sciences. It includes subcommittees for:
   a. Atmospheric Research
   b. Weather Modification.

7. The National Academy of Sciences - National Research Council has the following organizations which maintain a continuing review of meteorological programs:
   a. Climate Research Board
   b. U.S. Committee for the Global Atmospheric Research Program
   c. Committee on Atmospheric Sciences
   d. Committee on Impacts of Stratospheric Change
   e. Committee on Agriculture Use of Weather Forecasts

8. The National Science Foundation has an Advisory Committee for Atmospheric Sciences to advise the Division of Atmospheric Sciences.

9. The American Meteorological Society is a strong and active organization which contributes immeasurably to keeping all professional meteorologists informed on what is going on in their field. This is done through
   a. The annual meetings of the Society,
   b. meetings of standing committees and boards,
   c. special meetings and symposia, and
   d. bulletins and scientific publications of the Society.

The Society has a Board for Operational Government Meteorology and a Board on Industrial Meteorology. It also has a Scientific and Technological Activities Commission with a broad committee structure spanning the whole spectrum of meteorological services and research.

10. The following interdisciplinary organizations also play a significant role in the coordination of meteorological research:
    a. The American Geophysical Union
    b. The American Association for the Advancement of Science.

11. The World Meteorological Organization, a Specialized Agency of the United Nations, coordinates meteorology and hydrology on a worldwide basis.

12. The International Council of Scientific Unions (ICSU) is active in the coordination of international meteorological research programs.

13. The Committee on Space Research (COSPAR) assists in coordination of international interests in meteorological space programs.

All of the above mechanisms have an impact on the manner in which meteorological programs are conducted.

5.3 Studies and Investigations of Meteorological Activities

In addition, there are studies and hearings by the Legislative Branch of the government, OMB directed studies, studies by Federal agencies themselves, and studies by the Office of the Federal Coordinator for Meteorological Services and Supporting Research. A list of only those studies issued in recent years is included in Appendix F to give the reader some idea of the attention that has been accorded the field of meteorology. No representation is made that all such studies have been identified. The list excludes all studies reporting on the results of research and development.

SECTION 6 - ASSESSMENT, OBSERVATIONS, AND OPTIONS

6.1 Introduction

Earlier sections of this report presented agency views and positions on technology in the 1980s, future plans for weather services, the role of academia and the private sector, and the Department of Commerce implementation of OMB Circular A-62.

A summary of the major new programs planned by the agencies in the 1980s is presented in Section 2.2. New demands will be placed on weather services in the 1980s because of the increasing use of new technology. In addition, the problems related to the need for alternate energy sources and concern for the environment will generate needs for additional weather services. However, these new demands do not appear as likely to impact weather services nearly so much as two other factors:

a. New technology will enable providers of weather services to improve the effectiveness of their services to their users in terms of products available, their quality, and the speed and form in which they are delivered.

b. Budgetary constraints will move the weather services in the direction of automation in areas where it is an attractive alternative to ever increasing personnel costs.

In this section assesments are made of (1) the plans and programs of the agencies for the 1980s and (2) present and proposed methods for their coordination. Potential problem areas are identified. The authors of this report have assessed the adequacy of OMB Circular A-62 and the Department of Commerce implementation of the Circular and have presented observations and options to make the coordination process more effective.

6.2 Current and Potential Problems Requiring the Attention of the Federal Coordinator

6.2.1 Automated Surface Weather Observations

OMB guidance on this problem is cited in its FY81 budget guidance to the DOC. The guidance and subsequent agency actions were discussed earlier in Section 2.2.2. The OMB guidance states that a coordination mechanism must be operating before procurement actions are initiated by any agency. Negotiations are underway within three agencies, (DoC, DoD, and DoT), on the formation of a Program Office to coordinate their activities for automation of surface observations with the FAA as the lead agency. Pending full operation of the office, coordination work will continue in the Federal Coordinator structure.

The Federal Coordinator should be aware of planning and procurement activities for automated surface observational equipment by agencies other than DoC, DoD, and DoT. Examples of such programs are those under consideration by the DoI Bureau of Land Mangement and the USDA Forest Service (see Section 2.2.2). These systems are probably much less sophisticated than those of the DoC, DoD, and FAA, but the programs should be coordinated in the interest of savings that would accrue from joint procurement of common equipment.

OBSERVATION:
The Federal Program for automation of surface observations, approved in principle by OMB and funded in part in FY1981 and prior years, is very large and involves many complex factors. Actions to coordinate the various agency activities appear to be satisfactory and if given full support by the agencies, the Federal Coordinator, and the OMB, should result in effective development, procurement and implementation that will yield significant new mission capabilities and substantial economies.

6.2.2 Automated Weather Collection and Distribution Systems

Four major automated systems in support of weather service programs are being installed or are to be installed during the decade of the eighties. The Federal Agencies and the systems planned are:

1. The Department of Transportation's Flight Service Automated System and its National Airspace Data Interchange Network (FSAS/NADIN). Both include transmission of weather data along with other aviation data.
2. The United States Navy NEDS (Naval Environmental Display Station).
3. The United States Air Force AWDS (Automated Weather Distribution System).
4. The NOAA AFOS (Automation of Field Operations and Services).

The respective capabilities of these systems are summarized in Table 6.1.

6.2.2.1 DoT FSAS/NADIN

The FAA Flight Service Station Automation Program is designed to accommodate the increasing demand by the aviation community for services, including weather information, without increasing the staffing levels for these services within FAA. This will be accomplished by automation of alphanumerics in Model I, graphics in Model II, and pilot self-briefing in Model III. Also included in this program is a telephone activated system of providing preflight weather to the pilot by means of a Voice Response System. NADIN will provide a means of transferring data between the Flight Service Stations, the terminal facilities at airports, and the Center Weather Service Units at the Air Route Traffic Control Centers. This data transmission system will have a direct interface with the National Weather Service's AFOS to inject and receive weather information. The FAA has contracted for the FSAS and will contract for the NADIN late in 1980. These two systems will result in improved accessibility of weather information to the users of the National Airspace System.

6.2.2.2 USAF AWDS

The requirement for an automated weather distribution system was identified in the early seventies and validated by Hq USAF in 1977. The concept of operations (COP) of the fixed-base AWDS system was issued by the AWS on 5 Nov 1979. The COP indicated that AWDS is in the early development and acquisition stage as compared to AFOS and NEDS which are close to operational. However, a Program Management Plan, dated April 1980, is at Hq USAF awaiting a Program Management Directive to proceed with developing and purchasing AWDS.

Table 6.1

Existing or Planned Capabilities of Automated Weather Collection, Display and Distribution Systems

Function	System			
	AFOS (NWS)	NEDS (1) (NOC)	AWDS (1) (AWS)	FSAS/NADIN (FAA)
1. Data distribution (internal)	x	x	x	x
2. Data acquisition (direct and indirect sensing of meteorological phenonema, e.g., automated surface observation)			x	
3. Data storage, retrieval and message composition (access to systems data base and generation of forecasts)	x	x	x	x(3)
4. Dissemination				
a) internal	x	x	x	x
b) external users	x(2)			x
5. Data processing				
National Center	x	x	x	
local	x		x	x

(1) World-wide system

(2) Anticipated but not yet resolved

(3) The CWSU meteorologists will generate Center Weather Advisories that are actually short-term forecasts

Table 6.1 "Continued"

	System			
	AFOS (NWS)	NEDS (1) (NOC)	AWDS (1) (AWS)	FSS/NADIN (FAA)
6. Display (visual presentation graphic and alphanumeric forms)	x	x	x	x
a. color		x	x	x
b. hard copy	x	x	x	x
c. inter-active system for analysis of projected charts		x	x	x
d. capability for chart overlays	x	x	x	x
e. animation		x	x	
f. satellite data	x	x	x	x
g. radar data	x (2)		x (2)	x
7. External interface with other agency systems	- interoperability among systems being studied but still unresolved.			

(1) World-wide system

(2) Anticipated but not yet resolved

(3) The CWSUs meteorologists will generate Center Weather Advisories that are actually short-term forecasts

The Electronic Systems Division (ESD) of Air Force Systems Command is charged with development of AWDS. A significant effort has been made in studying AFOS and NEDS and in identifying equipment types and anticipated workloads for the system. The Air Force Communications Command is sizing and designing the supporting communications and distribution network system and has developed the maintenance concept. ESD is contracting with private industry to perform additional studies of workloads at Air Force and Army bases, software requirements, communications networking and systems costs. Operational system software for AWDS will be vendor-provided.

AWDS is composed of two major subsystems, an automated surface observation system and an executive system. The executive system, although somewhat similar to AFOS and NEDS, will be significantly more capable in terms of computational capability and automated assistance to forecasters. Some of the design capabilities of AWDS already incorporate planned upgrade capabilities of the AFOS and NEDS. (AWDS is not being specifically designed to receive, store, and display satellite imagery, but the capability has not been designed out.) Two types of AWDS will exist; the fixed-base AWDS will be installed at 163 permanent installations in the CONUS and overseas and an additional 20 Tactical AWDS (TAWDS) will be built. The TAWDS will be architecturally similar to fixed-base AWDs, but will be mobile and more rugged. TAWDS will be deployed to support crisis or contingency actions wherever required.

ESD presently estimates a cost of about $84M in FY80 dollars for development and procurement of AWDS and TAWDS exclusive of automated observations. The ESD cost estimate does not include site preparation or communication costs.

6.2.2.3 NAVY NEDS

The Navy's Naval Environmental Display Station (NEDS) concept evolved in the early sixties and pre-dated both the NWS AFOS and the AWS AWDS. It resulted only partially from a weather service requirement; the major impetus for its development was a Command and Control requirement. Its capabilities are similar to those outlined for the AF AWDS, but the system does not include an automatic surface observation system.

NEDS has been installed at the Fleet Numerical Oceanography Center, Monterey, CA; the four Fleet Oceanography Centers (Rota, Spain; Norfolk, VA; Pearl Harbor, HA; and Guam); the Fleet Weather Facility at Suitland, MD; and the National Military Command Center in the Pentagon. It is planned that all Naval Oceanography Command forecast activities and detachments and major command and control centers will be provided with a NEDS or similar capability.

Unlike the NWS system and the planned Air Force system, the NEDS system does not collect weather observations. These are currently collected through the USAF Automated Weather Network (AWN) system. NEDS currently uses dedicated circuitry to transmit alphanumeric and graphic data. Replacement of this circuitry by general purpose AUTODIN II is planned for the mid-1980s, while COMEDS and AUTODIN will be used to extend transmissions beyond these points to other activities and detachments.

6.2.2.4 NWS AFOS

The NWS Automation of Field Operations and Services (AFOS) concept began to evolve in the early seventies when the NWS started to consider ways and means by which emerging computer technology could be used to increase the effectiveness of field operations. A great deal of effort went into studies of equipment types, communications, maintenance, distribution network systems and projected alphanumeric and graphics data loads before a final decision was made with respect to the total configuration. Currently, the NWS has much of the equipment in place at the Weather Service Forecast Offices (WSFOs) and Weather Service Offices (WSOs) and is developing the necessary software in preparation for eventual operational status . Approximately 100 WSOs will not be equipped with AFOS hardware; the problem of providing them with the required weather support when AFOS is operational and other dissemination circuits (FOFAX, NAMFAX, NAFAX, DIFAX, RAWARC, and FAA teletype circuits A, C, O, NWWS, and others) are eliminated, is still unresolved. The NWS is well aware of the problem and is actively seeking a viable solution.

6.2.2.5 System Costs

The costs of automating field operations and services are considerable. Although there is no hard information on total costs by agency, the information that is available could serve as a guide to possible overall costs.

The NWS AFOS system, which is well along with regard to hardware installation and operation, has cost approximately $85 million from FY74 to FY80. This figure includes the capital costs of hardware (215 systems), facilities preparation, design and software development - the major cost areas.

The Air Force is projecting costs in excess of $100 million for FY80-88 for the development and procurement of 183 AWDS systems. The DoT/FAA Flight Service Automated System is projected at a total cost of $495 million from FY1977 through FY1987 ($252 million of this is for buildings and consolidation of facilities, and $243 million is for automation of the weather information system along with other aviation services). The NADIN program is projected at a total of $35 million from FY1977 through FY1983. (The two programs are aviation programs in which weather information automation is included along with other aviation services.) The total estimated project cost of Navy NEDS terminal display system is $15 million.

The AFOS costs and the projected costs of AWDS, FSAS/NADIN, and NEDS suggest that total costs for these automated systems for the agencies involved are substantial and probably in excess of $750 million.

6.2.2.6 Coordination

Two major questions arise about the apparent separate paths being taken by the agencies involved to develop and procure what appear to be systems with many similarities - as well as some differences. The first question is, "What coordination, if any, has taken place or is planned for possible joint development and procurement of a common system?" The second is, "Can compatibility (interoperability) between systems be achieved?"

Each agency involved was aware of the efforts of the other agencies and exchanges of views and ideas did occur. It appears that each of the agencies responded to its own internal requirements and budgetary considerations which matured at different times. Little emphasis was placed on the impact of internal decisions on other agencies or users. One example is that the problem of compatibility between systems is still unresolved, unless recourse to a major computer system is considered a solution.

The development of a single weather collection and distribution system to meet both civil and military needs would, of course, resolve the compatibility problem among weather services. In the absence of a single system, some compatibility among weather services might be achieved by standardizing particular features of the different systems. Another approach would involve the development of software to enable one weather system to "talk" to a second system. If a single system were adopted, there might still remain compatibility problems with command and control systems being served.

The Federal Coordinator in a Dec 23, 1979, memorandum to the chairman, ICMSSR, recognized this problem and asked the ICMSSR to study the problem.

The ICMSSR, meeting on April 10, 1980, addressed this request and agreed to refer the automation issue to its Subcommittee on Systems Development for examination of agency requirements and plans, and, on the basis of this examination, to prepare a report and recommendations for the Federal Coordinator. The approach being followed by the Federal Coordinator should have good results.

It is important that the OMB monitor this and similar activities closely to make certain that in the future no single agency proceeds with the development and procurement of its own weather collection and distribution system simply because it has funds available while other agencies with similar requirements do not. The Federal Coordinator should actively seek common requirements and system specifications and encourage common procurement by agencies. If it can be shown that a common system is feasible and practical and will produce significant economies to the Federal government, OMB should take steps to assure

that all agencies that would benefit from such a system join in the effort and receive the necessary funding to participate in the planned development and procurement. If OMB fails to do this, an agency with both need and funds should be permitted to proceed unilaterally. On the other hand, if the Federal Coordinator finds that a common system is not feasible and practical and economically attractive, he should use his office to promote maximum interoperability among the different systems that may evolve.

The coordination mechanism for handling weather communications appears to need attention, particularly in conjunction with the automated weather collection, display, and distribution systems. Communications planning and coordination in the past has been arranged internally by the communications community. Possibly because of the specialized nature of the service, weather communcations have been coordinated somewhat loosely. It appears that a strong effort should be made to bring the planning for all dedicated weather communications into the meteorological coordinating mechanism. High priority must be given to the review and coordination of the communications associated with current and planned weather collection , display, and distribution systems.

OBSERVATION:

The Federal Government has made a large investment in modern communications, display and dissemination systems and will make further large investments in the future. The four agencies involved have proceeded on separate development, procurement and implementation paths because of differing mission requirements and priorities. There are opportunities for significant economies in the future if a practical national system to meet all requirements can be developed and procured. If separate paths are followed, provisions should be made for maximum interoperability among the operational systems. Actions presently under way in the ICMSSR Subcommittee on Systems Development appear satisfactory to achieve these purposes if monitored by the Federal Coordinator and the OMB to assure that logical conclusions are reached within a realistic period of time.

OBSERVATION:

Coordination of dedicated weather communications plans and programs has not been entirely successful. All past annual Federal Plans have included weather communications resources, and the Federal Coordinator should take steps to improve coordination in this area. This will involve reviewing existing and planned agency programs for dedicated weather communications with the objective of achieving economies and effective interfaces without imposing unacceptable impacts on mission accomplishments. The study team believes that options for accomplishing these purposes include the following:

(1) The Federal Coordinator could establish a communications subcommittee under the ICMSSR to carry out the review and coordination functions. This course of action would provide the necessary focus for the work, but it would cut across the responsibilities of present ICMSSR subcommittees such as Basic Services and Systems Development. It might lead either to unwarranted duplication of committee work or to important programs not being reviewed and coordinated because of divided responsibilities.

(2) The Federal Coordinator could assign responsibility for review and coordination of existing and planned dedicated weather communications programs to ICMSSR with a clear statement of purpose and responsibility. ICMSSR would be free to use its present structure or create a special group. This course of action puts the responsibility for review and coordination of dedicated weather communication in ICMSSR in the same way as it is for other programs. On the other hand there may not be a highly visible communications coordination group if, for example, ICMSSR decides to assign the responsibility to its subcommittee on Systems Development

(3) The Federal Coordinator could establish a special communications coordination group outside the ICMSSR. This course of action represents

a step toward prolification of committees and clearly divides responsibility between ICMSSR and the new communications group. Both are undesirable. On the positive side the group would be very visible and the Federal Coordinator would be able to monitor the groups work closely.

6.2.3 Upper Air Systems

New remote sensors currently in development show promise for eventually replacing the conventional upper air sounding systems. Both surface based techniques, such as those being tested in conjunction with the Prototype Regional Observing and Forecasting Service (PROFS) experiment and satellite-based techniques show promise. Remote sensing systems lend themselves to full automation, and observational frequency can be varied to meet changing requirements and conditions. The new remote sensing upper air observing system is under constant review and assessment by NOAA and DoD. At this stage of development it is not possible to recommend replacement of conventional upper air observations with the new remote sensing technology. It is possible to measure winds aloft with sufficient accuracy at this time, but accuracy of upper air temperatures and humidities is not yet sufficient to meet operational needs. These assessments should continue to determine if the systems will yield measurements of all needed parameters with the required accuracies, whether each system can stand alone or will have to be used in combination with conventional balloon-borne systems, and whether installation and operating costs will make the new systems competitive with conventional systems.

OBSERVATION:

Remote sensing technology for atmospheric soundings from satellite-borne and surface based sensors has great potential for use by the meteorological service agencies in their analysis and prediction work. It is premature to view this new technology as a replacement for the conventional ground based atmospheric sounding and wind observing systems now in use. Because of the potential of these new systems to improve forecasts and warnings and to achieve economies in the observing function, it is important that the agencies and the Federal Coordinator continue to review developments in this area.

6.2.4 Weather Data

Programs planned for the 1980s will produce an abundance of new data. The Departments of Interior and Agriculture plan extensive use of automated weather stations. Satellites will be used to collect increasing amounts of data from land, ocean, and airborne platforms. NEXRAD and PROFS will produce new meso-scale data and NOSS will produce a whole new class of data. All of this points to the need for a plan to determine what data are to be archived in the 1980s. Work now underway in NOAA should be monitored by the Federal Coordinator to assure that such a plan in developed. This plan should include an assessment of the adequacy of existing facilities and need for expansion.

OBSERVATION:

A large volume of new types of meteorological data will become available from operational remote sensing systems such as NEXRAD, and a significant increase in surface weather observations will be produced by the surface observation automation programs of the Federal agencies. To avoid saturation of archival capabilities or losing irreplaceable data will require careful review of these new data sources to decide on an archival strategy. There is some urgency to this action since increased data flows will soon begin, and acquisition of adequate new archiving capabilities could require several years.

6.2.5 Aviation Weather Forecasts and Briefings

Four major Federal agencies are involved in the provision of aviation weather services: the National Weather Service (NWS), the Federal Aviation Administration (FAA), the Air Weather Service (AWS), and the Naval Oceanography Command (NOC).

Aviation weather service products provided are terminal forecasts, area and route forecasts of weather, winds, and temperatures at flight levels, significant en-route hazards, amendments to forecasts and advisories as required, and, finally, pilot weather briefings.

A study published by the General Accounting Office (GAO) dated March 31, 1977, dealt with aviation services in the United States. This report, "Using Aviation

Resources in the United States More Efficiently," discusses what are considered over-lapping services between the military and the civil aviation weather services and makes some significant recommendations.

While the aviation services provided by each of the Federal agencies do have certain commonalities, consolidation of services is not necessarily a reasonable solution. The following descriptions of the aviation programs of each agency show the common usage areas that must be considered before recommendations relative to consolidation of services can be made.

6.2.5.1 DOD - Naval Oceanography Command

Within the 48 contiguous states and the immediate coastal waters, Naval Oceanography Command detachments make use of NWS products in providing services for routine air operations. Over the oceans and on a global scale, the detachments are dependent upon the products and guidance issued by the Fleet Numerical Oceanography Center (FNOC) at Monterey. Terminal forecasts for the 0 to 24 hour period are manually produced locally four times per day for each of the bases. There is no current program for computerized terminal forecasts nor are there plans for such. Pilot weather briefings are provided at the local base detachment; briefings may be either face to face or via telephone or closed circuit TV networks.

6.2.5.2 DOD - Air Weather Service

Within CONUS, the AWS makes extensive use of NWS products as well as AWS mission-tailored products in preparing its own specialized forecast issuances. Specifically, it relies on basic NWS facsimile products, uses NWS terminal forecasts, considers NWS area and route forecasts, and coordinates, whenever possible, severe storm forecasts.(see Section 6.2.7, on Severe Storm Centers.) Zero to 24-hour terminal forecasts are prepared four times daily for approximately 150 bases, world-wide, by a specialized staff at the Air Force Global Weather Central (AFGWC) for bases not manned by meteorologists 24 hours per day. The remainder are prepared locally. Automated computerized terminal forecasts are prepared at the AFGWC for the 24 to 48 hour period for all bases using the

Model Output Statistics (MOS) provided by the NWS. The AFGWC staff also provides specialized longer range forecasts and takes care of requests for forecast information for special missions. The USAF Base Weather Stations (BWSs), making use of AFGWC guidance for global weather and NWS products, prepare terminal, route, and area forecasts, and brief flight crews and command and control centers. Computerized flight plans are prepared at AFGWC for strategic and tactical missions. AFGWC also prepares specialized forecasts beyond the capability of the local base station personnel.

6.2.5.3 National Weather Service

The NWS prepares terminal forecasts three times daily for about 480 locations in CONUS. These are prepared for the period 0 to 24 hours by 52 Weather Service Forecast Offices (WSFOs) and include forecasts of ceiling, visibility, wind, and significant weather. In addition, each office has the responsibility for producing route forecasts. Model Output Statistics (MOS) are used as guidance in preparing the aviation forecasts.

Twelve of the WSFOs are assigned responsibility for the production of Area Forecasts (FAs), and SIGMET and AIRMET bulletins (hazardous weather warnings for aviation). Pilot weather briefing service is provided by most WSOs and by many of the WSFOs. Pilot weather briefing, however, is a major function of the FAA which handles 90% of pilot weather briefings; only 10% of the pilot community obtains its briefings directly from the NWS.

6.2.5.4 DOT - Federal Aviation Administration

Weather briefing for civil pilots is a major responsibility of the FAA. Its Flight Service Stations (FSSs), which handle this responsibility, are completely dependent upon the NWS output of aviation products as the basis for providing this service. The FSS briefers use the NWS alpha numeric and graphic forecast material to brief the pilots, but provide little or no interpretation because the briefers are not qualified meteorologists.

Some FSS units are co-located with or are in close proximity to NWS offices. FSS briefers refer a pilot to a NWS briefer (usually by a tie-line arrangement) when there is a complex weather problem or when the pilot asks for the referral.

The other major units that provide weather information for use in the daily air operations are the CWSUs (Center Weather Service Units) located in the ARTCCs. These CWSUs are staffed by NWS meteorologists and have the specific responsibility for keeping the Air Route Traffic Controllers informed on hazardous weather developments. The CWSU is an excellent example of a coordinated and cooperative effort between agencies. In a previous study by SDC[1], this concept was endorsed and a recommendation was made to expand the program to all ARTCCs. This will be accomplished by the end of FY80 for 21 of the 23 ARTCCs.

6.2.5.5 Aviation Weather Services for Airfields in Close Proximity

The Federal Committee for Meteorological Services and Supporting Research requested the Working Group on Aviation Weather Resources to evaluate the feasibility and desirability of conducting a field experiment to determine the advantages of consolidating aviation weather briefing services where airfields were in close proximity. The Working Group reviewed the following three studies:

a. AWS Consolidation of Forecaster Services March/Norton, June 1974,
b. San Antonio Consolidation with AWS Forecasting Services, August 1973, and
c. Report of Working Group on Aviation Weather Services, September 15, 1978.

The Working Group concluded (1) that a field test was not needed since the problem had already been thoroughly studied, and (2) that the consolidation of forecast weather services for two or more bases in close proximity is not feasible. This report was accepted by the Federal Committee during its 1979 meeting and the matter was closed. We have reviewed the referenced studies and are in full agreement. The cases cited represent an extremely small fraction of the civil and military aviation weather facilities. The deterioration in the quality of services and consequences for aircraft safety that apparently would result from a forced consolidation cannot be justified by the small savings in resources that might be realized.

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1 Comprehensive Review of the Forecast and Warning System of the National Weather Service, Nov 1, 1979.

From time to time the same issue is raised with respect to the Air Force and Navy weather facilities which operate on opposite sides of Andrews Air Force Base, Maryland. Each of the services clears aircraft from its own side of the base and have justified separate weather briefing facilities for that reason.

OBSERVATION:
Previous studies have failed to produce convincing evidence of economic or operational factors justifying consolidation of all weather service facilities serving military airfields. The Federal Coordinator has the necessary structure and authority to assess this situation periodically in light of new technology or changing mission requirements to achieve savings from consolidations of facilities

6.2.6 Aviation Terminal Forecasts

Another area of concern is terminal forecasting. Verification of terminal forecasts prepared by both the military and civil sectors shows that meteorologists exhibit little skill over persistence in predicting critically low visibility and ceiling conditions for periods beyond six hours. A recent unpublished paper by Colonel K. E. German and Major P. Hicks, Jr., Headquarters, AWS, entitled, "Air Weather Service Ceiling and Visibility" verifies this statement with regard to ceilings less than 200 feet and visibilities less than 1/2 mile. Some positive, but small, forecasting skill versus persistence is exhibited for ceilings in the 200 to 1000 foot range and visibilities in the 1/2 to 2 mile range. It should be noted that computer produced terminal forecasts also show relatively low skill in predictions of very low ceilings and visibilities at the present time. This points up the difficulties in predictions of low ceilings and visibilities by either manual or computer techniques. As a result terminal forecasts must be monitored for amendments.

The AWS has expressed concern that automating terminal forcasts would result in a loss of forecaster expertise in terminal forecasting. According to AWS, terminal forecasting by man-machine mix techniques provides continual training for its forecasters. The loss of this training would impact negatively on its overseas forecast capability where automated guidance might not be available.

Air Weather Service must be in a position to immediately and effectively support the nation's Rapid Deployment Force anywhere in the world. Thus, these forecast skills must be maintained by placing responsibility for the 0-24 hour forecasts at the local level.

Currently, Model Output Statistics (MOS) guidance is available for ceiling and visibility for periods out to 48 hours and is used by meteorologists in preparing terminal forecasts. These computerized products are expected to increase in reliability in the early eighties and, perhaps, to exceed the skill of the meteorologists for the period beyond eight to twelve hours. There are major differences between civil and military requirements for terminal forecasts. For example, military aviation has much more stringent requirements for forecast detail in very low ceiling and visibility condition than does civil aviation. These differences will be very difficult to treat in the MOS programs.

If the computer produced terminal forecasts do become as effective as manually produced forecasts for periods beyond eight to twelve hours they should be adopted. By taking this step, the meteorological service agencies (NWS, AWS, and NOC) will be able to free meteorologists' time to concentrate on the critical low ceiling and visibility conditions during the first hours of the terminal forecast period. In addition, the NWS would be able to use a portion of the meteorologists' time to prepare forecasts for more than 500 terminals presently without this important aid to aviation safety. It is important to note that a man-machine mix undoubtedly will be necessary in aviation terminal forecasting for many years to come.

OBSERVATION:
Significant progress has been made in producing terminal forecasts by application of numerical weather prediction and model output statistics techniques Further progress logically may be expected in the future as new models and techniques are developed. Computer produced terminal forecasts are not yet as

reliable as those produced manually and both types have the least skill over persistence in the shorter time periods for the very low ceiling and visibility values so critical to safe aircraft operation. There appear to be sufficient incentives for agencies to continue development of computer produced terminal forecasts, and to implement them operationally to the extent that they equal or exceed manually prepared products. There is no doubt that skilled meteorologists will continue to play an important role for many years in terminal forecasting work and will be the only source of such forecasts for locations where suitable computer assistance is not available.

6.2.7 Severe Storms Centers

The responsibility for issuing severe weather advice rests with the NWS. Its National Severe Storms Forecast Center (NSSFC) located in Kansas City is the focal point for this function. The AWS Weather Warning Function, located at the AFGWC, is responsible for issuing severe weather warnings to military establishments worldwide. The Navy uses the NSSFC forecasts and does not have a separate severe storms forecast unit.

The NSSFC Severe Local Storm (SELS) unit is composed of twelve meteorologists and a support staff which consists of a public service unit (6 people) and a clerical unit. SELS has immediate access to the collocated NESS Satellite Field Service Station (SFSS). NSSFC was studied by an SDC study group; details are contained in a 1979 SDC study (1). Briefly the NSSFC SELS identifies severe storm potential and activity over CONUS and issues daily bulletins on storm potential and issues severe storm watches and aviation bulletins on convective activity when necessary. Local offices use the SELS bulletins and watches along with local data for issuing severe weather warnings for the general public; these warnings are disseminated to the public and governments through local communications systems, NOAA Weather Wire, NOAA Weather Radio, and commercial radio and television.

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(1) Comprehensive Review of the Forecast and Warning System of the National Weather Service, Nov 1, 1979.

The AWS Weather Warning Function was collocated with the NSSFC SELS in Kansas City but the AWS moved it to the AFGWC at Offutt AFB, NB., on Jan. 31, 1970, to make maximum use of the then-new UNIVAC 1108 computers at AFGWC. By relocating some AWS specialized centers to the AFGWC, the following results were anticipated:

1) Improvement of the weather warning and product services. This was to be accomplished because of the existence of a larger data base at AFGWC and by automation of many portions of the data processing and forecasting routine.
2) Elimination of duplication of the basic products processed by each unit.
3) Establishing a means for the worldwide extension of the warning services. The global data available at AFGWC was fundamental to this expansion of services.
4) Tailoring the service to military operations, some of which may be classified.

In fulfillment of its global severe weather forecast responsibility, AFGWC's Military Weather Warning Center (MWWC) issues routine six hourly warning summaries, and forecasts heavy rains and snow and many other parameters. In addition, it operates under more detailed severe weather criteria than does the NSSFC SELS. unit. It also issues warnings for ocean areas out to 200 miles offshore, point warnings for 500 CONUS locations, and forecasts for unclassified and classified Air Force and Army missions. There are, therefore, some basic differences in operation and scope of responsibility between NSSFC and the weather warning activities of AFGWC. Table 6.2 summarizes the respective responsibilities of each center.

The National Severe Local Storms Plan issued annually by the Federal Coordinator for Meteorological and Supporting Research defines the relative responsibilities of the two severe storm centers. Two major areas of cooperation are outlined in the plan:

Table 6.2 - Functions Of NSSFC And AFGWC

	NSSFC (SELS)	AFGWC (MWWC)
1. Area outlooks		
severe weather outlook	CONUS - once daily	---
area warning summaries	----	CONUS plus 200 miles offshore - 4 times daily plus amendments
2. Watches or Warnings		
severe storm watches*	CONUS - as required	----
point warnings	----	CONUS for 500 locations as required
3. In-Flight Warnings and/or Forecasts	SIGMET as required FA (aviation area forecasts) twice daily plus amendments	As required for classified exercises, special missions, TAC/SAC training missions
4. Parameters Forecast	Tornadoes severe thunderstorms and associated strong winds and hail	Tornadoes, severe thunderstorms, strong winds, hail, heavy snow, heavy rain, and freezing precipitation

*Warnings are issued by WSOs and WSFOs.

- In the event that NSSFC is unable to discharge its severe weather forecasting functions due to a communications outage, the AFGWC will provide backup. Upon notification from NSSFC that the Backup Plan is to be implemented, AFGWC will prepare and transmit watches, outlooks, and other advices regarding severe local storm activity as prescribed in Weather Service Operations Manual (WSOM) Chapter C-40.
- The NWS will notify selected military installations when severe convective weather is expected to affect such sites and the installation's AWS detachment is not manned by a forecaster or the station's radar is inoperative. The notification will be performed by selected NWS offices using radar and/or other information available. Notification will be via NOAA Weather Radio warning alarms for those sites within the receiving area, provided such sites are equipped with receivers. This is the most rapid notification available. Otherwise, notifications will be according to "alerting agreements" between the AWS/NWS offices concerned. Such written agreements are initiated by the AWS units, but require approval of NWS Headquarters before they can go into effect.

While the AFGWC does have a somewhat more diverse and global forecast responsibility with respect to severe weather activity than does NSSFC, the similarities in severe weather forecast and warning techniques might make co-location a reasonable arrangement.

If, on the other hand, the AFGWC responsibility to back up the NWS NSSFC in case of communications or other failures must continue, then a case may still be made for separate units. Furthermore, communications facilities for consolidated centers would have to be installed at the consolidation location, at some initial increased cost.

Although the AFGWC prepares and issues point warnings for 500 locations in the contiguous 48 states, nevertheless, by local agreements between NWS offices and AWS Base Weather Stations (BWS), the Air Force accepts warning services from the NWS for a substantial number of installations when the Base Weather Station is closed.

New technology aimed at the severe thunderstorm and tornado warning problem is on the horizon and its operational implementation is certain to have significant impacts on both accuracy of warnings and how they are prepared. The Vertical Atmospheric Sounder (VAS) that will be carried on GOES spacecraft D, E, and F (D is scheduled for launch in 1980) will provide hundreds of atmospheric temperature and moisture profiles daily for the U.S. Availability of these data will provide a data base for more detailed analyses (and predictions) of the atmosphere's potential for destructive convective storms. The large volume of data will require use of computers and a man-machine interactive approach. Work is presently underway at NSSFC to begin integrating VAS into the NWS operations. NEXRAD, the new Doppler weather radar will also have significant impacts on how severe thunderstorm and tornado warning requirements are met. The characteristics of NEXRAD point toward centralization of warning functions at locations with NEXRAD terminals. These are two major new technologies coming soon; others such as new numerical prediction models will have additional impacts. As all this new technology comes into use, the Federal agencies should look at their weather warning systems to be certain they have an optimum arrangement that takes full advantage of the very large investments being made.

OBSERVATION:

The present arrangements for public and military warnings of tornadoes, severe thunderstorms and other hazardous weather conditions are meeting agency mission requirements very effectively and efficiently with present technology. New technology which will become operational during the next few years will not only provide significant new capabilities but also may require changes in the arrangements for producing warnings in order to make optimum use of the technology. It would be appropriate for the Federal Coordinator and user and producer agencies to keep informed of the impact of new technology on weather warning requirements and techniques for production. In this way the Federal government will be in a position to make optimum use of costly investments in a critical area of weather service.

6.2.8 Weather Personnel

The automation of observing systems, collection and distribution systems, and terminal forecasts will remove people from labor intensive areas. The temptation and rationale to offset the costs of automation by reduction in personnel is strong. The entire meteorological area appears to be moving in this direction. Concerns are now being expressed as to how to retain enough qualified people to provide for operating the up-graded system, for training within the system and for the necessary interface with public and other users,particularly under emergency conditions. The military, in particular, have need for trained personnel to serve anywhere in the world; in many places centralized automated support will be minimal or non-existent.

OBSERVATION:

There is an increasing movement toward automation of almost all weather service functions, with a corresponding decrease in some categories of personnel and increases in others. Careful planning will be required to assure that enough trained and experienced civil and military meteorologists and technicians are available to provide meteorological services to meet national needs.

6.2.9 Role of Private Meteorology

The NWS, under continuing budget constraints, escalating costs of new technology, and manpower limitations, cannot meet all of today's demands and will find it incresingly difficult to meet all future demands for weather services. There are now, and will continue to be opportunities for the private sector to provide specialized weather services to users. The private meteorologists have, to some extent, been filling this need and can be expected to continue to do so more and more. While the total number of private meteorological organizations will probably not expand as rapidly as in the past, they will be larger and will offer increased services.

To provide the best total weather service (aside from military requirements) to the nation, a combination of Federal and private meteorological service effort and teamwork is required. The private meteorological sector should complement the National Weather Service. The impact of any proposed changes in NWS operational procedures on the private sector's ability to operate

economically and efficiently must be assessed before such changes are made. The private sector should not have a veto power over NWS changes, but the NWS must accept responsibility to discuss, explain, and coordinate changes as far in advance as possible.

Specialized meteorological services are provided by the private sector to a wide range of industrial, commercial and municipal clients, to news media, and to agencies of government at all levels. The NOAA/NWS weather data base provides the basic information that the private meteorologists use to produce specific, tailored forecasts and climate data for their clients. The major factors that make for successful marketing of these products are the short term accuracy specificity, and timeliness of weather information which the private sector can provide.

The mass communications media (major TV and radio networks) are more and more dependent upon the private sector for weather information to use in the presentation of weather programs. While most radio broadcasting stations do not have the resources to pay for these services, and so depend upon the NWS output, through NOAA Weather Wire Service (NWWS), NOAA Weather Radio (NWR), and press wire services, an increasing number of them are contracting for private sector.

The NOAA/NWS Policy on Industrial Meteorology appears to be realistic and consistent with present trends in the private sector. However, the task team has had some indication that a few NWS field stations may not be familiar with this policy or do not comply with its intent.

In view of (1) the constraints on the NWS that inhibit its ability to meet all the varied demands for weather service, (2) the projected growth and increased impact of the private meteorological sector in providing weather services and (3) the expressed policy of Federal Agencies to encourage, stimulate and support the private meteorological sector, the task team arrived at the following observation.

OBSERVATION:

The current NWS policy regarding industrial meteorology appears adequate, but needs to be followed throughout the organization.

6.3 Adequacy Of Department of Commerce Implementation of OMB Circular A-62 For The 1980s

To address this question, it is first necessary to consider what the Federal Coordinator should be doing in the 1980s. The recently approved realignment of the Office of the Federal Coordinator and the action to increase staffing will, essentially, return the Office to the mode of operation it had when it was formed in 1964. The following paragraphs discuss some of the functions of the office as originally envisioned by Circular A-62 and those actually implemented during the early days of its operation. Changes that appear desirable in the light of past experience and in consideration of the needs of the 1980s become evident.

6.3.1 User Requirements

Circular A-62 is somewhat unclear on this point. In Paragraph 1, the Circular states that the guidelines are designed to provide for evaluating user requirements within the context of a balanced and integrated Federal plan. Paragraph 3.a. requires the Department of Commerce to establish procedures designed to facilitate a systematic and continuing review of basic and specialized meteorological requirements, services, etc. However, Paragraph 4.a, calls for the Federal plan to be directed toward relating such meteorological services and research to requirements as established by the user agencies. Experience has shown that evaluation of user requirements is difficult at best and should be carried out by the mission agency. The agency has the added discipline of having to balance its meteorological requirements with its other mission demands to make them all fit within the anticipated agency budget.

There is a tendency to speak of "requirements" as though they were inviolate and any alteration would adversely affect the effectiveness of the units being being provided. If this concept of requirements is retained, there can never be a

successful JSPO, common specifications, common systems procurement or interoperability. The JSPO approach can only succeed so long as there is responsible give-and-take on requirements sufficient to achieve the commonality that would justify common specification and procurement. Often the "requirements" that bear most directly on weather system specifications are a reflection of the commander's or director's philosophy as to how he wishes to go about meeting mission requirements placed on him. For example, the Naval Oceanography Command, the Air Weather Service, the National Weather Service and Federal Aviation Administration all have requirements for weather collection, display, and distribution systems, but each has a somewhat different philosophy for meeting its requirements and assigns a different priority to its implementation.

The OFCM must be active in coordinating the means by which agencies intend to meet their requirements. In those cases where agency requirements are similar (techniques, procedures, equipment developments, observational networks, communications systems, processing centers, etc.), the means by which they are to be met can and should be carefully analyzed within the Federal Coordinator structure and a common approach recommended where feasible.

OBSERVATION:
Justification of mission oriented requirements and programs to meet those requirements must continue to rest with the agencies. The Federal Coordinator must examine these programs for possible economies and efficiencies from joint rather than individual agency actions if the purpose and intent of Circular A-62 are to be met. Formal program review within the present Federal Coordinator structure will accomplish this objective.

6.3.2 Supporting Research

The term "supporting research" has been a problem from the beginning. Circular A-62 uses the term almost interchangeably with "applied meteorological research." (In the original implementation of A-62, the Department of Commerce established a Federal Coordinator for Meteorological Services and Supporting Research and an Interdepartmental Committee for Applied Meteorological Research). No two agencies could agree on the dividing line between basic research and supporting or applied research. The Bureau of the Budget Circular A-62 defined

supporting research to include those applied research and development activities whose immediate objective is the improvement of the basic and specialized meteorological services. To illustrate the confusion in this area, the following is a quote from the current (FY81) Federal Plan: "As of FY1981 the Atmospheric Science Division of the National Science Foundation has begun reporting basic research activities which could ultimately (underlining supplied) improve either basic or specialized meteorological services."

The initial Federal Plan included a one-line statement of the total Federal expenditures planned for all meteorological research as provided to the Federal Coordinator by the Interdepartmental Committee for Atmospheric Sciences of the former Federal Council for Science and Technology.

The practice of presenting the reader with the total expenditures (basic as well as supporting meteorological research) was continued through the FY78 Federal Plan at which time it was stopped. The original reason for including this material was to enable the Federal Plan to meet the Administration's responsibilities for providing the Congress annually with a horizontal budget showing the totality of the programs for meteorology.

In the current realignment of the Office of the Federal Coordinator the former Interdepartmental Committees for Meteorological Services and for Applied Meteorological Research (ICMS and ICAMR) have been merged. The members on the new committee are now primarily from the services side of the agencies. In addition, the ICAMR standing subcommittees that provided the expertise to coordinate each of the functional areas of supporting research have all been abolished.

This represents a decided departure from the original approach to coordinating supporting research. The Federal Coordinator now will be coordinating only the supporting research that can have an immediate impact on the meteorological services. This is a more realistic approach. The coordination of all meteorological research is carried on extensively both within and outside the Federal Government (see paragraph 5.2.) In the past, the former Interdepartmental

Committee on Atmospheric Sciences overlapped the Office of the Federal Coordinator in the applied research area; this overlap now continues under the Committee on the Atmosphere and Oceans and its substructures under the Federal Coordinating Council for Science, Engineering, and Technology.

It is far more important that the Federal Coordinator focus his efforts on areas where duplication, if allowed to develop, will prove to be costly to the Federal Government. The costs of parallel efforts in the research area or even in the development of new methods for observing fundamental meteorological parameters (for example, laser ceilometer) are not large, but may have significant cost implications in later years. Even when costs may appear substantial, in most cases alternate approaches to the solution of these important research and development problems are both necessary and desirable. The R&D area that does require close scrutiny by the Federal Coordinator is where equipment, systems, technology, etc. are being considered for operational implementation.

The newly reorganized Office of the Federal Coordinator, if adequately staffed with talented people of the right background and experience, should be able to focus selectively on the R&D area. The following areas should be given priority. In these areas, the OFCM should:

a. Work closely with the agencies on their requirements for equipment and supporting systems with the objectives of reconciling differing requirements and establishing a single design and a common development and procurement (for example, as is currently being done for NEXRAD).

b. Ensure that equipment development underway meets valid operational requirements of the Federal agencies, and that wherever feasible, well-coordinated development programs aim at joint procurement of common equipment.

c. Insure that equipment development underway will meet the operational requirements of the Federal agencies.

d. Arrange with agencies engaged in field tests of techniques, instrumentation, etc. for the provision of needed operational support (for example, the PROFS program). The operational weather services can learn much about the application of the results of these tests to future operations through such participation.

e. Continue to provide coordination for major interagency field experiments.

Another approach that would have the advantage of completely eliminating the present overlap in coordinating meteorological R&D has been suggested. This would involve discontinuing the atmospheric responsibilities of the Committee on the Atmosphere and the Oceans and its Subcommittees on Atmospheric Research and on Weather Modification, and assigning them to the Federal Coordinator. He would then become Federal Coordinator for Meteorology. Although there is much to recommend in this approach, it does not appear politically feasible, because a number of the agencies may wish to continue to have the atmospheric sciences as a part of the coordinating structure of the Office of Science and Technology Policy in the Executive Office of the President.

OBSERVATION:
Coordination of research and development is difficult, time-consuming and costly under the best of circumstances. Coordination under the aegis of Circular A-62 is made more difficult by the introduction of a new category, "supporting research" and by the fact that significant parts of the total meteorological research effort are being coordinated by offices other than the Federal Coordinator. It appears that the Federal Coordinator has several options:

(1) The Federal Coordinator could attempt to coordinate all meteorological research and development. This would require agreements with the Federal Coordinating Council for Science, Engineering and Technology whose Committee on the Atmosphere and the Oceans presently has the responsibility for coordinating basic research and development, and with the National Climate Program Office which has a statutory requirement to coordinate climate-related research. The Federal Coordinator's

staff would have to be expanded substantially to handle the increased workload and duplication of coordination activities would be almost certain to occur. On the other hand, a focus for coordination of all meteorological programs may be desirable provided the institutional, bureaucratic and duplication problems can be resolved.

(2) The Federal Coordinator could limit his activities to those programs falling within the category of supporting research as specified in Circular A-62. There is no currently accepted definition of "supporting research" among the agencies and there is little prospect for such acceptance. Thus there would be no uniformity in programs submitted for coordination and no way for the Federal Coordinator to assure that all appropriate programs were being coordinated.

(3) The Federal Coordinator could limit the scope of his research and development coordination to two major categories where a majority of resources are directed and where, therefore, the potential for payoff from coordination is the greatest. The first category would be that research and development which has progressed to the point of being actively under consideration for operational implementation. The second category is major multi-agency field experiments. This option could be carried out by the current Federal Coordinator structure and office staff. Potential benefits from coordination of programs in these two categories are very high, especially for large development efforts leading to major new systems. In these cases, early and effective coordination has the greatest probability of achieving significant economies through joint development, procurement and implementation to meet mission requirements. If an agency, such as the NSF, wishes to report its programs to the Federal Coordinator for review and coordination, the Federal Coordinator would accept them because of the multi-agency impacts of such work. Admittedly, some small research and development programs may not be coordinated through the Federal Coordinator structure, but these appear to have insignificant economic impacts compared to the effort required to bring them into the structure. Further, results of coordination by either group could be reported by the Federal Coordinator

in records of action of ICMSSR and in the Annual Federal Plan, if it is desired to document what has been done in this way.

6.3.3 Federal Plan

Circular A-62 calls on the Department of Commerce to prepare and keep current a plan, and to obtain periodic information on its implementation, for the efficient utilization of meteorological services and supporting research. The plan is to relate meteorological services and research to requirements established by user agencies and to relate proposed programs to fiscal year and longer range objectives. The Department is to clearly identify planning assumptions, any unresolved interagency issues and the views of the agencies concerned with respect to such issues.

The initial implementation plan, prepared in 1964 for the FY 1966 budget year, covered the following:

a. Weather Activities of Federal Agencies - Reason for each agency's involvement in meteorological services or supporting research.

b. Summary of Fiscal Data - Funding for services and supporting research by basic and specialized services and by agency.

c. Weather Services - Current and projected weather services by function and the involvement of each agency in each function.

d. Research and Development - Same as Paragraph c but for supporting research.

e. Weather Satellite - The weather satellite operational and research and development programs.

f. Coordination and Planning - A discussion of coordinating activities of the Federal Coordinator and an identification of certain program areas in need of further study.

Beginning with the second plan (fiscal year 1967) there was a section devoted to a discussion of the operational and supporting research programs of each specialized service together with the budget changes being requested. This early format for the Federal Plan held constant until about FY 1967 when the emphasis appeared to shift more to the specialized meteorological services with less detail given to the program changes of each agency by function. The FY 1977 Federal Plan, while giving funding breakouts by function, did not discuss the program budget changes by function. Nowhere in the Plan could the reader see the degree to which each agency was involved in taking weather observations, engaged in weather communications, operation of processing centers, etc. nor could the reader tell the degree to which present and projected programs duplicated or complemented each other.

In the last two years (FY79 and 80), the publication has become only a presentation of agency budget requests with summary tables giving the funding breakout by agency, function, and specialized service both for operations and supporting research.

The Federal Plan for Meteorological Services and Supporting Research, FY 1981, presents the major budget changes proposed by each Federal agency. There is no way for the reader to tell whether these requests are interrelated or duplicative. An inordinate number of pages is devoted to compilations of individual agency programs. Aside from references to the Cross Cut Studies, there is little evidence of coordination of meteorological programs.

The FY81 Plan suggests that from the very beginning, the OFCM concentrated on the publishing of plans and devoted few resources to coordination of multi-agency programs. This presents a somewhat misleading impression.

Coordination was effective in the early period of the OFCM and the numerous plans developed in those early days were results of coordination of multi-agency programs. These early plans covered a few specialized weather services, some of the functional areas of the basic weather service, specific interagency problems, and annual operating plans covering hurricanes, winter storm reconnaissance, and severe local storm warnings. Routine coordination was also

carried on by the interdepartmental committees and their subcommittees and panels.

There is need for a change in the present format of the Federal Plan. It needs to show to what extent coordination is in progress, how effective it is, and what actions are being taken to eliminate current duplication and to avoid future duplication. The plans would contain the following minimum essentials (these suggestions assume that supporting research programs, as such, will no longer be emphasized, as discussed under 6.3.2):

a. A brief discussion of why each Federal agency must be engaged in meteorological services or supporting research. The supporting research should be restricted to only those projects having the immediate objective of improving weather services.

b. A summary of fiscal data:
   - Agency funding for weather services by function (observations, forecasting, etc.) and by service (basic, aviation, agriculture, etc.)
   - Agency funding for operational meteorological satellites, and
   - Agency weather services personnel by function.

c. A discussion by function of the projected programs and plans of all of the Federal agencies involved in any way in weather services. It may be necessary to go below the function level and devote a section of the Plan to what each agency is doing in certain sub-functions such as automated surface observations, radar, etc. Within each function there would be a discussion of the nature of each agency's participation, its plans, and how these plans interrelate with or duplicate other agency programs. If unjustified duplication is indicated, the plans should show what is being done about the duplication problem. At the end of each functional discussion there would be a summary of agency budget requests for the function (dollars and changes involved). R&D dollars would only be identified when R&D is needed to bring a system or technique into the operational weather services. Multi-year phasing and funding could be projected for approved programs having downstream budget implications (e.g., NEXRAD).

d. A final section should recapitulate, agency by agency, the major changes planned for the budget year (dollar and personnel changes and activities involved). This would provide a handy cross-reference to someone who wants to see the total agency budget requests and changes for the year.

There appears to be no valid reason to treat supporting research separately. The funding figures are meaningless since they show only a partial picture of research in meteorology and because agencies categorize their supporting research, as distinct from their basic research, in different ways. In addition, the full picture of research in meteorology is best coordinated and presented by the Federal Coordinating Council for Science, Engineering and Technology's Committee on the Atmosphere and the Oceans. Only that supporting research and development likely to have an immediate impact on the programs and plans of the weather services should be discussed and then only under the appropriate functional area of the weather services' portion of the Plan. In addition, major multi-agency field experiments would be highlighted when significant new information or plans are to be presented.

GAO report LCD-80-10, October 10, 1979, entitled, "The Federal Weather Program Must Have Stronger Direction," stresses the need for detailed and on-going program reviews to insure that opportunities for improvement can be promptly recognized and aggressively pursued. Reformatting the annual Federal Plan along functional lines will require submission by all agencies of the program information needed by the Federal Coordinator for the conduct of such reviews.

If it is desirable to present the totality of the Federal meteorological program in a single plan, it should be possible for OFCM to get the total funding in meteorological research and development from the Committee on the Atmosphere and the Oceans as in the past. However, if the CAO intends to submit an annual report to the Congress, that report could serve to meet this portion of the Congressional request for a horizontal budget presentation. Because the Climate Program Act (PL95-367) requires the National Climate Program Office to report to the Congress annually on the Federal Climate Program, it would seem redundant for the Federal Plan for Meteorological Services and Supporting Research to treat climatology in the future. Again, however, if it is desirable to have

the annual Federal Plan show the totality of meteorological programs, the fiscal data on climate activities could be obtained from the National Climate Program Office.

To avoid having to describe each agency's basic involvement in meteorology in detail in every annual plan, an alternative is to prepare a separate document for this purpose and update it only as necessary. The Federal Plan would then refer to this document in the event that the reader may want a more detailed presentation than the brief material included in the annual Federal Plan. The separate document probably would not have to be revised annually nor would it have to be prepared at the same time as the Federal Plan. Such a document, entitled "Weather Activities of the United States Government," was published shortly after the OFCM was first established.

The above approach deemphasizes the specialized weather services. Only a summary table would be presented to show how the Federal dollars are distributed among the basic and specialized services. Whether some of the specialized services even belong in that category is open to question. For example, the Director of the National Weather Service considers, with considerable logic, that the Marine Weather Service is nothing more than another facet of a public weather service.

Recent Federal Plans have dropped detailed discussions of program changes by specialized weather services. There is much to be said for this approach because those individualized discussions did nothing to highlight functional similarities between these services. And these similarities are the very ones that require the closest attention of the Federal Coordinator because this is the area where the potential for duplication and cooperation will be manifested.

OBSERVATION:

Some changes in the format and content of the Annual Federal Plan are needed to improve its information content and usefulness to readers. One option, that of emphasizing the meteorological service functions of the agencies, has been presented above in this Section 6.3.3. Other options include:

(1) The Annual Federal Plan could be structured around Basic and Specialized services with a functional cross-walk summary. This approach would present meteorological services in the way they are "sold" to Congress; services to user groups and benefits to various constituencies are more readily evident than is the case with functional presentations. This approach is not in consonance with the way programs are planned and coordinated. Almost without exception the common threads that constitute the fabric of planning and coordination run along functional lines.

(2) The Annual Federal Plan could be structured both functionally and by services. This dual presentation would about double the size and the cost of the plan. The increased size would be an undesirable feature for readers such as members of Congress already burdened by "mandatory" reading. In addition, the redundancy caused by repeated discussions of the same program that impacts all services (e.g., NEXRAD) would be confusing at best. On the plus side, a reader could get a more complete picture of the Federal programs if he were willing to devote the time and effort.

6.3.4 Other Plans

Circular A-62 talks in terms of a single Federal Plan. From the beginning it was evident that a single Federal Plan would be much too cumbersome and would be impossible to keep current.

In the early days of the Office of the Federal Coordinator there was an ambitious attempt to prepare individual Federal Plans for each of the specialized meteorological services (aviation, agriculture, fire weather, marine, etc.) and for each of the functional areas (observing systems such as radar, upper air, rocketsondes, etc.; processing centers, climatology, etc.). Through the years these plans have become outdated and few, if any, are current today.

There are probably several reasons for the decline in these plans. They were rarely followed up with the budgets needed to convert them into programs, and they required much OFCM staff time, which, in recent years, has not been available.

It is doubtful that the original concept of specialized meteorological service plans is still appropriate. In those instances where two or more agencies feel that a plan would be useful, such as the Joint DOA-DOC Agricultural Weather Service, it would be more effective if the plan were developed bilaterally. Copies of such plans would be sent to the OFCM. In recent years new program funds have not been provided in these areas and the outlook for the future is not encouraging. For these reasons,it is recommended that future plans deal with requirements for the service, a description of the present service program, and plans for changes in the program in small, logical increments. No attempt should be made to assign fiscal year goals for these items nor to put dollar figures on them. Plans written in this manner would not become obsolete a year after publication, but would be available for use in budget planning and reviews.

The need for the Federal Coordinator to develop plans in the functional areas (and even across functional areas, e.g. AFOS) is much greater than the need for plans in specialized meteorological services. It is in the functional area that the overlap and duplication of effort is most likely to occur, so attention to these areas should focus on detecting such problems before they become too complex. Priority should be given to carrying out program reviews in each functional area to seek ways to reach agreement on common requirements, on common equipment and systems design, on joint procurement, and, where feasible, on joint operations. At the least, operational systems must be compatible in products and interfaces.

This activity in the functional areas will generate the need for the only studies and plans that the OFCM should probably attempt. This is essentially the approach now being taken by the Department of Commerce and the Office of Management and Budget. The cross cut studies on surface observations and

radar have highlighted these two functional programs. In the case of surface observations, the study focused attention on divergent agency activities. As a result, efforts are now underway to establish common requirements and a common design. The radar area (NEXRAD) is further along toward achieving a single operational system to meet the common needs of all agencies. This is unquestionably the way to proceed. Additional areas should be identified.

One which has a very high priority has already been mentioned earlier in this report, i.e., the separate Air Force, Navy, FAA, and National Weather Service activities to develop integrated processing, communication, display, and presentation systems such as National Weather Services' AFOS and the U.S. Navy's NEDS system.

OBSERVATION:
The Federal Coordinator has a small staff and must deal with a wide spectrum of activities, including preparation of various types of plans. Certain of these plans have higher priorities than others. The Annual Federal Plan is at the top of the priority list since it is required by statute. It is followed by the operating plans for interagency activities in hurricane, severe storms and winter storm warnings. OMB Circular A-62 requires a long-term Federal Plan that appears to follow next on the priority list. Plans in the various functional areas can be prepared by the OFCM and serve useful purposes. Plans for specialized services seem to have the least usefulness and accordingly could be prepared by the agencies concerned, with the Federal Coordinator reviewing and publishing them.

6.3.5 Interagency Agreements and Memoranda of Understanding

In the early days of the implementation of Circular A-62, the Office of the Federal Coordinator objected to the use of bilateral agreements because it was felt that the office could not carry out its responsibilities unless it played a part in the development of such agreements. OFCM participation proved impractical as the number of such agreements increased. Today participation by the Federal Coordinator would unnecessarily delay these agreements

and would involve staff time that can be used more profitably working on current issues.

It is not suggested that the OFCM be unaware of these agreements. On the contrary, the Federal Coordinator should be fully aware of them. It would be appropriate for the Federal Coordinator to review them to determine (a) whether the agreement is consistent with the intent of Circular A-62; (b) whether the agreement will impact agencies not party to it, and (c) whether other agencies could benefit by being a party to the agreement.

OBSERVATION:
The agencies involved in Federal meteorological programs of all types make wide use of interagency agreements and memoranda of understanding covering cooperative efforts. It is clear that these agreements have resulted in significant economies and efficiencies in establishing and meeting agency mission requirements. This practice is worthy of special note. A small additional effort by the Federal Coordinator appears desirable to assure that these agreements are consistent with Circular A-62 and have considered potential impacts on additional agencies.

6.4 Adequacy Of Existing Authorities And Agreements In The 1980s.
All known statutory and regulatory documents and interagency agreements have been reported on earlier in this study. Other than the authority of the National Weather Service and the Federal Aviation Administration, statutory authorities that relate directly to meteorology are either very general or are derived from other authorities such as the Clean Air Act, or from support of general mission responsibilities.

However, existing authorizations that stem from the Federal budgetary process serve the purposes of most agencies. Programs are proposed and funded on the basis of program priorities rather than in response to particular authority. The Federal coordination mechanism serves to keep the agencies informed of each others activities. Relatively new and evolving agencies, such as the Federal Emergency Management Agency and the Nuclear Regulatory Commission, are

developing requirements and relationships in the meteorological area with other agencies with no significant problems with basic authorities.

Because the Department of Commerce has not always been successful in obtaining funds for some of its specialized meteorological services, consideration might be given to shifting the statutory responsibility and authority for providing those services to the agency that has the primary need. The advantage of this would be that the agency having the primary need for the service could provide for that service in its budget, and could then buy the service from the NWS or the private sector. Several agencies have such arrangements with the NWS; these appear to be working well. On the other hand, agency authorities are probably sufficiently broad to permit this option without any specific change in basic authorities.

The aviation roles of the military services, the NWS, and the FAA are discussed as special cases in sections 6.4.1 and 6.4.2.

OBSERVATION:
Current authorities appear to cover the needs of the agencies and few, if any, benefits would be realized from more specific authorities.

6.4.1 Coordination of Meteorological Programs

The real purpose of Circular A-62, the GAO reports, the revitalizing of the OFCM and this analysis is the matter of coordination of the meteorological programs of the Federal government. Coordination of these programs involves both the short and long-term plans and projects of the agencies, and the on-going operations of the various programs themselves. The OFCM is intended to accomplish both parts of the coordination task. Its committee structure has representatives of the agencies concerned: DoC, DoA, DoD, DoI, FAA, EPA, etc. It is important to note that DoD representatives, not USAF (AWS) or USN (NOC) representatives, participate in the normal OFCM committees and subcommittees. This arrangement permits DoD to speak with a single voice but it places a large responsibility on the Director of Environmental and Life Sciences, Office of the Deputy Under Secretary of Defense Research and Engineering (Research and Advanced Technology), who is charged with policy direction of DoD environmental

services. If the larger Federal coordination system is to operate properly, the DoD function must be carried out effectively because a large portion of the total Federal program in meteorology is in DoD and its services.

OBSERVATION:
The Department of Defense has assigned responsibility for policy direction and coordination of its meteorological programs to the Director of Environmental and Life Services (see above). Because the DoD programs constitute a sizable portion of Federal meteorological programs, it may be desirable to reaffirm this assignment and to assure the necessary authority and resources to carry out these responsibilities effectively.

6.4.2 Examining Institutional Arrangements

Just as there is a major interdependence between the DoD Weather Services and the National Weather Service, there is also a major interdependence between the Federal Aviation Administration and the National Weather Service. The major difference is that the FAA has not operated its own complete and independent weather service. As in the case of the Navy and Air Force, however, both NWS and FAA are involved in the development of high speed digital communications systems for collecting, displaying, and disseminating data and processed information for use in self-briefing pilots or for use by agency personnel at field offices.

These parallel efforts of the NWS and the FAA could result in two separate systems with many similarities. It is becoming increasingly apparent that implementation of these two new systems may cause increasing separation between the FAA and the National Weather Service. A single manager in this area is clearly not a consideration since the missions of the two agencies differ significantly. On the other hand, the development of these two civil systems deserves review to see if any changes in the roles of the two agencies in the meteorological area are indicated. That both systems have progressed so far down the road to implementation suggests a need for NOAA and the FAA to conduct a thorough review and update of their basic Letter of Agreement.

There are other cases of major interdependence between agencies; e.g., NOAA-EPA, NASA-NOAA, and FEMA-NOAA. Most of the institutional arrangements are formalized by some form of interagency agreement that has been in existence for several years. In some cases missions have changed, programs have been initiated and other terminated, but the agreements remain as originally written. A review of these agreements by the agencies concerned appears to be in order to assure that they reflect current policies and that existing and planned programs conform to the terms of the agreements.

OBSERVATION:
There is a need for agencies involved in interagency agreements dealing with interdependence and cooperation in meteorological programs to review those agreements to assure that they reflect current policies and that existing and planned programs conform to the terms of the agreements.

OBSERVATION:
That NOAA and the FAA should review and update their basic Letter of Agreement, paying particular attention to the impact that implementation of AFOS and FSAS/NADIN may have on their respective roles in aviation weather services during the 1980s.

6.5 Adequacy Of OMB Circular A-62 For The 1980s

Changes in interpretation and practice since Circular A-62 was published in 1963 are described in the following paragraphs.

As mentioned in Section 2.5, one agency representative interpreted the Circular as authorizing the Department of Commerce to coordinate programs between Departments but not within any particular Department. Under this interpretation, the Federal Coordinator would be unable, for example, to address areas of possible duplication between the weather services of the Air Force and the Navy. Paragraph 4.a of the Circular referring to the development of the Federal Plan, is somewhat ambiguous on this point.

"The Plan should include (1) all civilian meteorological services and supporting research, and (2) those meteorological services (basic and specialized) and supporting research programs of the military, which are significantly affected by, or which affect, civilian meteorological services and supporting research."

However the Department of Commerce must be in a position to coordinate meteorological programs regardless of where they exist organizationally; otherwise effective coordination of most functional areas will be next to impossible. Neither the OMB nor DoD appears to interpret the Circular in this restrictive manner, since, for example, OMB has directed a cross cut review of the three weather processing centers and DoD is cooperating in this effort. Thus, at least in certain specific cases, the Federal Coordinator has been given the authority to address programs within a Department.

It was recommended, in section 6.3.2, that the coordination of supporting research be greatly reduced from the amount carried out in the early days of the OFCM. Supporting research as defined in the Circular includes "those applied research and development activities whose immediate objective is the improvement of the basic and specialized meteorological services as defined herein." No change in this language appears necessary since the intent of the recommendation is to emphasize the coordination of supporting research having immediate application.

Some decisions made since the Circular was issued concern activities not included in the Circular. For example:

a. The Office of the Federal Coordinator by agreement of the agencies concerned, now coordinates space and environmental forecasting and certain additional marine functions.

b. With the formation of the National Climate Program Office, it is no longer appropriate for the OFCM to coordinate agency climatological programs.

Circular A-62 has withstood the test of time extremely well. Nearly all of the past changes in the approach to coordination as well as those put forward in this study can be accommodated within the present wording of the Circular. None of these changes appears to be of sufficient magnitude to justify a revision of Circular A-62.

OBSERVATION:
Circular A-62 has served the Federal government very well during the 17 years it has been in existence. It is sufficiently broad to allow for the agreements, changes and interpretations necessary for effective coordination of Federal meteorological programs in the 1980s. There appears to be no need to change Circular A-62 at this time.

6.6 Authority Of The Federal Coordinator And His Location Within The Department Of Commerce

6.6.1 Location

Circular A-62 does not provide for a Federal Coordinator for Meteorological Services and Supporting Research. In its implementation of Circular A-62, the Department of Commerce proposed the Federal Coordinator mechanism. It was approved by the agency representatives, was formally established on July 8, 1964 and has continued to this day. Nothing in the review of the history of the DOC's implementation of Circular A-62 suggests that there is anything basically wrong with the Federal Committee/Federal Coordinator arrangement. As stated earlier, however, frequent suggestions have been made that the Federal Coordinator lacks adequate authority. It has also been suggested that, because of his organizational location within NOAA, the Federal Coordinator is not sufficiently independent of NOAA's operational meteorological activities. The GAO, in particular, pointed out that in the original implementation of Circular A-62, Commerce intended to provide for the independence of the OFCM by placing it within a staff office in Commerce. The GAO report goes on to point out that the office no longer reflects that kind of independence because it is now located in an operating entity of NOAA.

There appears to be no realistic alternative to the Federal Coordinator being located somewhere within the NOAA structure. When first established, the office was assigned directly to the Office of the Assistant Secretary for Science and Technology, but this assignment ended when the National Oceanic and Atmospheric Administration was created and it became an agency reporting directly to the Secretary of Commerce. It hardly seems likely that the Office of the Secretary of Commerce would wish to be directly involved with the Federal meteorological coordinating functions on a routine basis.

The Federal Coordinator should be in a position to be of assistance to the Federal agencies once the OFCM is again fully staffed and functioning effectively. A well documented OFCM study or issue paper showing a clear need for a program, and positive evidence of interagency coordination on the program, should gain OMB support for programs, such as NEXRAD, for which the agencies might not get approval independently. The possibility of such support might be enhanced if the Federal Coordinator were given greater stature within the Department of Commerce.

In the present situation, the Office of the Federal Coordinator is managed by the Deputy Federal Coordinator, who apparently continues to retain some of his former responsibilities as Chief of the Special Projects Office. These do not seem to interfere with the coordination function. Further, in spite of the comments of some of the agencies that the OFCM is misplaced in NOAA, it appears that the present Federal Coordinator gives full support to the Office, provides physically separate quarters, and seems to do all possible to honor the need for keeping the Office unencumbered by operational tasks related to his position of Assistant Administrator.

However, the study team has some doubt as to whether there is any advantage in having the Deputy Federal Coordinator report to a Federal Coordinator who is not the Chairman of the Federal Committee. Such an arrangement requires the Deputy Federal Coordinator to keep two different individuals currently briefed on his activities. There appears to be an unnecessary echelon in this structure. Also, because the primary responsibility of the present Federal Coordinator is to oversee some operational programs at NOAA, it is possible that he would be

reluctant to bring issues before the Federal Committee that the National Weather Service would prefer not be raised. It is noted that during the past ten years very few matters of duplication were handled by the Federal Committee. During that time, the committee was almost totally preoccupied with the World Weather Program, the Global Atmospheric Research Program (GARP), the GARP Atlantic Tropical Experiment, and the First GARP Global Experiment.

The Office of the Federal Coordinator could be established as an independent office, within NOAA, reporting directly to the Office of the Administrator of NOAA. The Deputy Federal Coordinator position would be abolished and the Federal Coordinator position would become full time. The Chairman of the Federal Committee would continue to be the Associate Administrator, NOAA.

OBSERVATION:

There appears to be sufficient reason to consider various alternative organizational arrangements for the OFCM. The position of Deputy Federal Coordinator could be eliminated, making the Director of the OFCM the Federal Coordinator. The Office should be financially and physically independent. Several organizational options are presented, without indication of any particular preference:

(1) Continue the present arrangements whereby the OFCM is assigned to the Assistant Administrator for Oceanic and Atmospheric Services so long as NWS remains in its present position in the NOAA organization.

(2) Establish the OFCM as a special staff office of the Office of the Administrator with stature equal to that of Policy and Plans and General Counsel.

(3) Establish the OFCM as a special staff office reporting to the Deputy or Associate Administrator, NOAA.

(4) Make the Federal Coordinator a Special Assistant to the Administrator, NOAA.

6.6.2 Staffing

The staff of the Office of the Federal Coordinator is being rebuilt as is consistent with the realignment and revitalization of the office. The approach appears to be directed toward building a small, highly competent staff, with considerable emphasis on long term detail of personnel from concerned agencies, short term agency details for specific tasks, and on contracting for study assistance. Joint systems project offices such as NEXRAD demand a specific talent which is best provided by the agencies. Many of the studies will be better performed where the Federal Coordinator has the flexibility for getting the mix of personnel appropriate for the particular issue being studied either by detail from the agencies or by contract. Past experience has shown that the Office of the Federal Coordinator permanent staff will not always have the right people at hand for all of the tasks that arise. Thus, it becomes absolutely essential that the participating agencies make qualified people available whenever needed to carry on the work of JSPOs, study groups, etc.

OBSERVATION:

The current staffing of the OFCM is appropriate for the tasks assigned and expected results. Use of short-term details of personnel from participating agencies, and contract assistance to provide needed skills to augment the permanent staff of generalists is a sound practice that reduces the need for full-time OFCM staff.

6.6.3 Committee Structure

The new Interdepartmental Committee for Meteorological Services and Supporting Research apparently intends to address its responsibilities through some twenty-two subcommittees, working groups and panels. This unwieldy structure will demand an inordinate amount of OFCM staff time just to keep track of its activities. Little time will remain for the OFCM staff to do its primary coordination work.

The ICMSSR should supervise only a few standing committees, and these should be established along functional lines. Only those working groups that appear to be needed on a continuing basis should be established under the appropriate functional committee; all others should be convened ad hoc.

The Subcommittee on Systems Development will prove to be one of the most active and critical committees in the structure in that it has responsibility for coordinating all of the systems development efforts of the agencies (NEXRAD, automation of observations, Weather Collection and Distribution Systems, etc.).

OBSERVATION:
The Federal Coordinator needs an action committee, composed of agency representatives, with authority to make commitments and decisions, that meets on a frequent and regular basis to handle the varied and complex issues involved in meteorological services and supporting research. The present ICMSSR can fill this need. Its effectiveness will be enhanced if it consciously strives to keep the formal standing subcommittee structure to a minimum and makes use of short-lived ad hoc groups to handle issues the ICMSSR believes must be examined in more detail than is possible in the parent committee.

6.6.4 Role of the Federal Coordinator for Meteorological Services and Supporting Research As Related To the Director of the National Climate Program Office

The study group met with the Director, National Climate Program Office. His office has been established within the Department of Commerce to be the "lead entity responsible for administering programs," in accordance with P.L. 95-367, September 17, 1978. The purpose of the meeting was to learn how the program was being implemented since it has responsibilities similar to those of the Department of Commerce under Circular A-62.

The Director stressed the following differences between his office and the Office of the Federal Coordinator for Meteorological Services and Supporting Research. The Federal Coordinator is located in Commerce because Circular A-62 makes Commerce responsible for coordination and planning of meteorological programs, while the public law establishing the National Climate Program Office specifically makes it (rather than Commerce) the lead entity responsible for

administering the Federal Climate Program. His point is that coordination and planning of meteorology was given to Commerce because DOC was the primary meteorological agency of the government, while, the National Climate Program Office was established in Commerce primarily as an administrative convenience and possibly because of a reluctance to establish it in the Executive Office of the President.

The two offices do have many similar functions and will have to work closely to define the very ambigious line separating meteorology and climatology. Where the Federal Coordinator has a Federal Committee, the Director has a Climate Program Policy Board. Where the Federal Coordinator has an interdepartmental committee, the Director has a working group. Both have very similar staffing, including interagency details of personnel. Both are required to publish an annual plan.

One significant difference lies in the relationship of these two offices with the OMB. While the agencies and the OMB took strong objection to any suggestion that the Federal Coordinator might advise the OMB on budget submissions of other agencies, this appears to be the very procedure being followed by the Director, National Climate Program Office. The Director stated that he provides directly to OMB (not through the Department of Commerce) his analysis of agency budget submissions and recommends decisions to OMB. These recommendations are not coordinated with the agencies, although they are provided copies. This approach appears inconsistent with the study group's understanding of OMB policy in this area. In any event, it is not an option open to the Federal Coordinator, who has no official status with OMB since the position is a creation of the Department of Commerce and has no direct channel to the OMB. An alternative for OFCM is the following procedure which has been suggested by recent cross cut studies. It probably would be just as effective and far less controversial.

a. The Department of Commerce, on the advice of the Federal Coordinator, identifies to the OMB areas of possible duplication or areas where issue papers or studies are needed.

b. The OMB determines which of these areas (or any other areas it might wish to identify) should become issues in the coming budget year and then requests the DOC to carry out appropriate studies.

c. The studies are prepared by the Federal Coordinator with full participation and cooperation by the agencies. Provisions should be made for documenting opposing agency views where unanimity is not possible. The studies are then forwarded to OMB by the Department of Commerce.

d. Within the OMB, the cross cut studies are subjected to a horizontal review by the budget examiners of the agencies involved and a position is recommended to the Director. Once the Director reaches a decision it goes back to each budget examiner who is then responsible for ensuring that it is reflected in the agency budgets.

OBSERVATION:

The study team has examined the modes of operation of the National Climate Program Office and the Office of the Federal Coordinator for Meteorological Services and Supporting Research. It appears that the tasks and issues facing the Federal Coordinator are significantly different, larger and often more complex than those related to the National Climate Program. The procedures that have evolved for OFCM relationships with OMB seem well-suited to the needs of OMB, DoC and the OFCM. Continuing this type of effective communication is essential to successful coordination and planning in the 1980s.

APPENDIX A

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

November 13, 1963 CIRCULAR NO. A-62

TO THE HEADS OF EXECUTIVE DEPARTMENT AND ESTABLISHMENTS

SUBJECT: Policies and procedures for the coordination of Federal meteorological services

1. Purpose and coverage. This Circular prescribes policy guidelines and procedures for planning and conducting Federal meteorological services and applied research.

The guidelines are designed to improve organizational arrangements and procedures for the planning and conduct of Federal meteorological programs with the objective of meeting essential user requirements most effectively economically. The guidelines (a) reaffirm the central role of the Department of Commerce with respect to basic meteorological services; (b) clarify the respective responsibilities of the Department of Commerce and the user agencies for basic and specialized meteorological services; (c) establish procedures to facilitate coordination and the timely resolution of outstanding issues; (d) provide for evaluating user requirements within the context of a balanced and integrated Federal plan; and (e) fix responsibility for continuing and systematic review of meteorological services and supporting research.

Policies and procedures with respect to basic research in meteorology are not within the purview of this Circular because such research is only indirectly related to improvement of weather services and often has other objectives. The Federal Council for Science and Technology will continue to have cognizance over basic research in the atmospheric sciences, which includes meteorology. This also includes the supporting applied meteorological research, as defined herein, in terms of its dependence upon and contribution to the atmospheric sciences.

2. Statement of meteorological services and requirements. For purposes of this Circular:

a. "Basic meteorological services" include all activities, that are possible within the given state of meteorological science, required to produce or complete a describtion in time and space of the atmosphere. In general the

products of this process are meteorological in nature and are not necessarily useful in such form for the operational needs of users. These services also include those activities required to derive from raw data the products needed by the general public in their normal everyday activities and for the protection of lives and property.

The general functions involved in providing basic meteorological services include:

(1) Measurement of the meteorological characteristics of the atmosphere, made with sufficient density and frequency to meet the needs of the general public and the common needs of all users.

(2) Collection of these measurements for processing.

(3) Analyses and prognoses of meteorological variables, including estimates of their probable error distribution, and interpretation of the analyses and prognoses for meeting the needs of the general public.

(4) Distribution of the meteorological analyses and prognoses to outlets for subsequent interpretation for the operational needs of all users, and the distribution and display of operational products to meet the needs of the general public.

b. "Specialized meteorological services" include those activities, derived generally from the output of the basic meteorological services, which produce those products needed to serve the operational needs of particular user groups. These user groups include, among others: aviation, agriculture, business, commerce, and industry.

The general functions involved in providing these services include:

(1) Establishment of parameters needed to serve solely a particular operational purpose.

(2) Collection of data from specialized measurements which conform with the established parameters.

(3) Analysis of the data obtained from specialized measurements.

(4) Interpretation of the analyzed data and the making of prognoses to meet the operational needs of users.

(5) Distribution and display of these specialized products to meet the needs of individual users or groups.

c. "Supporting research" includes those applied research and development activities whose immediate objective is the improvement of the basic and specialized meteorological services as defined herein.

d. "User agency" is an agency whose mission requires meteorological services either for its internal operations or as part of its direct services to a clientele group. "Mission requirements" include those requirements directly related to the primary mission of the agency. When such mission involves direct service to a clientele group requiring the provision of meteorological services it is included within the terms of this defintion. Also, when the agency has no such clientele relationships but its internal operations require the provision of meteorological services, its mission is included within the terms of the definition.

e. "Common requirements of other agencies" include the needs for basic meteorological services necessary to support their specialized meteorological services. Such requirements also include those needs for specialized meteorological services common to two or more agencies.

3. Coordination of meteorological services

a. The Department of Commerce, with the advice and assistance of other agencies concerned, will establish procedures designed to facilitate a systematic and continuing review of basic and specialized meteorological requirements, services and closely related supporting research. The Department will undertake such reviews with the objectives of (1) establishing, and revising as appropriate, needed basic services, and (2) advising other agencies on the need for any organization of specialized services. The objectives of these continuing reviews are to assure a timely identification of need for new or revised services and to develop those services, either basic or specialized, that most efficiently meet the need.

b. The Department of Commerce, to the maximum extent practicable and permitted by law, will provide those basic meteorological services and supporting research needed to meet the requirements of the general public or the common requirements of other agencies. The Department of Commerce will arrange for the conduct of such services by the Department, by other agencies, or by non-Federal organizations, depending upon the most effective and economical arrangements.

c. User agencies will arrange for specialized meteorological services and supporting research when their mission requirements cannot be effectively accommodated through the basic services and supporting research. The user agency should obtain the views of the Department of Commerce as to whether its requirements can be met satisfactorily through the basic meteorological services and supporting research, including appropriate adjustments therein. The Department of Commerce will, to the extent consistent with effective and economical use of resources, conduct the specialized services that support the mission requirements of user agencies.

d. The above provisions will not apply to (1) the division of responsibilities between the Department of Commerce and the National Aeronautics and Space Administration for development of meteorological satellites; and (2) meteorological activities involving special military security considerations. Arrangements with respect to the foregoing activities will be set forth in separate determinations.

4. Development of a Federal plan.

a. The Department of Commerce will prepare and keep current a plan, and obtain periodic information on its implementation, for the efficient utilization of meteorological services and supporting research. The purpose of such planning is to achieve the maximum integration of current and future services and research consistent with the effective and economical accomplishment of mission requirements. The plan should include: (1) all civilian meteorological services and supporting research, and (2) those meteorological services (basic and specialized) and supporting research programs of the military which are significantly affected by, or which affect, civilian meteorological services and supporting research. The plan will be directed towards relating such meteorological services and research to requirements, as established by the user agencies. It will also serve to develop the coordinating arrangements needed for the optimal use of the basic and related specialized meteorological services and supporting research in an efficient overall system.

b. Planning should be directed towards the establishment of both long-range and intermediate agency objectives and the development of programs related to both sets of objectives. The Department of Commerce should assure that the plan, relating proposed programs to fiscal year and longer range objectives, is available for the annual preview of the various agencies' budgets for Fiscal Year 1966 and thereafter. The plan should clearly identify planning assumptions, any unresolved interagency issues, and the views of the agencies concerned with respect thereto.

c. In preparing and revising the plan, the Department of Commerce will obtain the advice and assistance of the principal agencies providing or utilizing meteorological services. To this end the Department should establish appropriate arrangements for obtaining continuing advice from the principal agencies concerned. The Department shoud exercise leadership in assuring that differences of opinion are resolved expeditiously. The division of responsibilities among agencies for provision of meteorological services and supporting research will, insofar as practicable and permitted by law, conform with the guidelines set forth under section 3 above.

5. Overall review procedures.

When major differences among agencies cannot be resolved through consultation, the head of any agency concerned may refer the matter to the appropriate agency within the Executive Office of the President for consideration. The Presidential staff agencies will keep each other currently informed of meteorological issues and will cooperate in achieving their timely resolution.

MERMIT GORDON
Director

U.S. DEPARTMENT OF COMMERCE
WASHINGTON, D.C.

IMPLEMENTATION
PLAN
FOR
BUREAU OF THE BUDGET CIRCULAR A-62, NOVEMBER 13, 1963

SUBJECT: POLICIES AND PROCEDURES FOR THE COORDINATION OF FEDERAL METEOROGICAL SERVICES

9 JANUARY 1964
(REVISED 13 JANUARY 1964)

DOC IMPLEMENTATION PLAN FOR A-62

DEPARTMENT OF COMMERCE PLAN FOR IMPLEMENTATION OF BUREAU OF THE BUDGET CIRCULAR A-62, NOVEMBER 13, 1963

1. Background. Bureau of the Budget Circular A-62, November 13, 1963, entitled "Policies and Procedures for the Coordination of Federal Meteorological Services: prescribes policy guidelines and procedures for planning and conducting Federal meteorological services and applied research and development to improve such services. The guidelines set forth in the circular:

a. Reaffirm the central role of the Department of Commerce with respect to basic meteorological services.

b. Clarify the respective responsibilities of the Department of Commerce and the user agencies for basic and specialized meteorological services.

c. Establish procedures to facilitate coordination and the timely resolution of outstanding issues.

d. Provide for evaluating user requirements within the context of a balanced and integrated Federal plan.

e. Fix responsibility for continuing and systematic review of meteorological services and supporting research.

Policies and procedures with respect to basic research in meteorology are not within the purview of the Circular. The Federal Council for Science and Technology continues to have cognizance over all basic research in the atmospheric sciences. In addition, the provisions of the Circular do not apply to (1) the division of responsibilities between the Department of Commerce and the National Aeronautics and Space Administration for development of meteorological satellites: and (2) meteorological activities involving special military security considerations.

2. Responsibility of the Department of Commerce. The operative portions of the Circular assign the following responsibilities to the Department of Commerce:

a. "The Department of Commerce, with the advice and assistance of other agencies concerned, will establish procedures designed to facilitate a systematic and continuing review of basic and specialized meteorological requirements, services and closely related supporting research. The Department will undertake such reviews with the objectives of (1) establishing, and reviewing as appropriate, needed basic services and (2) advising other agencies on the need for and organization of specialized services."

"The Department of Commerce will prepare and keep current a plan, and obtain periodic information on its implementation, for the efficient utilization of meteorological services and supporting research. The purpose of such planning is to achieve the maximum integration of current and future services and research consistent with the effective and economical accomplishment of mission requirements."

3. The Office of the Federal Coordinator for Meteorology. (See Attachment #1). To carry out the responsibilities outlined above in conjunction with implementation of BOB Circular A-62, the Department of Commerce plan provides that:

a. An Office for the coordination of Federal meteorological activities be established within the Office of the Assistant Secretary for Science and Technology of the Department of Commerce.

b. Dr. Robert M. White direct the activities of this office on behalf of the Department and hold the title of Federal Coordinator for Meteorology.

c. The Federal Coordinator have a permanent full-time staff headed by a Deputy Federal Coordinator for Meteorology.

Organizationally, the Office of the Federal Coordinator will be composed of the following staff elements:

(1) Operations Evaluation Group
(2) Operating Program Division
(3) Supporting Research Division

The Operations Evaluation Group will provide staff assistance to the Federal Coordinator for analyses of Federal meteorological activities as required to make assessments of economic and fiscal consequences of proposed actions. This group will also undertake independent analyses of specific areas of overlap or interface between the activities of the various agencies and render quantitative information on the consequences of various decision alternatives. While the Operations Evaluation Group will perform special studies for the Federal Coordinator, the Operating Program and Supporting Research Divisions will work closely with the interdepartmental committees (discussed in Paragraph 5, below) in the coordination and review of Federal meteorological requirements, services and supporting research and in the compilation of the Federal Meteorological Plan. These divisions will act as the permanent secretariat for the interdeparmental committees.

4. The Federal Committee for Meteorological Services and Supporting Research. The purpose of this Committee will be to provide high-level policy guidance to the Federal Coordinator, to review and validate proposed Federal meteorological plans, and to resolve differences which may arise in connection with the preparation, monitoring and coordination of the Federal meteorological plan. Each of the following agencies has need for meteorological services either for its internal operations or as a part of its direct service to a clientele group and will be represented by a member on the Federal Committee for Meteorological Services and Supporting Research.

Department of Commerce
Department of Defense
Department of Agriculture
Department of the Treasury
Department of Health, Education and Welfare
Federal Aviation Agency
National Aeronautics and Space Administration
National Science Foundation
Atomic Energy Commission

In addition, the Bureau of the Budget will be invited to designate an observer for attendance at Committee meetings. Representation should be at the Assistant

Secretary level or the equivalent such that Committee members can commit their agencies and speak authoritatively for them. Chairmanship will rest with Dr. J. Herbert Hollomon, Assistant Secretary of Commerce for Science and Technology. This will facilitate coordination of meteorological research between this Committee and the Interdepartmental Committee for Atmostpheric Sciences.

5. Interdepartmental Committees for Meteorological Services and Research. The principal work of coordination of meteorological activities; the systematic and continuing review of basic and specialized meteorological requirements, services and supporting research; and the preparation and maintenance of a Federal Meteorological Plan will be carried on within the following two key committees and their appropriate subcommittees:

a. Interdepartmental Committee for Meteorological Services

b. Interdepartmental Committee for Applied Meteorological Research

Membership on the Interdepartmental Committee for Meteorological Services will consist of the Commanders of the Military Weather Services, the Director of the National Meteorological Service and representatives of equivalent status in user departments or agencies. Membership on the Interdepartmental Committee for Aplied Meteorological Research will consist of senior managers and directors of departmental or agency programs of applied meteorological research. Chairmanship of these two committees will be vested in the Weather Bureau members.

6. Appeal and Arbitration. The Chairman, Federal Committee for Meteorological Services and Supporting Research will refer problems to the heads of agencies concerned when resolution cannot be obtained at the Federal Committee level. In the unlikely possibility that some problems are still unresolved, they will be referred to the Executive Office of the President for resolution.

7. Federal Meteorological Plan. The proposed content of the Federal Meteorological Plan required by the Circular is outlined in Attachment #2.

8. Staffing the Office of the Federal Coordinator for Meteorology. The proposed staffing of the full-time personnel of the Office of the Federal Coordinator for Meteorology is given in Attachment #3. The importance of obtaining staff personnel with extensive knowledge and experience in major user areas such as civil aviation and the military services is well recognized. For this reason, primary agencies involved in or concerned with meteorological support will be asked to designate high-level personnel to work on detail in one or more of the staff positions under the direction of the Federal Coordinator as a part of the permanent staff. All agencies who operate weather services or are users of such services will be invited to designate representatives on the appropriate committees and subcommittees. While these committees and subcommittees will meet only periodically, some of the agencies requiring a close working relationship with the Federal Coordinator may wish to assign additional full-time representatives to the Office of the Federal Coordinator for Meteorology to represent them on the various subcommittees.

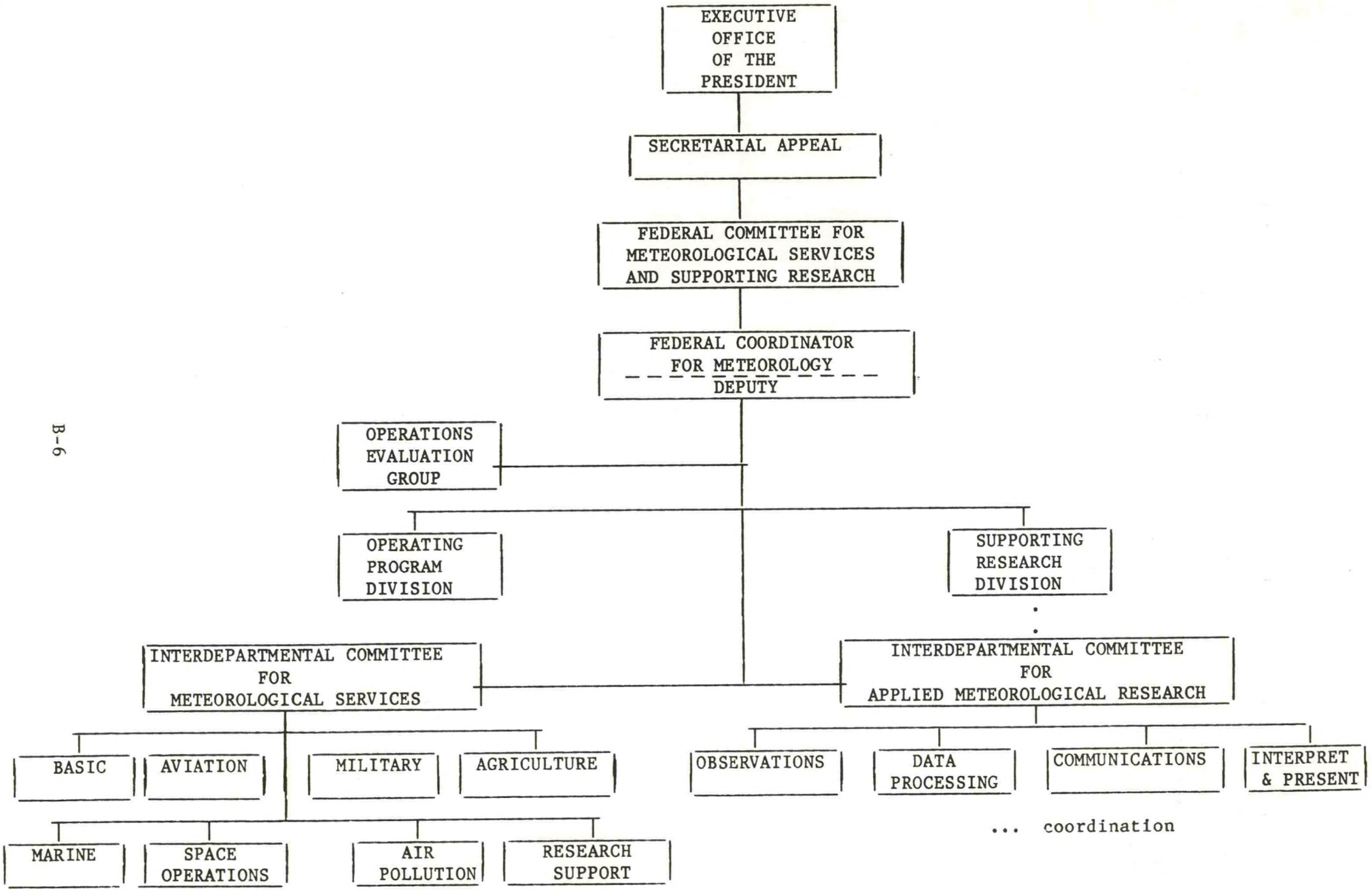
9. Status of Other Meteorological Coordinating Groups. There exist several mechanisms for coordinating meteorological activities in the Federal

Government. Coordinating groups, such as the National Coordinating Committee for Aviation Meteorology (NACCAM) and the recently formed FAA-WB Task Organization will be considered for possible absorption into the proposed coordinating structure. The NACCAM functions, especially in the areas of aviation, would be undertaken by the Aviation Services Subcommittee of the Interdepartmental Committeee for Meteorological Services. Many of the activities of the present FAA-WB Task Group might effectively be absorbed within the proposed mechanism.

10. Schedule of Implementation of BOB Circular A-62

	1964
Establishment of Office of Federal Coordinator for Meteorology	In Process
Designation of Membership on Federal Committee for Meteorological Services and Supporting Research	4th Week January
Recruiting of Staff	January - June
Designation of Agency Personnel for Detail to Office of Federal Coordinator for Meteorology	1st Week February
Establishment of Interdepartmental Committee Structure	2nd Week February
Designation of Membership on Committees and Subcommittees	3rd Week February
Commence Work on Federal Meteorological Plan	3rd Week February

ATTACHMENT # 1



ATTACHMENT # 2

PROPOSED CONTENT OF FEDERAL METEOROLOGICAL PLAN

1. The Federal Plan for Meteorology will be organized by meteorological service programs. A service program will consist of three distinct sections:

(1) a description of the requirement
(2) a 5-year operating program plan (including equipment & facilities)
(3) the supporting research program

Each of these sections will be further broken down into the following four functional areas:

(a) Observations
(b) Data Processing
(c) Communications
(d) Interpretation and Presentation

2. The Committee and subcommittee structure has been designed to facilitate the preparation of the Federal Plan. Primary responsibilitiy for each service program will rest with the appropriate service subcommittee. It will be the subcommittee's responsibility to develop its supporting research program in conjunction with the Interdepartmental Committee for Applied Meteorological Research and its funcitonally-alligned supporting research subcommittees.

3. The following service programs are now envisaged as encompassed by the Federal Meteorological Plan:

Basic Services
Civil Aviation
Military
  Air Force
  Navy
  Army
Agriculture
Marine
Air Pollution
Space Operations
Research Support

The Operating Program Division will have primary cognizance over the work of the services subcommittees while the Supporting Research Division will oversee the work of the research subcommittees.

ATTACHMENT #3

PLANNED STAFFING OF OFFICE OF FEDERAL COORDINATOR

Federal Coordinator	Dr. Robert White
Deputy Federal Coordinator	GS-17 or P1 313
Secretary	GS-7
Operations Evaluation Group	
Operations Analyst	GS-16
Operations Analyst	GS-15
Operations Analyst	GS-14
Secretary	GS-6
Operating Program Division	
Meteorologist	GS-16
Meteorologist	GS-15
Meteorologist	GS-14
Secretary	GS-6
Supporting Research Division	
Meteorologist	GS-16
Meteorologist	GS-15
Meteorologist	GS-14
Secretary	GS-6

Recapitulation (excluding Dr. White)	10	professionals
	4	subprofessionals
	14	

APPENDIX C - CONTACTS MADE BY STUDY GROUP

Department of Defense:

Col. E. W. Friday, Military Assistant for Environmental Service, DDR&E

Rear Adm. Ross Williams, Oceanographer of the Navy

Capt. John MacDonald, Commander, Navy Oceanographic Command

Bridadier General Albert Kaehn, Commander, Air Weather Service, U.S. Air Force

Mr. Donald Turner, System 433L, Air Force Systems Command, U.S. Air Force

Dr. Mort Barad, Air Force Geophysics Laboratories, U.S. Air Force

Department of Commerce:

Dr. George Benton, Chairman, Federal Committee for Meteorological Services and Supporting Research and Associate Administrator, NOAA

Dr. Thomas Owen, Federal Coordinator for Meteorological Services and Supporting Research and Assistant Administrator, Oceanic and Atmospheric Services, NOAA

Dr. Richard Hallgren, Director, National Weather Service

Mr. William Barney, Deputy Federal Coordinator for Meteorological Services and Supporting Research

Mr. David Johnson, Director, National Environmental Satellite Service

Dr. Edward Epstein, Director, National Climate Program Office

Department of Transportation:

Mr. Warren Sharp, Federal Aviation Administration, Acting Associate Administrator for Air Traffic Airway Facilities

Cmdr. W. P. Howell, U.S. Coast Guard, Office of Marine Science and Ice Operations, Manager, CO_2 and Climate Research Program

Department of Energy:

Mr. David Slade, Office of Health and Environmental Research

Department of Interior:

Mr. Harry Avery, Acting Director, Office of Science & Technology

Department of State:

Dr. John Dardis, OES/AT

Department of Agriculture:

Dr. Ralph T. McCracken, Associate Director, Science and Education Administration

National Aeronautics and Space Administration

Dr. Lawrence Greenwood, Director, Environmental Observations

Environmental Protection Agency:

Mr. Albert Trakowski, Principal Engineering Science Advisor

National Science Foundation:

Dr. Francis Johnson, Assistant Director for Astronomical, Atmospheric, Earth and Ocean Sciences

Dr. Eugene Bierly, Director, Division of Atmospheric Sciences

Federal Emergency Management Agency:

William Belford, Director, Operations Center

P. R. Ray, Disaster, Response & Recovery Division

Ashley Holmes, Disaster, Response & Recovery Division

Office of Management and Budget:

Mr. John Carey

Mr. John Dyer, Budget Examiner, NOAA

Nuclear Regulatory Commission:

Earl Markee, Chief, Meteorological Section

General Accounting Office:

Richard Helmer

House Committee on Appropriations

Ray Leffler, Chief, Investigation Team

National Academy of Sciences:

Dr. Robert M. White

Mr. Stanley Ruttenburg, Executive Secretary, Select Committee to Study Impact of Recent Technology Developments on the Operation of the National Weather Service

American Meteorological Society:

Dr. Kenneth Spengler, Executive Director

Private Meteorology:

ACCU Weather, Dr. Joel Myers, President

Weather Services Corporation, Mr. John Wallace, President

WNBC "Today" Show, Mark Davidson

Academia:

Massachusetts Institute of Technology, Dr. Fred Sanders

Pennsylvania State, Dr. Alfred Blackadar

(NOTE: This is by no means an all inclusive list. Only the principals involved have been listed above. Many staff members were involved in the discussions with these agencies as well as in follow-up calls and visits.)

APPENDIX D - Statutory and Regulatory Authorities of the Agencies

Statutory and Regulatory Authorities of the Agencies

Department of Agriculture (USDA) -

- o 5 U.S.C. 511 Organic Act of 1862
- o 16 U.S.C. 1641 Forest and Rangeland Renewable Resources Act of 1978
- o 16 U.S.C. 1600 Note National Forest Management Act of 1976.
- o 7 U.S.C. 1621-1627 also 427 Research and Marketing Act of 1946, as amended.
- o U.S.C. 3102 National Agricultural Research, Extension and Teaching Policy Act of 1977.
- o 16 U.S.C 590 Soil Conservation Act.
- o 33 U.S.C. 701 Flood Control Act of 1926.
- o 41 U.S.C. Water Resources Planning Act.

Department of Commerce (DOC)

- o 15 USC 311 et seq. "ORGANIC ACT" of the National Weather Service. It originated from the Act of Oct 1, 1890, which created the U.S. Weather Bureau in the Department of Agriculture. Section 313 sets forth the statutory duties of the Secretary of Commerce to, among other things, forecast the weather, issue storm warnings, display weather and flood signals for the benefit of agriculture, commerce, and navigation, gauge and report rivers, report temperature and rainfall conditions, and to take such meteorological observations as may be necessary to establish and record the climatic conditions of the United States.
- o 7 USC 450(B) Cooperative Agreements. This authorizes the Department of Agriculture to carry out cooperative agreements with state, county and municipal agencies and private organizations. This authority was transferred to the Department of Commerce by Reorganization Plan No.4, 1940.

- 15 USC 313 Study of Thunderstorms and Atmospheric Disturbances.
  The Act of June 16, 1948, authorizes and directs the Secretary of Commerce to study fully and thoroughly the internal structure of thunderstorms, hurricanes, cyclones, and other severe atmospheric disturbances.
- 115 USC 1525 Cooperative Agreements .
  Authorizes the Secretary of Commerce, in the case of nonprofit organizations, research organizations or public organization or agencies to engage in joint projects.
- 49 USC 1463 - Federal Aviation Act - Duties of the Secretary of Commerce.
  Title VIII, Section 803 of the Federal Aviation Act of 1958 provides that in order to promote safety and efficiency in air navigation, the Secretary of Commerce shall, in addition to any other functions or duties pertaining to weather information for other purposes, (1) make such observations, measurements, investigations, and studies of atmospheric phenomena, and establish such meteorological offices and stations for ascertaining, in advance, information concerning probable weather conditions; (2) furnish such reports, forecasts, warnings and advices to the Secretary of Transportation and other persons; (3) cooperate with persons engaged in air commerce, in meteorological service, establish and maintain reciprocal arrangements and collect and disseminate weather reports available from aircraft in flight; (4) establish and coordinate international exchanges of meteorological information required for the safety and efficiency of air navigation; (5) participate in the development of an international basic meteorological reporting network including stations on the high seas, in polar regions and in foreign countries; (6) coordinate meteorologicl requirements in the United States in order to maintain standard observations; and (7) promote and develop meteorological science and foster and support research projects in meteorology through the utilization of private and governmental research facilities and provide for the publication of the results of such research projects.
- 14 USC 147 Cooperation between the Department of Commerce and Department of Transportation (Coast Guard) Concerning Weather Reporting.

Provides that the Commandant of the Coast Guard may cooperate with the Department of Commerce by procuring, maintaining and making available facilities and assistance for observing, investigating and communicating weather phenomena and for disseminating weather data, forecasts and warnings.

- o 115 USC 330-330i - Weather Modification Activities.
  Public Law 92-205 of December 18, 1971 provides that no person may engage or attempt to engage in any weather modification activity in the United States unless he submits reports to the Secretary of Commerce with respect thereto.

- o Reorganization Plan No. 2, 1965, 79 Stat. 1318.
  Established the Environmental Sciences Service Administration (ESSA) in the Department of Commerce. The U.S. Weather Bureau (USWB) became an element of ESSA and prior USWB legislative and executive order authorities became applicable to ESSA.

- o Reorganization Plan No. 4, 1970, 84 Stat. 2090.
  Established the National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce. ESSA (and the USWB) became an element of NOAA and prior ESSA/USWB legislative and executive order authorities became applicable to NOAA.

Department of Defense (DOD)

- o Department of Defense; Joint Chiefs of Staff Publication 2, Section 10.
  " The deployment, employment and logistics of forces are affected by meteorological conditions. When determining how best to perform his mission, a commander should consider the meteorological factors involved and employ meteorological services as an integral part of his strategic and tactical planning operations."
- o 10 U.S.C. 6011 - States "U.S. Navy Regulations shall be issued by the Secretary of the Navy with the approval of the President."
- o Navy Regulation Act 8316 - Establishes the Naval Oceanographic Command.
- o AFR 105 - series establishes responsibilities of the Air Force for Weather Services.

Department of Energy (DOE)

- Public Law 95-91 Aug 4, 1979 Dept. of Energy Organization Act. Sec 203 (a)(3) "Environmental responsibilities and functions including providing the Secretary information with respect to the conformance of the Departments activities to environmental protection laws and principles, and conducting a comprehensive program of research and development on the environmental effects of energy technologies and programs."

Department of Interior (DOI)

- Public Law 90-537 authorizes the Secretary to investigate and initiate means of augmenting the water supplies of the Colorado River. These "means" are interpreted to include weather modification which now appears to be the best alternative available.

- Appropriations. The language accompanying the appropriation has included congressional directives such as "The committee recommends allowances of $100,000 to be used for research on increasing rainfall by cloud seeding" (the initial authorizing directive; Senate, 87th Congress, 1st Session; Report No. 1097, pages 28-29; 9-30-61)

  "...to expand the budget program for atmospheric water resources research and to initiate the planned nationwide program: (Senate, 89th Congress, 1st Session; Report No. 574, page 30, 9-28-67)

  "...prepare plans for the Colorado River Augmentation Program: (House, 95th Congress, 1st Session; Report No. 95-379, page 81; 5-29-77)

  "...to initiate a high-altitude downwind seeding effects research effort..." (Senate, 95th Congress, 2nd Session; Report No. 95-1069, page 90; 8-7-78)

  "...to conduct rain augmentation research in the Southwest in areas where drought patterns are developing" (Senate, 95th Congress, 2nd Session; Report No. 95-1069, page 97; 8-7-78)

Department of Transportation (DOT)

- Federal Aviation Act, 1958, Title III, Sec. 310 The Secretary of Transportation is empowered and directed to make recommendations to the Secretary of Commerce for providing meteorological service necessary for the safe and efficient movement of aircraft in air commerce. In providing meteorological services, the Secretary of Commerce shall cooperate with the Secretary of Transportation and give full consideration to such recommendations.

- Sec 803 Weather Bureau: (included under Department of Commerce)
  Sec 101 Definitions.
  As used in this Act, unless the context otherwise requires--
  (8) Air navigation facility means any facility used in, available for use in, or designed for use in, aid of air navigation, including landing areas, lights, any apparatus or equipment for dissemination of weather information, for signaling, for radio direction finding, or for radio or other electrical communication, and any other structure or mechanism having a similar purpose for guiding or controlling flight in the air or the landing area and take-off of aircraft.
- Section 103. Declaration of Policy.
  In the exercise and performance of his powers and duties under this Act, the Secretary of Transportation shall consider the following, among other things, as being in the public interest:
  (d) The consolidation of research and development with respect to air navigation facilites, as well as the installation and operation thereof.
- Section 307. Airspace Control and Facililties - Air Navigation Facilities.
  (b) The Secretary of Transportation is authorized, within the limits of available appropriations made by the Congress (1) to acquire, establish, and improve air-navigation facilities wherever necessary; (2) to operate and maintain such air-navigation facilities; (3) to arrange for publication of aeronautical maps and charts necessary for the safe and efficient movement of aircraft in air navigation

utilizing the facilities and assistance of existing agencies of the Government so far as practicable; and (4) to provide necessary facilities and personnel for the regulation and protection of air traffic.

- 14 USC 141 Authorizes the Coast Guard to utilize its personnel and facilities to assist Federal Agencies. Under this authority the CG broadcasts National Weather Service forecasts and advisories.
- 14 USC 147 authorizes the CG to cooperate with NOAA in the observation and dissemination of weather information.
- 14 USC 90 authorizes the Coast Guard to operate and maintain floating ocean stations for the purposes of search and rescue, communications, navigation, and meteorology.

Environmental Protection Agency (EPA).

- The Clean Air Act of 1963, as amended.
  (1) Research, development, demonstration and application of techniques, especially analytical models, to determine pollution dispersion, transformation, transport and fate in the atmosphere resulting from meteorological mechanisms are required to enable and support the mandates of:
    (a) Section 102 for EPA conduct of research, investigations, experiments, demonstrations, surveys and studies relating to the causes, effects, extent, prevention and contorl of air pollution.
    (b) Section 110 for EPA review and approval of State submitted implementation plans to meet national ambient air quality standards.
    (c) Section 111 for EPA establishment of stationary pollution source performance standards.
    (d) Section 112 for EPA establishment of national emission standards for hazardous air pollutants.
    (e) Section 113 and 114 for EPA acquisition, assurance of validity and interpretation of air pollution monitoring data for compliance and enforcement actions.

(f) Section 123 for EPA limitation of air pollution source stack heights.

(g) Section 157 for EPA issuance of regulations for control of substances or activities which may affect the stratosphere where such effects endanger public health or welfare.

(h) Section 160 through 169 for EPA action to prevent air quality deterioration in national parks, wilderness areas, monuments, seashores, or other national areas of natural, recreational, scenic or historical value.

(i) Section 169A for EPA issuance of regulations to prevent visibility impairment from air pollution in the areas stated in (h) above.

(j) Section 202 for EPA issuance of motor vehicle air pollution emission standards and regulations.

(k) Section 231 for EPA issuance of aircraft air pollution emission standards and regulations.

(l) Section 303 for EPA implementation of emergency powers authority to control air pollution releases that pose imminent and substantial threat to public health.

(2) Section 153 requires the EPA to conduct a study of the cumulative effect of all substances, practices, processes and activities which may affect the stratosphere, especially ozone in the stratosphere.

(3) Section 319 requires the EPA to issue regulations on and operate a national air quality monitoring system using uniform monitoring quality and criteria, using a uniform air quality index, providing daily analysis and reporting of air quality, and providing for record keeping and analysis of monitoring data.

(4) Section 320 requires the EPA to conduct a national conference each three years on air quality modeling related to issuance or revision of air pollution regulations.

o The National Environmental Policy Act of 1969, as amended.

(1) Section 102 requires EPA to prepare, review and approve statements of impact upon the environment of proposed actions by EPA and other Federal agencies. These preparations and reviews require analyses of meteorological effects on air pollution and the effects of air pollution on weather and climate.

National Aeronautics and Space Administration (NASA).

o Public Law 85-568, National Aeronautics and Space Act of 1958.
Sec 102 (c) "The aeronautical and space activities of the United States shall be conducted so as to contribute materially to one or more of the following objectives:

(1) The expansion of human knowledge of phenomena in the atmosphere and space;

(2) The improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles;

(3) The development and operation of vehicles capable of carrying instruments, equipment, supplies, and living organisms through space;

(4) The establishment of long range studies of the potential benefits to be gained from, the opportunities for, and the problems involved in the utilization of aeronautical and space activities for peaceful and scientific purposes;

(5) The preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere;

(6) The making available to agencies directly concerned with national defense of discoveries that have military value or significance, and the furnishing by such agencies, to the civilian agency established to direct and control non-military aeronautical and space activities, of information as to discoveries which have value or significance to that agency;

(7) Cooperation by the United States with other nations and groups of nations in work done pursuant to this Act and in the peaceful application of the results thereof; and

(8) The most effective utilization of the scientific and engineering resources of the United States, with close cooperation among all interested agencies of the United States in order to avoid unnecessary duplication of effort, facilities and equipment.

National Science Foundation (NSF).

- P.L. 507 Sec 3, a, b-1.
  The National Science Foundation is authorized and directed "to initiate and support basic scientific research and programs to strengthen scientific research potential and science education programs, at all levels in the mathematical, physical, medical, biological, engineering, social, and other sciences by making contract or other arrangements (including grants, loans, and other forms of assistance ..."

Federal Emergency Management Agency (FEMA)

- Title 3, Executive Order 12148, July 20, 1979.
  1.107 "including any of those functions re-delegated or reassigned to the Dept. of Commerce with respect to assistance to communities in the development of readiness plans for severe weather related emergencies."
- 2.101 "-coordinate, all civil defense and civil emergency planning."
- Executive Order 12127, March 31, 1979.
  1.105. "The functions transferred from the President are those concerning the Emergency Broadcast System...." This includes EBS oversight responsibility.

Department of State

- P.L. 95-426 Foreign Relations Authorization Act, Fiscal Year 1979. Title V of the Act requires the Secretary of State to undertake new initiatives in science and technology. The major responsibilities mandated by Title V include: 1) coordination and oversight with respect to all major science or

science and technology agreements and activities between the United States and foreign countries, international organizations, or commissions of which the United States and one or more foreign countries are members; 2) training of officers and employees of the United States Government, at all levels of the Foreign Service and Civil Service, in the application of science and technology to foreign policy and in the skills of long-range planning and analysis of the scientific and technological aspects of foreign policy.

The Conference Report (No. 95-1535) on the legislation elaborates specific tasks under Section 503:

-- identify and evaluate elements of major domestic science and technology programs and activities of the United States Government with significant international implications;

-- identify and evaluate international scientific or technological developments with significant implications for domestic programs and activities of the United States Government;

-- assess and initiate appropriate international scientific and technological activities based upon domestic scientific and technological activities of the United States Government and which are beneficial to the United States and foreign countries; and

-- transmit annually to the Congress a report with recommendations regarding (1) personnel requirements, standards and training for United States Government employees whose assignments involve science or technology and foreign policy, and (2) the continuation of existing bilateral agreements primarily involving science and technology, including an analysis of their benefits for the United States and other parties, adequacy of their funding and administration, and plans for their future evaluation.

- P.L. 91-190, National Environmental Policy Act (NEPA) sets forth responsibilities for all Federal agencies for the protection of the global environment, which includes preparation of enviromental impact statements on proposed actions in certain situations. The Act further calls for U.S. "initiatives, resolutions and programs designed to maximize international cooperation in anticipating and preventing decline in the quality of mankind's world environment, where consistent with the foreign policy of the United States." Although issued on the basis of the President's Authority rather than under the NEPA, Executive Order 12114 specifically sets forth U.S. agency responsibilities for actions undertaken in foreign jurisdictions and the global community.

- P.O. 95-367, The National Climate Program Act of 1978 calls upon the Departments of State and Commerce to cooperate in coordinating the U.S. Climate Program with climate activities of other nations and international organizations, and in providing U.S. representation at climate-related international meetings and conferences. The State Department is represented on the U.S. Policy Advisory Board established under the Act; plays a lead role in coordinating U.S. policies and positions related to the emerging World Climate Program, and its linkages to the U.S. domestic programs; and supports and participates in the work of the International Panel of the National Academy of Sciences which serves as a principal mechanism for assessing international needs and opportunities in the climate field.

- P.L. 95-95, The Clean Air Act, as Amended, August, 1977. Section 156 provides that the Department of State shall negotiate treaties, conventions and other agreements and support proposals in multilateral forums concerned with protection of the stratosphere, consistent with U.S. regulations. Under this authority, it provides foreign policy guidance and coordinates U.S. positions for the US-UK-France Agreement on Stratospheric Ozone Monitoring; and coordinates U.S. participation in the Global Plan of Action on the Ozone Layer, under UN Environment Program auspices.

APPENDIX E - CURRENT INTERAGENCY AGREEMENTS AND MEMORANDA OF UNDERSTANDING INVOLVING FEDERAL METEOROLOGICAL SERVICES AND SUPPORTING RESEARCH

1. Environmental Research Laboratories, NOAA-EPA: Continuation of the Interagency Agreement (EPA-80-D-40348). NOAA will provide personnel on detached service to EPA to provide research, development, technical information, advice and consultation on all meteorological aspects of pollution control. December 7, 1979.

2. NOAA-NASA: Agreement concerning polar operational meteorological satellite systems. September 24, 1974.

3. Commerce-NASA: Basic agreement concerning operational environmental satellite systems of the Department of Commerce. July 2, 1973.

4. NOAA-U.S. Navy: Memorandum of Understanding between NOAA and Navy Oceanographic Division, U.S. Navy, defining areas of cooperation between the National Meteorological Center, Washington, D.C, and the Fleet Numerical Oceanography Center, Monterey, California. January 18, 1980.

5. NOAA-U.S. Coast Guard: Working agreements between NOAA, Data Buoy Office and the U.S. Coast Guard on support for the National Data Buoy Office in the Atlantic and Pacific areas. April 20, 1976.

6. NOAA-U.S. Coast Guard: An agreement concerning support of the National Data Buoy Center. March 27,1972.

7. National Weather Service, NOAA-FAA: Memorandum of Agreement providing for the National Weather Service to establish and operate weather service units at the Air Route Traffic Control Centers. March 17, 1978.

8. NOAA-FAA: Memorandum of Agreement providing that the National Weather Service shall continue to furnish, to the extent availability of personnel permits, meteorologists to the ATC Systems Command Center, Central Flow Control Function, Washington, D.C. January 17, 1978.

9. National Weather Service - FAA: Memorandum of Agreement providing that the FAA shall furnish to the National Weather Service, to the extent indicated in the agreement, the equipment, installation, and maintenance that will provide weather radar data from Air Route Traffic Control radars for use by the National Weather Service meteorologists and Air Route Traffic Control Centers. March 25, 1976.

10. National Environmental Satellite Service - U.S. Navy: Memorandum of Agreement for the Joint Ice Center, Washington, D.C. December 15, 1976.

11. National Environmental Satellite Service - U.S. Navy: Memorandum of Agreement for the exchange of sea surface temperature data between the National Environmental Satellite Service and the U.S. Navy Fleet Numerical Weather Central. June 21, 1978.

12. NOAA-FAA: Interagency agreement to provide services to improve two-hour thunderstorm forecasting. November 29, 1979.

13. National Weather Service - U.S. Navy: Operating agreement defining responsibilities of the Director of the Naval Oceanographic Command and the Director National Weather Service for provision of meteorological services to civilian interests and residents of Guam, the Northern Marianna Islands, and the Trust Territories of the Pacific Islands. Undated and unsigned.

14. NOAA- U.S. Navy: Interagency agreement on the conduct of Ocean-Climate Observation Program using ships of opportunity. December 20, 1979.

15. National Weather Service - U.S. Navy: Agreement providing for receive-only extension service connection to the GOES Facsimile Circuit covering 24 locations. August 31, 1978.

16. NOAA - U.S. Navy: Agreement - "Synchronous Meteorological Satellite and the Geostationary Operational and Environmental Satellite Imagery Signals" authorizing the Department of the Navy to obtain from the local telephone company, at the user's discretion and cost, an appropriate receive-only extension user connection to the Synchronous Meteorological Satellite and the GOES Operational and Environmental Satellite Imagery. This and similar agreements cover 24 locations. September 15, 1977.

17. NOAA - Department of the Navy: Agreement concerning the distribution of tropical weather warning messages to other than United States addresses. Undated and unsigned.

18. NOAA-FAA: Interagency Agreement to provide work on a series of task orders for the wind shear program. Latest amendment. May 22, 1979.

19. Environmental Research Laboratories, NOAA-FAA: Interagency agreement to provide for the procurement, installation and maintenance of certain components of NWS Automation of Field Operations and Services (AFOS) equipment at the FAA's National Aviation Facilities Experimental Center, Atlantic City, New Jersey. Latest amendment, August 29, 1978.

20. National Weather Service, NOAA-FAA: Interagency agreement in which NOAA is to provide meteorological tests, experimentation, surveys and analysis in connection with certain aviation weather programs requiring a quick response to a stated problem. Latest amendment, February 9, 1979.

21. National Weather Service, NOAA-FAA: Interagency Agreement to provide for the design, development, test and evaluation of an automated low cost weather observation system to be integrated into the National Aerospace System. Latest amendment, May 10, 1979.

24. Environmental Research Laboratories, NOAA-FAA: Interagency agreement to provide for establishing correlation between gust velocities and radar reflectivities for use in flight planning when thunderstorms are present. Latest amendment, May 2, 1979.

25. National Weather Service, NOAA-Agriculture: Memorandum of agreement specifying policies and administrative arrangements to provide more effective and coordinated agricultural weather support to farmers and agri-business community. November 1977.

26. Naval Research Laboratory, U.S. Navy-FAA: Interagency agreement to obtain data on icing environment below 10,000 feet for helicopter operators. August 16, 1979.

27. NOAA-FAA: Interagency agreement to provide for the design, development, testing and evaluation of an automated aviation weather observing and display system to be integrated into the National Aerospace System. Date unknown.

28. NOAA-Federal Emergency Management Agency: Agreement to coordinate programs to improve the efficiency of operations and eliminate duplication of effort. February 11, 1980.

29. FAA-Environmental Research Laboratories, NOAA: Agreement to conduct an aviation weather system terminal area analysis and field test program. August 1979.

30. FAA-NOAA: Agreement for interpretation of storm echoes for airport surveillance radars. February 1977.

31. NASA-FAA: Memorandum of understanding concerning interagency cooperation on stratospheric studies. August 1976.

32. NASA-NOAA: Memorandum of understanding for the Centralized Storm Information System at Kansas City. 1980

33. National Weather Service, NOAA-Air Weather Service, U.S. Air Force: An interagency agreement to provide specialized services for the military flight operations at joint-use airports. October 1977.

34. FAA-U.S. Air Force: An agreement by which the FAA is to furnish weather services that the U.S. Air Force requires at Kingsley Field, Klamath Falls, Oregon. January 14, 1980.

35. NOAA-FAA: Agreement by which NOAA is to provide eight meteorologists to instruct in all phases of weather training and weather briefings in support of air traffic and two additional instructors for air traffic service training needs. October 25, 1977.

36. NOAA-Bureau of Land Management: NOAA is to provide information about the outer continental shelf environment that will enable the Bureau to make sound management decisions regarding the development of mineral resources on the outer continential shelf. December 20, 1974.

37. NASA-NOAA: An agreement establishing the basic operational support and reimbursement relations for NOAA's use of NASA's Mississippi Test Facility. 24 August, 1971.

38. NOAA-EPA: Provides for coordination in a program of ocean-disposal-site baseline surveys and evaluation. March 6, 1975.

39. NOAA-Air Force: Establish procedures by which NOAA will reimburse the Military Air Lift Command and the Air Force Reserve for airborne weather reconnaissance. October 1, 1974.

40. FAA-National Weather Service: Provides for an expanded pilot-weather-briefing quality-control program to insure top performance of this very important service activity. April 17, 1972.

41. NOAA-FAA: Establishes working arrangements for providing aviation weather services and meteorological communications. January 24, 1977.

42. National Weather Service-Forest Service, Department of Agriculture: An agreement to develop and test the concept of operating a forestry weather interpretation unit. Fiscal year 1977.

43. NASA-National Weather Service: Provides for procurement, installation, depot maintenance, and limited software support for the National Weather Service AFOS equipment at the NASA Wallops Flight Center. September 21, 1978.

44. Air Force - National Weather Service - Environmental Research Labs-Federal Aviation Agency. Cooperative development of techniques and equipment to provide Doppler radar capability suitable for operational programs. Undated.

45. Air Weather Service, U.S. Air Force-National Environmental Satellite Service, NOAA: An agreement for obtaining meteorological satellite products from the Air Force Global Weather Central. Undated.

46. National Environmental Satellite Service, NOAA - All Providers of Data Collection Platforms: An agreement stating that environmental data will be collected by NOAA satellites from data collection platforms operated by users of environmental data. 1975.

47. Environmental Research Laboratories, NOAA-Bureau of Reclamation: Agreement for NOAA to operate Doppler radars and acoustic sounders and to analyze the data collected. Undated and unsigned.

48. Environmental Research Laboratories, NOAA-Bureau of Reclamation: Agreement for NOAA to study the applicability of a technique to derive rain estimates from satellite measurements as opposed to surface based rain guages. March 13, 1978.

49. Environmental Research Laboratories, NOAA-Bureau of Reclamation: Agreement for NOAA to further develop cloud models in support of the Bureau's orographic weather modification program. May 5, 1978.

50. Environmental Research Laboratories, NOAA-Bureau of Reclamation: Agreement for NOAA to provide and operate a microwave satellite receiver-radiometer in support of Reclamation's Atmospheric Resources Management Program. September 18, 1979.

51. National Environmental Satellite Service, NOAA-Bureau of Reclamation: Agreement by which data from Reclamations data collection platforms will be collected by NOAA's GOES Satellite. August 22, 1979

52. Bureau of Reclamation-Forest Service: Agreement that Forest Service will develop information to evaluate the effect of precipitation augmentation upon natural resources. December 28, 1978.

53. National Environmental Satellite Service, NOAA-Forest Service: Agreement by which data from Forest Service data collection platforms will be collected by NOAA's GOES Satellite. April, 1980.

APPENDIX F - INQUIRIES, HEARINGS, STUDIES, REPORTS AND PLANS INVOLVING FEDERAL METEOROLOGICAL ACTIVITIES IN THE PAST FIVE YEARS

Congressional Hearings and Studies:

1. Inquiry into the operation and management of Federal weather and oceanographic programs by the Surveys and Investigation staff of the House Committee on Appropriations (1980).

2. Hearings on weather forecasting, past, present, and future, by the Subcommittee on the Environment and the Atmosphere of the Committee on Science and Technology of the House of Representatives, on July 25, 26, 27, 1978. The objective was to better understand the role of NASA and NOAA in improving weather and severe storms forecasting.

3. 1978 and 1979 workshops on NOAA Organic Act and role of private sector held at the Office of the American Meteorological Society by the National Resources and Environmental Subcommittee of the Committee on Science and Technology of the House.

4. Studies and reports by the General Accounting Office:
   a. B-133202. Feasibility of consolidating weather briefings, March 1977.
   b. LCD-76-445. Feasibility of consolidating certain aviation weather services, March 1977.
   c. B-16449(1). More effective use of aviation resources in the United States can be achieved, 31 March 1977.
   d. CED-78-77. Congress should clearly define National Weather Service role to provide specialized weather services, March 1978.
   e. LCD-78-437. Air Force and Navy Computer Flight Plans, March 10, 1978.
   f. LCD-79-413. Air Force Host Nation Support, May 11, 1979.
   g. LCD-80-10. The Federal Weather Program Must Have Stronger Central Direction, October 16, 1979

Department of Commerce - Office of the Federal Coordinator for Meteorological Services and Supporting Research:

1. Report of ad hoc group on aerial weather reconnaissance, August 1975.

2. Federal computer plan for operational forecasting and atmospheric modelling research, August 1975.

3. Review of Federal research and data collection programs for improved tropical cyclone forecasting, July 1979.

4. Report to House Committee on Appropriations, on NEXRAD, the next generation radar, January 1980.

5. Report of working group on aviation weather resources, September 1978.

6. The following plans are issued annually:
   - Federal Plan for Meteorological Services and Support Research
   - National Winter Storms Operations Plan
   - Hurricane Operations Plan
   - National Severe Storms Operations Plan.

7. Office of Management and Budget directed studies:
   a. Agency proposals for next generation weather radar, October 3, 1979.
   b. Agency proposals for surface weather automation, October 3, 1979.
   c. Agency roles, missions and programs, September, 1980.
   d. Numerical meteorological processing centers, September, 1980.

Department of Commerce - NOAA:

1. Comprehensive review of the functions, activities, and operations of the National Weather Service, Weather Service Offices, 1979.

2. National flash flood program development plan, FY 1979-84, September 15, 1978.

3. Weather modification reporting program, 1973-1978, June 1979.

4. A report to the Congress, National weather modification policies and programs, November 1979.

5. Comprehensive review of the forecast and warning system of the National Weather Service, 1 November 1979.

6. Coastal, Offshore, and Oceanic Prediction Services Plan, date unknown.

7. A proposal for the National Weather Service Field Organization in the 1980s, 1980.

8. National Climate Program, Five Year Plan, March 1980 (Draft).

Department of Transportation - Federal Aviation Administration:

1. FSS-01A, Flight Service Automation Plan, January 1978.

2. Aviation Weather Services Preliminary Program Plan, February 1978.

3. Aviation Weather System (AWES), Engineering, Architecture and Design Concept, 21 March 1979.

4. Aviation Automated Weather Observing System, prepared by NOAA, March 1979.

5. Aviation Weather System Engineering and Development Program, September 1979.

6. Aviation Weather System Design and Development Support, October 1979.

7. Nowcasts and Short Range (0-2 hour) Forecasts of Thunderstorms and Severe Convection Weather for Use in Air Traffic Control, prepared by NOAA, November 1979.

8. National Aerospace System Aviation Weather Operational Requirements Analysis, August 1979.

Department of Defense:

1. AWS Consolidation of Forecasting Services, March/Norton, June 1974.

2. San Antonio Area Consolidation of AWS Forecasting Services, August 1973.

Interdepartmental Committee for the Atmospheric Sciences of the Federal Committee for Science and Technology:

This committee has been superceded by the Committee on the Atmosphere and the Oceans in the Office of Science and Technology Policy in the Executive Office of the President. While it existed, the ICAS coordinated the atmospheric science research programs of the government and issued an annual report on the national atmospheric science programs.

National Academy of Sciences - National Research Council:

1. At the request of NOAA, a select committee is studying the impact of recent scientific and technological developments on the operation of the National Weather Service. (1980)

2. Weather Information Systems for On-Farm-Decision Making. (1980)

3. A Strategy for the National Climate Program. (1980)

4. Toward A U.S. Climate Program Plan. (1979)

5. Understanding Climate Change: A Program for Action. (1975)

6. Long-Range Weather Forecasting. (1975)

7. Atmospheric Chemistry: Problems and Scope. (1975)

8. Planning and Management of Atmospheric Research Programs. (1977)

9. Report of the Committee on Atmospheric Sciences on the Reviews of the NOAA Atmospheric Research and Development Programs. (1977)

10. Severe Storms: Prediction, Detection and Warning. (1977)

11. The Atmospheric Sciences: Problems and Applications. (1977)

12. The Atmospheric Sciences and National Goals: Priorities for the 1980's (Tentative Title Pending). (1980)

National Advisory Committee on the Oceans and the Atmosphere:

This committee issues annual reports on its findings.

1. Reorganization of the Federal Effort in Oceanic and Atmospheric Affairs, February 1979.

Coastal States Organization

1. Oceanic and Atmospheric Policy Issues of the 1980's - The Role of the NOAA Organic Act, May 13-14, 1980. Proceedings.

APPENDIX G - TERMS AND ABBREVIATIONS

AFOS	-	Automation of Field Operations and Services
AFGWC	-	Air Force Global Weather Central
AgRISTAR	-	Agriculture and Resource Inventory Surveys Through Aerospace Remote Sensing
AIRMET	-	Airmens Meteorological Information
ALWOS	-	Automated Low-Cost Weather Observing System
AMS	-	American Meteorological Society
ARTCC	-	Air Route Traffic Control Center
AV-AWOS	-	Aviation Automated Weather Observation System
AWDS	-	Automated Weather Distribution System
AWES	-	Aviation Weather System
AWN	-	Automated Weather Network
AWS	-	Air Weather Service
BWS	-	Base Weather Station
Circuit A	-	A long-line teletypewriter system used to collect and distribute aviation surface weather observations and products and Notices to Airmen
Circuit C	-	A long-line teletypewriter system used to collect and distribute meteorological data and products
Circuit O	-	A teletypewriter network that uses long-line, radio, and cable circuits to exchange meteorological information with other countries
CONUS	-	Continental United States
COSPAR	-	Committee on Space Research
CWSU	-	Center Weather Service Unit
DIFAX	-	Digital Facsimile (circuit)
DMSP	-	Defense Meteorological Satellite Program
DOC	-	Department of Commerce
DOD	-	Department of Defense

DOE	-	Department of Energy
DOI	-	Department of Interior
DOT	-	Department of Transportation
EDIS	-	Environmental Data and Information Service
EPA	-	Environmental Protection Agency
ERL	-	Environmental Research Laboratories
ETA	-	Economics Technology Associates, Inc.
FA	-	Area Forecast (Aviation)
FAA	-	Federal Aviation Administration
FEMA	-	Federal Emergency Management Agency
FNOC	-	Fleet Numerical Oceanography Center
FOUS 12	-	Statistically prepared Terminal Forecast Data
FSAS/NADIN	-	Flight Service Automated System/National Airspace Data Interchange Network
FSDPS	-	Flight Service Station Data Processing System
FSS	-	Flight Service Station
GAO	-	General Accounting Office
GARP	-	Global Atmospheric Research Program
GATE	-	GARP Atmospheric Tropical Experiment
ICAMR	-	Interdepartmental Committee for Applied Meteorological Research
ICMS	-	Interdepartmental Committee for Meteorological Services
ICMSSR	-	Interdepartmental Committee for Meteorlogical Services and Supporting Research
ICSU	-	International Council of Scientific Unions
JAWOS	-	Joint Automated Weather Observing System
JSPO	-	Joint System Project Office
MLC	-	Major Line Component
MOS	-	Model Output Statistics
MWWC	-	Military Weather Warning Center
NAFAX	-	National Facsimile (circuit)
NAMFAX	-	National Aviation Meteorological Facsimile (circuit)
NASA	-	National Aeronautics and Space Administration
NEDS	-	Naval Environmental Display System

NESS	-	National Environmental Satellite Service
NEXRAD	-	Next Generation Weather Radar
NOAA	-	National Oceanic and Atmospheric Administration
NOC	-	Naval Oceanography Command
NOSS	-	National Oceanic Satellite System
NSF	-	National Science Foundation
NSSFC	-	National Severe Storm Forecast Center
NWR	-	NOAA Weather Radio
NWS	-	National Weather Service
NWWS	-	NOAA Weather Wire Service
OMB	-	Office of Management and Budget
OFCM	-	Office of Federal Coordinator for Meteorological Services and Supporting Research
PAMOS	-	Panel on Automated Meteorological Observation Systems
PROFS	-	Prototype Regional Observing and Forecasting Service
RAWARC	-	Radar Reports and Warning Coordination Circuit
RAWS	-	Remote Automatic Weather Stations
SDC	-	System Development Corporation
SEASAT	-	Experimental satellite for ocean observations
SESAME	-	Severe Enviromental Storms and Mesoscale Experiment
SFSS	-	Satellite Field Services Station
SIGMET	-	Significant Meteorological Information
TDL	-	Techniques Development Laboratory
UCAR	-	University Corporation for Atmospheric Research
USAF	-	United States Air Force
USN	-	United States Navy
USDA	-	Department of Agriculture
VLSI	-	Very Large Scale Integration
WSOM	-	Weather Service Operations Manual
WMO	-	World Meteorological Organization
WSFO	-	Weather Service Forecast Office
WSO	-	Weather Service Office

APPENDIX H - BIBLIOGRAPHY

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Dept. of Commerce: Implementation Plan for BOB Circular A-62, DOC/NOAA, Rockville, MD, November 13, 1963, revised January 13, 1964.

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National Oceanic and Atmospheric Administration: NOAA Policy on Industrial Meteorology, Directives Manual, Chapter 27, Section 11, Rockville, MD, January 17, 1979.

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