NOAA ORGANIC ACT

HEARINGS

BEFORE THE

SUBCOMMITTEE ON THE ENVIRONMENT AND THE ATMOSPHERE

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

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NOAA ORGANIC ACT

TUESDAY, APRIL 18, 1978

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON THE ENVIRONMENT AND THE ATMOSPHERE,
Washington, D.C.

The subcommittee met, pursuant to notice, at 2 p.m., in room 2325, Rayburn House Office Building, Hon. George E. Brown, Jr. (chairman) presiding.

Mr. BROWN. The subcommittee will please come to order.

Good afternoon. Today, we hold our first hearing on H.R. 9708, the National Oceanic and Atmospheric Administration Organic Act of 1977, which was introduced by our colleague on the Merchant Marine and Fisheries Committee, Mr. Murphy. The purpose of this legislation, as currently written, is to establish a national ocean policy and set forth the missions and objectives of NOAA, the National Oceanic and Atmospheric Administration.

The need for this legislation is reflected in the fact that, although the importance of the oceans and the atmosphere to mankind is increasingly evident, there is no comprehensive national policy guiding their use or management. Similarly, there is no single comprehensive statute to guide the activities of our main oceans and atmospheric research and service agency.

The Congress should state its intentions with regard to the oceans and the atmosphere, and provide NOAA with the authority to carry them out.

In accordance with our jurisdiction on this committee, we will focus on, and uphold, the environmental R. & D. and atmospheric aspects of NOAA. The current bill's treatment of atmospheric policies, in particular, needs to be expanded.

Today, we will hear from the General Accounting Office and the NOAA Administrator. We plan to hold additional hearings in the future at which outside witnesses from the environmental and atmospheric research communities will testify.

Our first witness this afternoon is Baltas E. Birkle, Deputy Director, Community and Economic Development Division, General Accounting Office, accompanied by William Martino and Walter Hess.

Are you gentlemen ready? Why don't you come on up to the table, and we will move as expeditiously as possible.

Mr. Birkle, you may proceed, and introduce your colleagues, so that I will know which one is which. If they have anything to add, they would be welcome to do so.

STATEMENT OF BALTAS E. BIRKLE, DEPUTY DIRECTOR, COMMUNITY AND ECONOMIC DEVELOPMENT DIVISION, GENERAL ACCOUNTING OFFICE

Mr. BIRKLE. Mr. Chairman and members of the subcommittee:

We are here today at your invitation to discuss some of our work at the National Oceanic and Atmospheric Administration (NOAA). Here with me at the table are Mr. William Martino, Assistant Director in charge of our work at NOAA, and Mr. Walter Hess from our NOAA audit staff.

The subcommittee is considering H.R. 9708, the NOAA Organic Act, which recognizes the relationship between the oceans and atmosphere and the need for a national ocean policy. The bill designates NOAA as the lead civilian agency with responsibility for coordinating and carrying out a national ocean policy in order to improve the understanding, assessment, development, utilization, conservation, and protection of ocean and coastal resources, and the atmosphere.

While the current bill seeks to establish an ocean policy and essentially to codify NOAA's missions, it is our understanding that the subcommittee wishes us to focus our attention, today, on environmental and atmospheric activities of NOAA.

During the past 4 years we issued reports or made reviews dealing with the following activities:

Weather modification research efforts.

The coastal zone management program.

The accuracy of weather forecasting.

The adequacy of specialized weather services.

The outer continental shelf development environmental studies program, and

Various studies on the use of satellites in environmental monitoring.

In August 1974, we issued a report to the Congress entitled "Need for a National Weather Modification Research Program" (B–133202). The report identified common problems in Federal weather modification research hindering progress including:

No central authority to direct Federal departments;

Ineffective coordination and;

Insufficient resources to achieve timely, effective results.

Pursuant to the National Weather Modification Policy Act of 1976, the Secretary of Commerce established the Weather Modification Advisory Board to advise her on a national policy and an organizational structure for future Federal programs. The Board is preparing a report, but has not yet recommended a Federal role in weather modification nor the Federal agency for coordinating weather modification research.

On December 10, 1976, the Comptroller General issued a report to the Congress entitled "The Coastal Zone Management Program: An Uncertain Future" (GGD–76–107). The purpose of the program is to (1) encourage and assist the States in the exercise of their responsibilities in the coastal zone through the development and implementation of management programs, (2) obtain the cooperation and participation of all Federal agencies engaged in programs affecting the coastal zone, together with State and local governments and regional agencies, and (3) encourage the participation of the public, Federal, State, and

local governments and regional agencies in the development of coastal zone management programs consistent with the provisions of the act and according to published guidelines.

In this report we discussed the problems experienced by NOAA and the coastal States and territories in meeting the objectives of the Coastal Zone Management Act of 1972, as amended.

We concluded that (1) States have experienced delays and have had trouble obtaining funding, developing necessary implementing authority, receiving public and political support and coordinating program development with relevant Federal agencies, (2) Federal participation in State program development has been limited, and (3) NOAA has not always shown a good understanding of State problems and progress.

At the completion of our review none of the 33 coastal zone States had approved coastal zone management programs. Today the coastal zone management programs of three States—Washington, Oregon, and California, have been approved by NOAA and others are expected to be approved this year.

In our January 1978 report to the chairman, Task Force on Community and Physical Resources, House Committee on the Budget (CED–78–33), we commented on the quality of weather forecasts and options available to improve weather predictions for both short- and long-term forecasts.

Regarding two-day short-range forecasts, we reported that the National Weather Service (NWS) appears to have attained an acceptable level of accuracy for precipitation and temperature in terms of national averages.

The level of accuracy, however, varies for specific sections of the country. For example, although the nationwide level of accuracy for precipitation for 1976 was 85.6 percent, the average rate of accuracy for regions ranged from 77.0 percent for the Alaskan region to 89.9 percent for the western region. We pointed out that in short-term forecasting the degree of accuracy becomes much more significant in the case of severe weather, such as tornadoes, where life and property are threatened.

According to NWS, resources which would contribute to improving short-range forecasting include more observation stations, more sophisticated equipment, and more forecasters. For example, NWS said a denser network of observations in the Northeast Pacific Ocean would provide improved information on the development of storm systems.

In the area of long-range predictions, we reported that NWS's present ability falls far short of being useful to planners and policymakers for operational purposes because they are general in nature, they cover broad geographical areas, and they extend to only 90 days.

The present state of the art in long-range forecasting is such that the best potential for improvement lies in research and development programs. One area being researched involves the relationship between surface sea temperature and long-range weather forecasting. Another area involves the relationship of the wobble of the Earth's axis and long-range weather forecasting. NOAA is also attempting to improve long-range forecasts with more sophisticated mathematical computer models.

The Congress has recognized the need for improving long-range forecasting. Legislation (H.R. 6669) has been introduced to establish a national climate program. Also the Inter-departmental Committee for Atmospheric Science has prepared a plan which provides a means for Federal agencies to coordinate climatic research. NOAA has taken action on one of the committee's recommendations and established a National Climate Program Coordinating Office.

In a March 29, 1978, report to the chairman, House Committee on Science and Technology, entitled "The Congress Should Clearly Define the National Weather Service's Role To Provide Specialized Weather Services" (CED–78–77) we discussed NWS's role and responsibilities for providing specialized weather services to Federal agencies.

The Service's basic mission is to provide meteorological services to meet public needs or the common needs of Federal agencies. It also provides specialized services—including the facilities, products, and distribution mechanisms—for servicing the meteorological needs of specalized users. These services include agricultural weather, aviation weather, marine weather, forestry weather, environmental air quality, and weather conditions affecting activities such as space flight operations and energy development, including atomic testing.

About $32 million of the Service's total fiscal year 1978 budget of $185 million is for specialized services.

We concluded that NWS's role and responsibilities for providing specialized weather services to Federal agencies need to be clearly defined. Because higher priorities have been placed on more clearly defined responsibilities, the commitment to planning, and supporting specialized weather services has not been adequate, and it appears unlikely that the need for expanded services will be met.

We recommended that the Congress (1) clearly define the NWS's role and responsibilities for providing specialized weather services to user agencies and (2) assure that resources available to the Service are adequate to carry out the responsibilities.

We also recommended that the Secretary of Commerce assure that specific operational plans for specialized weather services are formally agreed to by it and the user agencies, and that the Secretary, together with user agencies and in consideration of other program priorities, provide such services through reallocation of existing resources.

We are completing a review dealing with environmental studies in support of outer continental shelf development. Specifically, we have addressed the overall studies program and also focused on NOAA's management of studies in Alaska.

We found that there is little agreement among Federal and State agencies on (1) how the environmental studies can best be used in the decisionmaking process affecting development of the Outer Continental Shelf, and (2) what type of information is needed to assess the environmental impact of oil and gas development in the Outer Continental Shelf. These problems are compounded by the absence of coordinated Government-wide plans which adequately define the information needs of Outer Continental Shelf managers and the direction and approach needed to obtain such information.

We have reported to the Congress on several remote sensing satellite projects in which NOAA, the National Aeronautics and Space

Administration (NASA), and other agencies participate. These projects involve Earth resources and oceanic monitoring. NOAA has been involved in varying degrees in these projects.

Our reports point out the lack of a clear Federal Government policy role in satellite-based remote sensing technology and bring out the interrelationships that exist among weather, pollution, environmental, and Earth resources monitoring systems.

In our staff study, "Land Satellite Project" (PSAD–76–74), issued in January 1976, we suggested that the participating agencies develop a plan which included requirements, milestones, and dates for evaluating progress being made toward the goal of deciding if there should be an operational satellite system.

In our June 1977 report on "LANDSAT's Role in an Earth Resources Information System" (PSAD–77–58), we pointed out that no agreement had been reached among the users on what performance objectives must be achieved to justify an operational system. We recommended that the Director of the Office of Science and Technology Policy (OSTP), in conjunction with cognizant Federal agencies, study the issues involved and recommend a Government policy role in satellite-based, remote sensing technology. In following up on this recommendation, we noted that only limited progress has been made.

NOAA is also involved in NASA's SEASAT–A project. In our September 1977 report to the Congress on "The Seasat–A Project: Where It Stands Today" (PSAD–77–126), we pointed out that there was no formalized agreement between NOAA and NASA to make certain that the responsibilities of each agency are clearly defined.

NOAA is also involved in the large area crop inventory experiment (LACIE) which involves crop forecasting by satellite. In our April 1978 report to the Congress on "Crop Forecasting by Satellite: Progress and Problems" (PSAD–78–52), we recommended that, since there have been technical problems in reaching LACIE objectives and the research direction has changed, cognizant congressional committees should be provided with periodic assessments of the LACIE project and related efforts.

In summary, our audit work has pointed to the need for a strong lead agency to plan, coordinate, and improve the management of atmospheric science activities. Accordingly, we support the concept of a strong lead agency for atmospheric sciences.

Mr. Chairman, this concludes my prepared statement. We shall be glad to respond to any questions.

Mr. BROWN. Thank you very much, Mr. Birkle.

Could I ask you if it would be possible for you to supply the committee with a copy of each of these reports you discussed?

Mr. BIRKLE. We will be glad to.

Mr. BROWN. We probably should have them in our files, so if you could do that, we would appreciate it.

There are a number of questions that your studies have pointed to, such as the need for better coordination amongst the agencies, and a clearer concept of who is responsible for what, which we have tried to focus on in this committee over a period of time. In connection with your description of the Earth satellite monitoring programs, a subject we have been interested in for some time, you recommend that OSTP take the responsibility for recommending a governmentwide policy in this area.

I am informed, I think correctly, that OSTP is participating in a review of satellite policy, particularly as it involves civilian versus military responsibilities in this area. I believe this is a joint operation between OSTP and the Domestic Council staff.

Are you by any chance informed or aware of this effort?

Mr. BIRKLE. Also with me is Mr. Joe Johnson from our Procurement and Systems Acquisition Division, the division in GAO that has handled the work on the satellite program. I would like to ask him to help me with this question.

Mr. JOHNSON. Yes, sir, Mr. Chairman. The study is an ongoing effort. We are not aware of the results of it to date. DOD has taken a lead in the study, and our understanding is that this was at the direction of the administration. OSTP will provide an input. We will follow-up on this in time.

Mr. BROWN. This is a sensitive area, as I am sure you are all aware, but you are not precluded from looking at coordination policy problems in examining the roles of military versus civilian agencies in this matter, are you?

Mr. BIRKLE. No; we are not. We often get into that type of problem, like in the weather forecasting area, where the military and civilian agencies could have duplicative efforts, or could coordinate and make use of each other's efforts.

Mr. BROWN. I do not think the problem in this case is so much one of duplication. Obviously, we have classified military sensing operations going on, as well as the unclassified, and there are some very real policy questions as to what you do about that dividing line between civilian and military agency roles. If you have any wisdom to shed on this particular problem, we would be glad to hear it, for whatever it might be worth.

Mr. BIRKLE. Well, this could be something we could look into, and supply for the record. I guess we really do not have anything to add today.

Mr. BROWN. All right.

I will not press the problem today. This committee is trying to get a progress report on the status of this study that I referred to, and so far we have not been able to pin anything down, but possibly we will in the near future.

Mr. Walker, do you have any questions?

Mr. WALKER. Yes; thank you, Mr. Chairman.

Is it GAO's viewpoint that the lack of focus in many of NOAA's areas could be improved if there were specific organic legislation?

Mr. BIRKLE. I would think so; if the leadership role could be clearly defined it would help in many areas, where there is conflict and overlap between agencies, or where there is no coordination between agencies.

Mr. WALKER. As a general rule, does GAO find that those Government programs subjected to regular legislative review are better managed and more responsive to the requirements of the public than those which are not regularly reviewed?

Mr. BIRKLE. I do not know if I could generalize on that and say yes or no. We find problems in agency programs in both categories. I would hate to say which one would be better managed, one as opposed to the other.

Mr. BROWN. The proper answer would be to say those regularly reviewed by Congress would have better results. [Laughter]

Mr. BIRKLE. You have much better criteria to measure against, when you have a specific role laid out. If the missions are clearly defined, we, as auditors, can make a better assessment.

Mr. WALKER. What needs to be done to minimize these problems?

Mr. MARTINO. I think it is a matter of education to convey to the general public what NOAA is trying to do, and what the States are trying to do. There is a complete lack of understanding in many areas of the country.

Mr. WALKER. A lack of understanding by the public or by the agencies?

Mr. MARTINO. In the public's view.

Mr. WALKER. In the public's view?

Mr. MARTINO. Yes; more emphasis should be given to conveying to the public the overall purpose of what is trying to be accomplished through NOAA programs.

Mr. WALKER. Is the lack of this kind of public knowledge delaying or frustrating programs?

Mr. MARTINO. They are afraid of it and delaying it; even some of the local politicians at the county level and State level do not understand the objectives of certain programs.

Mr. WALKER. In your report on NOAA's specialized weather activities, you say Congress should define the role of the National Weather Service in providing these services.

What would such services achieve? In particular, I am interested in the agricultural-weather aspects.

Mr. BIRKLE. I think some very worthwhile specialized weather programs are being delayed because of disagreements over the role of the different Federal agencies; over who should be responsible for identifying needs, and providing services.

Aviation weather is a good example, where FAA and NOAA agreed that meteorologists were needed in the air route traffic control centers, but the program was delayed because of disagreement over who should supply the meteorologists.

Mr. HESS. In agriculture, I think one of the problems is who should actually go out and work with the users. We are currently working on a report, which should be issued in several months, that gets into this in some detail. Here you have some problems with who should establish the specialized agricultural weather centers. As you know, the agriculture weather program only covers about one-third of the country right now, and we felt the Congress should clearly make it known as to whether or not it wants this program to be expanded. For example, many of the drought-prone States are not covered.

We felt the Congress should clearly define what it wants the Department of Agriculture to do, and what it wants the National Weather Service to do, and indicate how these resources should be supplied.

There might be interface with farmers and extension agencies in supplying the basic forecasts and supplying the specialized agriculture forecasts. The concerned agencies have to work together and need to know who should do what. The agencies need to get together to agree on specific areas of operations.

Mr. WALKER. Finally, what specific problems have arisen from a lack of a clear weather policy, and would an Organic Act be a supervehicle for expressing this policy?

Mr. JOHNSON. As Mr. Birkle pointed out in his testimony, we identified this problem in several NASA–NOAA projects.

It is common to any multiagency program, where each one has their own narrow parochial interest, so to speak, NASA is an R. & D. outfit; NOAA is a service outfit. There is no overall Federal policy saying that in remote sensing a particular agency would take the lead and do this type of thing. We found that NASA was spending quite a large sum in one project, and the user agencies did not have the funding necessary to really take advantage of the R. & D. breakthroughs that were being achieved. Legislation, as you probably know, has been introduced to make remote sensing operational, yet there are so many unanswered questions about international aspects, economic payoffs, and security aspects that we felt there should be a clearly defined Federal policy in this area. We recommended that OSTP work in this area, and it is moving in that direction.

Mr. WALKER. Is it your feeling if we had a comprehensive policy with regard to the services coming from remote sensing, the information would get to the users more quickly? Again, I think in particular about the agricultural area, where, as I understand, we could get some very elaborate knowledge from the sensing satellites, but because of the processing time it takes to get the information out to the farmers, it is of little or no use to them.

Mr. JOHNSON. There are delays in these projects, because they are experimental in nature. They are not geared up for day-to-day operations. The large area crop inventory experiment (LACIE) was an effort to try to develop this technology, to see if this information could be obtained and used in time, and it has problems.

Mr. WALKER. If there were a coordinated policy, would that solve that kind of problem?

Mr. JOHNSON. It would let the user speak. Nobody can depend upon it now. Right now in NASA, an R. & D. outfit, once they have achieved their R. & D. objectives, their charter in effect still says keep on doing other R. & D. work.

They are not concerned within their present charter in doing day-to-day operations. The users are the ones that need to have a more active role in this thing, perhaps more active participation in the funding.

Mr. WALKER. Thank you, Mr. Chairman.

Mr. BROWN. Any questions, Mr. Spensley?

Mr. SPENSLEY. Just a couple, Mr. Chairman.

You made reference in your recent National Weather Service report on the adherence to the OMB Circular A–62, with respect to providing specialized weather services.

I think your report indicated that this OMB circular was not being closely adhered to.

Could you comment any further on that?

Mr. HESS. Our comment basically has to do with the circular being somewhat vague; it says that to the extent possible, NWS should provide these specialized services.

We felt there was a need for the Congress to define these services. There have been some problems in getting the funding approved, and

also disagreement over who should actually have the bodies, the people, and the funding.

The other problem that we found was that, although the circular also requires that plans be developed, and while there is an overall plan which includes these services, specific plans have been developed for only two of the specialized services, agriculture and forestry weather. We felt they needed plans for aviation, environmental quality, marine, and the other services.

Mr. SPENSLEY. Were you referring to the Federal plan for meteorological services?

Mr. HESS. That is the overall plan, and in the back it lists the other specific plans that have been developed.

The aviation weather service is also currently putting together a specific operational plan that ties in what the FAA will do, what the National Weather Service will do, and how they interface with the pilots, et cetera.

Mr. SPENSLEY. As I recall, your report was not very specific with respect to the amount of participation by the agencies in the preparation of these specialized weather plans.

Did you examine that, and do you have any further comment on that?

Mr. HESS. We did not examine that to any great extent. We found, however, that it varied from agency to agency. They have participated. The aviation weather plan is now being prepared, with a great deal of joint cooperation and participation.

In agricultural weather, the NWS has basically taken the leadership with the Department of Agriculture commenting on the plan. In that case, we felt it should perhaps be the reverse. Agriculture should be identifying the users' needs, with NWS serving as the supplier of weather information to meet those needs.

Mr. SPENSLEY. Do those plans seem to be followed closely in terms of implementing the specialized services?

Mr. HESS. The plans as they now stand are outdated. They are revising them. The plans we felt needed to be a little more specific as to the specific operational responsibilities of each of the agencies.

As we said, they are rather general in nature, and to that extent they are followed, but they are outdated.

Mr. SPENSLEY. Thank you, Mr. Chairman.

Mr. BROWN. Mr. Wirth?

Mr. WIRTH. I have no questions, Mr. Chairman.

Thank you.

Mr. BROWN. Mr. Clement?

Mr. CLEMENT. One, Mr. Chairman.

Mr. Birkle, in response to an earlier question, You indicated that from an auditor's point of view, it is much easier to measure program performance within an agency if you have a legislative chart of some kind to work against.

On page 9 of your testimony you summarize your statement by saying GAO's audit pointed to the need for a strong lead agency plan to coordinate and improve the management of atmospheric science activities.

You also just discussed the interrelationship between NOAA and a number of agencies throughout the Federal Government.

Would the corollary to your earlier statement be that such cross-agency arrangements and coordination and cooperation also work better with a legislative mandate?

Mr. BIRKLE. Anything that clearly defines the roles of the different agencies would help, and it could be a legislative mandate, or it could be agreements in writing between the agencies.

Probably with the legislative mandate, you have more assurance that it will be followed by the agency, whereas agreements between the agencies sometimes are not as formal, and are not necessarily followed and adhered to; so the legislative mandate would help, and would be the best way, I would believe.

Mr. CLEMENT. Thank you, Mr. Chairman.

Mr. BROWN. Gentlemen, I do not know whether I can phrase a question to elucidate any more information from you on this point or not, but the Congress has had a great deal of experience in trying to mandate interagency coordination and cooperation, and when we get down to the details of trying to prescribe in written law the nature of an arrangement between the multiple agencies, we sometimes encounter as many problems as when we do not.

I remember that this committee spent something like 2 years trying to persuade EPA and the Department of Energy (then ERDA) just to agree on a system for dividing the work on municipal waste systems, to decide whether projects should be financed by one agency or the other, or whether grants should be made by one agency or the other, depending primarily on whether the projects objective was to produce energy, or primarily to get rid of the waste.

I am not sure that we have a satisfactory arrangement yet, and we ended up writing into law the actual words of the interagency agreement, which was, as I say, some time in the making.

The question is, how can we be sure that spelling out interagency arrangements specifically is the best way to achieve coordination and cooperation, rather than merely placing a joint responsibility with the various agencies to achieve a particular purpose, and then holding them accountable?

Maybe that is what you are saying. In effect, I am trying to make a distinction between setting a broad goal versus setting out details of how to accomplish coordination.

Could I elicit any comments from any of you?

Mr. BIRKLE. I would agree that Congress has generally tried to avoid spelling out in great detail procedures that various agencies should follow when coordinating with each other or working together. The Congress tends to spell out goals and objectives, and then leaves it to the agencies to seek the best way to achieve those things.

It would be nice if you could get agreement, and spell these things out, but from a practical standpoint, as I understand what you are saying, that becomes very difficult, and maybe even impossible in some cases. So I guess what I really wanted to say, and what I really meant, was that you should go as far as you can in that direction, and then you will have to leave it up to the agencies to work out the details that you cannot specify.

Mr. BROWN. Well, I am sure that part of the problem stems from the fact that Congress itself is not exactly certain about some of the goals it wants to accomplish. That of course puts a very great burden on the executive agency.

Well, gentlemen, thank you very much for your statement. It will be very helpful to the subcommittee. We may call on you for more information later.

Mr. BIRKLE. Thank you.

Mr. BROWN. Our next witness is Mr. Richard Frank, Administrator of NOAA.

Mr. Frank is accompanied by Dr. Richard Hallgren and Dr. George Benton.

We welcome all of you gentlemen.

STATEMENT OF RICHARD FRANK, ADMINISTRATOR OF THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Mr. FRANK. It is a great pleasure to be before you today and the committee.

I am accompanied on my left by Dr. George Benton, who is Associate Administrator designate of NOAA. Dr. Benton is a meteorologist and hydrologist. He comes to us from Johns Hopkins University. On my right is Dr. Richard Hallgren, Acting Assistant Administrator.

I appreciate this opportunity to appear before you to comment on H.R. 9708, a bill which would establish a national ocean policy and further refine and define the mission of NOAA.

I would like to submit my testimony for the record and speak to you about various elements of it.

Mr. BROWN. Without objection, that is the order.

Mr. FRANK. Because of the nature and quantity of NOAA's various responsibilities, we operate under or are affected by over 100 different statutes. Reorganization Plan No. 4 of 1970 sets forth NOAA's responsibilities under these statutes in terms of the various functions transferred to NOAA from other agencies. However, neither these statutes nor the reorganization plan provide NOAA with a comprehensive organizational framework. As NOAA becomes more involved in conservation programs, regulation of various activities, resource management, climate, and environmental and science planning, our authorities will have to be reviewed to insure that they are adequate to meet our needs. The need for review is apparent, for example, in areas where NOAA interfaces with other governmental units, and it is in those interagency agreements you are concerned with today.

As you are aware, the administration presently is conducting a comprehensive natural resource reorganization study which includes NOAA, and is preparing to undertake a comprehensive review of Federal ocean policy late this spring. We believe that it would be premature for us to take a position on the ocean policies and organizational structure of NOAA set forth in H.R. 9708, the proposed NOAA Organic Act. Therefore, we strongly recommend that your committee defer action on this bill until the administration has completed its reviews. During this process, the administration will take the findings and proposals put forth in H.R. 9708 into careful consideration.

I am not, Mr. Chairman, suggesting this subject should be deferred for all time. Simply that the reorganization project which is proceeding, should have the opportunity to present to you and to others its conclusions, and that the President should have an opportunity to make a judgment on what should happen to the natural resource agencies, including NOAA.

I would like to focus my testimony on two subjects this morning, and then perhaps to answer a couple of questions which are raised by the GAO testimony earlier.

First, with respect to NOAA's present capabilities, existing authorities, and changing role, there were a variety of entities in which other parts of Government came to NOAA at that time. We have amalgamated those entities into what we believe is a very carefully designed structure and have reorganized NOAA more recently.

I will speak on that subject in a second.

Much of the impetus for the creation of NOAA came from the recommendations contained in the 1969 report of the Stratton Commission which was established by President Johnson. That report assumed a couple of fundamental propositions, one is that ocean and atmospheric matters should be together because of the significant interactions of oceans and the atmosphere.

For example, if we look at the CO_2 problem, which is an atmospheric problem, it is the oceans which absorb more CO_2 than any other element. Therefore, it is not only an atmospheric problem, but also an oceans problem. The weather is in part derived from the oceans, so oceans and atmosphere should be tied together, and they have been put together in NOAA.

In addition to those responsibilities we got in 1970, Congress has given NOAA additional programmatic responsibilities, such as the Marine Mammal Protection Act of 1972, the Marine Protection, Research, and Sanctuaries Act of 1972, the Coastal Zone Management Act of 1972, as amended in 1976, the Endangered Species Act of 1973, the Fishery Conservation and Management Act of 1976, and the 1976 Amendments to the National Sea Grant College and Program Act.

In addition, we have moved forward in two other areas of interest to this committee.

First, as mentioned earlier today, we have established a National Climate Office and are moving with the development of a national climate program. I hope shortly that the President will be signing an executive order in connection with that subject.

Furthermore, because of action taken by this subcommittee and Congress, we are soon to propose to Congress a weather modification program for the country. An advisory committee has been established by the Department of Commerce, and a report will be due this August from that advisory committee. Shortly thereafter we will comment on that report, and also make proposals to this subcommittee.

Let me turn to the reorganization of NOAA now. I will be brief, because we have discussed this subject with the committee both before the reorganization took place, in an effort to solicit the committee's views, and after the reorganization took place.

There are some elements of that reorganization that I think are particularly pertinent to what we are discussing today.

For example, we have created the position of Assistant Administrator for Research and Development. It is important to note that we have kept the various program responsibilities under this office such as the Sea Grant program, the Office of Ocean Engineering, the national climate program, and other matters such as U.S. participation in the Global Atmospheric Research Program, again relying on the proposi-

tion that those elements should remain together. This person will help us not only in research and development, but also in the transfer of that technology to the line components of NOAA.

In other words, we will attempt to define our mission better and to have our research and development programs oriented more toward that mission than they have been in the past.

When I testified before the committee last, I mentioned that within 30 days or so, we would have someone designated for the position of Assistant Administrator for Research and Development. I am pleased to inform you today that Ferris Webster, formerly of Woods Hole, has been offered that position and has accepted. He has now joined NOAA and I hope he will be on board permanently very soon.

We have also created an Office of Ocean Management, which will allow us to use more prudently the ocean areas around this country.

In addition, we have created the position of Assistant Administrator for Oceanic and Atmospheric Services, and Dr. Hallgren is the Acting Administrator for Oceanic and Atmospheric Services. It is my impression that keeping those two elements together has worked to our great benefit.

We have merged two elements in the fisheries area, the National Marine Fisheries Service and the Office of Marine Resources. These two have been merged into the Office of Fisheries under an Assistant Administrator.

We now have an Office for Policy and Planning. I am hopeful that office will resolve some of the problems we have had highlighted today. Some of our long-term planning has not taken place as it should, primarily because line elements get caught up in day-to-day activities in fulfilling their programmatic activities and responsibilities. They are not able because of that to have as much long-term planning as we would like.

I mentioned earlier the National Climate Office, a new component of NOAA in its reorganization. The National Climate Office is part of the Office of the Assistant Administrator for Research and Development. We are moving forward in that area.

Ultimately, if we get the weather modification responsibilities within the Government, that too may have a separate office. It may be in the research and development area, or it might report directly to the Administrator of NOAA.

We are working on one other issue which relates to science. Dr. Benton has been given the responsibility of analyzing our relationships with universities and other research institutions to make sure that Government research, either performed by NOAA or contracted to NOAA, is performed in an efficient and effective manner. I think there is a good deal of Government research that should be done outside the Government, outside NOAA, and we want to define what research should be done outside. There is also a good deal that should be done inside. We want to define the kinds of relationships that will foster better research, whether it is done inside or outside. For example, some of our laboratories are located at universities, and that fosters relationships between the best scientists at those universities and the best scientists in NOAA.

Let me add one other point. I think this committee has highlighted science and technology very well, and so has the President. In this

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last budget, the President indicated he wanted a substantial increase in funds allocated for basic research. A good deal of credit for that decision goes to the President's Adviser on Science and Technology, but the President has recognized the importance of science and is putting more money into science.

Let me deviate from the testimony and add a couple of words about issues raised by the GAO's testimony earlier today.

One has to do with specialized services in the area of weather concerning our relationship with FAA, and weather services provided to FAA centers. We now have meteorologists which are part of the National Weather Service in the FAA centers, so that program is already in operation.

There is some implication that because two agencies were involved, this took longer than it would otherwise have taken had one agency been involved, and there was a lack of collaboration and of coordination in this area. It is true that we did not resolve this question in a matter of weeks. It is also true that I have yet to see anything in the Government resolved in a matter of weeks.

There were some knotty questions since this is a subject of aviation and it is also a subject of weather. One can wonder under those circumstances whether the FAA should put meteorologists in the FAA centers, or whether we should. The FAA and NOAA ultimately concluded that we are talking about providing a weather service. We are talking about hiring and directing meteorologists, and that is a function NOAA can best perform.

We have a collaborative agreement with the FAA. It makes no difference whether the funds are in the FAA budget or our budget, or whether the personnel ceiling points are FAA ceiling points or ours, since they would be used for the same purpose.

The fact remains that we do have a collaborative agreement; our meteorologists are in their centers; and the service is being performed well.

This is in connection with the specialized services statement in the GAO testimony that bothers me just a little bit, because it raises an issue, but does not give an answer.

There is a suggestion on page 7 of the testimony, for example, that in order to provide better specialized services, we should reallocate existing resources. However, there is no indication in the testimony, nor in the GAO report, what existing resources we should reallocate, from where we would take resources, or what programs we would do away with.

Our programs are congressionally mandated, and it is very difficult to take funds or personnel away from existing programs, unless one can conclude that those programs are of a lower priority or nonessential.

NOAA has hardly more people today than in 1970 when it was created, even though it has more programs and more functions. It is therefore very difficult for us to take people away from some programs even though newer programs are intriguing, and would perform substantial service to other interests of the country.

Let me mention one other element of the GAO testimony which is of concern to us and obviously to GAO. That has to do with remote sensing by satellite.

The testimony implied that we are not moving forward in a coordinated fashion to utilize as well as possible the remote sensing capabilities we now have.

First of all, until recently, we have been in an experimental phase with remote sensing capabilities of systems such as Landsat. We are rapidly learning more about what remote sensing can do, and I think within the near future, the Government will move into an operational phase with applications of both Landsat and Seasat data.

That, too, takes time, because we are now talking about funds, which will be available to the executive branch 1 year, or 1½ years, or 2 years hence. Also, we need to collaborate with other agencies to find out what the needs are and who can best provide those needs.

We are not sitting still. We have an arrangement and we are working with the Department of Agriculture, in connection with the provision of weather services to the Department of Agriculture.

In addition, we have an interagency committee, which includes the Department of the Interior, NASA, the Department of Agriculture, and NOAA, that is working on the subject of remote sensing, and the provision of satellite services to the agencies.

We will have a more complete answer to this question in the near future. I assure you we will move forward. We will provide the services and use this technology, but it does take time to arrange it.

I am happy to answer any questions which the subcommittee may have, Mr. Chairman.

Dr. Benton can amplify answers to any questions, as can Dr. Hallgren.

Thank you, sir.

[The prepared statement of Mr. Frank follows:]

TESTIMONY OF RICHARD A. FRANK
ADMINISTRATOR
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
DEPARTMENT OF COMMERCE

Before the

COMMITTEE ON SCIENCE AND TECHNOLOGY
U. S. HOUSE OF REPRESENTATIVES

April 18, 1978

Mr. Chairman and Members of the Committee:

Thank you for inviting me to appear before you today to comment upon H.R.9708, a bill which would establish a national ocean policy and further refine and define the mission of NOAA.

Because of the nature and quantity of NOAA's various responsibilities, we operate under or are affected by over 100 different statutes. Reorganization Plan No. 4 of 1970 sets forth NOAA's responsibilities under these statutes in terms of the various functions transferred to NOAA from other agencies. However, neither these statutes nor the Reorganization Plan provides NOAA with a comprehensive organizational framework. As NOAA becomes more involved in conservation programs, regulation of various activities, resource management, and environmental and science planning, our authorities will have to be reviewed to ensure that they are adequate to meet our needs. The need for review is apparent, for example, in areas where NOAA interfaces with other governmental units.

We share your concerns that our ocean and coastal resources should be managed, protected, and utilized in a sound and balanced manner. As you are aware, the Administration presently is conducting a comprehensive natural resource reorganization study which includes NOAA, and is preparing to undertake a comprehensive review of Federal ocean policy late this spring. We believe that it would be premature for us to take a position on the ocean policies and organizational structure of NOAA set forth in H.R. 9708, the proposed NOAA Organic Act. Therefore, we strongly recommend that your Committee defer action on this bill until the Administration has completed its reviews. During this process, the Administration will take the findings and proposals put forth in H.R. 9708 into careful consideration.

In my testimony this morning, I will discuss the following issues:

(1) NOAA's present capabilities, existing authorities, and changing role; and

(2) an internal restructuring of NOAA which I instituted as Administrator.

Present Capabilities and Existing Legislative Authorities

I would like to begin by discussing our present capabilities and existing legislative authority since NOAA's

changing role has a direct bearing on the organizational/ mission issues raised in this proposed Organic Act.

NOAA was created in 1970 by Reorganization Plan No. 4 in recognition of the need to undertake a comprehensive and unified approach to the problems confronting both the use and preservation of the oceans and atmosphere. Under the terms of the Reorganization Plan several organizations throughout the government were moved into NOAA:

-- The Environmental Science Services Administration, including the Weather Bureau, the Coast and Geodetic Survey, Environmental Data Service, the National Environmental Satellite Center, and the ESSA Research Laboratories.

-- From the Department of the Interior, the marine sport fish program of the Bureau of Sport Fisheries and Wildlife, and elements of the Bureau of Commercial Fisheries.

-- From the Department of the Interior, the Marine Minerals Technology Center of the Bureau of Mines.

-- From the National Science Foundation, the Office of Sea Grant Programs.

-- From the Department of the Army, elements of the United States Lake Survey.

In addition, the programs of the National Oceanographic Data Center, the National Oceanographic Instrumentation Center, and the National Data Buoy Project were transferred to NOAA.

Much of the impetus for the creation of NOAA came from the recommendations contained in the 1969 report of the Stratton Commission which was established by President Johnson. The report, Our Nation and the Sea, recommended, among other things, that an independent ocean and atmospheric agency be created. In addition, as Chairman of the National Council on Marine Resources and Engineering Development, Vice President Humphrey played a strong leadership role in marine sciences, and was responsible for a number of recommendations from that Council concerning the Federal effort in ocean related programs. These recommendations were also considered in the formulation of NOAA. Those responsible for the creation of NOAA -- legislators, scientists, engineers, environmentalists, and public officials -- wanted to bring the problems of oceans and atmosphere to the national prominence that other scientific and technical fields had attained during the 1960's.

In the last seven years, under the leadership of Dr. Robert M. White, a distinguished scientist and able administrator, NOAA moved increasingly toward becoming

more than just a science service organization and became the more broadly-based resource management, environmental planning organization proposed by the Stratton Commission and contemplated by those who favored establishment of NOAA.

A number of legislative additions to, or changes in, NOAA's responsibilities have occurred over the last few years.

-- The Marine Mammal Protection Act of 1972.
Under this Act, NOAA and the Fish and Wildlife Service administer programs designed to conserve the many species of marine mammals.

-- The Marine Protection, Research, and Sanctuaries Act of 1972.
Under Titles II and III of this Act, NOAA is responsible for various programs designed to find out more about ocean pollution and minimize pollution problems, and to protect certain ocean areas through the establishment of marine sanctuaries.

-- The Coastal Zone Management Act of 1972, as amended in 1976.
This Act gives NOAA the authority and

responsibility to protect our Nation's coastal zone through joint Federal-state efforts.

-- The Endangered Species Act of 1973.
NOAA and the Fish and Wildlife Service jointly administer this Act to ensure protection of fish, wildlife, and plants which have been declared to be either endangered or threatened species.

-- The Fishery Conservation and Management Act of 1976.
This Act gives NOAA the responsibility for the protection and management of the fishery resources found off our coasts.

-- The 1976 Amendments to the National Sea Grant College and Program Act.
Under the Sea Grant Program authorized by this Act, NOAA supports research projects throughout the Nation designed to learn more about the marine environment and the rational use of our marine resources.

In addition to these legislative expansions of NOAA's role, NOAA has undertaken other significant activities in

oceanic and atmospheric sciences. For example, NOAA conducts the Alaskan Outer Continental Shelf Environmental Assessment Program, in support of OCS energy development, for the Department of the Interior's Bureau of Land Management. To support these energy-related studies, the Energy Research and Development Act of 1975 provided for the reactivation of NOAA vessels. Also, the Law of the Sea negotiations, a direct responsibility of the Department of State, have involved NOAA support in areas of marine pollution control and abatement, fisheries, and environmental effects of seabed mining.

Reorganization of NOAA

In order to integrate NOAA responsibilities in a logical manner, and in order to improve NOAA's operating effectiveness generally, I initiated the task of restructuring the organization upon my arrival at NOAA. At the outset, I received a comprehensive reorganization Option Paper that had been prepared by the Assistant Secretary for Policy of the Department of Commerce. That paper had been stimulated by reorganization proposals suggested by Congressional leaders and included options suggested by others, including Secretarial officers of the Department of Commerce, Dr. Robert M. White, and other NOAA personnel. I distributed the Option Paper to senior NOAA personnel, asked their views about reorganization, and met

with them in groups and individually. Furthermore, I met with all potentially interested Members of Congress, Congressional committee staffs, interested persons in the Department of Commerce, White House staff, OMB staff, the scientific community, constituencies, and others in the ocean and atmospheric communities. During these meetings, I discussed several possible reorganization plans and solicited views.

The overwhelming majority of individuals with whom I spoke believed that a reorganization was advisable to make NOAA more cohesive and efficient, to improve specific aspects of the agency's operations, or simply to revitalize NOAA.

On the basis of these discussions, and with the approval of Secretary Kreps, a new structure was adopted which includes the following changes.

We created the position of Assistant Administrator for Research and Development to provide a focus for our R&D activities and to become a national center for oceanic and atmospheric science and technology. The Office of Research and Development has under its jurisdiction our Environmental Research Laboratories, the Sea Grant Program, the Office of Ocean Engineering, the National Climate Program, and such other matters as U.S. participation in

the Global Atmospheric Research Program. I believe this Office will provide NOAA with the means to coordinate our many different research and development activities. As with all of our programs, I hope that by centralizing these various efforts under an Assistant Administrator we will be able to provide a better, more cost effective service to the Nation.

In the 1977 NOAA reorganization, we also established an Office of Ocean Management which brings together a number of NOAA programs and formulates decisions on priority needs for ocean use both with NOAA elements and, to the extent required by law, with the ocean-related programs of other Federal agencies. When conflicts are identified between users of ocean resources or between conservation needs and resource uses, interagency management strategies will be developed to resolve these conflicts. As a synthesizer of information, that office will seek improved methods of analysis and assessment of socio-economic and environmental impact evaluation, resource use planning, and decisionmaking. Where further research and development is required to improve the decision process, the Office of Ocean Management will help identify priority areas.

NOAA is a major repository for information, and scientific and technical skills concerning ocean resource

management. Of course, for some areas, the Government's expertise is in other agencies. Through implementation of our responsibilities under such Acts as Title III of the Marine Protection, Research, and Sanctuaries Act, the Deepwater Port Act, the Coastal Zone Management Act, and the Fish and Wildlife Coordination Act, we have acquired considerable experience for making ocean resource management evaluations. I believe that effective assessments by NOAA of proposed ocean activities is essential for the development of rational ocean management programs.

In other areas, NOAA's major service functions such as the National Weather Service, National Environmental Satellite Service, National Ocean Survey, and Environmental Data Service, have been combined under an Assistant Administrator for Oceanic and Atmospheric Services. As with our R&D programs, I believe that we will be able to provide better services by having these several programs coordinated by a single office. These activities must become more integrated and mutually supportive.

NOAA has become more responsive to its fishery responsibilties through the merger of the National Marine Fisheries Service and Office of Marine Resources into the Office of Fisheries under an Assistant Administrator. The complex issues which we deal with involving our Nation's fisheries resources demand our constant attention. For

example, the development of rational fishery management plans and programs should be facilitated by bringing together the expertise which we have in these two offices. Our important marine mammal and endangered species programs will be given more emphasis and should become more effective. The Assistant Administrator for Fisheries will be in a better position to ensure that our fisheries programs are coordinated with the activities of NOAA carried out by the other Assistant Administrators. Thus, we believe that for the first time we will have a truly NOAA wide effort which we can bring to bear on these crucial fisheries issues.

Finally, prior to the reorganization NOAA lacked a long-range planning capability designed to coordinate NOAA policy with other agencies and Congress. An office has been established under the Assistant Administrator for Policy and Planning, which has primary responsibility for developing long-range NOAA policies, designing programs to implement these policies in conjunction with the other Assistant Administrators, and coordinating NOAA policy development and implementation with the Office of Policy of the Department of Commerce, other Departments, the Congress, and the public. This Office includes a separate office responsible for working on issues about ocean minerals policy and planning in conjunction with the Department of the Interior.

This restructuring has improved our internal coordination and enhanced our policy and planning activities, as well as our ability to carry out our statutory mandates. It is too soon, of course, to make meaningful judgments about the success of this reorganization, and experience may ultimately dictate modifications. I am quite hopeful, however, that with the outstanding individuals we have been fortunate to bring into NOAA, the reorganization will substantially improve our operating effectiveness.

Conclusion

I appreciate this opportunity to discuss with the Committee NOAA's activities, the opportunities we have, and the efforts we are making to assist in solving some of the critical scientific, social, economic, and environmental problems our Nation is faced with today.

Mr. BROWN. Thank you, Mr. Frank.

I do wish to pay tribute to the fact that in the relatively brief time you have administered the agency, you have moved aggressively in accomplishing a number of important initiatives in terms of reorganizing and strengthening the administrative personnel of the agency. You have also moved very rapidly in providing this committee with a vast amount of information which we have asked for and which we appreciate receiving, particularly the details you recently supplied about the many laboratories that you operate.

Being aware of this, I am inclined to agree with your point that some of the problem areas that have been pointed to by GAO and by this committee, and probably others, may stem from what you might call start-up, or transitional kinds of problems. I presume that this would lead us to conclude that at the end of a reasonable period of time you would have solved all of these types of problems.

Mr. FRANK. I guess the answer to that has to be yes, sir.

Mr. BROWN. We keep asking that year after year, you know.

Mr. FRANK. Let me raise one area which we have not dealt with adequately. I am not sure it is a transitional problem, because it predates this administration.

There was some mention of plans in the meteorological area, plans relating to environment, plans relating to specialized services, and some of those plans are out of date; we admit that. However, we have now determined that those plans should be updated, and we will update them and follow them to the best extent we can. That is an area that has fallen by the wayside and should not have, but we will do better.

Mr. BROWN. When you mentioned that NOAA had relationships with universities, I think the implication was that you wished to rely more than you have on outside sources of research and development at some of the research labs.

To what degree does NOAA rely upon extramural contracts or grants for its research and development work? Is that a major aspect of your operation?

Mr. FRANK. It is a major part, but not the major aspect of the operation.

Basically the criteria which I would like to use is to have a function performed by the individual or laboratory which can do it best. If that happens to be in NOAA, then NOAA should do it. If it happens to be in a university, then that university ought to do it under grant or contract. We are now attempting to determine which is the best way to find the answer to that.

I might say, especially in the atmospheric area, NOAA's laboratories are doing excellent work, and we can be very proud of them. Indeed, I was somewhat surprised to find out the quality of the work. We were able to attract outstanding scientists. I think that Dr. Hess, who runs the Environment Research Laboratories, has done an excellent job. We also have individuals running specialized NOAA laboratories in Princeton and Boulder who are doing an outstanding job. However, if one of the labs outside NOAA can do better, then I think we ought to contract with that lab.

Mr. BROWN. Fine.

Since you mentioned Boulder, I will ask Mr. Wirth if he has any questions.

Mr. WIRTH. Thank you, Mr. Chairman.

I was pleased to hear that endorsement for the laboratories. I think that before you came on board, we were concerned that the Atmospheric Physics and Chemistry Lab (APCL) was going to be disbanded, and I was pleased when you decided not to disband it, and endorsed its mission. I have not talked to Dr. Hess during the last couple of months, but I understand that he has some reorganization ideas in mind for strengthening that lab's mission, which seems to make a lot of sense.

This committee, as you know, has been very concerned about overlapping responsibilities, and about who is responsible for what. One of the major concerns that we have had relates to air pollution, the role that NOAA has in that, the role EPA has in that, how NASA is being involved and how other agencies are involved as well. Do you find, now that you have been at NOAA for a while, that you have the capability, the time, and that you and others feel a responsibility to coordinate with other agencies? Is there any kind of mechanism that ought to be developed to foster coordination?

Mr. FRANK. There may be two kinds of air pollution we should talk about.

If we are talking about something like the CO_2 problem, we will have better coordination through the new National Climate Office and NOAA will be responsible for that. We would also be able to assure that there is no redundancy, and that there are no gaps.

If we are talking about air pollution at lower levels, then I suppose we have to divide that into several areas. For example, the National Weather Service is responsible for weather forecasts to support air pollution alerts, and Dr. Hallgren could speak to that subject.

If we are talking about research in connection with air pollution, we work with EPA.

In this area there is an involvement of several agencies, and I think everyone, especially those of us in the Government, recognizes that there could be better coordination.

I would be happy to respond to your question in a specific area, if you would like to refine it.

Mr. WIRTH. Let me talk about the missions of the agencies in atmospheric research. I assume NSF is sponsoring a good deal of research in this area, that EPA is sponsoring research in that area, and that you are not only doing a lot of research in-house, but you are probably contracting a good deal of research. What kind of mechanism should be developed, to make sure that we are not inventing the wheel in three or four different agencies?

Mr. FRANK. I think the new National Climate Office will be doing that kind of coordination.

Let me ask Dr. Benton if he could amplify on that response.

Dr. BENTON. I think, Mr. Wirth, there is rather close coordination between the National Science Foundation, for example, and NOAA. We discuss these kinds of problems with our colleagues in NSF quite frequently. Their mission is, of course, somewhat different from ours. The National Science Foundation supports basic research in the academic community, for example, and our research tends to be much more mission-oriented. This does not mean it is not related to fundamental

questions in science, but it does mean that we try to focus on problems where the solutions can have particular value to the missions for which we are responsible.

There are a number of coordinating groups within the executive branch which are helpful. For example, there is a Federal Committee on Meteorological Services and Research, of which I am now the chairman.

There is a Federal Coordinator for Meteorological Services and Research. Dr. Hallgren has just recently been appointed to that role.

There is an interagency committee on meterological research, which includes the National Science Foundation, NASA, the Department of Agriculture, and the Department of Transportation. This committee is a useful vehicle for attempting to focus on interagency problems.

In addition to this, however, we have a number of bilateral arrangements with other agencies to treat coordination of specific problems that pertain to more narrow areas.

Mr. WIRTH. We have talked a number of times on this subcommittee about the management problems, the public administration problem, that we are in the business of trying to figure out. These are very thorny problems related to the management of very complex institutions which address very complex problems. Your job is to take care of the research end; our job is to try to make sure that each agency: NASA, NSF, NOAA, has a definable role. While it is part of your responsibility to make sure that your agency has momentum, and as much funding as possible. it is not necessarily in your interest to coordinate with NSF and NASA. Is that the nature of the beast?

Dr. BENTON. I would in general disagree. I do not mean to imply there are never issues where two agencies may disagree, but different agencies can be more effective, can use their resources to better advantage, can perform their missions better, and generally speaking have a more satisfactory program if unnecessary duplication is avoided.

I can give one example, where our cooperation has worked very well. We have a bilateral arrangement with the Geological Survey. A rather large committee of representatives from NOAA and the Geological Survey meet regularly to discuss matters that are in the border area between the responsibilities of the two agencies, and we find this to be an extremely useful mechanism in furthering our programs by cooperation.

Mr. WIRTH. Presumably, one of the solutions to this is to provide an agency with a lead role, a responsibility you have in several areas. I know you cannot comment on that.

Dr. BENTON. No; that is correct. I think it is quite helpful to have lead roles clearly established. However well you do this, in a policy sense, there will aways be border-line areas between two functions which will require clarification. It is far better for the agencies to cooperate rather than to be at war with each other.

Mr. WIRTH. I would like, Mr. Chairman, to follow up one more step. I was struck by the report done by the National Academy of Sciences on the various NOAA atmospheric R. & D. laboratories. I am sure you are familiar with that report, since you were chairman of the Committee on Atmospheric Sciences at the time. Should we be doing

more to encourage outside groups like the National Academy to be working with you, NASA, NSF, on this kind of problem? I am troubled by the mechanisms which we have. We do not have the technical capability and time to routinely look at the problem in the kind of depth that is necessary. Therefore, how do we assure that the public treasury is being protected through development of the most effective atmospheric research program that we can achieve?

The lead agency concept is one vehicle for that. What other vehicles are available for attempting to develop a closer coordination or better directed programs?

Dr. BENTON. Well, I think that your example is an excellent one.

The National Academy of Sciences has been extremely helpful to NOAA, and to the Federal Government, in reviewing programs, in pointing out inadequacies, and in suggesting directions in which programs might go.

The particular report to which you refer was one that was prepared by the Committee on Atmospheric Sciences of the National Academy. At the time, I was chairman of the committee; that was before I joined NOAA. I am very well aware of its contents. I spent a very long day with NOAA officials when Dr. White was Administrator, reviewing the contents of the report, and bringing to his attention some of the things which we as members of the Committee on Atmospheric Sciences felt should be known to NOAA.

None of us operate in an ideal manner. I am certain, for a whole variety of reasons, that our research programs can be improved. We strive to do so, and I think the involvement of groups such as the National Academy of Sciences is a very important part of the total process.

Dr. HALLGREN. I might add that the Global Atmospheric Research Program (GARP) is a good example of extensive cooperation with the agencies and with the involvement of the National Academy of Sciences.

Many of you may recall that there have been a number of major experiments carried out in the last 8 or 9 years, starting with the Barbados oceanographic meteorological experiment in 1959, followed by others in the international field, such as the one for the Great Lakes, and the upcoming Global Weather Experiment, which will start very shortly.

If you trace through this particular type of activity, you will see that the National Academy of Sciences made a great contribution in assisting all of the Federal agencies in formulating the scientific plans for these experiments. Based on these comprehensive scientific plans, the agencies get together and marshall much of their resources in unison against these plans. By doing so, an experiment can be carried out that is far greater than any one agency ever could have carried out. NOAA has been the lead agency throughout this. This is the second time I have been coordinator. It started when I was originally Federal coordinator back in the late sixties and early seventies, and we have had excellent cooperation in mustering the types of efforts that are required for this type of research, which must be done on a very large scale if you are ever to get meaningful answers to the scientific questions being posed.

Mr. WIRTH. Thank you, Mr. Chairman.

I will close by saying to all present that you have a very impressive sense of being in control of the newly developed agency that has been all over the block, and that is nice to see. I hope you will let us know when this committee can be of assistance to you, whether formally or informally, in terms of bringing greater order out of what I think are diverse projects and programs.

I appreciate your testimony.

Thank you, Mr. Chairman.

Mr. BROWN. Mr. Walker?

Mr. WALKER. Mr. Frank, I note that on page 1 of your testimony, you state that NOAA operates under or is affected by over 100 different statutes. Is it your intention to indicate to this subcommittee that NOAA can operate more effectively through over 100 different statutes than under a single statute that is specifically designed to give NOAA congressional direction?

Mr. FRANK. I suppose it is much easier from a logistic point of view to have it all in one place, and that is a conceivable benefit of something like an Organic Act.

There may be certain disabilities also. Most agencies have more than one statute, and so you do have to look in various places of the United States Code to find out where your authority is and to find the programs.

There happens to be a large number of statutes for NOAA, and they are diverse. I think there would be some benefit to combining some of those programs and some of the laws.

Mr. WALKER. Realizing that NOAA stands for the National Oceanic and Atmospheric Administration, it appears to me that the legislation before this subcommittee tends to place a far greater emphasis on oceans and ocean policy than it does on atmosphere and general science.

Would you care to comment on that view?

Mr. FRANK. I would prefer not to comment on the specific legislation, because we have not had an opportunity to look at it. As I mentioned earlier, we think it is somewhat premature to do so.

If this subject were to come up again at some point, whether in the context of Government reorganization, or an Organic Act, it seems to me a balanced proposal, whatever it is, would be called for. We want to have well balanced oceanic and atmospheric programs, whatever our mandate is.

Mr. WALKER. On page 11 of your testimony, you indicate that prior to the reorganization, NOAA lacked a long-range planning capability designed to coordinate NOAA policy with other agencies and Congress. This committee in a number of instances has included sections within legislation mandating institutional arrangements which enhance such long-range planning and coordination among and between the agencies of Government. Would you agree that having such a clause in NOAA's organic legislation would, in fact, do much to resolve this problem and not leave you dependent on the good will of other administrators to achieve coordination?

Mr. FRANK. I guess you are asking the same question that was asked of GAO a minute ago, and that is whether a congressional mandate for coordination helps. I think the answer given by the GAO is quite right.

One way coordination can come about is simply through through the agencies involved agreeing to coordinate. We do that with NASA, USGS, and FAA.

Another way is for Congress to require it. There is a greater degree of certainty if Congress requires something to be done.

Mr. WALKER. You mentioned that you had resolved some of the coordination problems with the FAA. What about in the agricultural services? I understand that there have been ongoing difficulties with regard to the Department of Agriculture, and its jurisdiction. Would some kind of congressional mandate in that area, for instance, be helpful to you?

Mr. FRANK. I think a definition of the issue, and a definition of what we ought to be doing, and by we, I mean the Federal Government, would be useful. I am not sure that it should come from Congress, but we are working towards those definitions in our relationships now with the Department of Agriculture. It is true that we need to provide better services to the Department of Agriculture. We are now more aware of the need to do that. The technology only recently has allowed us to provide some services.

The Secretary of Agriculture, Secretary Bergland, himself has become more aware of the importance of weather. Indeed, I think it is stated that it is the single most critical element in determining whether the crops will be good or bad in any particular year.

We now have the awareness. We are working with the Department of Agriculture. Coordination could come about through that interaction. It could also come about through a mandate from Congress.

Mr. WALKER. I am interested in whether the service ultimately gets down to the individual farmer. If it gets to the Department of Agriculture, you are depending on them to get it to the individual farmer.

Mr. FRANK. Let me call on Dr. Hallgren and let him respond also.

First, we have developed with the Department of Agriculture something called the green thumb box which I think you may be interested in seeing in operation. It is simply a box which can be connected acoustically to the telephone and electrically to the television set for the use of the farmer in getting current weather information.

Eventually it could be sold for as little as $35 or $40. We would propose to provide weather information that would be useful to the farmer through two computers. The farmer could get that information stored in the green thumb box, simply by placing a phone call.

It will all be done automatically after that, and could be selectively recalled and displayed on the television set. The farmer would be able to receive information such as where the frostline is, what the satellite pictures show, what the weather forecast is, and the like. We would feed the information directly into the computer through our NOAA weather lines.

That is an example of how we will be providing more information on a timely basis to farmers. The box was worked out using technology off the shelf. It was worked out by an interplay between the National Weather Service and the Department of Agriculture.

The Department of Agriculture has a better understanding of what the farmer needs, and the National Weather Service has a better understanding of what we can provide.

Dr. HALLGREN. I would like to make a couple of comments.

Of course, there are a number of areas of interaction between the Department of Agriculture and the Department of Commerce, with regard to weather matters.

You mentioned remote sensing and the LACIE project. I would like to focus on a third one, the Agriculture Weather Services, which the gentleman from GAO mentioned.

It is true today that we only have approximately one-third of the Nation covered with agriculture weather service stations, and these are the type of services that go directly down to the farmer. The information is in regard to what they should do on planning operations such as harvesting and spraying.

Mr. WALKER. Excuse me.

Is this the kind of information in the green thumb box which you could provide to the farmer?

Dr. HALLGREN. The green thumb box concept would be a part of an overall program. It would be one of the important mechanisms through which you disseminate the information.

Of course, you have to have those forecasts prepared by the forecasters around the country. We have put together, in full cooperation with the Department of Agriculture, a plan for expanding the weather services across the Nation. Like all specialized weather services, whether they be aviation, marine, air pollution, or agriculture, they require personnel to do the job correctly. We are presently proposing these, and are hopeful in due course that they will be up for your consideration.

Mr. WALKER. Thank you, Mr. Chairman.

I have no more questions.

Mr. BROWN. Mr. Frank, you or perhaps Dr. Hallgren mentioned an example of successful coordination of multiple-agency activity, in fact multinational activity, and you stated that the program was based on a comprehensive scientific plan. As a theoretical matter, I ask if it is not obviously easier to coordinate activities and resources when you are operating in accordance with a generally accepted comprehensive plan, than when you are operating not only with a plan, but also with substantial policy differences in what you are trying to achieve?

Mr. FRANK. The answer is yes.

Mr. BROWN. Specifically in the service area, you have a situation where regardless of the kind of service, the first element in successful coordination would be, it seems to me, agreeing upon the scope and level of services which need to be provided, and then achieving coordination to meet those goals. Perhaps we are not doing as well as we should in approaching that aspect of the problem, particularly when it will involve coordination of not only a number of agency departments, but different levels of government in the private sector.

Mr. FRANK. Again, we could do better. I might say we talk a lot about the distinction between Congress on one hand and the executive branch on the other.

We are all in this together. A lot of good ideas, and a lot of prompting have come from Congress. In other areas, it has come from us. So when the question is asked, "Is it better for Congress to mandate something?" I would say generally that it is perhaps preferable. Not just because there is a legislative mandate, but because an idea can come from your staff, which because of the press of business, or the absence of an individual, would not come from us.

Mr. BROWN. Gentlemen, we are faced with a dilemma, and I will resolve it by asking if we can submit some additional questions to you in writing. We have a number of other questions which we have not had time to explore, but I am anticipating a series of votes in the near future, and I hesitate to delay you unduly because of that. So, if you are willing to assist us by supplying some written answers, we could dispense with any further questions at this time.

Mr. FRANK. We would be happy to, Mr. Chairman.

[See appendix for prepared questions and answers.]

Mr. BROWN. This is the first of a series of hearings on this subject, and on this legislation, and we will possibly be back in touch with you with regard to additional hearings.

Mr. FRANK. Thank you, sir.

Mr. BROWN. The subcommittee will be adjourned subject to the call of the Chair.

[Whereupon, the subcommittee was adjourned at 3:30 p.m.]

NOAA ORGANIC ACT

THURSDAY, JUNE 22, 1978

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON THE ENVIRONMENT AND THE ATMOSPHERE,
Washington, D.C.

The subcommittee met, pursuant to recess, at 2 p.m., in room 2325, Rayburn House Office Building, Hon. George E. Brown, Jr. (chairman) presiding.

Mr. BROWN. The subcommittee will please come to order.

We have three distinguished witnesses this afternoon, and we will try to minimize the imposition on their time by starting approximately on time.

I have a brief opening statement which I would like to read.

This afternoon we hold a second hearing on H.R. 9708, the National Oceanic and Atmospheric Administration (NOAA) Organic Act. The purpose of these hearings is to lay the groundwork for development of a truly comprehensive yet explicit charter for NOAA's activities. Specifically, this subcommittee is concerned that the proposed legislation, as currently written, largely overlooks NOAA's atmospheric and environmental activities.

Therefore, we hope to identify through these hearings which atmospheric and environmental policies and responsibilities need to be considered in the development of a NOAA Organic Act. These needs will be addressed through a revised NOAA Organic Act which balances NOAA's oceanic and atmospheric activities, which will be introduced in the 96th Congress.

In addition, we plan to sponsor a workshop in the fall at which the issues relating to atmospheric research and services raised during these hearings will be reviewed and hopefully resolved. Participants in the workshop will involve members from both user and scientific communities from Federal and State governments and the private sector.

The subcommittee has already heard from NOAA officials, who supported the intent of the bill but recommended that it be postponed until after various Administration ocean policy and reorganization proposals have been made. We also heard from the General Accounting Office, which testified that the need for a strong lead-agency in atmospheric sciences had surfaced in several of its past reports.

Obviously, we are not trying to rush through any legislation in this area, but are engaging in what might be described as a planning and foresight procedure which we hope will better equip the Congress to act intelligently on this legislation, when it has become a little clearer as to what the Administration's posture will be.

Our first witness this afternoon is Dr. Louis J. Battan, member of the National Advisory Committee on Oceans and Atmosphere (NACOA). We are very pleased to have you with us this afternoon, Dr. Battan.

STATEMENT OF DR. LOUIS J. BATTAN, MEMBER, NATIONAL ADVISORY COMMITTEE ON OCEANS AND ATMOSPHERE

Dr. BATTAN. Thank you very much.

At the outset let me say that I would like to acknowledge the assistance of Dr. Abram Bernstein of the NACOA staff, who worked with me on the preparation of the statement which your staff has.

With your permission, I would like to not read the whole thing, but read parts of it as I go through.

Mr. BROWN. Without objection, the full text of the statement will be included in the record, and you may abbreviate it in whatever way you wish, Dr. Battan.

Dr. BATTAN. Thank you.

Mr. Chairman, I am Louis J. Battan, director of the Institute of Atmospheric Physics at the University of Arizona. I have served in the past as president of the American Meteorological Society, and as Chairman of the Committee on Atmospheric Sciences of the National Academy of Sciences. I am a member of the National Advisory Committee on Oceans and Atmosphere, and it is in that capacity that I appear before you today to offer some thoughts concerning H.R. 9708.

We are pleased to have this opportunity to offer our views on this bill. NACOA believes that every effort should be made to centralize nondefense oceanic and atmospheric activities of the Federal Government within a single organization. As part of its basic mission, the centralized agency should be charged with a wide spectrum of responsibilities involving research and services.

On April 17, 1978, Mr. Marne A. Dubs, on behalf of NACOA, discussed H.R. 9708 before the Subcommittee on Oceanography of the Committee on Merchant Marine and Fisheries. He reaffirmed the position stated in the preceding paragraph. At the same time, he noted that NACOA is in the process of studying the question of specific organizational arrangements. NACOA expects to conclude its considerations in October or November of this year, and will present its findings to the Administration and the Congress.

NACOA feels that the passage of an Organic Act for NOAA, such as H.R. 9708, is a step that will strengthen NOAA by bringing together the basic and routine authorities under which it is operating. Among other consequences of such an action would be the requirement for periodic authorization hearings for NOAA. This would offer NOAA and the Congress the opportunity to explore in detail whether the oceanic and atmospheric interests of the Nation are being adequately handled.

Since Mr. Dubs, in his testimony before the Subcommittee on Oceanography, has already given NACOA's view about the needs for a national ocean policy and about the oceanic responsibilities of NOAA, I will concentrate on the atmospheric responsibilities.

As you know, various Federal agencies have important responsibilities which involve weather and climate, particularly as they impact

on their specific missions. For examples, one could cite the Department of Agriculture, the Department of Energy, EPA, FAA, and so forth.

NOAA's unique meteorological functions are threefold. It collects weather and climate data by operating a system of networks, of weather stations and satellites, and performs computerized analyses on the data, makes forecasts, and issues forecasts and severe weather warnings; it maintains archives and information centers for weather and climate data; and it conducts research to improve the above activities. As an outgrowth of all this, it provides interpretations and other forms of technical assistance needed by other agencies in the performance of their missions.

The Federal Government also has a program of scientific research and related services involving the upper atmosphere and the planetary and space environment. These matters do not ordinarily demand our attention the way weather and climate do; however, concerns in recent years about the effect on the ozone layer of engine emissions from supersonic aircraft operating in the stratosphere, and of fluorocarbons used as aerosol spray propellants, may serve to remind us of the importance of understanding these matters better than we do now. The upper atmosphere responsibilities of the Federal Government are today handled primarily by the National Science Foundation, the Air Force, and NASA, with NOAA playing a lesser but important role.

The Federal Government has other significant atmospheric responsibilities apart from weather and climate. The promotion and regulation of aviation and air safety to meet our Nation's transportation needs is one example. Minimizing air pollution to protect our health is another. Providing insurance, loans, and financial relief to individuals, businesses, and communities beset by weather disasters such as floods and severe storms is another. Weather enters into each of these, but in a peripheral way, and is not the major concern of the responsible agency.

The FAA is primarily concerned with air traffic control, air safety technology, airport development, and pilot training; EPA is primarily concerned with the development of technology to reduce emissions of hazardous substances; the Defense Civil Preparedness Administration, Federal Disaster Assistance Administration, Federal Insurance Administration, and Small Business Administration are concerned with community planning and economic programs.

The present Federal organization does not seek to bring all these "atmosphere-related" programs into a single agency, nor do we think that is necessary. We believe aviation is most properly dealt with in the broader context of transportation, air pollution in the broader context of overall environmental protection, and waste disposal management, relief for flood and storm victims and community preparedness for weather disasters in the broader context of community and business development and economic assistance. More important than the principle, however, is the fact that there are no problems associated with the assignment of these responsibilities to different agencies.

There is no parallel to the situation that confronts us in ocean affairs where different activities—fishing, shipping, oil and mineral development, power production, recreation—compete for use of the same piece

of ocean space, and decisions made in connection with one such activity affect others. We need a coherent ocean policy to guide the Federal decisionmakers, and we need a coherent ocean organization to appropriately link authority to responsibility.

Mr. Chairman, I would ask that the last sentence on page 5 of my prepared statement be deleted.

Mr. BROWN. Without objection, the last sentence on page 5 will be deleted.

Dr. BATTAN. Thank you.

Let me return, then, to the prime atmospheric responsibility that is, and should be, NOAA's: the responsibility for providing those weather and climate operations and services, and the research, necessary to keep them at the forefront of our technological and scientific capability, which are the backbone upon which the bulk of the weather and climate activities of the Federal Government depend.

This mission is important and essential in its own right, quite apart from NOAA's responsibilities in ocean affairs. And here, Mr. Chairman, I come to an important distinction which has perhaps not been adequately made before.

On the one hand, the oceans and the atmosphere are indelibly linked. Both are fluid systems overlying the solid Earth. Their behavior is governed by the same physical laws. They both manifest motions over a wide spectrum of scales which, overall, play essential roles in determining climate, weather, and consequently the distribution of life forms from wheat to fish throughout our world. The two interact with each other to a significant degree. It is simply not possible to understand the behavior of one without understanding the other.

On the other hand, the missions of the Federal Government regarding, say, fish, or marine minerals, and those concerned with weather and climate, are separate and distinct. Each is important in its own right, quite separate and apart from the other. And while NACOA believes it makes sense, from the point of view of how best to get the work done, for the bulk of our oceanic and our weather and climate programs to be housed within the same agency, we believe that the mission statements should be separate and distinct, with each set forth in terms appropriate to it and determined by its fundamental importance.

DEFINING NOAA'S MISSIONS

To do this, I suggest that title I of H.R. 9708 be retitled "Declaration of a National Policy for the Oceans and the Atmosphere," and that section 101, which is concerned with the oceans, be retitled "Declaration of Ocean Policy." This section sets forth the reasons why the oceans are important to us, the objectives that should underly the oceanic and coastal programs of the Federal Government, and the purposes of the act, one of which is "to designate (NOAA) as the lead civilian agency with responsibility for coordinating and carrying out national ocean policy in order to improve the understanding, assessment, development, utilization, conservation, and protection of ocean and coastal resources."

I would then suggest insertion of a new section 102—renumbering the present section 102, which offers definitions, as section 103—which might be titled "Declaration of Policy on Weather and Climate" and which would contain statements of the following sort:

(a) Findings:
(1) Weather, climate, and the processes of the upper atmosphere are important to the United States and the world because of their impact on health, agriculture, industry, and the economy; the extent to which they affect transportation, communication, air pollution, and energy demand; the potential loss of life and destruction of property associated with severe storms and floods; and the role of weather and climate in national security.
(2) An understanding of weather, climate, and the state of the upper atmosphere, an ability to predict weather and climate at a future time, and an ability to modify weather and climate, could satisfy many human needs and contribute to national and international aspirations.
(3) The weather, climate, and upper atmosphere activities, programs, and functions of the Federal Government should be conducted so as to contribute materially to the following objectives:
(A) The preparation and issuing of weather and climate forecasts, and of warnings of severe storms, floods, and weather hazardous to transportation, for use by the general public and by Federal, State, and local governments and by industry.
(B) The prevention, control, and reduction of air pollution.
(C) The development of long-range plans for agriculture, energy, transportation, and so forth, incorporating knowledge of the likelihood of weather and climate events, and incorporating the capability for modifying weather and climate.
(D) * * *.

Paragraphs (D) through (K) would parallel their oceanic counterparts in section 101, except that paragraph (E) would include mention of the development of community preparedness plans for responding to weather disasters, and would also speak of cooperation with the private sector to insure as good a match as possible between the Nation's weather and climate capabilities—both Government and private—and the Nation's weather and climate needs. I shall return to these two subjects a little later.

Among the purposes of the act would then be "to designate NOAA as the lead civilian agency with responsibility for carrying out national weather and climate policy in order to improve the understanding, prediction, and modification of weather and climate, and the application of weather and climate information to agriculture, industry, and other sectors of the economy."

Insertion of language into H.R. 9708 along these lines will provide an essential element which is now missing and which must be there if NOAA's missions are to be adequately set forth.

Let me turn now to the activities which NOAA is responsible for now, and for which it must continue to be responsible if it is to carry out the weather and climate mission I have outlined.

NOAA must collect weather and climate observations. It must develop and maintain a data management system. It must prepare weather and climate forecasts and it must disseminate them, along with other weather and climate information. It must conduct research to enable it to continually improve the skill with which it does these things. And it must interact with other Federal agencies that need its services or that can provide it with information it needs to do its job.

I will touch only lightly on observations and data management, and then go into more detail on services and research.

Collecting observations involves operating and maintaining networks of surface and upper air sounding stations. It also involves

satellites, river gages, and radars—both conventional and doppler. It involves observations from buoys and ships at sea and from airplanes in flight. It involves both routine observations and special observations for special purposes, such as aircraft reconnaissance of hurricanes. And it involves getting comparable data from other nations of the world and sharing our data with them.

NASA, the Geological Survey, the FAA, the Coast Guard, and the military services cooperate with NOAA in this task. On the international side, NOAA works with the State Department and with other nations through the World Meteorological Organization, a U.N. agency.

Generally speaking, the observational activities are in good shape. New technology does not always get incorporated into the system as rapidly as it should, and in some locations there are simply not enough observing stations. These problems are due primarily to inadequate resources, rather than to organizational structure or to lack of adequate statutory authority.

Data management means getting data of the right quality to the right place at the right time and in the right form. It involves quality control, archiving, and retrieval, and conversion of basic data into useful information. This must be done on a real-time basis for use in day-to-day operations, and also on a longer time basis for subsequent use in research and in provision of climatological information.

Here too, what problems there are relate to resources—funds and technology—rather than statutory authority or organizational arrangements.

Preparing and issuing weather and climate forecasts and warnings and other related information is, of course, the ultimate purpose of all of these activities, and I would like to go into this in a little more detail.

Weather and Climate Services

Let me say at the outset that in this area I see two serious issues which do, perhaps, require statutory clarification. These are:

(1) How far should NOAA's public service responsibilities go? Should NOAA be responsible only for issuing forecasts and warnings, or should it also have responsibility for educating the public on matters of safety preparedness in the event of tornadoes, hurricanes, and other life-threatening storms? Should it participate actively in the development of community disaster preparedness plans? Should it participate in setting limits to development in regions which are prone to weather disasters, such as hurricanes along the coast and flash floods in certain inland regions?

(2) How should NOAA interact with private businesses offering weather and climate services? Where should the Government service end and private enterprise take over?

The significance of these questions will become clear as I proceed.

TYPES OF WEATHER AND CLIMATE SERVICES

One can think of weather and climate services as falling into three basically different categories: disaster warnings, economic benefit services, and convenience services.

Disaster warnings are typified by forecasts and advisories of impending hurricanes, tornadoes, flash floods, and other life-threatening weather events, and also of droughts and other longer term climatic disasters. I believe that everyone would agree that the Federal Government should give a high priority to this type of service. An appropriate system of weather observations, prediction, warning, and public education can save lives and, in many cases, can reduce property damage.

What is not so clearly agreed to is just how far the Federal responsibility should go. Should it extend, for example, to the development of community disaster preparedness plans, or to regulations affecting development in hazard-prone areas such as coastal regions subject to hurricanes and inland regions subject to flash floods? These are both emerging issues, and it is not clear just what the limits of NOAA's responsibilities in these areas are today, or what they should be.

The familiar public forecasts are examples of convenience services. They tell us whether to take an umbrella to work or to cancel plans for tomorrow's picnic or ball game. These services probably belong at the low end of the priority spectrum. It certainly is important that the predictions be accurate and timely, but the benefits of success and the costs of failures tend to be relatively small.

Economic benefit services are those used in the production and distribution of goods and services. The following list gives a number of prominent examples of activities where dependable climatological studies, reliable up-to-date weather observations, and accurate weather predictions can be very valuable: These include aviation, commercial and private, agriculture, smoke-stack industries, construction, marine operations, ground and waterway transportation, oil, gas, coal and electric companies, municipalities, and commodity exchanges.

The actual operations which must be undertaken to produce the three kinds of services mentioned above are not very different from each other. For all three, there must be an observing network, a data analysis and forecasting activity, and a means of dissemination. Apparently for this reason, our national weather service system has, in the past, given almost equal attention to all three categories.

Let me say a word at this point about climate. Climate refers to the aggregate of weather conditions prevailing over a portion of the Earth for an extended period of time. The significant difference between weather and climate services lies not in the technical nature of the service, but in the use that is made of it. Weather information is needed for day-to-day operations, climate information for long-term planning. Our ability to predict climate is virtually nil. The term "predict," as used in this context, means the ability to predict the climate with a skill superior to what one might achieve strictly on the basis of climatological statistics. Let me illustrate this point with an example. Consider predicting rain for the city of Los Angeles. If each day for July and August for the years 2000 to 2010, you predict "no rain," you can be correct 99 percent of the time.

Climatologically, we know it only rains 1 out of 100 days in July and August in Los Angeles. Unfortunately, an accuracy of 99 percent of predicting rain in Los Angeles is worthless. Any idiot can do that well. The skill resides in predicting the 1 out of 100 days when it does rain. When we use the word predict in the context of this statement we mean an ability to predict with greater skill than could be done by means of strictly climatological techniques.

Predictions on the basis of climatology are extremely useful and need to be made, but one would like to do better.

Our ability to predict climate is virtually nil, and our capability for incorporating that climatic information which we have today into long-term planning is far less developed than our capability for incorporating weather information into daily operations. Legislation to establish a national climate program—legislation which was developed largely by this subcommittee, and on which NACOA has already commented extensively—is now in conference and, I hope, will shortly become law. One of the major elements of this new program should be the development of techniques for incorporating climatic knowledge into long-term planning for agriculture, energy, air pollution control, and so forth to a greater extent than we do today.

THE PRIVATE SECTOR

Over the last 30 years there has been a slow but steady growth in the number of private consulting meteorologists and privately owned companies rendering a wide spectrum of weather and climate services. The professional directory in the March 1978 Bulletin of the American Meteorological Society contains 78 advertisements for private individuals and companies providing such services.

As in any business, the quality of the private services is highly variable, depending mostly on the competence and integrity of the individuals involved and the type of service offered. In order to encourage high standards among private consulting meteorologists, the American Meteorological Society has a program of certification. Individuals who have had adequate training and experience and who pass a written and oral examination are designated certified consulting meteorologists.

Private meteorologists have prospered largely by providing specially tailored services to industrial, commercial, and municipal clients. Many cities and industries concerned with the effects of snow on motor vehicle transportation have purchased snow forecasts. Gas and electric companies concerned with power needs on cold, windy days, ski lodges concerned about snow cover, offshore oil drillers concerned with winds and waves, commodity dealers and traders concerned about the effects of future weather on future prices, and agriculturists concerned about water availability all have found private weather and climate services of value.

Many large companies have meteorologists on their staffs. The "smoke-stack companies"—that is, those that discharge waste products into the atmosphere from tall stacks in a controlled manner depending on air pollution potential—employ their own meteorologists. Certain television stations seeking to give their viewers specialized weather services have full-time meteorologists and well-equipped weather stations of their own.

One could cite many more examples of the role of private meterologists in supplying high quality weather services to customers willing to pay for it.

Not too many years ago the U.S. Weather Bureau regarded itself as the only authorized supplier of weather forecasts to the public. When there were very few private meteorologists offering their services to the public or to industry, this view was seldom disputed.

In the late forties and fifties private meteorologists were tolerated rather than encouraged by the Federal Government. Nevertheless, over the last three decades there has been substantial growth of private weather service companies in the United States.

Over the last decade the Weather Service has been encouraging the growth of private practice. For the most part, it is conducted by relatively small organizations which supply specialized services to industries or municipalities. By concentrating on the specific needs of their clients and by offering services not available from the National Weather Service, certain private companies have been quite successful.

Over the last few years NOAA's National Weather Service (NWS) has not been permitted to grow in size and capability to meet the growing weather service demands of this country. We believe that it would be in the national interest to strengthen NWS. At the same time, it is clear that an increasing part of the Nation's weather service needs will have to be met by private meteorologists. This is particularly true in the case of weather and climate services in the category I have called economic benefit services.

What is needed is a definition of the respective roles of Government and private meterologists. The division of responsibilities would be expected to differ depending on the types of service offered. Let me illustrate this by considering, separately, disaster warnings and economic benefit services.

DISASTER WARNINGS

It seems clear that the Federal Government has, and should have, the responsibility to observe, predict, and issue advisories of impending violent weather. The Federal Government has been doing this with increasing competence and effectiveness. More still needs to be done in the area of alerting the public about the predicted weather events and enabling the public to respond in a manner that will maximize public safety.

How should we deal with a case in which Federal Government meteorologists and private meteorologists retained by local government or industry reach conflicting prognoses of a possible severe storm event? We do not have an answer at this time.

ECONOMIC BENEFIT SERVICES

NOAA must continue to carry the major responsibility for supplying weather services to government and industry. At the same time, it appears to me that as a matter of policy, private organizations requiring special weather services for their own gain should be encouraged, if not required, to purchase these in the private market.

It seems clear that a new partnership has to be forged between the Government weather service and private meteorologists. The various parties involved, including NOAA, the private meteorologists, and their industrial, commercial, and municipal clients, must work together to establish a formula which will maximize the effectiveness of weather service for all concerned.

A great deal needs to be learned about public understanding and appreciation of weather forecasts and their meanings. To a large

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extent, existing practices for disseminating weather forecasts and advisories have been developed within the Government without adequate testing. For example, there is still considerable misunderstanding of the use of probability forecasts. How many people know what is meant by the statement, "The probability of rain today is 20 percent?" Moreover, the meanings of terms such as "tornado watch" and "tornado warning" are not clear to many people. Which one means that a tornado may occur, and which one means a funnel has been sighted and may be headed towards you?

Even when the terms are properly understood, it is not certain that an appropriate response will follow. For example, if the NWS issues a series of forecasts advising of the approach of a hurricane along the gulf coast, will the public understand the nature of the threat and the need to take appropriate actions, such as evacuation, on time?

The point I am trying to make is that it is necessary to devote more attention to the best ways to communicate with the clients—in most cases the public. This requires that meteorologists, educators, psychologists, sociologists, and the public interact. It requires testing, market analysis if you like, of new ways and new words.

WEATHER SERVICES AND THE MEDIA

Virtually every daily newspaper, radio station, and television station in the United States gives weather forecasts.

To this extent they do a great national service. If we had to pay for the information services that are granted by the media, it would cost probably more than it does to make the weather forecasts.

Some weathercasts are comprehensive, up to date and as reliable as the state of the art permits. Some are none of these. Some broadcast stations hire competent meteorologists, who have earned the Seal of Approval of the American Meteorological Society. Some stations employ people who know nothing about meteorology and seem to care less. Meteorologists and broadcasters need to develop a greater understanding of how to better serve the public.

Let me now turn to the subject of weather and climate research. A major share of our Nation's fundamental or basic research in the atmospheric sciences is conducted in universities and in research organizations such as the National Center for Atmospheric Research in Boulder. Much of this work is sponsored by the National Science Foundation, but other Government agencies—notably NASA, and to a lesser extent the Air Force and NOAA—also supply funds because of the possible applications of the research.

Within NOAA, considerable meteorological research is carried out ranging from the very fundamental to the highly applied. It is widely believed that there is too little interaction between researchers and operational weather groups. As a result, new techniques, particularly observational techniques, are brought into operational use at too slow a rate.

Let me illustrate this by referring to a proposal which is now developing within NOAA under the acronym PROFS, standing for "prototype regional observing and forecasting service." The PROFS concept emerged from one of NOAA's research laboratories which has been developing remote sensing technology and which saw in its products

a possible means for providing some sorely needed improvements in local weather services. PROFS would bring together research scientists and operational meteorologists in the solution of an important practical problem. However, it is not clear whether NOAA, with its limited resources, will be able to provide the personnel and funds needed to bring this concept to the point of operational testing.

Mr. Chairman, this illustrates the general problem that transfer of research findings into practical applications is too slow. The problem does not lie in a lack of statutory authority or in the quality of the research.

Right now there is a gap between the point where the researchers say they have new technologies and techniques to apply and the point where the operational people are ready to put them to an operational test. Neither group is willing to devote their scarce resources to a project at this stage. Funds and personnel resources need to be earmarked for this purpose.

Thus far I have been speaking about research in general terms, but with research relating to weather forecasting primarily in mind. I want to mention, briefly, three other research areas in which NOAA should have a major responsibility—climate, weather modification, and air pollution.

I have already referred to the legislation to establish a national climate program, which is now in conference. If NOAA is to have the mission of providing the nucleus of the Federal Government's civil weather and climate activities, then NOAA must play a major role in this new program of climatic research and services. Since the bill is in conference, I will say no more about it at this point.

Recommendations concerning weather modification—a subject on which NACOA has commented frequently in the past—are now being developed by the Weather Modification Advisory Board, which is scheduled to deliver its report to the Secretary of Commerce next month. I shall not comment further at this time except to say that this is another area in which NOAA must play a significant role.

Air pollution is primarily an industrial and technological problem having to do with the invention of ways to dispose of waste products without dirtying the air and is a responsibility of the Environmental Protection Agency. However, in order to know how much pollution the atmosphere can tolerate without becoming unacceptably contaminated, it is essential to know how winds and turbulence mix and disperse material injected into the air. Weather information is essential to do this, and NOAA must play a major role—as it does now—in addressing this problem.

I could name other areas—agriculture and aviation, for example—in which weather and climate have major impacts. While NOAA does not and should not have primary responsibility for these areas in the broad sense, it must be able to provide the weather-related information needed by the agencies that do have the responsibility. This in turn means it must collect the observations and conduct the research which it (NOAA) will need to properly do its job.

This leads me to one more area which may require statutory clarification: NOAA's responsibility for providing weather and climate services needed by other Federal agencies for their own missions. NOAA

has this responsibility today, as indeed it must if it is to provide the nucleus of weather and climate services. But there are no adequate provisions to insure that NOAA will have, or be able to get, the resources—the funds, and the personnel—that it must have if it is to carry out this responsibility. Some statutory clarification of this situation seems to be called for.

SUMMATION

In summation, Mr. Chairman, I have identified four areas involving weather and climate which I believe an NOAA Organic Act should explicitly address. These are:

1. An explicit statement of NOAA's weather and climate mission;
2. Specification of how far NOAA's responsibilities should go in the direction of insuring appropriate response by the public to the forecasts and warnings it issues, and to information it provides about the likelihood of weather disasters in certain locations;
3. Specification of the respective roles of NOAA and of private enterprises offering weather and climate services; and
4. Identification of NOAA's responsibility to provide weather and climate services to other Federal agencies, and provision for obtaining the resources needed to do so.

I realize, Mr. Chairman, that except for the first of these I have not told you just what the act should say. There are some difficult questions involved, and we on NACOA are addressing them and hope to be able to deliver our recommendations to you later this year, in time for consideration of such legislation during the next session of the Congress.

There is little further that I can say. I am sorry it took me so long to read this.

Mr. BROWN. We appreciate your recommendations; they are specific and to the point, and while they do not solve all of the problems, they at least clarify them considerably.

I do not think that there would be any disagreement on the part of the committee with regard to the first point you make about the need for an explicit statement on NOAA's weather and climate mission as a parallel to the ocean statement. The areas which become cloudy involve the areas of interface, the linkage areas that you have indicated. How do we clarify these linkages between oceans and atmosphere programs in NOAA, and between NOAA and other agencies which are engaged in some aspects of the oceans or the atmosphere? We would hope we can develop further answers to this point as we go along.

I was rather intrigued by your discussion of the relationship between NOAA and the private meteorological sector. I frankly confess I am not nearly as expert in this as some of our colleagues such as Congressman Milford, who is much more familiar with these things than I am.

Do I take it that the private meteorologist serves primarily as the linkage between certain services produced in NOAA and a particular client group?

Dr. BATTAN. That is right.

Mr. BROWN. They do not produce data independently?

Dr. BATTAN. Virtually none.

Most private meteorologists have their own equipment tied into the National Weather Service teletype and facsimile network.

They get, from the National Weather Service, the same data at the same time, as do the National Weather Service offices around the country. The private meteorologists use that data to make specialized forecasts. One well known group, for many years, made snow forecasts for the Chicago Motor Club. This group, one of the oldest private consulting firms, called Murray & Trettel, has been in business for more than 20 years. They have many kinds of clients with special problems. As I mentioned, the Chicago Motor Club wants up-to-the-minute, accurate forecasts of snow. For a number of reasons the National Weather Service does not supply such specialized service. Murray & Trettel know they have a client concerned with snow, and they do not have to worry about the weather at picnics or baseball games. Murray & Trettel have a client who cares only about when the snow starts, and how much will fall, so they can concentrate their talents and attention on this and a limited number of other special problems.

Many private meteorologists have served clients in the utility industries. They like to know, as long in advance as possible, how much gas they have to store for the next weeks. This depends on forecasts of temperatures and wind speeds. If gas and oil companies think it will be mild in the next 2 or 3 days, or week, they can get along with a lower inventory. One private meteorological company thrived for a long time, and probably still does, by predicting wind and wave conditions for offshore oil operations in the Gulf of Mexico. It is very crucial that they know what is coming the next 2 or 3 or 4 days.

I should emphasize that the meteorologists of the National Weather Service are as competent as these people. It is not a matter of competence. It is a matter of specializing on specific problems.

Mr. BROWN. In other words, these private meteorologists have an incentive to do a more detailed job of archiving and possibly analyzing certain kinds of data than the meteorological service would do?

Dr. BATTAN. Not so much the archiving, but the second part of it. It is a matter of using all of the data they can have.

They can concentrate their attention on fewer things, and do a better job for that reason, not because they are smarter than the people working on the National Weather Service.

Mr. BROWN. Let me indicate what I mean by archiving more detailed data. As in the example you gave of snow forecasts for Chicago, they might very well want to have records of the amount of snowfall in each geographical block of the city, for example, which the Weather Service would not be particularly interested in, except in a general sort of way.

Dr. BATTAN. In that sense, you are absolutely right.

My guess is if you are concerned with, let us say, the snow distribution over Chicago, and Chicago has some very peculiar snow problems, you need to know about the local snow climatology. About 25 years ago, I worked for the Weather Bureau in Chicago. We were located in the Museum of Science and Industry, which is right on the lake shore. In the wintertime when the wind blows down the lake and over the shore of Chicago, it sometimes snows only along the lake shore. On one such day the boss was away and I was put in charge of the office. Snowflakes were coming down the size of this coffee cup right at the Museum of Science and Industry, which is about 100 yards from the water. I though the way the snow was com-

ing down, nobody would get home that night unless they left early. I was about to send everyone home, but thought I better check with the forecasters at the Weather Bureau office at Chicago Midway Airport, which is about 7 or 8 miles from the lake shore. I told them that I was considering sending everybody home because of the heavy snow. There already were 3 or 4 inches on the ground.

They said, "Don't send anybody home. It is not snowing here."

In Chicago there is a distinct lake effect. A mile or two from the lake, you can get 3 or 4 inches of snow, while 10 miles inland and there is nothing.

Anyone forecasting snow in Chicago better understand the effect of Lake Michigan on snowfall.

Mr. BROWN. We can generally describe this phenomenon as microweather or microclimate, and there is a point at which it is important to a very specific and maybe small clientele, but not to the general public or to the National Weather Service.

Dr. BATTAN. Yes.

Mr. BROWN. I think it would be the mood of the Congress in terms of policy to encourage the maximum role for the private meteorological services; that is, to establish a policy framework within which they can function as actively as possible. Do you see that as posing any difficulty?

Dr. BATTAN. No, I think it is just a matter of defining the boundaries.

In my statement, I mentioned another area of private meteorology which is somewhat different. There seems to be a growing trend among certain companies to hire their own meteorologists.

In Arizona, the copper smelters have their own staff meteorologists. They have developed a system to maximize copper production while reducing air pollution. Apparently the EPA has some doubts about the efficacy of this system. The essence of the system is to set up a series of sampling points around a smelter and develop a model relating atmospheric conditions to air pollution. The model is used to predict atmospheric pollution potential. The production rate is adjusted to maintain air quality. The smelting companies have their own meteorologists to deal with this specific problem.

I think it is a matter of setting the boundaries on whether a franchise is properly in the realm of private meteorology. It will not be an easy job in some cases.

For example, in the statement, I mentioned that it is clearly the responsibility of the Federal Government to predict violent weather events. But problems arise for example, when a private meteorologist forecasting snow in Chicago, disagrees with the forecast of the Weather Service.

Ten or twenty inches of snow in Chicago is violent weather. The city comes to a grinding halt. One can conceive of a situation where the National Weather Service, looking at the data, predicts 2 inches of snow, while a private meteorological group looking at the same situation predicts 10 or more inches of snow, and supplies the data to the mayor's office. The mayor would reason that he needs to inform and protect the citizenry and picks up the phone and calls the radio stations.

These kinds of situations are possible, and obviously create problems of various kinds.

Mr. BROWN. Well, the problems are at the heart of some of the policy issues you have raised in your statement.

I am inclined to suggest that the National Weather Service should be considered as the generator of weather-related information. Then there is a user community; it could be the mayor, or the ski lodge operators, or anybody else. Then there are links between the generation of the data and the user community, which may be public links, under the responsibility of the Weather Service, or private links. The policy question is when should it be a public link, and when should it be a private link.

Essentially, it would seem to me that the users then have to make the decision on how they will interpret the data, and what actions they will take as a result of it, except when the ultimate user is the public in general, or when the decision involves public health and welfare. Then it is a public responsibility to ensure that that data is used properly.

As you say, these policy boundaries need to be delineated as carefully as possible, or delineated in such a way that they can develop into a logical framework of some sort.

Mr. Walker, do you have any questions?

Mr. WALKER. Just a few. Thank you, Mr. Chairman.

Does some of the private forecasting that you are talking about include the Accu-Weather kind of forecasts done by some radio stations? Is that an example of private forecasting?

Dr. BATTAN. I think it is. There are some stations who make their own forecasts.

I think Accu-Weather is one, but I am not sure about that, but there are some that do that, yes.

Mr. WALKER. My question is really whether the radio stations are using some of the services of private meteorologists.

Are you saying that they use data developed by the National Weather Service?

Dr. BATTAN. Some do. Some have their own weather stations.

With what the Weather Service makes available, I know you have to pay the line charges. I do not think you have to pay the Federal Government for the data.

I can see that sometime in the future it may be necessary to assess charges for weather data which includes the cost of collecting the data as well as the transmission charges. Right now a radio or television station can get hooked into the transmission lines and get the same data that goes in the National Weather Service offices. Some of the radio and television stations, especially the better ones, in Oklahoma, Texas, Florida, New York, Chicago, and some of the bigger cities have their own weather radar sets, and their own observing systems which they use as a supplement, for their own local weather.

Mr. WALKER. They would essentially be providing convenience kinds of forecasts, general kinds of forecasts.

Why would the stations spend considerably more money to go to a private forecaster who is probably evaluating essentially the same data and utilizing the services provided by the National Weather Service?

Dr. BATTAN. There are a number of examples. The stations that have their own radar sets get something they cannot get through the Weather Service.

They have in the studio a radar set, and they put a camera on the scope and show the locations of storms in real time. This is important in a place like Oklahoma, where there are many tornado forecasts. Generally tornadoes are associated with a line of thunderstorms. If a television station has a radar set you can see the line of thunderstorms as it develops and moves. The station meterologist will have various electronic pointers and can say such things as "There is a tornado sighted here and moving this way."

The Weather Service does not supply that type of information.

Mr. WALKER. You are saying they are able to pinpoint tornades better than the Weather Service?

Dr. BATTAN. In violent weather they can pinpoint.

In the PROFS program I mentioned in my statement, the National Weather Service wants to use remote-sensing techniques such as radar and various other services to try to enlarge the scope of these kinds of specific forecasts.

In the case of violent weather, particularly severe thunder storms, tornadoes, and hail storms weather forecasters are confronted with difficult problems. These storms are of the order of a few miles across and extend for many tens of miles. One end of town may be experiencing heavy rain, stormy wind, lightning, and hail while at the other end of town the sun is shining. The weather forecast covering the entire city might have said there was a chance for a tornado.

There exist radar techniques for tracking these severe thunderstorms, but there still are problems in using the other rational information in an effective way to inform the public.

The television stations that have their own radar sets and their own instrument can observe what is happening over a large region and can report that information quickly.

Mr. WALKER. I assume the essential element is communication. Is that what this weather alert system is all about?

Well, you have dwelt in your testimony somewhat on the need for the Weather Service to provide essentially disaster and violent storm warnings; you put a lot of priority on that. Would you put that as a higher priority for the National Weather Service than the convenience kind of forecasting?

Dr. BATTAN. Yes; if proposition 13 were to come to Washington at the moment, I would say, in my own personal view, that the Federal Government's first priority should be on violent weather.

As far as the economic benefit forecast, I would try to get that done as much as possible by the private sector.

Mr. WALKER. What do you think the public would say to that?

Dr. BATTAN. I don't know.

The public is hard to fathom. Taking weather forecasts out of the daily newspaper might be like taking astrology out. A lot of people would be unhappy. The fact is that every newspaper in the country, with maybe one or two exceptions, has that weather forecast in it. Even though people say that the forecasts are often wrong, they want them in the newspaper. How the public would act if the forecasts were not available, I am not sure, but I think the public would be unhappy.

In my scheme of things, the preservation of life and limb is the top priority item. In this country, we have an outstanding Weather Service. There is no question that ours is the best in the world and it does an outstanding job in observing and forecasting violent weather.

It could be better, and in a sense we have been lucky, in terms of violent weather.

We have not had a really first-rate hurricane, for example, hit a coastal, populated area in quite a few years. One of these days we will have one.

Mr. WALKER. Hurricane Agnes hit Pennsylvania pretty hard.

Dr. BATTAN. Yes; but I have in mind a hurricane moving over the ocean toward a coastal city. About 80 or 90 percent of the people killed in hurricanes are killed by the storm surge. As the hurricane approaches land, ocean water piles up and sweeps over coastal low lands. The storm surge can be 10 or 15 feet high or higher.

I think it was in 1969 or 1970 that a hurricane hit Bangladesh, and in 1 day, the number of fatalities was at least a quarter of a million people. Most of them died because of the storm surge. They did not get the warning in time to take evasive action. Some might say it happened because Bangladesh is a backward country. But a hurricane disaster can happen in the United States.

Some day you should hear Dr. Neil Frank talk about what may happen if a severe hurricane were to hit New Orleans or the keys of Florida. Even with the best Weather Service in the world, even knowing a hurricane is coming, even with the best forecast, the fact is that with that kind of weather event, we could still have a major catastrophe. We have not had one of those for a long time, but the odds are that one of these days we will have one. Those are the kinds of things I worry a great deal about, because all we need is one and the cost would be phenomenal.

Mr. WALKER. I guess the question of the subcommittee relates largely to the public's needs. I would tend to agree with you that the public should be given the option of having good weather service to protect life and limb, except that weather disasters are not foremost in their minds. They are more concerned about getting accurate enough weather forecasts to know whether or not to have a barbecue out back or to move it inside, whether there is a good weekend ahead for going to the beach, and that kind of thing. These are the immediate needs for weather forecasts that they have. I wonder, if you questioned them, whether or not they would say, over the long run, that these convenience services are most important, as far as where research and resources should go to get us more accurate weather forecasts. It is one of the frustrations we face here, and I am interested in your view of that.

Dr. BATTAN. I certainly agree with you. I think if the Weather Service stopped doing that, you would get a storm of protests; you would get all kinds of letters.

I think the National Weather Service must seek to improve its forecasts for public convenience. Fortunately, at least in our lifetime, I do not think we will be faced with the unpleasant option of making only this kind or only that kind of weather forecasts.

It seems to me that these so-called convenience forecasts (at least that is the phrase we use for designating them) are the kind of services that have to be available, and it seems to me that it is the kind of job that has to be done by the Federal Government, because it is for the public at large.

Mr. WALKER. One final question. Do we have some new technology on the horizon that you foresee which will give us some real opportu-

nities to quickly expand the accuracy of weather forecasting, or are we going to see some new breakthroughs in the relatively near future?

Dr. BATTAN. I think the advances in the near future in improving weather services, the complex of weather services, will come from the development and application of new technological devices for observation, and essentially data management.

I think we can make much better use, given adequate resources and manpower, of the data we are collecting right now.

I think a lot more could be done in terms of climate services which would benefit to the public. The National Weather Service is aware of many additional services it could render if it had the manpower.

Mr. WALKER. Based on the data base already available?

Dr. BATTAN. Based on the available data base, I would put a high priority on the global climate problem.

The payoffs are not so obvious, but the consequences are so profound, that you have got to learn what is happening to the planet we are living on.

Mr. WALKER. Thank you, Mr. Chairman.

Mr. BROWN. Dr. Battan, are you suggesting in your statement that the National Weather Service should have an operational responsibility for the public response to weather-related disasters, such as the type you mentioned, hurricane storm surge, or any kind of similar weather which threatens the health and safety of large numbers of people?

Dr. BATTAN. I guess I am saying that unless someone comes up with a better way to do it, the direction in which the National Weather Service has been going in the last year or two should not be abandoned.

As you know, the President came out yesterday, or the day before yesterday, with a plan to combine various disaster preparedness organizations. It is not clear where such an organization's responsibilities begin and end.

I do know that as far as the hurricane problem is concerned, the National Weather Service has the responsibility of predicting hurricanes. The National Weather Service has the technical knowledge and competence to specify what are the essential statistics of hurricanes, where they are likely to hit, how strong the winds are likely to be, how high are the waves likely to be. Therefore, for planning purposes NWS meteorologists have the technical knowledge.

Dr. Neil Frank, the head of the National Hurricane Center, has been a missionary for the National Weather Service in getting the States conscious of what has to be done in terms of hurricane safety. It seems to me that whatever system is worked out, the people with the technical and scientific expertise in the National Weather Service, in NOAA or wherever they are ultimately located, have got to play a very major role, not just in making the forecasts, and putting them on the air, but in seeing that forecast is understood, and in seeing that the people down at the city and State level know what the forecast means.

Mr. BROWN. Well, that I understand. It is going to be a very ticklish job to draw the fine line between their operational responsibilities for, say, ordering the evacuation from a coastal area, and their responsibility to transmit accurate data to the disaster agency and to make sure it is understood.

Dr. BATTAN. I might say. Mr. Chairman, that NACOA is discussing this very problem this afternoon to try to arrive at some kind of judgment on what NOAA should do about coastal hazards.

Mr. BROWN. You discussed the PROFS situation, the prototype regional observing and forecasting service. That is strikingly similar to a concern of the committee over some period of time for developing a prototype regional monitoring system for a broader range of purposes. We are proposing to draft some tentative legislation which would move us in that direction.

I gather from your statement that PROFS has suffered from a lack of resources to move it forward?

Dr. BATTAN. Yes.

Mr. BROWN. But not a lack of statutory authority?

Dr. BATTAN. Our understanding is that it is more a lack of resources.

My understanding is that the concept has been bouncing around now for a number of years, within NOAA.

If I may, let me read you a summary of a talk given recently by Gordon Little, who is the Director of the Atmospheric Research Review Workshop.

"In recent years, there has been major progress in observing the atmosphere by satellite and ground-based remote sensors, and by automatic surface weather stations.

"There has been similar, though largely uncoordinated, progress in data processing and display, in mesoscale numerical modelling and prediction, and in color TV display and dissemination.

"This PROFS initiative proposes a 3-year exploratory development program, at a cost of $5.9 million per year, to integrate these advances into the research prototype of a radically new local weather observing and forecasting service, (PROFS—Prototype Regional Observing and Forecasting Service).

"The prototype will be developed under ERL leadership by a joint team of NWS, NESS, and ERL staff, and is designed to provide dramatic improvements in the accuracy, timeliness, scope, and dissemination of the local weather services.

"Such improvements are needed by industries like transportation (especially aviation), agriculture, and construction, and by the general public, especially under conditions of severe storms, tornadoes, flash floods, damaging winds, blizzards, and freezing rains."

The plan is to supply vitally needed weather observations and forecasts for periods of up to 10 or 12 hours and over a region of the order of a mile to a hundred miles.

Mr. BROWN. Did you read the complete statement on that matter, or is there some additional material?

Dr. BATTAN. I just read the summary of a working paper.

I just read the first paragraph. There is a lot of documentation.

Mr. BROWN. We would like to have further documentation for the committee's files.

Dr. BATTAN. Fine.

Mr. BROWN. It does at least parallel the line of thinking of the committee.

Let me ask you one further question. You have suggested, in your summation, that a specification be made of how far NOAA's responsibility should go in the direction of insuring appropriate response by the public to the forecast and warning issue.

I am trying to place this in a framework I am familiar with, such as agricultural extension service, or other outreach programs of Govern-

ment. Basically, it is a problem of assuring the adequate dissemination of scientific data so that the user public will be motivated to take advantage of the data. In the case of agricultural extension, there has been an historic role for the appropriate educational institutions within the community, such as land-grant colleges.

The point I am trying to make is that this kind of outreach program could be integrated into our educational framework in some way to insure a broader, more accurate understanding of weather phenomena.

Could the knowledge of the public about weather services be enhanced by integrating meteorological or weather courses in the school curriculum, or having special responsibilities in some of our educational institutions for this kind of thing?

Dr. BATTAN. Well, the answer is yes.

The question is how do you do it, how do you do it effectively?

As you know, I am in the education business, and I would like to spread the word as much as possible, but there has been I think a large expansion in atmospheric sciences educational activities.

Quite a few years ago, 10 or 12 years ago, the National Science Foundation put a lot of money into its Earth Sciences Curriculum Committee. It developed a textbook, a teaching program, and so on, and if you look at the statistics on the growth of the number of students taking earth science courses in high school, the numbers have grown very impressively over the last 10 or 15 years.

When I went to high school, if you took earth sciences, it meant geology, and you looked at rocks.

In the last 10 years or so, there has been a growth in meteorology training at the high school level. If you examine the available books and learning aids, you find more and more dealing with the weather and the atmosphere.

I think that that area is growing.

Mr. BROWN. Dr. Battan, I have to respond to that rollcall, so I would like to excuse you at this point. I will take a 10-minute recess, and when we come back, we will go on to our next witness, Dr. White, who is waiting patiently behind you. We have not explored all of the ramifications of your testimony, but I hope we can continue to call on you for assistance.

Dr. BATTAN. Thank you.

[Whereupon, the subcommittee was in short recess.]

[The full prepared statement of Dr. Battan follows:]

TESTIMONY OF LOUIS J. BATTAN

Director
Institute of Atmospheric Physics, University of Arizona

and

Member

National Advisory Committee on Oceans and Atmosphere

before the

Subcommittee on the Environment and the Atmosphere
Committee on Science and Technology
U.S. House of Representatives

June 22, 1978

INTRODUCTION

Mr. Chairman, I am Louis J. Battan, Director of the Institute of Atmospheric Physics at the University of Arizona. I have served in the past as President of the American Meteorological Society, and as Chairman of the Committee on Atmospheric Sciences of the National Academy of Sciences. I am a member of the National Advisory Committee on Oceans and Atmosphere, and it is in that capacity that I appear before you today to offer some thoughts concerning H.R. 9708.

We are pleased to have this opportunity to offer our views on this bill. NACOA believes that every effort should be made to centralize non-defense oceanic and atmospheric activities of the Federal Government within a single organization. As part of its basic mission the centralized agency should be charged with a wide spectrum of responsibilities involving research and services.

On April 17, 1978, Mr. Marne A. Dubs, on behalf of NACOA, discussed H.R. 9708 before the Subcommitte on Oceanography of the Committee on Merchant Marine and Fisheries. He reaffirmed the position stated in the preceding paragraph. At the same time, he noted that NACOA is in the process of studying the question of specific organizational arrangements. NACOA expects to conclude its considerations in October or November of this year, and will present its findings to the Administration and the Congress.

NACOA feels that the passage of an organic act for NOAA, such as H.R. 9708, is a step that will strengthen NOAA by bringing together the basic and routine authorities under which it is operating. Among other consequences of such an action would be the requirement for periodic authorization hearings for NOAA. This would offer NOAA and the Congress the opportunity to explore in detail whether the oceanic and atmospheric interest of the Nation are being adequately handled.

Since Mr. Dubs, in his testimony before the Subcommittee on Oceanography, has already given NACOA's view about the needs for a national ocean policy and about the oceanic responsibilities of NOAA, I will concentrate on the atmospheric responsibilities.

ATMOSPHERIC RESPONSIBILITIES OF NOAA AND OF OTHER FEDERAL AGENCIES

NOAA's atmospheric responsibilities lie primarily in the area of weather and climate. NOAA is not the only agency concerned with this subject. The Department of Agriculture is concerned with the impact of weather and climate on crop yields both at home and abroad, and with weather in relation to forest fires. The Department of Energy is concerned

with the impact of weather on energy demand, and also with the impacts that energy production systems can have, through the release of heat and fuel wastes, on weather and climate. The Department of the Interior is interested in the development and use of weather modification techniques to augment precipitation. The Environmental Protection Agency is concerned with weather and climate as they affect air pollution. The Federal Aviation Administration is concerned with weather as it affects aviation safety. The Coast Guard is concerned with weather in relation to safety at sea. The National Science Foundation, as part of its mission to foster basic research in our universities, supports research relating to weather and climate. The National Aeronautics and Space Administration develops systems for sensing weather and climate, on earth and on other planets, from space platforms. And the military services have their own extensive programs to meet their operational weather and climate needs.

There is considerable cooperation between the various agencies. The Air Force cooperates with NOAA in aircraft hurricane reconnaissance, for example, and the Geological Survey cooperates with a network of river gages. There is, in fact, a formal structure of interagency committees at various levels, from policy to operations, which operates under the aegis of the Federal Coordinator for Meteorological Services and Supporting Research, to try to provide a match between the needs and the capabilities of the various agencies.

NOAA's unique contribution to all this is threefold: (1) it collects weather and climate data by operating a national network (actually, a system of networks) of observing stations and a system of weather satellites,

performs computerized analyses on the data, makes forecasts, and issues forecasts and severe weather warnings; (2) it maintains archives and information centers for weather and climate data; (3) it conducts research to improve the above activities. As an outgrowth of all this, it provides interpretations and other forms of technical assistance needed by other agencies in the performance of their missions.

(The Federal Government also has a program of scientific research and related services involving the upper atmosphere and the planetary and space environment. These matters do not ordinarily demand our attention the way weather and climate do; however concerns in recent years about the effect on the ozone layer of engine emissions from supersonic aircraft operating in the stratosphere, and of fluorocarbons used as aerosol spray propellants, may serve to remind us of the importance of understanding these matters better than we do now. The upper atmosphere responsibilities of the Federal Government are today handled primarily by the National Science Foundation, the Air Force, and NASA, with NOAA playing a lesser but important role.)

The Federal Government has other significant atmospheric responsibilities apart from weather and climate. The promotion and regulation of aviation and air safety to meet our Nation's transportation needs is one example. Minimizing air pollution to protect our health is another. Providing insurance, loans, and financial relief to individuals, businesses and communities beset by weather disasters such as floods and severe storms is another. Weather enters into each of these, but in a peripheral way, and is not the major concern of the responsible agency.

The FAA is primarily concerned with air traffic control, air safety technology, airport development, and pilot training; EPA is primarily concerned with the development of technology to reduce emissions of hazardous substances; the Defense Civil Preparedness Administration, Federal Disaster Assistance Administration, Federal Insurance Administration, and Small Business Administration are concerned with community planning and economic programs.

The present Federal organization does not seek to bring all these "atmosphere-related" programs into a single agency, nor do we think that is necessary. We believe aviation is most properly dealt with in the broader context of transportation; air pollution in the broader context of overall environmental protection and waste disposal management; relief for flood and storm victims and community preparedness for weather disasters in the broader context of community and business development and economic assistance. More important than the principle, however, is the fact that there are no problems associated with the assignment of these responsibilities to different agencies. There is no parallel to the situation that confronts us in ocean affairs where different activities -- fishing, shipping, oil and mineral development, power production, recreation -- compete for use of the same piece of ocean space, and decisions made in connection with one such activity affect others. We need a coherent ocean policy to guide the Federal decisionmakers, and we need a coherent ocean organization to appropriately link authority to responsibility.

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Let me return, then, to the prime atmospheric responsibility that is, and should be, NOAA's: the responsibility for providing those weather and climate operations and services, and the research necessary to keep them at the forefront of our technological and scientific capability, which are the backbone upon which the bulk of the weather and climate activities of the Federal Government depend.

This mission is important and essential in its own right, quite apart from NOAA's responsibilities in ocean affairs. And here, Mr. Chairman, I come to an important distinction which has perhaps not been adequately made before.

On the one hand, the oceans and the atmosphere are indelibly linked. Both are fluid systems overlying the solid earth. Their behavior is governed by the same physical laws. They both manifest motions over a wide spectrum of scales which, overall, play essential roles in determining climate, weather, and consequently the distribution of life forms from wheat to fish throughout our world. The two interact with each other to a significant degree. It is simply not possible to understand the behavior of one without understanding the other.

On the other hand, the missions of the Federal Government regarding, say, fish, or marine minerals, and those concerned with weather and climate, are separate and distinct. Each is important in its own right, quite separate and apart from the other. And while NACOA believes it makes sense, from the point of view of how best to get the work done, for the bulk of our oceanic and our weather and climate programs to be housed within the same agency, we believe that the mission statements should be separate

and distinct, with each set forth in terms appropriate to it and determined by its fundamental importance.

DEFINING NOAA'S MISSIONS

To do this, I suggest that Title I of H.R. 9708 be retitled "Declaration of a National Policy for the Oceans and the Atmosphere," and that Sec. 101, which is concerned with the oceans, be retitled "Declaration of Ocean Policy." This section sets forth the reasons why the oceans are important to us, the objectives that should underly the oceanic and coastal programs of the Federal Government, and the purposes of the Act, one of which is "to designate (NOAA) as the lead civilian agency with responsibility for coordinating and carrying out national ocean policy in order to improve the understanding, assessment, development, utilization, conservation, and protection of ocean and coastal resources . . ."

I would then suggest insertion of a new Sec. 102 (renumbering the present Sec. 102, which offers definitions, as Sec. 103) which might be titled "Declaration of Policy on Weather and Climate" and which would contain statements of the following sort:

"(a) Findings

(1) Weather, climate, and the processes of the upper atmosphere are important to the United States and the world because of their impact on health, agriculture, industry, and the economy; the extent to which they affect transportation,

communication, air pollution, and energy demand; the potential loss of life and destruction of property associated with severe storms and floods; and the role of weather and climate in national security.

(2) An understanding of weather, climate , and the state of the upper atmosphere, an ability to predict weather and climate at a future time, and an ability to modify weather and climate, could satisfy many human needs and contribute to national and international aspirations.

(3) The weather, climate, and upper atmosphere activities, programs, and functions of the Federal Government should be conducted so as to contribute materially to the following objectives:

(A) The preparation and issuing of weather and climate forecasts, and of warnings of severe storms, floods, and weather hazardous to transportation, for use by the general public and by Federal, State, and local governments and by industry.

(B) The prevention, control, and reduction of air pollution.

(C) The development of long range plans for agriculture, energy, transportation, etc., incorporating knowledge of the likelihood of weather and climate events, and incorporating the capability for modifying weather and climate.

(D) . . ."

Paragraphs (D) through (K) would parallel their oceanic counterparts in Sec. 101, except that Paragraph (E) would include mention of the development of community preparedness plans for responding to weather disasters, and would also speak of cooperation with the private sector to ensure as good a match as possible between the Nation's weather and climate capabilities--both government and private--and the Nation's weather and climate needs. I shall return to these two subjects a little later.

Among the purposes of the Act would then be "to designate NOAA as the lead civilian agency with responsibility for carrying out national weather and climate policy in order to improve the understanding, prediction, and modification of weather and climate, and the application of weather and climate information to agriculture, industry, and other sectors of the economy."

Insertion of language into H.R. 9708 along these lines will provide an essential element which is now missing and which must be there if NOAA's missions are to be adequately set forth.

NOAA'S ATMOSPHERIC PROGRAMS

Let me turn now to the activities which NOAA is responsible for now, and for which it must continue to be responsible if it is to carry out the weather and climate mission I have outlined.

NOAA must collect weather and climate observations. It must develop and maintain a data management system. It must prepare weather and climate forecasts and it must disseminate them, along with other weather and

climate information. It must conduct research to enable it to continually improve the skill with which it does these things. And it must interact with other Federal agencies that need its services or that can provide it with information it needs to do its job.

I will touch only lightly on observations and data management, and then go into more detail on services and research.

Collecting observations involves operating and maintaining networks of surface and upper air sounding stations. It also involves satellites, river gages, and radars--both conventional and doppler. It involves observations from buoys and ships at sea and from airplanes in flight. It involves both routine observations and special observations for special purposes, such as aircraft reconnaissance of hurricanes. And it involves getting comparable data from other nations of the world and sharing our data with them.

NASA, the Geological Survey, the FAA, the Coast Guard, and the military services cooperate with NOAA in this task. On the international side, NOAA works with the State Department and with other nations through the World Meteorological Organization, a U.N. agency.

Generally speaking, the observational activities are in good shape. New technology does not always get incorporated into the system as rapidly as it should, and in some locations there are simply not enough observing stations. These problems are due primarily to inadequate resources, rather than to organizational structure or to lack of adequate statutory authority.

Data management means getting data of the right quality to the right place at the right time and in the right form. It involves quality control, archiving and retrieval, and conversion of basic data into useful information. This must be done on a real-time basis for use in day-to-day operations, and also on a longer time basis for subsequent use in research and in provision of climatological information.

Here too, what problems there are relate to resources--funds and technology--rather than statutory authority or organizational arrangements.

Preparing and issuing weather and climate forecasts and warnings and other related information is, of course, the ultimate purpose of all of these activities, and I would like to go into this in a little more detail.

WEATHER AND CLIMATE SERVICES

Let me say at the outset that in this area I see two serious issues which do, perhaps, require statutory clarification. These are:

(1) How far should NOAA's public service responsibilities go? Should NOAA be responsible only for issuing forecasts and warnings, or should it also have responsibility for educating the public on matters of safety preparedness in the event of tornadoes, hurricanes, and other life-threatening storms? Should it participate actively in the development of community disaster

preparedness plans? Should it participate in setting limits to development in regions which are prone to weather disasters, such as hurricanes along the coast and flash floods in certain inland regions?

(2) How should NOAA interact with private businesses offering weather and climate services? Where should the government service end and private enterprise take over?

The significance of these questions will become clear as I proceed.

Types of Weather and Climate Services

One can think of weather and climate services as falling into three basically different categories:

- disaster warnings
- economic benefit services
- convenience services

Disaster warnings are typified by forecasts and advisories of impending hurricanes, tornadoes, flash floods, and other life-threatening weather events, and also of droughts and other longer term climatic disasters. I believe that everyone would agree that the Federal Government should give a high priority to this type of service. An appropriate system of weather observations, prediction, warning and public education can save lives and, in many cases, can reduce property damage.

What is not so clearly agreed to is just how far the Federal responsibility should go. Should it extend, for example, to the development of community disaster preparedness plans, or to regulations affecting development in hazard-prone areas such as coastal regions subject to hurricanes and inland regions subject to flash floods? These are both emerging issues,

and it is not clear just what the limits of NOAA's responsibilities in these areas are today, or what they should be.

The familiar public forecasts are examples of convenience services. They tell us whether to take an umbrella to work or to cancel plans for tomorrow's picnic or ball game. These services probably belong at the low end of the priority spectrum. It certainly is important the the predictions be accurate and timely, but the benefits of success and the costs of failures tend to be relatively small.

Economic benefit services are those used in the production and distribution of goods and services. The following list gives a number of prominent examples of activities where dependable climatological studies, reliable up-to-date weather observations, and accurate weather predictions can be very valuable:

- Aviation (commercial and private) - fog over airports, severe weather and turbulence along flight routes, optimal routing to take advantage of winds.
- Agriculture (cultivated crops, domestic animals, grasslands, forests) - frosts, hailstorms, blizzards, droughts, floods; forest fires; irrigation; long range agricultural planning.
- Smoke-stack industries (power plants, smelters and refineries, etc.) - air pollution.

- Construction - excessive precipitation, low temperature, or other conditions that inhibit pouring of concrete and similar operations.

- Marine operations (merchant shipping, fishing, offshore oil drilling) - wind and wave forecasts, ocean routing, sea surface temperature patterns.

- Ground and waterway transportation - fog, snow and ice on highways, rivers and lakes.

- Oil, gas, coal, and electric companies - unusually cold or hot weather causing excessive power demands, lightning strikes to power lines or transformers.

- Muncipalities - snowfall, water supply, floods, air pollution.

- Commodity exchanges - forecasts for as far into the future as possible of expected weather over food-growing regions of the world.

The actual operations which must be undertaken to produce the three kinds of services mentioned above are not very different from each other. For all three, there must be an observing network, a data analysis and forecasting activity, and a means of dissemination. Apparently for this reason, our national weather service system has, in the past, given almost equal attention to all three categories.

Let me say a word at this point about climate. Climate refers to the aggregate of weather conditions prevailing over a portion of the earth for an extended period of time. The significant difference between weather and climate services lies not in the technical nature of the service, but in the use that is made of it. Weather information is needed for day-to-day operations, climate information for long-term planning. Our ability to predict climate is virtually nil, and our capability for incorporating that climatic information which we have today into long-term planning is far less developed than our capability for incorporating weather information into daily operations. Legislation to establish a national climate program -- legislation which was developed largely by this Subcommittee, and on which NACOA has already commented extensively -- is now in conference and, I hope, will shortly become law. One of the major elements of this new program should be the development of techniques for incorporating climatic knowledge into long-term planning for agriculture, energy, air pollution control, and so forth, to a greater extent than we do today.

The Private Sector

Over the last thirty years there has been a slow but steady growth in the number of private consulting meteorologists and privately owned companies rendering a wide spectrum of weather and climate services. The Professional Directory in the March 1978 Bulletin of the American Meteorological Society contains 78 advertisements for private individuals and companies providing such services.

As in any business, the quality of the private services is highly variable, depending mostly on the competence and integrity of the individuals involved and the type of service offered. In order to encourage high standards among private consulting meteorologists, the American Meteorological Society has a program of certification. Individuals who have had adequate training and experience and who pass a written and oral examination are designated Certified Consulting Meteorologists.

Private meteorologists have prospered largely by providing specially tailored services to industrial, commercial and municipal clients. Many cities and industries concerned with the effects of snow on motor vehicle transportation have purchased snow forecasts. Gas and electric companies concerned with power needs on cold, windy days, ski lodges concerned about snow cover, offshore oil drillers concerned with winds and waves, commodity dealers and traders concerned about the effects of future weather on future prices, and agriculturists concerned about water availability all have found private weather and climate services of value.

Many large companies have meteorologists on their staffs. The "smoke-stack companies" -- i.e., those that discharge waste products into the atmosphere from tall stacks in a controlled manner depending on air pollution potential -- employ their own meteorologists. Certain television stations seeking to give their viewers specialized weather services have full time meteorologists and well-equipped weather stations of their own.

One could cite many more examples of the role of private meteorlogists in supplying high quality weather services to customers willing to pay for it.

The Role of the Government and of the Private Meteorologists

Not too many years ago the U.S. Weather Bureau regarded itself as the only authorized supplier of weather forecasts to the public. When there were very few private meteorologists offering their services to the public or to industry, this view was seldom disputed.

In the late forties and fifties private meteorologists were tolerated rather than encouraged by the Federal Government. Nevertheless, over the last three decades there has been substantial growth of private weather service companies in the United States. For the most part, they are relatively small organizations which supply specialized services to industries or municipalities. By concentrating on the specific needs of their clients and by offering services not available from the National Weather Service, certain private companies have been quite successful.

Over the last few years NOAA's National Weather Service (NWS) has not been permitted to grow in size and capability to meet the growing weather service demands of this country. We believe that it would be in the national interest to strengthen NWS. At the same time, it is clear that an increasing part of the Nation's weather service needs will have to be met by private meteorologists. This is particularly true in the case of weather and climate services in the category I have called economic benefit services.

What is needed is a definition of the respective roles of government and private meteorologists. The division of responsibilities would be expected to differ depending on the types of service offered. Let me illustrate this by considering, separately, disaster warnings and economic benefit services.

Disaster Warnings -- It seems clear that the Federal government has, and should have, the responsibility to observe, predict and issue advisories of impending violent weather. The Federal Government has been doing this with increasing competence and effectiveness. More still needs to be done in the area of alerting the public about the predicted weather events and enabling the public to respond in a manner that will maximize public safety.

However, a great deal still remains to be learned about the atmosphere. Meteorologists, like their counterparts in medicine, psychology and geology, for example, are not perfect by any means. Equally competent people viewing the same evidence can arrive at different prognoses. Occasions arise when equally competent meteorologists arrive at conflicting forecasts of the likely behavior of a severe storm. The official National Weather Service forecast may call for heavy snow in Chicago while a private meteorological company serving the same city may disagree. The NWS might predict that a hurricane will hit New Orleans while a private meteorological company will be convinced, after examining the same data, that the storm will miss the city.

How should we deal with a case in which Federal Government meteorologists and private meteorologists retained by local government or industry reach conflicting prognoses of a possible severe storm event? We do not have an answer at this time.

Economic Benefit Services -- NOAA must continue to carry the major responsibility for supplying weather services to government and industry. At the same time, it appears to me that as a matter of policy, private organizations requiring special weather services for their own gain should be encouraged, if not required, to purchase these in the private market.

In the past many individuals and organizations have refrained from buying weather services that could be obtained "free of charge" from the National Weather Service. Unfortunately, this free information is not always the most relevent for the intended purpose. It is not uncommon, when there is a lack of close communication between meteorologists and those engaging in weather-sensitive activities, for neither party to understand the nature of the weather service really needed, and the use that can be made of it.

Private meteorologists working closely with industrial, commercial and municipal clients can identify the type of weather services needed by the clients. They can tailor the product and the timing of forecasts to maximize the effectiveness, for the client, of the specialized weather information.

At present, private meteorologists can obtain weather data and facsimile-transmitted weather maps simply by paying transmission charges. I can visualize that as the private meteorological industry grows, payment to the government for such weather data and analyses might be in order.

As noted earlier, budgetary and personnel restrictions have been reducing the quantity and quality of service that the National Weather Service can offer to individual groups having specialized needs. It seems clear that a new partnership has to be forged between the government weather service and private meteorologists. The various parties involved, including NOAA, the private meteorologists, and their industrial, commercial and municipal clients, must work together to establish a formula which will maximize the effectiveness of weather service for all concerned.

Weather Forecasts and the Public

A great deal needs to be learned about public understanding and appreciation of weather forecasts and their meanings. To a large extent, existing practices for disseminating weather forecasts and advisories have been developed within the government without adequate testing. For example, there is still considerable misunderstanding of the use of probability forecasts. How many people know what is meant by the statement, "The probability of rain today is 20 percent"? Moreover, the meanings of terms such as "tornado watch" and "tornado warning" are not clear to many people. Which one means that a tornado may occur, and which one means a funnel has been sighted and may be headed towards you?

Even when the terms are properly understood, it is not certain that an appropriate response will follow. For example, if the NWS issues a series of forecasts advising of the approach of a hurricane along the Gulf Coast, will the public understand the nature of the threat and the need to take appropriate actions, such as evacuation, on time?

The point I am trying to make is that it is necessary to devote more attention to the best ways to communicate with the clients -- in most cases the public. This requires that meteorologists, educators, psychologists, sociologists and the public interact. It requires testing, market analysis if you like, of new ways and new words.

Weather Services and the Media

Virtually every daily newspaper, radio station and television station in the United States gives weather forecasts. Some are comprehensive, up-to-date and as reliable as the state of the art permits. Some are none of these. Some broadcast stations hire competent meteoro-

logists, who have earned the Seal of Approval of the American Meteorological Society. Some stations employ people who know nothing about meteorology and seem to care less. In the hands of the latter type, the best weather information from the most competent meteorologist, government or otherwise, can be rendered worthless.

What can be done to improve the quality of weather information in the news media? When the weather is benign, the consequences of poor public communication are minor. But in the event of a disastrous weather event, the message to the public can be crucial. Incorrect or untimely information can undo the products of even the best technology and the best scientific minds. Meteorologists alone cannot solve this problem, nor can the news media alone. A greater mutual understanding is needed.

RESEARCH

Let me now turn to the subject of weather and climate research. A major share of our Nation's fundamental or basic research in the atmospheric sciences is conducted in universities and in research organizations such as the National Center for Atmospheric Research in Boulder. Much of this work is sponsored by the National Science Foundation, but other government agencies (notably NASA, and to a lesser extent the Air Force and NOAA) also supply funds because of the possible applications of the research. Within NOAA, considerable meteorological research is carried out ranging from the very fundamental to the highly applied. It is widely believed that there is too little interaction between researchers and operational weather groups. As a result, new techniques, particularly observational techniques, are brought into operational use at too slow a rate.

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Let me illustrate this by referring to a proposal which is now developing within NOAA under the acronym PROFS, standing for "Prototype Regional Observing and Forecasting Service." The PROFS concept emerged from one of NOAA's research laboratories which has been developing remote sensing technology, and which saw in its products a possible means for providing some sorely needed improvements in local weather services. PROFS would bring together research scientists and operational meteorologists in the solution of an important practical problem. However, it is not clear whether NOAA, with its limited resources, will be able to provide the personnel and funds needed to bring this concept to the point of operational testing.

Mr. Chairman, this illustrates the general problem that transfer of research findings into practical applications is too slow. The problem does not lie in a lack of statutory authority or in the quality of the research. Rather, it appears that there have been difficulties in organization, management, and communication between those involved in research and those concerned with operations. Right now there is a gap between the point where the researchers say they have new technologies and techniques to apply, and the point where the operational people are ready to put them to an operational test. Neither group is willing to devote their scarce resources to a project at this stage. Funds and personnel resources need to be earmarked for this purpose.

Thus far I have been speaking about research in general terms, but with research relating to weather forecasting primarily in mind. I want to mention, briefly, three other research areas in which NOAA should have a major responsibility--climate, weather modification, and air pollution.

I have already referred to the legislation to establish a national climate program, which is now in conference. If NOAA is to have the mission of providing the nucleus of the Federal Government's civil weather and climate activities, then NOAA must play a major role in this new program of climatic research and services. Since the bill is in conference, I will say no more about it at this point.

Recommendations concerning weather modification--a subject on which NACOA has commented frequently in the past--are now being developed by the Weather Modification Advisory Board, which is scheduled to deliver its report to the Secretary of Commerce next month. I shall not comment further at this time except to say that this is another area in which NOAA must play a significant role.

Air pollution is primarily an industrial and technological problem having to do with the invention of ways to dispose of waste products without dirtying the air, and is a responsibility of the Environmental Protection Agency. However, in order to know how much pollution the atmosphere can tolerate without becoming unacceptably contaminated, it is essential to know how winds and turbulence mix and disperse material injected into the air. Weather information is essential to do this, and NOAA must play a major role--as it does now--in addressing this problem.

I could name other areas--agriculture and aviation, for example--in which weather and climate have major impacts. While NOAA does not and should not have primary responsibility for these areas in the broad sense, it must be able to provide the weather-related information needed by the agencies that do have the responsibility. This in turn means it must collect the observations and conduct the research which it (NOAA) will need to properly do its job.

NOAA'S RESPONSIBILITIES TO OTHER FEDERAL AGENCIES

This leads me to one more area which may require statutory clarification: NOAA's responsibility for providing weather and climate services needed by other Federal agencies for their own missions. NOAA has this responsibility today, as indeed it must if it is to provide the nucleus of weather and climate services. But there are no adequate provisions to ensure that NOAA will have, or be able to get, the resources -- the funds and the personnel -- that it must have it is to carry out this responsibility. Some statutory clarification of this situation seems to be called for.

SUMMATION

In summation, Mr. Chairman, I have identified four areas involving weather and climate which I believe a NOAA organic act should explicitly address. These are:

(1) An explicit statement of NOAA's weather and climate mission.

(2) Specification of how far NOAA's responsibilities should go in the direction of ensuring appropriate response by the public to the forecasts and warnings it issues, and to information it provides about the likelihood of weather disasters in certain locations.

(3) Specification of the respective roles of NOAA and of private enterprises offering weather and climate services.

(4) Identification of NOAA's responsibility to provide weather and climate services to other Federal agencies, and provision for obtaining the resources needed to do so.

I realize, Mr. Chairman, that except for the first of these I have not told you just what the Act should say. There are some difficult questions involved, and we on NACOA are addressing them and hope to be able to deliver our recommendations to you later this year, in time for consideration of such legislation during the next session of the Congress.

There is little further that I can say as a NACOA spokesman. However I will be glad to answer any questions that I can, speaking for myself.

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AFTER RECESS

Mr. BROWN. The subcommittee will please come to order.

Our next witness will be Dr. Robert M. White, Chairman of the National Climate Board, National Academy of Sciences, who is well known to all members of the committee as the former Administrator of NOAA. We will also call up Dr. Thomas F. Malone, of the Holcomb Research Institute.

May I invite both of you gentlemen, Dr. Malone and Dr. White, to come to the desk, and we will try to expedite this a little bit?

I have been informed, Dr. Malone, that you are now serving as Foreign Secretary for the National Academy of Sciences. I know at least one of your predecessors, Dr. Harrison, and I know some of the problems he had in that job, which I am sure you are capable of overcoming.

Dr. White, suppose you go first, since you are the first on the list, then we will hear from Dr. Malone. Then we will engage in a little colloquy with both of you, and see if we understand what you have told us.

STATEMENT OF DR. ROBERT M. WHITE, CHAIRMAN, NATIONAL CLIMATE BOARD, NATIONAL ACADEMY OF SCIENCES, FORMERLY ADMINISTRATOR OF NOAA

Dr. WHITE. Thank you, Mr. Chairman.

Mr. BROWN. Without objection, the full text of your statement will be included in the record and you may proceed as you wish.

Dr. WHITE. Mr. Chairman, I have prepared only a very brief statement, which I would like to read. It will take me just a few minutes to go through this.

Mr. Chairman and members of the committee, I am pleased to have the opportunity to appear before you to discuss issues raised by H.R. 9708, the National Oceanic and Atmospheric Administration Organic Act and H.R. 8763, the National Weather Service Act of 1977. I have previously testified before the Subcommittee on Aviation and Weather on H.R. 8763 and before the Subcommittee on Oceanography of the House Marchant Marine and Fisheries Committee on H.R. 9708. That testimony is available to this committee for its consideration.

Mr. BROWN. We will take it into consideration.

Dr. WHITE. Thank you, Mr. Chairman.

Your letter of May 16 indicated that you would like me to address issues not considered by the other committee. I have therefore prepared my testimony specifically to address the questions you have raised.

The first issue identified by your letter is "How should atmospheric research and development including weather and climate research be dealt with?" This raises the questions of "by whom" and "for what purposes?" In approaching weather and climate research, the important thing is to establish clear objectives. The research and development program must be related to them. These objectives could for example, be to provide warnings of tornado, hurricanes, and other severe weather hazards, or forecasts and warnings to serve agriculture, or outlooks for months or seasons in advance to serve as a basis for

advance planning of various economic activities, or modifying the weather to increase rainfall or to lessen the destructive force of hurricanes. The important thing is that a set of goals or missions be established. This is vital for the specification of research and development functions to be undertaken by NOAA, and for the establishment of the responsibilities of NOAA and other agencies for their funding and execution.

The specific set of research and development problems that should be undertaken are those whose solutions will provide the greatest social and economic benefits and also those which appear to be amenable to amelioration by scientific research. If we approach problems in this way, we can organize a coherent atmospheric research and development program responsive to the objectives. One part of this program can be directed at obtaining immediate improvements in services. These will generally be applied research efforts. If we do this it will become apparent that there are gaps in our basic knowledge of various physical processes which represent limitations on our ability to progress toward our objectives. These problems require a concerted effort in basic atmospheric science. This suggests that if we are to "deal" with atmospheric research and development, we should insure that our atmospheric R. & D. maintains a balance between efforts directed at immediate improvements in our ability to solve atmospheric problems which have major socioeconomic consequences, and those directed to more basic problems which enable us to deal effectively over the longer term with these issues.

In fact the organization of the weather research and development efforts at NOAA have followed this general concept. Investments were made in both the shorter applied and in the more basic longer-term research. Research and development activities were conducted both within the service arms of NOAA such as the National Weather Service or the National Environmental Satellite Service and at the same time in NOAA's central research laboratories, the Environmental Research Laboratories. The Environmental Research Laboratories (ERL's) have been able to focus their attention on the longer term more basic science aspects of the atmosphere while the service arms have been able to address the shorter-term applied research necessary to yield immediate improvements in services.

In your letter, you ask "How much detail in terms of NOAA's missions and current organization is necessary?" I believe great detail should be avoided in an Organic Act. It seems to me that the NOAA Organic Act must be drawn in broad terms insofar as the research and development efforts are concerned, to allow NOAA the necessary flexibility to meet problems as they arise, and to take advantage of opportunities as they manifest themselves. It would be sufficient to specify broad categories of research and development which would be expected of the organization. These categories should be closely aligned with the specific operating missions of the organization so that one supports the other.

I believe that provisions must also be made for a wide range of exploratory investigations not directly related to current missions to provide the opportunity for the organization to build a more general base of knowledge about the oceans and atmosphere. I believe it would be helpful if the Congress also provided policy guidance on how it

would like NOAA to carry out its R. & D. responsibilities. It is important that NOAA draw not only upon its own laboratories for its research and development needs, but also upon the nongovernmental scientific and technological community. Just as there needs to be a balance between applied and basic research, there is also a need for balance between the efforts carried out in Government laboratories and in nongovernmental academic and industrial institutions.

This leads naturally to another of your questions, "What long-term mechanisms could be instituted which better link the research and development task to NOAA's missions?" The transfer of know-how and technology from research and development to operations is a very resistant problem. It is by no means peculiar to NOAA. It is common to organizations which have both service and research functions. I have experienced this problem in industry, the Department of Defense, and in the National Oceanic and Atmospheric Administration. There is no substitute for talented and sensitive management in dealing with the problem. Fundamentally it is a problem of getting the people who are responsible for services and those responsible for research and development together. It is in most cases a problem of communication. Those responsible for research must understand and be sensitive to the problems of the operating services. On the other hand, those responsible for operating services must understand the developments in and potentials of research for improving their services.

Many techniques can be used. Regular coordination meetings, workshops, or symposia can be organized. Requirements can be prepared by operating services to which research and development groups must be responsive. Funding arrangements can be adopted which provide motivation for the technology transfer. But these are all management approaches to achieving the necessary technological and scientific transfer. An alert management will select the particular tools appropriate to the organization and the personalities involved.

Technology transfer is a difficult matter to legislate. One thing the Congress might do is to write into the Organic Act the requirement for a periodic report, hopefully not once every year, but perhaps once every 3 years, explaining how, and in what way, NOAA has brought about a transfer of scientific and technological developments into the operating services. This requirement could be a useful stimulus to management.

Last, you have raised the question about whether there is a "competitive situation for funding and manpower arising in the areas of research concerning climate, weather, and weather modification?" The answer to this is—Yes. There is competitive funding. And that's as it should be. Each of these kinds of research activity can provide economic and social benefits to the citizens of this Nation, and each is at a different stage of scientific development. The claims of each area for the dollar must rest on the benefits and the potential of science and technology to yield useful results.

The Congress in establishing an Organic Act for NOAA can help in addressing these questions. It can insure that the NOAA Organic Act provides for annual authorization procedures. This would require NOAA to come before the Congress to present its proposals for the

allocation of resources among competing areas of research. It would give the Congress an opportunity to review the balance of effort and modify this balance if necessary.

Mr. Chairman, these are short comments on the questions raised in your letter to me. I hope they can be helpful in your deliberations. I would be pleased to answer any questions that you may have.

Mr. BROWN. Thank you. That is a very statesmanlike response to our broad questions and one which will be extremely helpful to us, Dr. White.

I think we will go ahead with Dr. Malone and then question both of you. Go ahead, Dr. Malone.

STATEMENT OF DR. THOMAS F. MALONE, DIRECTOR, HOLCOMB RESEARCH INSTITUTE, BUTLER UNIVERSITY, INDIANAPOLIS, IND.

Dr. MALONE. Thank you, Mr. Chairman.

Mr. BROWN. Dr. Malone, your statement will be made a part of the record, and you may present it in any manner you wish.

[The prepared statement and biographical sketch of Dr. Malone follows:]

STATEMENT BY THOMAS F. MALONE
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BUTLER UNIVERSITY
INDIANAPOLIS, INDIANA 46208

BEFORE THE U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY

HEARINGS ON THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)
ORGANIC ACTS H.R. 9708 (AND H.R. 8763)
Thursday, June 22, 1978 2:00 p.m.
Room 2325 Rayburn House Office Building

As a prefatory note, let me make four comments:

(1) It is very important to the effective management of our oceanic and atmospheric resources that there be formulated a basic charter for the government agency responsible for the R. and D. and the service aspects of the ocean and the atmosphere.

(2) I share the Chairman's feelings (expressed in his letter of June 2, 1978) that the present version of H.R. 9708 needs to be broadened and needs to be brought more nearly into balance in its treatment of the ocean and the atmosphere if it is to serve as the organic act of NOAA.

(3) To develop Title I of H.R. 9708 -- a declaration of national policy -- into a statement that will constitute watershed legislation and stand without major modification for a number of years will require more thought and discussion than we can give to it this afternoon, and I support the proposal to bring together NAS, NACOA, the AMS, the user communities, and state and federal agencies for a series of workshops this fall.

(4) Finally, I would like to reference my testimony before your committee on August 3, 1977, as germaine to these deliberations. I stressed then (a) the need for more applied research, and development to meet the specialized needs of fields such as aviation, agriculture, and transportation, (b) the need to augment the "in-house" capabilities of NOAA by involving more effectively the talents in our university system, and (c) the desirability of authorization hearings for NOAA prior to appropriation hearings.

To respond in order to the issues you have raised as guidelines to our testimony, I would list the following points:

(1) The centerpiece in a declaration of national policy might well be a declaration that the ocean and atmosphere, taken together as an

inextricably linked physical system, constitute a prominent part of our physical environment and are a renewable natural resource of major importance in providing the food and fiber that sustain life and give meaning to sheer existence. Moreover, it is a matter of high national priority that we understand this physical system better and understand in a quantitative manner how it impacts human activity and is, in turn, impacted by human activity, in order that we may manage this resource more effectively. The role and the potential of the ocean as a source of food and energy, the influence of the atmosphere on the productive capacity of the ocean and of the terrestrial biosphere, the importance of the ocean and the atmosphere in modern transportation, merchandising, construction, and recreation should be emphasized.

I would counsel caution in getting too detailed but would stress the importance of (a) describing the atmospheric-oceanic system through physical measurement employing the marvelous array of tools that modern technology has placed in our hands, (b) understanding the physical processes that determine its state at a given instant as well as its average state over an interval of time, employing such techniques as simulation modeling to sharpen and test that understanding, (c) predicting the future state of a highly interactive ocean and atmosphere in order that human activity can be harmonized with anticipated conditions, and (d) controlling the behavior of this system as our capability grows to enhance the atmospheric and oceanic environment.

Important as I believe the carbon dioxide problem to be -- and I am persuaded it is one of the most important of a new kind of global problem confronting the world -- I would recommend that it not be singled out in an organic act but should be subsumed under the imperative to understand how human activity impacts the ocean and the atmosphere. We have now reached a level and character of human activity that we must take care in using our ocean and atmosphere as sewers into which we can dump the residuals of human activity with impunity.

I do urge that services be distinguished from research, but in the general framework of the need to illuminate our understanding and improving our predictive capability.

I would suggest two additional points that should be made in a Declaration of Policy. The first is the fact that the atmosphere and ocean are inherently global in character and require international cooperation of a uniquely necessary character. The second is the responsibility that we -- and the world -- should readily accept to manage this aspect of our environment in a manner which will insure its beneficial use by generations yet to come -- centuries, thousands and, yes, even millions of years in the future. I was pleased to note the phrase, "fulfill the needs of present and future generations", in the proposed declaration of policy in H.R. 9708.

(2) NOAA should be designated as the lead agency for the conduct of research with the understanding that mission-oriented agencies should maintain supporting programs of applied research in specialized applications and the National Science Foundation should continue its important role of supporting basic research conducted by individual investigators and through institutional mechanisms such as NCAR. Lead agency responsibility for provision of services relating to weather and the state of the sea should be assigned to NOAA. Modern prediction techniques increasingly require sophisticated computational and communications capabilities. Specialized applications of the fundamental prediction products should be carefully constructed to build upon core predictions prepared by NOAA and should avoid duplication of products which are provided by the lead agency. Clearly, NOAA should, unambiguously, be charged with responsibility for public safety. In this respect, I was disappointed to understand that it is proposed to transfer NOAA's responsibilities in disaster preparedness to a new agency. I can understand the good intentions behind this proposal, but I do hope that the Congress will examine the matter with some care before approving it.

Pluralism is a powerful force for diversity and innovation in our nation. The private sector of meteorology is currently flourishing because it can supply a product more precisely tailored to the user's needs than can -- or should -- a federal agency. I do not recommend user's charges for the services provided to the private sector by NOAA. I tend to view the private sector as an extension of NOAA's basic mission with the incremental costs of this extension very properly borne by the user.

The roles of local and state governments relative to the federal government are influenced by factors that transcend scientific or technological considerations, but I identify two emerging developments which will converge in making it desirable to develop new "partnerships of effort" among those three levels of government. The first, of course, is the increasingly structured nature and sheer demographic growth in local and state socio-economic-political complexes that increase their vulnerability to weather and coastal zone conditions. The second is the recognition that recent developments in sensing equipment, minicomputers, communications technology, coupled with an appreciation of the fact that we are on the threshold of a better understanding of so-called mesoscale meteorology and coastal zone oceanography, are bringing within reach a predictive capability at the local level which may be so specialized that it might be impractical for any federal agency to replicate it at each of the Standard Statistical Metropolitan Areas. For these reasons, I would favor a positive attitude toward possible sharing of responsibility -- and cost — at the several levels of government.

(3) With respect to relative priority among the several areas of responsibility for NOAA, it is important to note that these areas are not mutually exclusive. Weather forecasting, climatic analysis, weather modification, coastal zone management, and oceanic analysis and resource inventoring and management are each part of the larger issue of describing, understanding, predicting and managing the ocean-atmosphere portion of our physical environment. This task, rather than weather forecasting, should be considered the foundation for all of NOAA's activities. Weather forecasting will continue to be a major activity of NOAA, but it is timely that the inventoring, assessing, and planning for the use of ocean resources, a climatic program, and weather modification be woven into NOAA's activities in a fashion that is responsive to developing knowledge, technology, and needs, and in a manner which takes full advantage of the large degree of interdependence among these activities. For example, the impact of weather and climate on human activity is a matter of basic concern in both a climate program and a weather modification program, just as it is important in determining the most effective kind of weather forecast.

The matter of priorities becomes important in the allocation of incremental resources. The action of the Congress in moving toward a national climate program and the funding for climate proposed by the administration for the next fiscal year reflect a consensus that climate is a topic which now deserves a high priority. Among the various climate subprograms that seem to me to deserve special attention are (a) the CO_2 problem, which has mind-boggling implications if present indications are substantiated by further study, (b) analysis of the annual seasonal march of weather, which would permit assessment of the possibilities of anticipating departures from the usual climate for the next season, and (c) climatic diagnostics which would enable us to bring to bear presently available data on climate and presently available knowledge of climatic variability.

There will soon be available a proposal that will recommend that it is in the national interest to adopt a policy of establishing a twenty-year program to develop proven technologies in weather modification of atmospheric resource enhancement.

It seems likely that the workshop on atmospheric sciences in Colorado earlier this month will call for special attention to the meso-scale phenomena and the short range forecast and communications task.

Rather than attempting to set priorities among activities which are still in the gestation stage, I think it is important to recommend the mechanism by which these priorities can be established in relation to their relative importance and anticipated benefits. Here I would underscore my recommendation of ten months ago that authorization hearings would be the best available method. I urge that they be incorporated into the proposed legislation.

(4) Coordination among the several federal agencies is, in my opinion, adequate in both research and services. This is one of the goals and accomplishments of the former NOAA Administrator Dr. Robert White. I might repeat a comment that I have made earlier that greater stability in programs and possible improvements in cost effectiveness might be achieved were some of the considerable portion of research in NOAA funded by direct appropriations rather than interagency transfer of funds. I am somewhat uneasy about the relatively small percentage of the cost of collecting data that is allocated to its proper archiving. The Environmental Data Service of NOAA is highly capable, but I think the resources made available to this unit need strengthening in the light of the monumental task with which it is charged. The Institute of Ecology, with support from the Department of Energy, is currently addressing the important matter of access to environmental data.

(5) I will leave to others who have studied more closely than have I the organizational issues within NOAA.

I would like, however, to comment forcefully on the advantages of strengthening the ties between NOAA and the universities. I believe I can speak without bias since my own university does not now, nor does it contemplate, research supported by NOAA. In my view, our national program in the atmospheric and ocean sciences would be appreciably strengthened by a closer interaction between NOAA and the talents at our universities. Moreover, I am persuaded that only by congressional mandate can an appropriate balance be achieved between "in-house" R. and D. and R. and D. supported at universities. The advantages are threefold: (a) some of the most productive scholars in basic and applied research are found at the fifty or more institutions with doctoral programs in the atmosphere or ocean sciences and a closer linkage between these individuals and NOAA's mission problems would strengthen NOAA's posture, give its programs diversity, and enrich the intellectual thrust of the agency, (b) there is underway a veritable revolution in the educational requirements for professional and scientific work in the atmospheric and ocean sciences, and our nation needs a vigorous, well-supported array of universities to supply personnel familiar with the mission needs of NOAA and the sophisticated technology employed to meet those needs, and (c) the lag time between scientific and technological breakthroughs and applications to the provision of services could well be shortened.

Over a century ago a new era in agricultural productivity and university institutional vitality began with the introduction of the Land Grant College System. More recently, we have seen another thrust in the Sea Grant Program. I think this might be an appropriate time to fashion a separate title to H.R. 9708 which would address specifically the NOAA-university interaction. This is more than a plea for special support to our hard-pressed university system.

The work at Pennsylvania State University and at the University of Wisconsin in short-range local forecasting indicate that this can be a two-way street.

(6) Although NOAA does have quality-control programs to measure performance (see my testimony of August 3, 1977), much remains to be done in pinning down, in quantitative terms, weather and climatic impact on human activity. This is just now beginning to be recognized in the development of a national climate program and in the attempts to evaluate the cost-effectiveness of weather modification activities. It is a peculiarly interdisciplinary problem with strong overtones of a holistic systems approach to a set of complex problems. The work of Dr. McQuigg in agro-climatology is exemplary in this sense.

(7) I believe the wording of the policy statement on cooperation to the effect that "the Federal Government, in cooperation with ... foreign states ... and international organizations ... utilize its capabilities to create and maintain conditions under which ocean and coastal, and the atmospheric resources may be utilized without harming the environment ..." is just about right as a policy statement on international responsibilities and agreements. It is important that this dualism of cooperation with "foreign states" and "international organizations" be retained since one of the most successful international programs involves dealing with foreign states through the World Meteorological Organization and with the world scientific community through the International Council of Scientific Unions. There might even be some merit in introducing the words "intergovernmental and nongovernmental" between the words "international" and "organizations."

(8) In a dynamic and fast-breaking field with intense human impact, there will inevitably arise legislation expressing the national need for special programs in areas such as climate, weather modification, ocean pollution, utilization and conservation of both renewable and nonrenewable resources. As a lay person in drafting legislation, I would envision two alternative courses: (a) making the organic act sufficiently broad and general that it can embrace new legislated activities, or (b) amending the organic act as may be required. I tend to favor the first alternative.

(9) It is for the reason just mentioned that I would be inclined to restrict the amount of detail in the organic legislation. Certainly, there are substantial parts of H.R. 8763 which could be incorporated into the organic act. For example, I see much merit in the section under "Authority for Functions and Activities" which gives the Secretary authority to "establish and maintain an equipment replacement fund equal in value to one-fifteenth of the replacement value of the current inventory of capital equipment used in carrying out the functions and activities under this Act, and use such fund for

> the routine replacement of equipment when justified by equipment obsolescence, excessive maintenance costs, deterioration, or program requirements."

My final comment would be that the "lead agency" concept is viable only when the lead agency is provided with the authority and the resources to fulfill its responsibilities and there is acceptance by the other agencies of this concept. We have both a notable example of success and a notable example of failure in the atmospheric sciences. The success is the effectiveness with which this concept has been applied to the Global Atmospheric Research Program (GARP) and the failure is the inability of the concept to function effectively in the case of weather modification. These two examples merit examination in more detail to ascertain the resiliency of the lead agency concept.

BIOGRAPHICAL SKETCH

THOMAS F. MALONE

Research Professor at Butler University and Director, Holcomb Research Institute, at that University, Thomas F. Malone received his doctorate in meteorology at MIT in 1946. He rose at MIT from research assistant in 1941 to Associate Professor in 1951. Editor of the fourteen hundred page Compendium of Meteorology, Dr. Malone left MIT in 1955 to become Director of Weather Research at The Travelers Insurance Company. He subsequently became a Senior Vice President and Director of Research at The Travelers. Past Secretary and President of the American Meteorological Society and Past President of the American Geophysical Union, Dr. Malone was chairman of the Board of Trustees for the University Corporation for Atmospheric Research during 1973-74. A Member of the National Academy of Sciences he served as a member of the Committee on Meteorology from 1957-61 and Chairman of the Committee on Atmospheric Sciences from 1961-1968. He was a member of the Environmental Studies Board of the Academy from 1969-74 and Chairman of the Geophysics Research Board from 1969-75. He was Chairman of the Panel on Weather and Climate Modification from 1969-1973. Dr. Malone served as a presidential appointee on the National Advisory Committee on Oceans and Atmosphere from 1971-1975 and has served on numerous advisory committees to the Department of State, National Science Foundation, HEW, and NASA from 1952 to the present.

Vice President of the International Council of Scientific Unions, 1970-72, he was Secretary General of the ICSU/IUGG Committee of Atmospheric Sciences from 1964-1968. He currently is a member of the Weather Modification Advisory Board to the U.S. Department of Commerce.

Dr. MALONE. Since I cannot read as fast as Dr. Battan, I will summarize some of the highlights here and save you from going to sleep.

First, a basic charter is needed.

Second, H.R. 9708 is much too focused on oceans, I agree.

Third, we cannot resolve all of these issues this afternoon.

Fourth, I refer to my testimony 10 months ago on August 3, which I think is germaine to some of the questions you raised.

I would like to suggest a workshop sometime later this year which would involve the Academy, NACOA, the Federal agencies, State and local agencies, and the user community.

I think that would be very important to get those groups together for 2 or 3 days, and I think that would contribute to your objective, which I applaud.

Now, in the charter, you did raise nine basic issues, and I have tried in my testimony to respond to them.

In some cases I have evaded the issue, and in other cases, I think they are the wrong questions to ask, but I will touch very briefly on each of those without reciting all that I have put into the paper here. I think the major issue is that the national policy might very well include a declaration that the ocean and the atmosphere taken together as a linked system constitute a prominent part of our physical environment, and that this system is a renewable natural source of major importance in providing food and fiber that sustains life and gives meaning to sheer existence. I would also add that it is a matter of national priority that we understand the system better, in a quantitative manner on how it impacts human activity, and how it in turn is impacted by human activity.

In my view, those are the kind of words that belong in an Organic Act which will stand the stress of years ahead.

I would join with Dr. White in cautioning against too much detail.

I think the four things that are important include describing the atmospheric-oceanic system, understanding how it behaves in any given instance, and over a period of time, and being able to predict it and control it. Those are the four fundamental functions, and this implies, Mr. Chairman, that the Organic Act make specific reference to the role of the NOAA in weather modification.

As you know, you are going to receive the report from the Weather Modification Board sometime next month, and I think that will highlight that function.

You raised the question whether or not carbon dioxide should be mentioned in the Organic Act.

I would think not. I happen to think that this is one of the most important problems confronting society, and the atmospheric and oceanic community, and the biological community today, but I do not think as such it should be in the organic legislation.

It is the impact of human activity on the system that should be included, and that would take care of the carbon dioxide problem. I would hope that the statement would stress the global character of the atmosphere and oceans, and the absolute necessity of international cooperation. I especially like the words I found in H.R. 9708, "fulfill the needs of present and future generations."

In the management of this resource, we have got to learn to think years and centuries, and thousands of years, millions of years ahead, and I think that is very important that you stress that.

Now, the second question you raised was a very key question, one of R. & D. responsibility. I think NOAA should be the lead agency in research, but the other agencies should be doing the applied specialized application, and NSF should retain basic support of individual investigators and operations such as NCAR. This is a very important part of our total infrastructure and should be preserved.

Clearly, NOAA should lead in services, and the legislation should be written in such a fashion that a gung-ho official in another agency who is really hot on a problem does not try to replicate the fundamental service that NOAA provides. He should concentrate on adding special services rather than duplicating the basic services NOAA provides.

I think that the role of NOAA in public safety should be unambiguously stated. I think you can have only one agency concerned with public safety. I would commend to your attention the statement of Dr. Cressman before the Milford committee, which is a restatement of NOAA policy with regard to the private sector. I do not think there should be user charges, but the cost of tailoring the forecast should be borne in the private sector. There is plenty of room and strength in that kind of diversity. Over the last 25 years, we have passed from an era of hostility between the Government and the private sector to an era of cooperation.

I think for the reasons I spell out here—the complexity of modern society, its sheer size, the revolution in sensing equipment in minicomputers, and so on—that we should retain a positive attitude toward cooperation, sharing of responsibility, and costs at the several levels of Government.

I cannot imagine a Federal agency adequately servicing 225 standard statistical metropolitan areas, so I think there is a role for regional and Federal cooperation.

A third point in priorities, and here I suggest that maybe the wrong question is asked.

You are right, a key issue is the matter of priorities, but I think the question should be how do we insure that priorities are attended to over the years rather than how the matter is resolved this afternoon. I would support the view of Dr. White, that authorization hearings, plus the deliberations of NACOA, plus deliberations of the Academy, and so on, are an excellent way to establish priorities, and I think authorization hearings should very definitely be built in. Then the Congress can assess the relative importance of proposed programs.

You are going to have weather modification, you have climate, you have the regular services, you have got research, and I obviously feel we have the capacity and resources to do that, but I also know that you never get everything you want, and you do have to set priorities, and I think the authorization procedure is a good way to go about that.

Our coordination in my view is good, and that is testimony to the accomplishments of the gentleman on my right here, and by the way, on page 5, after I refer to NOAA, I left out a word that got lost there, research in NOAA being funded by direct appropriations.

What I am talking about is that there should be more direct funding, and less transfer of interagency funds.

As one who has had a look at the Environmental Data Service of NOAA, I am a bit uneasy at the relatively small portion of the dollars

spent collecting data to archive it. This problem is exploding in both the technological capability and sheer volume, and I think that needs a good look. It is the kind of thing an authorization committee could do very effectively.

Now, I ducked the fifth issue you raised, because I do not pretend to know all of the facets of the relationship between assistant administrators for this and that.

I do comment on a point that Dr. White raised here, and in the Milford subcommittee, and that is the tie with the universities, and I think that some of our most productive scholars are at universities, and we need to strengthen our universities. The kind of training required now is totally different from the kind Dr. White and I received as graduate students, and there needs to be a more intimate interaction between this agency and the producer of the talents. We are running out of the wartime generation of meteorologists, and we have to replace them. There is an opportunity for an entirely new type of training, and the unversities have got to get geared up to it. That means interaction. The manpower limitations on in-house research are greater than the dollar limitations, and one way you can resolve that problem is by supporting research at universities.

So important I see this, that I would like to see a separate title in this Organic Act, which would be equivalent in impact and importance to the land grant and the Sea Grant Acts, which would explicitly charge NOAA with responsibility for supporting outside research.

You can imagine the difficulty of an administrator of NOAA, if his own people come and ask him for some money, and he supports some research in the university, and the man comes in and says, "Bob," or "Dick," whoever it is, "you would not give me $25,000, but you went out to Seattle and gave $25,000. How come?" So my point is that a congressional mandate is necessary to give the Administrator the kind of freedom he needs. That is why the Sea Grant Act is so important, because it is mandated that that money be spent, so I would commend to your attention the possible title that would do this.

You talk about measures of performance, and in my testimony 10 months ago, I referred to that, but now there is a growing recognition in both the climate program and evaluating the cost effectiveness of weather modification, cost effectiveness of various kinds of prediction we need to measure the weather and climate impact, and this is a whole fuzzy area just beginning to emerge. One of the leaders in that is Dr. McQuigg, who has looked at these things very effectively.

As you can imagine, I am strongly in support of the notion of international cooperation, I like the words you have in there, and I would stress the dualism in this international effort, because the most successful program we have involves working with foreign states, and the international scientific community, and we fashioned a high breed kind of instrumentality, which brings together the talents of the world scientific community through the International Council of Scientific Unions, and capability and talents of the governments, and I would like to even see that intergovernmental, nongovernmental inserted between the words "international organizations" in your text.

Now, you raised a question of how much do you put in the Organic Act, and how do you handle climate, weather modification, and ocean pollution.

I don't know. I could very easily imagine you would have short titles which would specify NOAA's responsibility for services, research, climate, weather modification, coastal zone management, and then bills which would elaborate on those missions. They would not be a part of the Organic Act, and as a matter of fact, tthe Organic Act would support the specialization which will come along in a fast-breaking field.

I think that would be preferable to constantly amending the Organic Act.

I agree with Dr. White that it should not go into too much detail.

I did mention a type of revolving fund for equipment replacement. It worries me sometimes. You can get adequate funding for exotic new sensing tools, but the heart, the real workhorse of the Weather Service tends to deteriorate, and I think that problem is mentioned in the Milford bill, H.R. 8763. There is some wording that you might wish to consider incorporating.

Finally, I close with the point that the lead agency concept is viable only if it has the authority and the resources to fulfill its responsibilities, and I point out that we have got a success story, and a nonsuccess story. The success story is the global atmospheric research program which works like a charm. For some reason, it has never worked in weather modification because of conflict over who is the lead agency. As you know, the Weather Modification Board debated this at great length, and they are skeptical of a lead agency in that particular field.

I think two examples should be looked at very carefully in proposing the concept of a lead agency.

Well, Mr. Chairman, those are some of the highlights. The one thing I am a little bit unclear about is the talk about responsibility for the management of nonliving ocean resources. Does that suggest that NOAA would have responsibility for mineral resources? I think that issue has to be resolved. It is a question of where you stop, of course, but I think it should be unambiguous in its resolution.

Thank you, Mr. Chairman.

Mr. BROWN. That last point you bring up, Dr. Malone, is also a highly sensitive one in the international sphere.

I am reminded of it because I will be participating in a scheduled briefing by some oceans people in the executive branch as to where we stand on that issue. It may be that there will be some breakthrough in this area which will lead to the enactment of legislation, and such legislation will need to spell out just where the responsibility lies among the various agencies of the Federal Government.

Well, I certainly do appreciate your statement, Dr. Malone. It is one of great wisdom. Let me indicate one of the areas that stimulated me most in your presentation: the utilization of the universities. You point out the parallels with the land grant and sea grant colleges, and suggest that the interaction between, say, the Department of Agriculture and the multitude of institutions of higher learning that are associated with them in agricultural research and development is a valuable model. You then suggest that the NOAA Organic Act ought to specifically authorize a similar model for climate research and related service activities.

Is there any disagreement between the two of you on that?

Dr. WHITE. No, I think this would be desirable.

It could be formulated in many different ways. It could range from a simple provision in the Organic Act for a university grants program to something as complex as arrangements in the Agriculture Department. They support not only a research program, but also an extension services program. The formulation is something I think needs further debate, but the general thrust of it I think is there.

Mr. BROWN. I raise the question of the applicability of something similar to an extension service to the growing awareness of the significance of the interaction between man's activities and climate and weather. There is a need to have this awareness penetrate more effectively into our public understanding, possibly through incorporation in the science curricula in our elementary, secondary, and higher education institutions, and perhaps even into the agricultural and specific user communities. I think there would be a growing recognition that this area represents a legitimate field of activities for an appropriate agency of the Government.

Dr. MALONE. I think you are breaking entirely new ground in this area, very important ground.

Mr. BROWN. We have the Sea Grant model, which I think has been accepted.

We have something similar, although not functioning with the effectiveness I would like, in the water resources area, where we have a Water Research Institute in every State. The problem is that they do not have adequate funding to really incorporate this kind of program. Nonetheless, we begin to see models emerge which, properly integrated, might be very fruitful.

Weather and water are connected, weather and oceans are connected, and weather and land are connected, so it seems to be there is no basic reason why we could not encourage both a tie with the educational system, and an extension program which would assist in getting information out to the broader public.

Dr. WHITE. Mr. Chairman, I think the idea of an extension service is sound. However, I would like to sound one or two notes of caution. I think in this particular case, we ought to tailor it specifically to the properties of atmospheric services. In a sense, the Government provides an extension service because the Weather Service provides information to many, many sectors.

Second, we have the private sector, as Dr. Battan has discussed. Their bread and butter is dependent upon providing consulting services to commercial clients. When we design an extension service in the climatological area, I think we want to keep our eye on the fact that there are some differences and there are some problems. Maybe some of our objectives are not exactly coincidental with other extension programs.

Mr. BROWN. You are absolutely correct, and the warning is timely. To some degree, these problems exist in the agricultural field, for example, and have been worked out in a reasonably satisfactory way over decades.

However, we are still arguing over some aspects of extension services, and we will probably continue to do so. This is causing the Congress to move in the direction of annual authorizations and a closer scrutiny of specific extension programs.

We have been debating the R. & D. and extension work of the Department of Agriculture this afternoon on the floor.

Mr. WHITE. I see some real opportunities, as Dr. Malone said, for some innovative kind of approaches to the extension service.

I do not see why we could not meld the concepts, and begin to use the private sector, funded in part by the Federal Government, to provide an extension service.

This would be a direct encouragement to the growth of the private sector, and I think would avoid many of the problems you have in the Federal Government, for example, the manpower controls, and so forth.

Mr. BROWN. I think the Federal Government and the Congress are going to be seeking ways to act creatively with the private sector, to make sure that their role and responsibility is not infringed upon. If we are successful in that delicate task, I think that we might make some progress, but the key point that both of you are stressing is that there has to be a tie with the university community, a framework of some sort through which their talents can be utilized to supplement the work of NOAA.

Dr. Malone, you raised a point that was made earlier by Dr. Battan, and I think Dr. White has touched on it; the NOAA responsibility for weather-related public safety activities.

Do you see any problems in defining this responsibility clearly and concisely?

Dr. MALONE. No, sir, I do not.

I think that the proper words can be put together, and I think it is imperative that the responsibility be focused, and that we not confuse the public with the different interpretations.

It is better to have a very carefully thought-out explanation of the degree of hazard in a particular situation, coming from authoritative source, than having people compete with one another, trying to capture the interest and activate a response by the public.

Mr. BROWN. Be as specific as you can for my enlightenment, since I am not as well versed in this subject as I should be. In the case of a major prospective catastrophe, such as an ocean-based storm, or an extremely heavy snowfall—such as hit Boston this year—would you want NOAA to be able to take the necessary action to trigger the public response?

Dr. MALONE. Yes, sir.

Mr. BROWN. Would NOAA be responsible for calling in the National Guard, and the other kinds of public safety activities?

Dr. MALONE. Yes, sir. I would say I would even go further.

Perhaps I do not understand what the intent is of this reorganization plan on emergency preparedness and response but what I read in the Indianapolis papers led me to believe the responsibility of NOAA for weather-related disaster preparedness had been eroded, or transferred out.

I have not looked at all of the issues, but I think that this reorganization should be examined rather carefully, because I think that there is no such thing as a professional worrier on hazards, you have to have the substantive knowledge, and I thought that thing was operating fairly well.

Probably there are reasons for the coordination, but I am uneasy about this reorganization.

Mr. BROWN. Does subcommittee counsel want to elaborate on this?

Mr. SPENSLEY. Perhaps I could, Mr. Chairman.

I think the intent of the reorganization, Dr. Malone, is that while the new agency would have the same objectives that you stated earlier, there ought to be one agency to which people can look for all types of emergencies. There are natural hazards which are not weather-related, such as earthquakes, things of that sort; therefore there is a feeling that there ought not be a different voice in the community for different kinds of hazards. Although I do not think it is completely clear from the proposals that have been made, it is my understanding that the weather service would still have the primary responsibility for predicting weather-related disasters, providing the warning, and applying its knowledge of weather disasters to community preparedness plans, but the system by which emergency preparedness plans would be made and implemented would reside in the new agency as a centralized system.

Mr. BROWN. This is a most delicate question of the relationship between let us say staff and line executives. Actually, the command has to come from the agency in charge, and the other organizations merely serve with different degrees of responsibility to advise this agency as to what action should be taken.

Dr. WHITE. Mr. Chairman, I would really welcome an opportunity to express my views on this very important subject.

I look at this public safety problem as consisting of more than one function, and I think we have to break it down. There are real problems in each one.

First, there is a public weather warning function when there is a hazard. That clearly is the responsibility of the Government.

There are problems, because the public receives warning information from many media. The only direct link it has to the Government is through the NOAA weather radio system.

All other warnings transmitted to the public go through public media of one kind or another, and the ability of the Government to control or say what those warnings will be is minimal or nonexistent. I believe there should be a requirement in the law that every person responsible for issuing public weather information be required to transmit a Government weather hazard or other hazard warning.

He may be allowed to put his own view on it, but the general public should know what the Government means when it issues a hazard warning.

I think that is something that might be attended to in the Organic Act.

Mr. BROWN. Dr. White, are we talking about a system such as the military attack warning system?

Dr. WHITE. No; I am talking about the forecasts that are made on radio and television, the normal weather forecasts.

Mr. BROWN. I understand that, but in the case of a military attack, all of the media are coordinated into a warning system. Most of them go off the air, and a message that is centrally coordinated, comes through, as I understand it.

Dr. WHITE. I do not think that degree of control is necessary, mostly because weather hazards are highly localized. In some regions of the country, as in Florida, you have the cooperative effort of the broadcasting networks down there, triggered when a hurricane is approaching, that makes all of their facilities available.

I do not think you have to go that far.

The second function dealing with the public safety is the community preparedness function. Here is where the proposed Presidential Disaster Preparedness and Response Agency has hit NOAA.

I believe that NOAA needs to have the community preparedness function. An earthquake hazard is different from a hurricane hazard, which is different from a tornado hazard. The community response requires a knowledge of individual hazards, where they are likely to come from, and what their intensity is likely to be. I think the community preparedness functions and educating the community about what to do must be closely linked to the people issuing the warnings. In that sense, I think the proposal of the President to extract the community preparedness functions from NOAA is poor. NOAA has attempted to build this capability over many years, because it has been identified as the critical element in saving lives and protecting communities. I do not think that is wise to detach this function from NOAA, but that is the way it is going.

Lastly, there is the question of the public response function. I do not think public response should be the responsibility of NOAA. I think NOAA should transmit the warnings. The decision whether to evacuate involves more than just the warning. It involves the consequences of the evacuation. Where are the people going to go? It may be better, given the nature of the hazard, for the people to remain, because other consequences may be worse if they do evacuate.

I do not think NOAA has the capability or knowledge to make that kind of decision. So, I believe the actual public response to a warning has to be in the hands of people who are more directly connected to the local community, to the local authorities, where they have the executive responsibility for the protection of the public welfare and safety.

Mr. BROWN. Obviously, this is a complex problem, and this clarification is helpful.

Gentlemen, we have a final passage on an important appropriations bill. Could you remain for a few more minutes? I will return as quickly as I can, so the subcommittee will be in recess for 10 minutes.

[Whereupon, the subcommittee was in short recess.]

AFTER RECESS

Mr. BROWN. The subcommittee will be in order.

We were discussing the role of NOAA and the public safety aspects of weather disasters. Did we wish to state anything further on that? Are there any further questions from Counsel?

Another question that I wanted to raise for any possible clarification was brought up by you, Dr. White, in your discussion of problems of technology transfer. You remarked upon the difficulty in legislating processes that would guarantee the effectiveness of technology transfer and suggested instead something along the line of a periodic report to the Congress at 3-year intervals or something of that sort.

There is a practice enacted into legislation which calls on certain departments to make periodic reports in the form of program plans. These have been used as a device to facilitate congressional input into these programs, and it would not be too unlikely that perhaps something along that line could be incorporated in the NOAA Organic Act. For example, it might require that NOAA prepare a 5-year plan which would be updated every 1 or 2 years and presented to the Congress.

In your opinion, could that device be used to accomplish some of these goals, rather than by making an effort to be specific in the organic legislation itself?

Dr. WHITE. Yes; I think I would prefer establishing a mechanism, whether it is a prospective mechanism such as a plan, which provides forward look, or a retrospective mechanism which tells how it was done.

Mr. BROWN. Well, the annual authorization gives us a chance to see how the plan is moving along in general terms, that is, how current accomplishments relate to the plan, which nonetheless does allow for some flexibility.

Do you have any thoughts on that, Dr. Malone?

Dr. MALONE. No; except that it is really additional argument in favor of the authorization process, which I very strongly support.

Mr. SPENSLEY. Mr. Chairman, under the recent marine pollution R. & D. Act (Public Law 95–273) there is a requirement for NOAA to develop a 5-year research plan. I am wondering if that sort of mechanism could be incorporated on the atmospheric side so that we do not get a lopsided resource allocation in favor of the ocean R. & D. side. That act developed largely on account of the fact that we felt NOAA was not moving in an explicit direction in the oceans R. & D. area.

Dr. MALONE. I feel very strongly you should plan ocean and atmosphere research programs jointly, rather than separately.

Mr. BROWN. One thing that we always are in danger of is mandating a proliferation of piecemeal approaches, piecemeal research plans, for example.

I think that the mandate for a research plan should be drawn as broadly as possible, just as the Organic Act according to your recommendations should be drawn, giving considerable flexibility, but allowing opportunity for appropriate organs of Congress to then have something specific to review in terms of the future course for the Agency.

Mr. HOSKINS. I have one basic question for Dr. White.

I see that there are two approaches which have been suggested. One approach involves writing two separate titles, one for oceans and one for atmosphere. Dr. Malone's approach, on the other hand, combines the oceans and the atmosphere as a single system which we try to understand, predict, and manage.

Would you favor either of those two approaches in the development of an Organic Act?

Dr. WHITE. I do not think they are inconsistent. I think there can be a general section which requires the treatment of the oceans and atmosphere together; then, as Dr. Battan pointed out, those functions you want discharged in both the oceans and atmosphere that are reasonably separate and distinct could have separate titles. I think you could meld the two ideas.

Ms. HOSKINS. Thank you.

Mr. CLEMENT. One question, Dr. White. Now that you no longer have a vested interest in the Agency, perhaps you would care to comment on some of the proposals that have been made to place NOAA in a proposed Department of Natural Resources. Since we are currently attempting to take a look at NOAA as an entity, and attempting to give some coherence to NOAA's activities, I would like your views on what a reorganization of this type could do.

Dr. WHITE. I addressed that question very specifically in my testimony before the House Subcommittee on Oceanography. I pointed out that there are three real possibilities I see for reorganization; the first one retaining NOAA in the Department of Commerce, the second establishing NOAA as an independent agency, and third NOAA transferred to a Natural Resources Department.

All three have pros and cons, and I have listed those pros and cons in that testimony. Where I came down in that testimony, was for NOAA as an independent agency for the reasons cited in that testimony. However, if it were possible, by transferring NOAA to a Department of Natural Resources, or a Department which had a spectrum of functions dealing with natural resources and environment, to significantly strengthen the functions of NOAA, that should be seriously considered. If that were not the case, then I think leaving it in the Department of Commerce would probably be best.

The problem in transferring NOAA to a Department of Natural Resources and Environment is that unless you build in the integrity of the organization, statutorily, the tendency would be by different groups who came into Government, either in the Congress or in the new Department, to take a look at the set of functions, and not being aware of the long history that went into bringing them together, to think in terms of other alignments and amalgamation of functions. I think over the long term you would see a change in the function and structure of NOAA, and it would lose its integrity.

I personally believe very strongly that this Government needs a central strength in ocean and atmospheric affairs.

It is very important to the economic welfare of this country and to its environmental welfare. I would be concerned about losing NOAA's integrity in a new Department. But, if you built it in statutorily, and if you could strengthen it as a result of that transfer, it is something that should be considered seriously.

Mr. CLEMENT. Based on your experience as a bureaucrat in this particular area for some years, and having served through a period when there were numerous problems, do you reasonably expect that incorporating NOAA in a Department of Natural Resources would lead to a retention of the integrity of the agency and its functions?

Dr. WHITE. Well, if it were a built-in item statutorily, presumably you could retain it.

Without a statutory basis, my belief is it could not retain its integrity.

Mr. CLEMENT. Thank you.

Dr. MALONE. In thinking over these remarks, Mr. Chairman, I was led to conclude that the distinction between a renewable and nonrenewable resource is important.

You talked about a Natural Resources Department, and this includes a nonrenewable resource, and I think that is where the hazard lies, in trying to combine them.

If you take the three, you have pretty much your renewable oceans and atmosphere resources, and if you keep them apart from this very sensitive nonrenewable resources such as mineral deposits, then I think you would have the possibility of retaining the integrity.

Now, whether this is feasible or not is the question, and it never hit me until I began looking at the NOAA Organic Act.

Mr. BROWN. I think it gets back to the point Dr. White made earlier about the need to very clearly establish the objectives, missions, and goals of the agency.

If these missions have integrity and general understanding, the agency can be protected in almost any setting, but lacking that, you find increasing pressures on it from every side. I think this is a key point to remember.

The organization actually is a device of convenience for executing specific missions, and wherever the mission is not clear, the organization will suffer a great deal from it.

I would like to direct the staff, if there are no objections, to include Dr. White's testimony before the Oceanography Subcommittee and the Milford subcommittee in the record of this hearing, so that we may have his complete views on this general subject. [See appendix.]

Mr. BROWN. If there are no further responses, the subcommittee will be adjourned. I am very grateful to you, Dr. White and Dr. Malone.

Dr. WHITE. Thank you.

Dr MALONE. Thank you.

[Whereupon, the subcommittee was adjourned at 4:35 p.m.]

APPENDIX

Additional Material for the Record

TESTIMONY OF

DR. ROBERT M. WHITE

FOR DELIVERY BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION, AND WEATHER

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY
RE H.R. 8763

MAY 25, 1978

Mr. Chairman, members of the Committee, I welcome the opportunity to appear before you to discuss H.R. 8763, the National Weather Service Act of 1977. It is timely that the Congress consider the issues raised by this bill. There clearly will be a need to relate the legislation under H.R. 8763 to the Organic Act for NOAA now under consideration by various committees of the Congress. How this is to be done is a matter for the Congress to decide.

The Weather Service of the United States is without question the finest in the world. The excellence of our service rests on the pioneering efforts of the past two decades to place new scientific knowledge and technology in the service of meteorology. It is useful to take stock of some of these achievements to give us perspective on some of the problems and issues addressed by H.R. 8763.

Technology has vastly changed our weather services. In the past two decades we have seen the development and deployment of both polar orbiting and geostationary weather satellites for routine operations. Satellite observations of clouds, winds, and temperature have become an integral part of the every day weather forecasting routine.

But the satellite is merely the most spectacular of the technological innovations of the last 20 years. Large scale computer capacity has grown with giant strides, enabling us to capitalize on the scientific progress made in numerical prediction. Today we prepare forecasts by numerical means of

a complexity and diversity that would have been unimaginable even a decade ago.

The increase in availability of economic computer capacity has revolutionized our observing, communication, data archival and display systems. As a result, we are deploying the most recent addition to our weather service technological base, the AFOS system (the Automation of Field Observations and Services). We have replaced our entire network of short range radars and have developed and deployed reliable, automatic weather stations. We have now installed communications systems of such speed that we are capable of transmitting and displaying weather data in great diversity and quantity to serve almost any specialized needs. Our capability for communicating directly with those we serve has taken enormous strides. We have installed our continuous broadcast VHF/FM systems, as one step in this process. We have completely transformed the practice of meteorology.

The technological advancements have been matched by advancements in our forecasting capabilities. The recent introduction by the National Weather Service of experimental ten day forecasts are a mark of just how far we have come. There has been a remarkable improvement in our ability to predict major new storm developments. The precision of the forecasts of storms which buried much of the east coast in snow this past winter were noteworthy. Our forecasting capabilities have

come a long way.

While this modernization and development of our weather services was taking place, other developments --- in governmental management, interagency relations, user needs, were raising a different set of questions about the future of our weather services. Some of these questions caught us without good answers. The most telling of these has since become known as the "Don Rice" question. Don Rice, then Assistant Director of the Office of Management and Budget and now President of the Rand Corporation, in the course of our annual budget justification, asked the question, "How much weather service is enough ?" A simple but difficult question. We tried to answer this question in terms of observational network densities, frequency of storms, etc. These technical answers didn't work. The problem was that the question addressed the degree of risk to be taken in operating the weather warning system. It is a value judgment that best be made by the Congress.

If we look back through the history of the weather service, it has not been unusual for the Congress to indicate the scope of the weather services of one kind or another it felt should be provided. The first legislation establishing the National Weather Service in the Signal Corps in 1870 resulted from the sense of the Congress that something had to be done to provide severe storm warnings on the Great Lakes. When later transferred to the Department of Agriculture in 1890, the Congress

xpressed its views that weather forecasts to serve agriculture :ere to be provided. In the transfer of the Weather Service :o the Department of Commerce in 1940, the need to serve aviation was paramount.

Through the years the Congress has expressed its sense of what was needed, sometimes in connection with other legislation as in the '30s when dust bowl conditions led to the establishment of a long range weather forecasting service, sometimes in connection with appropriations actions, as when the Weather Bureau was asked to fund and operate weather satellites. In many cases the statutory language written a century ago is so general it authorizes NOAA to do almost anything it wishes in providing weather services. On the other hand the lack of specificity has permitted easy rejection of programs not clearly authorized. Under the present statutory charter there is no way to obtain the sense of the Congress at frequent intervals because there is no authorization process.

The form and character of the statutory charter of the Weather Service were designed for a different world. The time is overdue to take stock and set a new course after 100 years. It is timely to examine anew what the nation wants in the way of weather services, how it wishes to organize them, and what their relation should be to other federal agencies and the states and local communities. It is timely to examine what the Congress feels should be the role of the

Weather Service in research, in weather modification, in the provision of specialized weather services.

Let's examine some of the problems which need to be addressed. Some stem from impact of broad governmental management decisions which affect our weather services without a real understanding of their consequences. A good example is the concept of a central civil national weather service. I am concerned that a variety of disparate government wide management decisions may significantly weaken this concept. Take the manpower issue --- a perennial problem. Some 15 years ago, as a result of the urging of Congress, the then Bureau of the Budget issued OMB circular A-62. This Circular established the Weather Bureau and now NOAA as the central weather service for the nation to meet the common needs of various user groups, to avoid duplication, and prevent costly growth of competing weather services in other agencies of the government. However the purposes of this Circular can only be implemented if it is possible for NOAA to undertake tasks requested by other agencies. It is not the money that is the problem. It is the authorization to hire people to perform work that is the Achilles heel. Government wide manpower controls make implementation of this concept difficult.

If you look at the manpower allocations to the Weather Service they have remained approximately constant for the past ten years at about 5,000 people. It is impossible to

render expanded and improved services only by increasing the productivity of the service through managerial and technological changes. My own evaluation is that the system has been squeezed as much as it can tolerate.

From here on out, unless manpower policies are changed, serious difficulties loom. The Weather Service can undertake tasks for other agencies only at the expense of other services for which it has a statutory responsibility. This makes no sense. You cannot expect other agencies who are vitally dependent upon weather services to forego them if they cannot receive them from NOAA. Thus pressure grows in other agencies to provide their own weather services. We see this taking place for example in the Department of Agriculture. The recent decision to have the Federal Aviation Agency provide NOAA with manpower authorizations for the new Air Traffic Control Center weather support is the way the system should work.

One way to insure that it will work properly is to have the sense of the Congress in legislation. The concept of a central civil weather service with necessary manpower should be a cornerstone of any new legislation.

The manpower limitation raise a host of other problems. I'm concerned with the ability of the Weather Service to provide the necessary warnings of weather disasters. Time after time in weather disaster situations we have seen manpower stretched dangerously thin. Many of the disaster survey

reports point out just how thin the manpower available to the Weather Service is in covering such disasters. Even the Department of Commerce's own analysis of the problem some years ago suggested the need for substantial manpower increases. These have never materialized. It is a remarkable tribute to the dedication of the people in the Weather Service that they have done so well under such difficult circumstances.

We all recognize that weathermen are in a sense "fire-fighters". As with fires there are peak demands for manpower. For some disasters, there is adequate time for the deployment of staff to cover vulnerable areas. Some hurricanes are good examples. On the other hand, for many situations such preparatory time does not exist. I hope it will not require some tragedy to force the realization that manpower is indeed insufficient. Congress needs to express its views on the risks it is prepared to take and on how much weather service is enough.

Manpower limitations are at the root of other problems confronting the Weather Service. Take for example the number and distribution of weather service offices. To obtain manpower savings the service is under constant pressure to close weather offices. I have been responsible for my share of closures. It is always a painful experience. We need to face the fact that our network of weather stations is growing thin. Our weather offices serve two functions. The first is a

scientific function to take observations and make forecasts. For these functions scientific criteria are available. The number, spacing and frequency of observations or forecasts can be determined by the dynamics of weather systems. The other function is community service. The level of service is a matter for political decision. When we cannibalize the manpower of our weather stations to provide for other programs we are reducing the levels of public service. In some cases we reduce the scientific integrity of our observing systems. Congress needs to address the levels of service it feels are necessary.

The question "How much weather service is enough? has its companion question, "Who pays?" If some states or localities want a higher level of service than provided by the Federal government, how shall it be provided and who shall pay for it? Today there is no systematic policy governing this issue. Basic questions about the structure of our National Weather Service are involved. There is opportunity here to provide increasingly specialized weather services to state and local communities to meet their needs. There is no reason why we cannot examine the possibility of Federal/State weather services in which the costs of weather services beyond a level provided by the Federal government will in part be borne by the States through cooperative programs. We have some experience along these lines. We have had remarkable

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success in Federal/State cooperative arrangements in the introduction of the VHF/FM radio broadcast systems. We need to generalize this concept.

Then there is the problem of specialized weather services. Over the last two decades we were unable to extend our agricultural weather services to more than 20% of the United States. We had great difficulty in expanding our aviation weather services. We never were fully able to provide adequate weather service to support forest management, marine resource development, air pollution control, and other economic activities. As you know, the General Accounting Office has looked at this question and has come to the conclusion that the Congress should act to define the role of the National Weather Service in providing specialized weather support and to provide the manpower and funding necessary to carry out the tasks assigned.

Among the most frustrating and inconclusive issues I had the privilege to address over the years was that of weather modification. We all await the recommendations of the Secretary of Commerce's Weather Modification Advisory Board, which will respond to Congressional legislation on this question. If we are considering a new charter for the Weather Service, there is a need to address the kinds of roles that might be envisioned for it.

It will be said that there is no need for new basic legislation for the Weather Service. It will be argued that the present authorities are sufficiently broad to accomplish all of the objectives which I have set forth. It will be reasoned that if there are specific programmatic needs, specific legislative remedies would be preferable.

I agree that a new charter for the Weather Service should not attempt to legislate specific programs. These will need to be legislated as needed. The present National Climate Program Act, in the final stages of consideration by the Congress is a good example. The specific requirements of such a program can only be detailed in a separate act. The need for a new charter is to establish basic national policies.

I appreciate the reluctance of some to seek a codification of legislative authority where it already exists. However, we have lived too long with a fragmented statutory base. We know what can happen. Without the sense of the Congress on the policies it wishes to govern the conduct of the NOAA weather services we will continue to be faced with the kinds of problems that have plagued us in the past two decades. Many of these issues are not scientific or technical in nature. They are problems of value judgments that can only be made in our political system by the responsible political bodies. A new statutory charter for the weather service can resolve these kinds of issues.

TESTIMONY OF

DR. ROBERT M. WHITE

FOR DELIVERY BEFORE THE

HOUSE MERCHANT MARINE AND FISHERIES COMMITTEE

SUBCOMMITTEE ON OCEANOGRAPHY RE HR 9708

JUNE 12, 1978

Mr. Chairman, members of the Committee. I appreciate the opportunity to appear before you to discuss HR 9708 -- The National Oceanic and Atmospheric Administration Organization Act of 1977.

I think it is most timely that Congress consider this matter. It is important to know the sense of the Congress about the scope of activity and range of responsibilities of the National Oceanic and Atmospheric Administration as new organizational concepts are being widely discussed.

We have come a long way in the establishment of a center of strength for oceanic and atmospheric affairs in NOAA. However, the statutory authorities of the organization are widely scattered through many different legislative acts, each enactment considering separate functions of NOAA, apart from their relationship to other functions and in some cases, functions of other agencies. NOAA's statutory authorities trace a long history of over a century. The time is propitious to take a broad look at NOAA's statutory charter.

NOAA was established as an agency to undertake both oceanic and atmospheric functions. It is important in drafting an organic act for the organization to insure that there is full consideration of all its functions. In my opinion, the present draft does not address the atmospheric responsibilities of NOAA adequately. Last month I testified before the Subcommittee on Aviation and Weather of the Committee on Science and Technology on the need for new

comprehensive legislation for NOAA's weather services. I, therefore, will not address NOAA's weather functions at this time, but would like to make the testimony I have already given on this matter available to the Committee. Today I will focus on oceanic matters.

Drafting an organic act for an organization as complex as NOAA implies a knowledge of the policies and functions the organization is expected to carry out. Over the past several years there has been great concern about the lack of "a national oceans policy". At one time there was indeed a vacuum. While it is clear that some aspects of national ocean policy remain to be defined, I feel that we have made great progress in establishing a diverse set of farsighted ocean policies over the past decade. I believe our major problem now is to determine what further needs to be done that cannot be done under our present oceans policy or our present organizational structures.

It is clear that there are some areas of ocean activity in which national policy has not yet been clearly formulated. The Congress, however, is actively grappling with this problem in its present consideration of legislation on deep ocean mining and amendments to the Outer Continental Shelf Land Act.

We have become much too self conscious about the policy issue. I believe our energies are best directed at implementing the excellent ones we have already developed, while continuing to formulate new ocean policies in those areas where they are still clearly needed. The discomfort we have about oceans policy is due to our feeling that ocean programs have suffered from inadequate financial support and an inadequate organizational structure.

We need to stand back for a moment. Nobody can fail to be impressed with the remarkable record of the Congress in formulating national oceans policy over the past decade. Starting more than a decade ago with the passage of the Sea Grant Program Act, we have had the Coastal Zone Act, and the Marine Mammal Protection Act of 1972, the Marine Protection Research and Sanctuaries Act of 1974, and the Fisheries Management and Conservation Act of 1976 and others. These actions, taken largely at the initiative of the Congress, have provided us with a very broad set of ocean policies to serve our nation.

We need to focus on the sources of our discomfort. As I have indicated one principal source has been with matters of organization: We need to go back to basics. One problem in structuring an organic act for NOAA is that the oceans are not easily accepted as a way to organize the affairs of government. Governments are problem oriented, not place oriented. Our major societal concerns are with food, energy, pollution, national defense, and similar problems, and not with the oceans as the oceans. Solution of these problems cannot be carved up by ocean/land boundaries. Only in the case of food have we separated the land from the sea. The management of any program directed at solving problems, requires the capability for making necessary tradeoff and resource allocation decisions. Whenever an ocean program is an essential element in the tradeoff, decisions essential for the solution of major national problems, for example in the case of energy, we encounter both substantive and bureaucratic resistance to linking those programs in a broad national ocean organization.

We face the difficulty in drafting an organic act of deciding where the sensible linkages are, that allow us to place various ocean functions together, and where they are so closely integral to the solution of other national problems that it is not in the overall national interest to separate them from their present organizational structures. This is the root of our dilemma.

In organizing NOAA in 1970 we were able to bring together 9 different agencies and functions. While there was some difficulty in detaching them from their parent agencies, in no case were they critical to the major purposes of the parent organizations. We now face a different situation. Any further growth in NOAA, except as a result of new programs that might be assigned by legislation, can only come at significant sacrifice to essential functions of other departments or agencies.

This issue was debated in the Presidential Commission on Marine Science, Engineering and Resources, the Stratton Commission, whose recommendations led to the establishment of NOAA. I was privileged to be a member of that Commission and recall the many discussions on a suitable set of functions for NOAA, and whether it should be an independent agency or lodged in a Cabinet department. We have taken giant strides since the recommendations of the Stratton Commission. NOAA is the major center of strength in oceanic and atmospheric affairs in the Federal government. It has, in the intervening years, developed its technical and scientific base and moved vigorously into the field of ocean management. While all the Stratton recommendations for the organizational structure were not

implemented, NOAA went a long way toward satisfying the objectives of that Commission.

As you will recall, that Commission recommended that NOAA be established as an independent agency. It also recognized that independent agency status should be regarded as only a first step in the evolution of a more comprehensive ocean and atmospheric organization, possibly within the context of a new department which could accommodate its objectives.

Some of the organizational options advanced by the President's reorganization task force which call for NOAA to be an element in a new department structured around natural resource functions, and recommendations of the members of this Committee for an independent NOAA have to be viewed against this general background.

It seems to me that there are three serious possibilities that need to be considered, each of which has its advantages and disadvantages. The first would involve retention of NOAA within the Department of Commerce where it can continue to be strengthened over the years. The second is to seek to make NOAA an independent agency very much like the National Aeronautics and Space Administration and the National Science Foundation; and lastly to join NOAA in a new department concerned with natural resource conservation and environmental affairs. Each of us will have our preferences.

The Department of Commerce has been a good home for NOAA during the past seven years. NOAA has had the support of all the Secretary's of Commerce who have served in that post since NOAA's formation. NOAA has been able to operate within the Department of

Commerce almost as an independent agency. To the extent that it has been able to obtain resources, it has been able to plan and implement its programs without interference from the Department. Indeed, this has been one of the principal values of being in the Department of Commerce -- this measure of independence and the lack of competition and bureaucratic entanglements with other Commerce Department agencies. It has been a valuable association in that NOAA has had a Cabinet officer speak at the highest levels of government on behalf of its programs.

As an independent agency NOAA would be able to speak for itself without going through a Departmental filter. NOAA's programs could be judged in a different framework than they are at present. In the Department of Commerce it is the task of the Secretary to allocate resources to programs as diverse as those of NOAA, the Economic Development Administration, the Census Bureau, and the Office of Minority Business Enterprise. As an independent agency its Administrator would be able to interact directly with the political and budgetary arms of the White House. The programs of NOAA would perhaps be judged in a context of science, natural resources, and environmental problems. NOAA would be more deeply involved in the annual budget decisions. Independent status, without the necessary authority for coordination of oceanic programs broadly throughout the government, would have the same interagency difficulties experienced by NOAA in the Department of Commerce, without the virtue of being able to have a Cabinet level officer to speak for it.

Amalgamation of NOAA in a new department structured around natural resource functions would have the virtue of placing NOAA and its functions in a natural resources context. The Secretary of that Department would be in a position to make tradeoffs between NOAA's functions and other more closely related functions than is possible at the present time. Unfortunately, the placement of NOAA in a new Department of Natural Resources could lead to centrifugal forces that could result in the dispersion of some NOAA functions that are closely related to others in the new Department. Whether this would happen will depend upon the degree to which NOAA's integrity is written into statute. If the amalgamation of NOAA into a Department of Natural Resources were to provide an opportunity for a significant step forward in broadening its strength to include more oceanic and atmospheric functions, then a move might be salutary.

If I balance these competing factors, my first preference would be for an independent NOAA. If it were possible, to provide for a significant expansion and broadening of the NOAA concept by moving it into a new Department of Natural Resources, then this option should be seriously considered. Barring this kind of augmentation of NOAA, I believe a move to a new department would be less desirable than the continuation of NOAA within the Department of Commerce. I'd be pleased to answer any questions you may have.

STATEMENT OF MR. LARRY MEIEROTTO, DEPUTY ASSISTANT SECRETARY FOR POLICY, BUDGET AND ADMINISTRATION, DEPARTMENT OF THE INTERIOR FOR THE COMMITTEE ON SCIENCE AND TECHNOLOGY, U.S. HOUSE OF REPRESENTATIVES

Thank you for requesting our views on H.R. 9708 (S. 2224), the "NOAA Organization Organic Act."

This legislation would set forth a national ocean policy and some of the functions of the National Oceanic and Atmospheric Administration.

The Administration recommends that the Congress defer action on the bill, pending the outcome of the natural resources study by the President's Reorganization Project. In addition, the Administration plans to conduct a review of Federal ocean policy later this year. Until these two projects are completed, it would be premature for us to take a position on the bill.

We do, however, have some initial comments which we would like to share with you at this time.

Section 102. Definitions

A number of key terms, e.g., "marine environment" and "ocean resource," are defined so broadly that it is difficult to determine the intent of the drafters. Unless these terms are properly defined, the bill could affect responsibilities and jurisdictions of other departments.

Section 101(b), for example, would designate NOAA as "the lead civilian agency with responsibility for coordinating and carrying out national ocean policy in order to improve the understanding, assessment, development, utilization, conservation, and protection of ocean...resources."

"Ocean resources," as defined in the bill, include "nonliving resources" such as "energy sources, minerals, and chemical substances" of the "marine environment," which by definition clearly includes the OCS substrata and the deep seabed.

The Department of the Interior now has responsibility for many of these activities as a result of the Mineral Leasing Act of 1920, Submerged Lands Act of 1953, OCS Lands Act of 1953, and the Mining and Minerals Policy Act of 1970. It is unclear if these Congressionally mandated responsibilities would be transferred to NOAA or if NOAA would assume separate but similar responsibilities.

Natural Resources of the OCS

Pursuant to the OCS Lands Act, the Department of the Interior, primarily through the Bureau of Land Management, Geological Survey and the Fish and Wildlife Service, already exercises conservation and management authority over some ocean resources.

The OCS Lands Act gives the Secretary of the Interior the authority and responsibility to "prescribe and amend such rules and regulations as he determines to be necessary and proper in order to provide for the prevention of waste and conservation of the natural resources of the OCS." Since 1953, the Secretary has promulgated a large number of regulations and orders pursuant to the authority granted in the Act.

The term "natural resources" used in the OCS Lands Act determines the extent of the Secretary's conservation authority on the OCS. The judicial definition given this term is very broad and covers many of the same things covered in the proposed H.R. 9708 (S. 2224). In Gulf Oil Corp. v. Morton, 493 F. 2d 141 (9th Cir. 1974), the Ninth Circuit Court of Appeals defined "natural resources" using the definition contained in the Submerged Lands Act:

> The term "natural resources" includes, without limiting the generality thereof, oil, gas, and all other minerals, and fish, shrimp, oysters, clams, crabs, lobsters, sponges, kelp and other marine animal and plant life. 493 F. 2d 141, 145 (1973)

H.R. 9708 (S. 2224) seems clearly inconsistent with the authority granted by the OCS Lands Act to the Secretary of the Interior.

Earth Sciences

Section 204(13) would grant NOAA authority overlapping the Geological Survey's responsibilities to study geophysical phenomena such as crustal movement and earth tides.

Deep Seabed Mining

The jurisdictional issue on whether deep seabed mining by U.S. companies should be regulated by the Department of the Interior or by the Department of Commerce has yet to be developed by the Administration. We believe that H.R. 9708 (S. 2224) should not be enacted until the Congress has the benefit of an Administration recommendation on this important issue.

Fish and Wildlife Resources

Prior to Reorganization Plan 4 of 1970, essentially all Federal fishery management responsibilities resided in the Department of the Interior. The Bureau of Sport Fisheries and Wildlife (now the Fish and Wildlife Service) had recreational fishery programs and the Bureau of Commercial Fisheries had commercial fishery programs. Subsequent to Reorganization Plan 4 of 1970, the division of responsibility between the two departments has resulted in some areas of overlapping jurisdiction. In some cases, this problem has been reduced through coordinating committees, memorandums of understanding and other forms of interagency cooperation. Still, in almost every area where there is shared responsibility there has been duplication or gap. Examples are presented below.

Anadromous Fish

Because of their migrations between marine and fresh water, anadromous fish are one of the resources most affected by overlapping jurisdictions. The areas of overlap between NOAA and the Fish and Wildlife Service (FWS) include fish stock assessments and evaluation, environmental studies, studies of fish genetics, and fish-run prediction. In addition, both NOAA and FWS gather information, provide technical assistance to States, enforce fishery laws and fund fish hatchery operations.

Environmental Assessment

The FWS shares a number of responsibilities with the Environmental Assessment Division of NOAA. The most obvious cases involve the Nation's estuaries and marine coastal areas.

Under the Fish and Wildlife Coordination Act, FWS and NOAA review Federal construction projects of the Corps of Engineers and the Bureau of Reclamation and license and permit applications regulated by Federal agencies. NOAA's review is directed mainly to those projects affecting marine, anadromous and commercial fish, whereas the FWS's review includes those as well as sport freshwater fish and wildlife. NOAA has the responsibility to identify and develop commercial fishery potentials in Federal reservoirs, which can conflict with FWS's charge to enhance sport fishing in such reservoirs.

NOAA's National Marine Fisheries Service and the FWS share responsibilities under the Coastal Zone Management Act and the Marine Protection Research and Sanctuaries Act. These agencies as well as the Geological Survey review and provide comments on proposed and adopted State CZM programs and on proposals for estuarine sanctuaries.

Endangered Species

Under the Engangered Species Act of 1973, responsibilities are divided between the Secretaries of the Interior and Commerce according to species and as program responsibilities have been divided pursuant to Reorganization Plan 4 of 1970.

Some difficulties have arisen in the past in clearly delineating responsibilities for species with both terrestrial and aquatic habitats. This was particularly apparent in agreeing on procedures for handling sea turtles because it was perceived by some that basic philosophical, protection-versus-commercial-utilization differences existed between the two agencies.

The FWS also shares responsibility with NOAA under the Marine Mammal Protection Act.

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Section 209. Annual Report

This section would mandate to the Department of Commerce responsibility to report annually a description, evaluation, budget analysis and forecast, and legislative recommendations for our OCS program as well as for all other Interior and Federal ocean programs.

We believe that this provision is irreconcilable to the appropriate roles of Cabinet officers. It would inevitably confuse and obscure the lines of authority and responsibility in the Executive Branch. It would confuse the legislative authorities of the various committees of the Congress. Delays and duplications of effort would be unavoidable. The public would be unsure as to where to look for authoritative information. The accomplishment of our national goals would be impeded.

Donald L. McKernan, chairman of the National Advisory Committee on Oceans and Atmosphere expressed similar reservations about this provision in his April 6, 1978, statement to the Senate Commerce Committee.

Delegation of Authority

The bill grants the bulk of authority and responsibility to the Administrator of NOAA rather than to the Secretary. We feel the reverse would be preferable. Cabinet officers should be empowered to manage the bureaus within their departments. Whereas the Secretary can always and surely would delegate these authorities to the Administrator, it is more difficult for a Cabinet officer to

obtain authority and influence over an agency once the Congress assigns it to one of the Secretary's subordinates.

Federal-State Relations

The bill does not address the Federal role in relation to State management of living marine resources, especially in those coastal and marine areas of traditional State jurisdiction. The bill, therefore, could be construed as a further intrusion into State management responsibilities and prerogatives. We believe it should be amended to clarify the Federal and State roles in these matters.

Again, I want to thank you for this opportunity to comment. We would be pleased to receive and answer any questions you might have.

PROTOTYPE REGIONAL OBSERVING AND FORECASTING SERVICE (PROFS)

Working Paper prepared by C. Gordon Little for
Atmospheric Research Review Workshop
Snowmass, Colorado, June 5-9, 1978

Summary: In recent years, there has been major progress in observing the atmosphere by satellite and ground-based remote sensors, and by automatic surface weather stations. There has been similar, though largely uncoordinated, progress in data processing and display, in mesoscale numerical modelling and prediction, and in color TV display and dissemination. This PROFS initiative proposes a three-year exploratory development program, at a cost of $5.9 million per year, to integrate these advances into the research prototype of a radically new local weather observing and forecasting service, (PROFS--Prototype Regional Observing and Forecasting Service). The prototype will be developed under ERL leadership by a joint team of NWS, NESS, and ERL staff, and is designed to provide dramatic improvements in the accuracy, timeliness, scope, and dissemination of the local weather services. Such improvements are needed by industries like transportation (especially aviation), agriculture, and construction, and by the general public, especially under conditions of severe storms, tornadoes, flash floods, damaging winds, blizzards, and freezing rain.

The Needs for Improved Local Weather Services

For over a hundred years, NOAA and its predecessors have provided weather services in response to public and private needs. Such services enhance public safety, improve the efficiency of the industry and commerce, and help guide the myriad of small, weather-related decisions made each day by our citizens.

The most dramatic of these needs relate to public safety. Despite the best efforts of the National Weather Service, each year hundreds of Americans are killed, and thousands injured, by a combination of hazardous weather events such as tornadoes, flash floods, blizzards and wind shear at airports. Many of these deaths and injuries would have been avoided if adequate warnings had been disseminated and received. Recent examples of such tragic losses are the flash flood disasters in Johnstown, Pennsylvania, and the Big Thompson canyon, Colorado, in which 215 lives were lost, and the weather-induced crashes of Eastern Airlines Flight 66, and Southern Airlines Flight 242, in which 183 lives were lost.

Less dramatic (but having more total impact on the nation's economy), is the cumulative effect of avoidable inefficiencies in commerce and industry. Each day, tens of thousands of persons in industries such as agriculture, aviation, construction, fishing, and recreation make weather-related decisions affecting the efficiency of their operations. The accuracy of these decisions is dependent upon the quality (accuracy, timeliness, relevance, and accessibility) of the available weather information. Many analyses have indicated that savings amounting to hundreds of millions of dollars each year could result if major improvements in weather services could be achieved. Perhaps the strongest indication of the magnitude of the needs lies in the actions of other Federal agencies. Currently, both the U.S. Department of Agriculture and the Federal Aviation Administration

are developing their own version of a local weather observing, forecasting, communicating, and disseminating service to meet the specific (though limited) needs of the farming and aviation communities respectively. These activities, coupled with the remarkable increase in consultant meteorologist activity, are a clear indication that real and significant gaps exist in NOAA's national weather services.

More mundane, but not to be ignored, are the cumulative needs of our 220 million citizens for weather information. Here we are dealing with the myriad of phenomena that can be placed under the general category of significant local weather. Sometimes the "significant weather" has major impact, as when a sudden snowstorm paralyzes the metropolitan rush-hour traffic of a million persons; in other cases, it may affect only the convenience of citizens who would (for example) prefer to know ahead of time whether or not their planned game of tennis will be terminated by rain. It has not been possible to estimate the net benefit to society of meeting such needs; indeed it seems likely that accurate estimates will require multi-year operation of radically improved local weather service at at least one location. It is, however, clear that large improvements in short-term local weather services could be made for major population centers such as New York at a per capita cost small compared with the approximately $2 per citizen annual cost of NOAA's existing weather programs.

PROFS--A new Approach to Improved Local Weather Services

1. Introduction

From the point of view of the individual user, weather problems are almost always local in scale, since his interest is naturally focussed on his local environment. This basic premise is clearly not the driving motivation for NOAA's present emphasis on centralized synoptic scale services, and it is therefore not surprising that analyses show that the principal unmet service needs are for local (e.g., 0-100 km), short-term (e.g., 0-12 hours) weather forecasts.

The most demanding of these needs are those for detailed, highly site-specific, local weather forecasts on very short time scales, especially at airports. Analyses, particularly of the airline crashes at Kennedy (New York) and Stapleton (Denver) airports, show that under thunderstorm wind-shear conditions, spatial resolutions of the order of 1 km, and temporal resolutions of the order of 1 minute, will be required to observe, describe, and warn of the phenomenon. Similar resolution is required to monitor and warn of tornadoes, most of which last only a few minutes and traverse only a few kilometers. Such resolutions are orders of magnitude beyond the present operational capabilities of the National Weather Service. Moreover, it is clear that centralized numerical weather prediction will never be able to operate on these space and time scales, and therefore that a radically new approach will be required to meet these needs.

Historically, each major advance in meteorological services has been produced by the incorporation of a new technology, such as radiosondes,

satellites, or large computers. In each case, the introduction of the new technology revolutionized the way in which observations were obtained or forecasts made. It is therefore reasonable to seek for new technologies capable of solving the short-term local weather problem. Ideally, the new technologies should solve the problem of short-term local weather services, and also contribute strongly to improved weather services on larger space and time scales. Moreover, the method of implementing the new technologies should provide for natural and flexible growth of weather service capabilities, as new needs arise, or as more effective technologies are created.

In the search for relevant new technologies, it rapidly becomes apparent that there has been a quiet technological revolution in each of the main areas comprising a weather service; namely, observation, forecasting, communications, and information dissemination.

In the area of observation, ground-based remote-sensors have demonstrated the ability to monitor the three-dimensional fields of wind, clouds, precipitation, and aerosol, with spatial and temporal resolution adequate to meet the most demanding current service needs. A further recent advance indicates that it is practicable to provide, continuously, vertical profiles of wind, temperature, and humidity using automatic, unmanned, ground stations. Remote sensors mounted on satellites have achieved remarkable global coverage, often with temporal and spatial resolution appropriate to the needs of local weather services. Important advances have also been made in automatic, in situ, measuring instruments for use at the earth's surface, or on board aircraft.

In the area of forecasts, there have been similar major advances. Mesoscale numerical models, covering a domain as small as 200x200 km, have demonstrated an excellent ability to incorporate local stationary mesoscale forcing functions such as topography, land-water effects, the effects of cities, etc. Other numerical mesoscale models are being developed that demonstrate the onset, evolution, and dissipation of traveling mesoscale convective systems such as squall lines and thunderstorms.

New methods for communicating weather information within NOAA have also made rapid advances. The AFOS system is one important such example; others include satellite communication and interrogation techniques that could further revolutionize the transmission of weather data. Novel uses of the touch-tone telephone system also are opening up new methods for the acquisition and exchange of data with cooperative observers.

Dissemination, the final critical link with the user, is also a rapidly developing field. Animated color TV displays of current weather are now practicable, with enormous increases in information content when compared with the typical brief spoken weather message--again, with a temporal and spatial resolution appropriate to local weather services. Examples include the University of Wisconsin IVAM program, and the computer-prepared animated TV pictures now being prepared by some private meteorological firms for TV dissemination, as well as the rapidly increasing number of TV stations using digitized color TV presentation of precipitation maps obtained using their own weather radars.

Thus it is apparent that major technological advances have been made in each of the four main areas essential to a local weather service. One thing remains--an effective strategy capable of integrating these advances into a single system that simultaneously solves the problem of short-term local weather prediction, and provides opportunities to make important improvements to weather services on larger temporal and spatial scales.

Here, one final area of advance is of critical importance. Largely as a result of the space program, major progress has been made in learning how to design complex systems. The so-called "systems engineering approach" is essential to success in such endeavors. Systems engineering does not itself solve problems; it does however provide a process or framework whereby problems can be clearly identified, alternative solutions evaluated, and optimum compromises selected.

2. The PROFS Plan

The PROFS plan calls for the creation, using the systems engineering approach, of the research prototype of a radically new local weather service capability. It integrates the above technological advances into a single flexible system designed to provide radically improved local weather services that are fully responsive to user needs.

A total plan leading to the eventual operational deployment of PROFS-type capabilities would be divided into the general phases of:

1) Information collection
2) Analysis and planning.
3) System design
4) Development of research prototype
5) Development of operational prototype
6) Operational implementation

The exploratory development phase described in this initiative covers only the first four of the above steps, and will result in the demonstration (internally within NOAA) of the feasibility of the improved services. The critical next step, the creation and evaluation of an operational prototype, would follow completion of this exploratory development phase.

Following the methodology of system analysis and design, some limited effort in the information collection phase is already underway. User needs in the proposed PROFS region are under study, and a workshop was held in March 1978 to explore potential solutions, system component constraints, existing services, and other environmental factors. By employing a systems design approach and by viewing the problem from the perspective of the user rather than the producer of a weather service, we are able to focus more directly on the needs of society.

Observing System

Until the user need studies and the full system analysis and design are completed, it is not possible to specify the PROFS observational

system in detail. However, at this time it seems likely that it will include the following components, including existing NWS observational capabilities in the PROFS area:

Surface data

Network of cooperative observers (intermittent data)

Array of automatic surface weather stations (continuous data)

Profiles, area, and three-dimensional data

Satellite remote sensing systems (continuous and intermittent data)

Ground-based remote sensors (continuous data)

All-weather Doppler radar
Continuous vertical profiling systems

Radiosonde (once per 12 hours)

Aircraft reports (intermittent data)

Forecasting System

PROFS forecasts cover three different time frames, each involving different methods of preparation.

a) Nowcasts. The enormously richer data sets produced by the above observational system will be processed in essentially real time, and used to prepare "nowcasts" (information on the current state of the atmosphere in the PROFS region). These nowcasts will be prepared automatically in TV format for video display, as well as for use in oral or written messages.

b) Extrapolation (0-3 hours).

The next step in providing improved local weather services involves short-term extrapolation of the locally- and satellite-acquired nowcast data for periods of up to two or three hours. The current nowcast will be extrapolated using advection and temporal trends derived from the sequence of nowcasts; simple physical models (incorporating major terrain features, and simple models of significant meteorological processes) will also be applied, in conjunction with NMC forecasts and satellite observations. In addition, once a major series of PROFS data sets and nowcasts are available, powerful statistical techniques will be applicable. Experience with the much less dense CRAB network in the Chesapeake Bay area indicates that major improvements in the accuracy, specificity, and scope of short-term local weather services can readily be provided by these means.

c) Numerical Forecasting (3-12 hours)

The next and most difficult step involves bridging the gap between these detailed PROFS 2-3 hour extrapolations, and the much more general 12 hourly forecasts put out by the National Weather Service. (For periods of 12 hours and longer, the full power of the existing NWS synoptic scale system would be available; however, this system is tied to the twice-daily release of radiosondes, leaving a critical PROFS forecast gap for time periods of 3 to 12 hours.)

Ideally, one would wish to fill this gap by detailed meso-β scale numerical weather predictions. These models, working over a domain of perhaps as little as 200x200 km, would work on a grid scale about an order of magnitude smaller than existing NMC models, and could therefore incorporate significant terrain and surface features, important to meso-β and meso-γ scale meteorology, that cannot be incorporated into the larger-scale NMC models. They would also produce much more detailed forecasts than those available from NMC.

Such models would have to operate within some nested grid model covering a very much larger area, if they were to produce accurage meso-β scale forecasts for as long as 12 hours. Moreover, the space-time density of data within this larger area would have to be significantly greater than the present synoptic scale network, which does not adequately resolve the larger meso-β and smaller meso-α scale waves important to short-term weather forecasts.

Several possibilities exist for the acquisition of such data sets. The most important of these are the satellite observing systems, especially the geostationary vertical atmospheric sounding systems planned for the early 1980's. These unproven systems offer promise of temperature and humidity profiles at spacings as close as 30 km, with high sensitivity to spatial gradients of these quantities.

A second very important opportunity lies in the remote profiling capabilities of ground-based sensors. Recent research has shown that profiles of wind, temperature, and humidity can be obtained continuously in time, using unmanned, ground-based, remote sensing systems. The replacement of the existing network of highly intermittent radiosonde measurements by continuous data sets would greatly improve the ability to identify the smaller scale atmospheric waves that are easily missed in the existing radiosonde data. Note that eventually each PROFS region might well include a small network of four automatic profiling systems, at the corners of a 150 km-200 km square surrounding the urban area. This spacing of profilers is half the current spacing of the existing NWS radiosonde network; a contiguous series of PROFS regions, such as might develop in the more densely populated areas of the U.S., would then provide improved coverage in space as well as continuous coverage in time.

Other possibilities include the use of commercial aircraft as platforms for automated weather observations, and the modification of the PROFS ground-based sensor array to permit wider spacing of sensors at the periphery than at the center of the PROFS area. The optimum long range

solution likely to evolve with time is the combination of satellite observations with a ground array of PROFS stations; this may well develop in major concentrations of population, such as northeastern U.S.A.

Dissemination System

Many experts believe that dissemination is the single factor most seriously limiting the effectiveness of existing NWS local weather services. Currently, in addition to brief weather forecasts appearing in local newspapers, services to the public are limited to short oral messages, available intermittently from local radio and TV stations, plus (in populated areas, if the user possesses a suitable FM radio receiver) continuous oral messages from the local NWS FM weather radio. More specialized users can receive weather data by teleprinter, or, in some cases, facsimile reproductions of NMC maps.

The use of broadcast and cable TV for dissemination of meteorological information to the public is a rapidly growing field, larely due to the entrepreneurial activities of private meteorologists and TV stations. Thus, many TV stations are already broadcasting color images (and oral interpretations) of their own digitized weather radar data. These are beginning to be supplemented by computer-developed animated drawings of meteorological information in TV format, prepared by private meteorological firms for sale to TV stations. Thus, we can anticipate that much of the dissemination bottleneck is about to be removed through the growing availability of large-information-rate video presentations, including continuous video presentations via broadcast or cable TV. Such presentations could dramatically change the amount, specificity, and frequency of up-dating of weather information available to the public.

For specialized users, the rapidly growing field of computer-to-computer communications offers great promise for rapid and efficient transfer of meteorological information to suitably-equipped users. Depending on needs, the facilities required can be quite cheap. For example, a joint NOAA/Dept of Agriculture plan envisages farmers acting as cooperative meteorological observers, entering their data into the local Dept of Agriculture Extension Service computer by touch-tone telephone. In return, the farmer could receive, via his $100 "Green Thumb Box" telephone interface, up-to-date meteorological or agricultural information for storage and display on the farmer's TV set. (An equivalent British system, known as "Viewdata" will become operational in early 1979 within the U.K., and will give users continuous access (on demand) to a library of some 300,000 pages of data, including weather information.)

3. Impact of PROFS on the Synoptic Scale

PROFS is primarily designed to improve short-term local weather services. It will, however, have direct, and beneficial impact on longer-term, synoptic scale forecasts through the following features:

a) Development of the continuous profiling system.

As advances are made in different areas of the PROFS program, it will be important to consider their application to synoptic scale forecasting. The continuous profiler is one of the most important candidates for such use. Its eventual application as a replacement for the radiosonde after a full program of engineering development and testing would have major impact on synoptic scale modelling and forecasting. Particularly important will be the temporal continuity of the data, permitting better identification of changes and movements in weather patterns across the United States, and reducing some of the "noise" in the essentially instantaneous radiosonde profiles.

b) Development of improved dissemination methods.

The proposed video dissemination techniques to be developed under PROFS will be directly applicable and equally beneficial to synoptic scale forecasts.

c) Development of improved mesoscale models incorporating fixed local forcing functions.

Successful forecasting of local weather requires not only the correct prediction of synoptic scale events for a local area, but also requires understanding how the synoptic scale weather will be modified and modulated by stationary local surface and boundary layer features. Examples of these include 1) the formation and distribution of stable clouds, fog, and precipitation by topographic features; 2) orographic windstorms and their attendant temperature effects; 3) land-water configurations and their effects on winds, clouds and precipitation, and temperature; and 4) the evolution and dissipation of atmospheric pollution episodes in urban areas.

Thus, numerical models which successfully incorporate these fixed local forcing functions will be directly applicable to the longer term synoptic scale forecasts for that local area, and will provide enormously more detailed prediction on the local scale.

d) Development of improved regional data sets.

Particularly in the eastern half of the United States, and along the western seaboard, a contiguous series of PROFS stations may well develop. Since each PROFS station is presently conceived as containing its own array of continuous profilers at the corners of a 150-200 km square, a contiguous array of PROFS stations would provide profiles continuously in time at a spatial frequency twice that of the existing radiosonde network. This would do much to ensure accurate identification and monitoring of the smaller synoptic scale waves so difficult to identify and track in the present intermittent, widely spaced radiosonde network. This greatly improved data set should significantly enhance synoptic scale numerical weather predictions and hence local weather predictions.

e) Improved parameterizations of sub-grid-scale processes.

The ability to monitor continuously atmospheric profiles during changing meteorological conditions offers major opportunities to check the performance of numerical models and improve the basic parameterizations they must use to incorporate the effect of sub-grid-scale phenomena. Improved parameterizations should then result in improved numerical weather predictions on all scales.

4. PROFS and the Technology Transfer Gap in NOAA

The magnitude of the opportunities for improved services inherent in PROFS raises two very significant questions--why does such a major backlog of unused technology exist? What can be done to improve the flow of new research capabilities into operational use?

In retrospect, the answer to the first question is clear. NOAA has had no effective strategy for the transfer of research capabilities to operations.

Many organizations, faced with this problem, have found that the transfer is best accomplished within an organizational framework that recognizes that the creation and transfer of new capabilities involves four phases, as follows:

a) Research. In response to user needs, or their own research, the research group identifies an idea or concept for the improvement of operations.

b) Exploratory development. Under the leadership of the research group, a joint research/operational team then develops and demonstrates (using research techniques and hardware) that the concept is indeed capable of producing the desired operational improvement.

c) Engineering development. Under the leadership of the operational group, a joint operational/research team then develops and tests fully engineered models of the concept, redesigned with emphasis on simplicity and low capital, operating, and maintenance costs, etc.

e) Operations. The new models (hardware or software) are then brought into full operational group by the operational agency.

Traditionally, NOAA management has focussed attention on only the first and last of these four phases. This has resulted in a major backlog of meteorological capability, awaiting transfer and urgently needed by the operational group.

The PROFS plan proposes that an ERL-led, joint NWS, NESS, and ERL team create the exploratory development prototype of a radically improved local weather service, using the systems engineering approach. In so doing, it will, with the existing NWS Systems Development Office, provide the two essential pillars of the technology transfer bridge hitherto missing in NOAA--a bridge over which new research capabilities will be able to flow continuously in the future.

5. PROFS and the U.S. Balance of Trade

Better local weather services are required by all nations, to improve public safety and the efficiency of industry and commerce. Extrapolation of present trends in the U.S. and overseas indicates that by 1985 it will be possible to provide each major urban center and airport with dramatically improved local weather services (based on technologies and concepts similar to those planned for PROFS)--and that this will be done. Such services will, however, require integration of satellites, ground-based remote and in situ sensors, computers, communication circuits, dissemination channels and meteorological know-how into a single, flexible system.

The United States currently leads the world in almost every technological aspect required to bring the PROFS concept into being. Therefore, the U.S. has a unique opportunity to create the next-generation weather service system. By moving rapidly, it could capture a major share of the world market for advanced meteorological hardware, software, services, and systems. This market is currently fairly small, but is expanding rapidly. Thus, we understand that Iran alone is contemplating spending over a billion dollars in the next several years to improve its weather services. Similar plans are being discussed by the U.S., Saudi Arabia, and Britain, and no doubt by other countries.

We therefore believe the Department of Commerce should fund PROFS, not only to improve local weather services within the U.S., but also as a mechanism to create and capture a large share of the world market for improved weather services. This would help reduce unemployment and improve the U.S. balance of trade through increased overseas sales of U.S. hardware and software. We believe that major opportunities exist in such areas as satellite systems, computers, communication systems, remote sensors, etc., as well as meteorological services such as installation, training, and operation of PROFS-type components and systems. Each year of delay reduces the U.S. lead in this field; it is important to recognize that (for example) the U.K. is currently in the third year of a simpler version of PROFS, and plan to implement it operationally by 1979 or 1980.

May 30, 1978