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A NACOA RETROSPECTIVE: 1971 - 1977

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INFORMATION CENTER

A summary of what NACOA has said in
the past on some important issues con-
cerning the oceans and the atmosphere

National Advisory Committee on Oceans and Atmosphere

Prepared by the Staff of the

**National Advisory Committee on
Oceans and Atmosphere**

November 1977

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The National Advisory Committee on Oceans and Atmosphere reports to the President and to the Congress on national marine and atmospheric affairs, and to the Secretary of Commerce with respect to the National Oceanic and Atmospheric Administration. Its members are appointed by the President and serve for a term of 3 years.

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Prepared by the Staff of the

NATIONAL ADVISORY COMMITTEE ON OCEANS AND ATMOSPHERE

NOVEMBER 1977

U. S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER
2234 SOUTH HOBSON AVENUE
CHARLESTON, SC 29405-2413

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PREFACE

In the 6 years of its existence, the National Advisory Committee on Oceans and Atmosphere (NACOA) has commented or advised on many oceanic and atmospheric issues of importance. These comments and recommendations have appeared in NACOA annual reports, special reports, and in letters and memoranda to the President or to Members of Congress. Some of these issues have been treated only once. Some have been treated several times.

In this series of short papers, the NACOA staff has brought together material which describes NACOA's past positions on a variety of current issues. The purpose is to introduce new members of the National Advisory Committee on Oceans and Atmosphere to the work of those who preceded them. Fuller treatment may be found in the documents themselves, in detailed minutes, and in staff memoranda. These papers are not meant to imply a NACOA party line. Since the subjects chosen are lively ones, a great deal may have happened--or should have happened--since the original statements were made. References to current documents are included where possible.

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COASTAL ZONE MANAGEMENT

Our Nation's coastal zone contains an increasing concentration of industry, population, and commerce giving rise to a complex interplay among local, regional, and national interests. This interplay raises policy issues that are so interdependent that they affect the nature of the decisionmaking process itself. The issues that arise cannot be resolved by decentralized local authority nor can they be centralized and made the exclusive responsibility of the Federal establishment. The decision process must take into account not only economic factors but also the changing nature of the values and priorities of U.S. society. Political processes must be invented to strike a balance among these new values, national interests, and local and private interests. One such invention is the Coastal Zone Management Program.

Developments to Date

The land and waters of the coastal zone support a complex mix of activities: recreation, commercial fishing, transportation, and perhaps in the future aquaculture, nonfossil sources of energy, and the mining of seabed minerals. Moreover, it seems virtually certain that over the next several years there will be accelerated oil and gas development in the Outer Continental Shelf, particularly in "frontier" areas where there is not now any production.

When NACOA was established in 1971, the need for action in the coastal zone had already become the subject of a series of studies, commissions, and policy proposals which had accumulated over the previous 5 or 6 years.

Two coastal zone management bills were already under active consideration by the Congress. Also pending, as an Administration initiative, was legislation which would have established a comprehensive national land-use policy and program. In its First Annual Report, NACOA strongly supported legislation to create a management process for the coastal zone, and advised against the much larger land-use management approach for which it appeared the Nation was unready. It recommended that coastal zone legislation also provide for the establishment of research and technical advisory assistance for each level in the management hierarchy, which was to include local, State, and Federal elements. The NACOA recommendations were based in part upon the findings of the Stratton Commission, which noted the inability on the part of State and local governments to develop and implement long-range coastal zone plans on their own.

In late 1972, Congress passed and the President signed into law P.L. 92-583, the Coastal Zone Management Act, assigning the Secretary of Commerce the responsibility for providing Federal funds on a matching basis to assist the States in developing and, after approval by the Secretary, implementing coastal zone management plans. The Act also authorized the Secretary to match State funds for acquiring, developing, and operating estuarine sanctuaries. A significant feature was the so-called Federal consistency provision, requiring Federal programs affecting the coastal zone to be consistent with approved State coastal zone management plans. In 1976, the Act was amended to provide aid to coastal States in planning how to deal with the coastal impact of Outer Continental Shelf oil and gas activity and to compensate for adverse effects.

The program was slow in getting started. Funds were not appropriated until December 1973. Since then the program has continued to grow, with planning grants awarded to all 30 coastal States by the end of FY 1976. In FY 1977, three States had moved from the planning to the management phase of their coastal programs and others were expected to

follow shortly. The budget had been running about \$18 million, but \$40 million was appropriated for FY 1978 for the basic program. In addition \$125 million was appropriated in FY 1977 for loans, loan guarantees, and grants which were authorized under the Coastal Energy Impact Program.

NACOA has periodically reviewed the progress of the Coastal Zone Management Program and offered recommendations as it felt appropriate. These have included increased funding, amendments to the Act providing funds for the research and advisory services needed by the States as a basis for coastal zone planning, and provisions for drawing on other existing Federal programs for information services and research support. In 1976, amendments were enacted that did much to meet this need and that also authorized funding for the specific purpose of helping the States to integrate into their plans ways to deal with the onshore impacts of coastal energy-related projects.

An interesting development parallel to the Federal program has been the formation by the States of the Coastal States Organization, also stimulated by the Stratton Commission Report. This organization has served as a clearinghouse for information and ideas among the coastal States and as a coordinating body for policy recommendations to both Congress and the executive branch.

Looking Ahead

The so-called "Federal consistency" provision of the Act is one of its most important features. This provision requires that Federal projects directly affecting a State's coastal zone must, to the maximum extent practicable, be consistent with the State's approved management program. Converting this into effective practice has been a difficult matter. Many Federal agencies have expressed concern that this provision would seriously impede their activities in coastal areas. OMB has recently intervened to assure that the regulation of Federal activities in accordance with approved CZM plans will permit Federal agencies to move

ahead with their coastal-related missions. This is likely to be a continuing issue, however.

Another continuing issue is the authority of the States to impose coastal zone plans and regulations on local bodies. This authority is a precondition to Federal approval of a proposed State plan. A number of coastal States now lacking such authority are finding it difficult to legislate it into law. The implications of long delay or even failure of some State governments to acquire this authority should be examined and fallback policies devised.

Meeting the information needs of coastal zone managers is a continuing problem to which NACOA has in the past given considerable thought. The Stratton Commission had suggested the establishment of coastal zone laboratories for this purpose. As events developed, Sea Grant College Programs have stepped in and in some States, such as California, have apparently done a good job. Nonuniversity research centers also represent a capability, and there may be others. The new Regional Fisheries Management Councils set up by Congress in 1976, the prospect of Federal action to establish management bodies for the 200-mile Extended Resource Zone, and the perennial presence of advocates of land-use management legislation provide a continually evolving context for coastal zone management. Finally, the program--now 5 years old--is such an innovative and complex activity, touching on so many interests, that the Committee may wish to evaluate its overall impact.

Background

NACOA First Annual Report, June 30, 1972, "The Coastal Zone," pp. 30-39.

NACOA Second Annual Report, June 29, 1973, "Managing the Coastal Zone," pp. 24-28.

NACOA Third Annual Report, June 28, 1974, "Coastal Zone Management," pp. 30-35.

NACOA Fourth Annual Report, June 30, 1975, "Information Needs of Coastal Zone Managers," pp. 13-17.

NACOA Fifth Annual Report, June 30, 1976, "Coastal Zone Management," pp. 58-59.

NACOA Sixth Annual Report, June 30, 1977, "Progress in Coastal Zone Management," pp. 77-78.

GAO Report, GGD-76-107, "The Coastal Zone Management Program: An Uncertain Future," December 10, 1976.

NOAA, OCZM Report, "Report to the Congress on Coastal Zone Management," April 1977.

Report of the Commission on Marine Science, Engineering, and Resources, "Our Nation and the Sea," January 1969, Superintendent of Documents. (Often referred to as The Stratton Report for Julius Stratton, President Emeritus of MIT, and then the chairman of the Ford Foundation, who was chairman of the Commission which issued the Report.)

ENERGY

The fact that a dwindling fossil-fuel energy supply in the face of rising demand around the world would bring on a period of difficult transition was well (if not widely) known before the oil embargo in the fall of 1973. NACOA sought to bring attention to the role of the oceans in meeting this combination of increasing energy demand and a tightening supply. First, it pointed out that intensified exploration and drilling on the Outer Continental Shelf (OCS) is the most promising way to increase the domestic discovery rate of oil and gas. On shore, except for Alaska, the possibilities on land had been well worked over at the then economic depths. Second, it noted that rapidly increasing dependence on oil importation from foreign sources underscored both the economic and national security importance of access to the overseas supplies and to the shipping to carry it to our own shores.

Developing our own resources raised questions about the relative roles of government and industry and the tradeoff between environmental safeguards and resource exploitation. NACOA put it rather simply, in those days. The government's role was to prescribe environmental norms, make forecasts, monitor, and regulate. Industry's role was to finance and carry out offshore exploration, drilling, and production. There never was a question, in NACOA's view, of the technical feasibility of doing both, or the ability to balance environmental safeguards with oil and gas production. It was simply a matter of seeing that it got done.

With an increase in foreign oil importation inevitable in the near term, and transportation costs then such a large portion of the total cost,

the Committee felt that development of several single-point mooring terminals offshore of the continental United States was desirable and so recommended. These deepwater terminals (not deepwater ports which are more difficult to build and more expensive) would permit use of super tankers, of the 300,000 to 500,000 deadweight ton size, an advantage largely denied us because only one U.S. port, San Pedro, California, could at that time accommodate tankers as large as 120,000 dwt, although Seattle, Washington, could be adapted and Machiasport and Eastport in Maine, though undeveloped, had the requisite depth. Long Beach, California, was deepening its main channel to 62 feet, which could accommodate 200,000 dwt tankers, but dredging present ports on the east coast to suitable depths is either impossible or presents many drawbacks.

The Committee also pointed to the value of the ocean as an absorber of the waste heat in power production and recommended considering siting energy-related facilities offshore.

In its Third Annual Report, NACOA made a vigorous exposition on climate and its relation to the oceans, food, and energy. The energy aspect in this treatment dealt largely with the effect of climate on energy demand and the possible effects of increased energy use on climate and weather.

By this time latent anxieties about adverse impacts of expanded oil operations on the OCS were raising questions more rapidly than satisfactory answers could be provided, and progress had been effectively stopped. In its Fourth Report, NACOA proposed the then somewhat subtle concept of "decoupling" the exploration and development phases in the resource development. This would allow both developmental and safety aspects to proceed with greater dispatch and certainty than is the case when they are lumped together and one tries to know everything at the beginning, before starting. "Decoupling" meant matching the environmental impact statement requirements with the immediate process planned. This separated in a formal, licensing, sense the exploration and

production phases. Such decoupling was intended to avoid delay of exploration while amassing information not required until oil and gas production had been proven as a possibility. This was suggested as a way of removing a major obstacle to accelerated leasing and development, which the Committee favored. The Committee pressed, at the same time, for environmental safeguards with resource development. It emphasized the technological feasibility and economic compatibility of the two. It drew away from the concept that it was an either-or proposition. It also called for greater attention to onshore impact, a relatively fresh concept then.

A virtual stalemate persisted, and in its Fifth Annual Report in 1976, NACOA emphasized the need to get the national act together rather than suppose we were fulfilling our citizen's responsibility by stopping the other fellow from acting. To quote:

"It has proven so easy to delay the development of needed domestic offshore oil and gas resources that an essential fact is being lost sight of: enforceable, environmentally safe procedures can be reconciled with an economic atmosphere suitable for development and, in the national interest, they must be."

In a discussion of more technical matters, the Committee attacked the current propensity to put a great deal of effort into far-in-the-future schemes while, at the same time avoiding doing something about more practical--and therefore more socially difficult--things we should be doing today. The discussion brought out the need for technical oversight of competing but separately-valued energy alternatives (such as energy from fusion or from solar sources) to establish program priorities. These were then arrived at by an advocacy approach which put a high premium on presentation. NACOA proposed DOER, a Directorate for the Oversight of Energy Research "to act as a technical staff and advisor to the Administrator of ERDA."

NACOA, in addition, reviewed the many proposals for nonfossil-fuel energy from the oceans such as those having to do with using energy from winds, waves, tides, ocean thermal and salinity differentials, marine biomass, etc. The Committee deplored the tendency toward heavy support of long-term uncertain payoff R&D programs on the basis of possible promise while neglecting practical short-term ideas for developing energy sources faced by market infrastructure, distribution, or economic obstacles. An example was the inattention to demonstration for the use of methanol, whose manufacture has been going on for decades, as a gasoline extender and turbine fuel for peak power production demand.

In the Sixth Annual Report, it treated again the question of safety and proposed licensing people in the field as well as the field activity itself as one means of reducing human error and ensuring proper observation of environmental safety precautions during field operations. However, the major emphasis was on the political, international, economic, and production aspects of fossil fuels. In particular, the Committee expressed deep concern over a national policy that relies on the nations of the Organization of Petroleum Exporting Countries (OPEC) to furnish ever increasing amounts of oil to industrial nations, noting that we ourselves have become the largest importer of all. It reiterated its previous recommendations for expediting OCS oil and gas exploration and development in the context of the ominous worldwide energy trends.

Current Issues

The possibilities here are so rich it is presumptuous to imply priority by listing. Furthermore, the ocean aspects are deeply embedded in the even larger issues surrounding the articulation of a national energy policy and plan currently under debate in the Congress and the executive branch. However, they could include:

Expediting development of ocean sources of energy

Stabilizing environmental standards and monitoring

Defining relative roles of government and industry in particular activities

Improving blowout and spill protection

Resolution of conflict with other uses of the sea such as fishing and recreation

Background

Second Annual Report, June 29, 1973, "Energy and the Oceans," pp. 16-23.

Third Annual Report, June 28, 1974, "Climate and the Ocean, Food, and Energy," pp. 5-12.

Fourth Annual Report, June 30, 1975, "Coastal Zone Management and Oil and Gas Development on the Continental Shelf," pp. 8-12.

Fifth Annual Report, June 30, 1976, "Energy from Offshore Sources," pp. 5-10, and "Energy Research, Development, and Demonstration," pp. 19-25.

Sixth Annual Report, "Energy and the Sea," pp. 13-19.

The available literature on energy is vast--both general and specialized--and is increasing constantly. Staff is prepared to develop selected bibliographies for members based on their expressed interests.

ENVIRONMENTAL INTERACTION

The Federal Government carries on a wide variety of activities aimed at enhancing effective use of our physical environment, protecting the Nation from natural disasters such as severe storms and floods, and minimizing the adverse environmental impacts associated with air and water pollution and their effects on health and on the ecosystem. Among these activities are:

- publishing maps and charts to aid in marine and aerial navigation;
- issuing weather forecasts to assist in safe and expeditious air and sea travel;
- disseminating information on climate and climatic fluctuations to assist agriculture and industry in planning operations in a manner that takes maximum advantage of prevailing weather conditions;
- issuing warnings of weather conditions which endanger life and property, and assisting local governments in developing emergency disaster plans; and
- issuing and enforcing regulations designed to minimize the adverse impacts of air and water pollution on health and on the environment.

Generally speaking, each such activity involves a host of subsidiary programs including observation and monitoring, mapping and charting, research, prediction, regulation, enforcement, information dissemination, education and community planning. Sometimes one or more of these programs lag behind the need, or fail to take advantage of available technological capabilities, or do not appear to have a priority commensurate with the social and economic importance of the problems they address. This may be due to poor management, or to insufficient funding, or to bureaucratic obstacles, or to technological gaps. NACOA has, at various times, devoted attention to such deficiencies affecting three specific areas:

- predicting and warning of natural disasters such as hurricanes, flash floods, and local weather conditions which endanger air travel;
- providing long-term forecasts of prevailing weather conditions to assist planners in agriculture, energy, and industry; and
- protecting the public from the ill effects of air and ocean pollution.

Weather Disaster Warnings

In June 1972, Hurricane Agnes battered the eastern seaboard of the United States, causing 118 deaths and \$3.5 billion in damage. At the request of the Administrator of NOAA, NACOA undertook an independent assessment of the effectiveness of the forecasts and storm and flood warnings prepared and disseminated at that time. What NACOA found, then in connection with Agnes, and later in a review of weather-related aircraft accidents and forecasts of severe storms, flash floods, and other weather disasters generally, is essentially that the collection of weather observations and the preparation of forecasts by the National Weather Service (NWS) is

as good as present technology allows, but that the dissemination of emergency warnings to the public, and the development of community disaster preparedness plans for coping with such emergencies, leaves much to be desired. In part, at least, this is because responsibility is diffuse. Observation and forecasting are clearly responsibilities of NWS. But dissemination and preparedness involve a host of players besides NWS. These include State and local police, rescue, and civil defense agencies; the Defense Civil Preparedness Agency; the FAA (where air traffic is concerned); the FCC and the news media for dissemination of warnings. NACOA's recommendations have consistently called for greater emphasis on the dissemination of weather forecasts and warnings and the development of greater awareness, on the part of recipients of forecasts and warnings, of what they mean and how best to respond.

NACOA has also looked into the methods used to locate and track major storms, and has been concerned, for example, about possible deficiencies in the use of weather ships and reconnaissance aircraft for surveillance of storms over the oceans.

Long-Term Weather Outlooks

NACOA has long felt that not enough was being done to develop means for improved assessments, on the order of a month to a year ahead, of what prevailing weather conditions are likely to be and how these might affect industry, transportation, energy consumption, and agriculture. With the shrinking of food surpluses, and the growing scarcity of energy resources, the matters have taken on greater urgency in recent years. Forecasting of weather and climate on this scale, however, is not currently possible with any precision, nor is it known whether it lies within the realm of possibility. However, because the usefulness of such forecasts would be great, NACOA has urged a greater research effort in this direction.

Pollution

Minimizing the ill effects of pollution in an industrial society that

produces more waste material and waste energy than it can handle is a major challenge. Regulations must be made and enforced, and this in itself is a demanding task. But more information and understanding is needed as a basis for regulation than is presently at hand. We must know the extent to which our environment is polluted, we must know what the impacts of this pollution are, and we must know what steps will reduce either the extent or the impact. Basic to all of these is a monitoring program to continually determine how much of what is where, and a research program aimed at determining what happens to pollutants after they enter our environment, what damage they cause, and what steps might be taken to alleviate this.

The Environmental Protection Agency (EPA) is the primary Federal body responsible for these matters. But EPA is basically a regulatory body, and consequently monitoring, technical analysis, and scientific research must often play subsidiary roles to regulation and enforcement. EPA's monitoring and research activities are under severe pressure to serve primarily the agency's short-term regulatory needs, rather than the long-term goal of understanding the pollution problem and inventing remedies. To counter this, NACOA has recommended that while EPA should conduct what long-term research it can, the primary responsibility for such research should rest with other Federal agencies having health or environment oriented missions, with the Council on Environmental Quality providing policy guidance and coordination. NACOA also recommended establishing a central focus for monitoring responsibility within EPA headquarters to assure that the myriad monitoring programs now operated by a variety of Federal, local, and private groups meet standards that permit the data thus produced to be incorporated into a single body of high quality environmental data capable of serving research and planning as well as operational and regulatory purposes.

Looking Ahead

The recent NOAA reorganization is designed, among other things, to increase

the effectiveness of weather and ocean services by combining all service activities in a single major division of the agency. It must be viewed in the broader perspective of various proposals for reorganizing the executive branch currently under study within DOC and OMB and which are expected to emerge within the next 6 months. NACOA may be asked to comment on how well these proposals meet the Nation's oceanic and atmospheric needs, or may wish to do so on its own initiative.

The National Academy of Sciences recently published a multivolume report for EPA aimed at assisting in the incorporation of scientific information and procedures in that agency's activities. How EPA responds, over the next months and years, should be of considerable interest to NACOA.

A bill to establish a National Climate Program has passed the House, and a similar bill is expected to pass the Senate early next year. The fate of this legislation, and the shape the new program takes if it is established, should be of interest to NACOA.

Background

"The Agnes Floods," NACOA, November 22, 1972.

NACOA Second Annual Report, June 29, 1973, "Atmospheric Activities," pp. 29-34.

NACOA Fourth Annual Report, June 30, 1975, "Atmospheric Affairs," pp. 42-45.

NACOA Fifth Annual Report, June 30, 1976, "Air Pollution R&D," pp. 27-35, and "Weather and Air Safety," pp. 37-44.

NACOA Sixth Annual Report, June 30, 1977, "EPA Management of the Nation's Air Pollution Monitoring Programs," pp. 55-61, and "Weather Warnings and Forecasts," pp. 63-72.

"Analytical Studies for the U.S. Environmental Protection Agency," National Academy of Sciences, 1977.

LAW OF THE SEA

The Third United Nations Conference on Law of the Sea convened in December 1973. In its six sessions, the last of which closed in August 1977, some 155 member nations tried with limited success to develop a new ocean regime more suited to the rapidly evolving international interplay of ocean interests than the centuries-old principle of free use of the high seas beyond a 3-mile territorial limit.

Since World War II this principle had become increasingly inadequate. Overfishing of many species, growing pollution of some marine regions, crowded shipping lanes, oil spills and other new problems required new authority to regulate farflung ocean operations for their own and the general good. The increasing determination of the developing nations, both coastal and landlocked, to influence the use and allocation of the earth's resources at sea as elsewhere towards a new international economic order in which they might participate as equal partners could not be ignored.

Malta's Ambassador Arvid Pardo, in a speech to the U.N. General Assembly in 1967, excited worldwide interest in the possibilities of deriving vast wealth from deep seabed minerals while at the same time advancing the cause of world peace through internationalizing their exploitation. His ringing phrase, "the common heritage of mankind" appealed to many on both economic and idealistic grounds and provided an irresistible impetus towards the treaty process. At the same time, many less developed nations

discovered considerable bargaining leverage in the possibility of their withholding agreement on other jurisdictional issues of great moment to the developed nations. The result was an agenda for the Conference based on the objective of universal agreement on a comprehensive treaty covering all major points of issue.

The issues included the width of the territorial sea, naval transit through international straits and off foreign coasts, ownership of fish stocks and mineral resources of the seabed, control and regulation of shipping and scientific research in offshore waters.

In its First Annual Report, dated June 30, 1972, NACOA expressed misgivings about the likelihood of agreement resulting from the Conference, then about to convene. NACOA noted that the transition being attempted was "comparable to that which took place in our own country when the frontier and the open range disappeared." With so many participants and with many issues technically as well as politically complex, NACOA felt it should be recognized that, while waiting for a satisfactory treaty, economic and other pressures could mount to the point where individual nations, including the United States, would find it necessary to take unilateral action. NACOA urged the United States to prepare interim arrangements that would protect U.S. interests but which could mesh with the international agreements expected eventually from the Conference. Meanwhile, it recommended that the U.S. "engage other countries, particularly the developing nations, in as many joint projects as possible and in as great a variety as reasonable." The purpose would be to improve their understanding of the "harsher realities of oceanic research and development," give them "a better technical base to protect themselves in economic negotiations," and help allay unwarranted suspicions of unilateral exploitation.

NACOA repeated its recommendation in 1974 with regard to U.S. unilateral action on coastal fisheries, an active issue domestically, if UNCLOS failed to reach agreement by the end of the 1975 session. NACOA

strongly supported passage of the Fishery Conservation and Management Act of 1976 to accomplish this purpose. Looking back in June of 1977, it characterized this Act as a good example of how the nature and timing of unilateral action can serve a vital domestic need while showing due regard for the international community.

Status

When UNCLOS reconvened in late May of 1977, the issue of control over seabed mining beyond the range of national jurisdiction was the dominating issue of contention, although the right to conduct scientific research offshore beyond the territorial seas of other nations was also strongly contested. With regard to deep seabed mining, the industrialized and developing countries appeared fixed on divergent and seemingly incompatible courses. The developing nations sought complete control over deep seabed development by an International Seabed Authority which they would dominate. The industrialized nations continued to insist upon some system of guaranteed access to seabed minerals, not only at the start but into the foreseeable future.

Because of the disparities on this issue, NACOA saw little hope that the most recent session of the Conference would result in agreement. Hence, in its Sixth Annual Report in June 1977, NACOA urged the President and the Congress to support domestic deep seabed mining legislation that would make it economically feasible for interested companies to proceed with development and production.

The less developed countries are striving to share in the presumed revenues from the seabed. Since they have neither technical capability nor risk capital to contribute, the Secretary of Commerce recently offered the following observation:

"Unless we have a commercially-successful seabed mining industry, there would be no revenues to share. Therefore, it is in the interest of the United States and the

entire world that the industry proceed with commercial recovery as soon as it is technically, environmentally, and economically feasible."

NACOA took the position that deep seabed mining is technically and environmentally feasible now. Legislation is needed, however, to make it economically feasible. This does not require guarantees against financial loss from all causes. It does require "assurance that a legal regime laying the foundation for a stable investment climate will exist during the lifetime of commercial operations." This could be provided either by financial guarantees or by assuring grandfather rights to operations predating the passage of a treaty.

NACOA endorsed the Administration's position, "that any seabed mining legislation would have as a minimum the following characteristics: it should be interim in nature, clearly indicating that it is our intent that it be superseded by a Law of the Sea treaty; it should reaffirm the legal position of the United States that seabed mining is a freedom of the high seas, subject to the duty that it be carried out reasonably, with due regard to other ocean users; it should provide for sound environmental assessment and management; it should provide duty-free entry of seabed minerals mined under permits granted by the United States; and it should encourage harmonization of other nations' seabed mining legislation."

A second issue of special importance to the United States is that of the right to conduct scientific research within the 200-mile economic resource zones beyond the territorial sea. At the time of the NACOA report, the negotiating text required coastal nation consent but failed, in NACOA's opinion, to give the applicant sufficient assurance that observing reasonable conditions would result in consent.

On the other hand, the conferees went into the 1977 session with a general consensus on a 12-mile territorial sea, unimpeded transit through straits, a 200-mile exclusive economic resource zone, and general

provisions to prevent pollution from vessels, although many details were either unclear or undesirable to the United States.

Looking Ahead

In October of this year, Ambassador Elliot Richardson reported on the results of the latest UNCLOS session to the Senate Committee on Commerce, Science, and Transportation, and to the Committee on Energy and Natural Resources. The United States is now assessing its position on the various issues and is formulating its plans for the upcoming session, scheduled to meet in Geneva from March 28 through May 19, 1978, according to his account.

He noted that prior to the last session of UNCLOS he had opposed unilateral legislation in order to avoid adverse effects on good will and tone at the meeting. He believed that there was then a reasonable prospect for progress on the seabed mining issues.

But since a breakthrough did not materialize, he now advocates unilateral legislation to authorize U.S. companies to begin development of deep seabed mining pending international agreement. It is his view that U.S. legislation establishing a domestic regime for seabed mining will be needed whether there is an international agreement or not.

Other issues remain to be resolved. Although some progress was made on the question of freedom for research in the exclusive economic zones of coastal nations, the remaining restrictions and provisions for impartial dispute settlement are still unsatisfactory by NACOA's previous standards. It became clear that the United States and a few other researching nations are isolated on this issue. "The developing countries and some developed countries, particularly the U.S.S.R., favored complete coastal state discretionary authority over all marine scientific research," he reported.

The nature of the 200-mile exclusive economic zone outside of the 12-mile

territorial limits of coastal nations was clarified in the new Informal Composite Negotiating Text (ICNT) and the changes "appear to safeguard traditional high seas freedoms within the exclusive economic zone except for specific resource-related rights accorded coastal states." He also noted improvements on issues relating to our military and commercial interests in freedom of navigation and overflight, as well as broadening support on transit through, over and under straits.

The possibility seems high that no general Law of the Sea treaty will come into effect. In the absence of a general, multilateral agreement, NACOA has recommended that in addition to taking judicious and considered unilateral action to resolve these issues in its own interest, the United States make full use of present bi- and multilateral agreements and the special international bodies which oversee those agreements.

The new NACOA is likely to wish to follow closely the development and progress of these issues.

Background

NACOA First Annual Report, June 30, 1972, "Some International Issues Related to Law of the Sea," pp. 3-11.

NACOA Third Annual Report, June 28, 1974, "After Caracas/Vienna--What?" pp. 21-27.

NACOA Sixth Annual Report, June 30, 1977, "Law of the Sea and International Cooperation in Marine Affairs," pp. 35-40.

Testimony of the Honorable Juanita Kreps, Secretary of Commerce, before the U.S. House of Representatives Committee on Merchant Marine and Fisheries, Subcommittee on Oceanography, May 11, 1977, on H.R. 3350, the Deep Seabed Hard Minerals Act.

Testimony of Ambassador Richardson before the Committee on Commerce, Science, and Transportation and the Committee on Energy and Natural Resources, October 4, 1977.

LIVING RESOURCES

Fisheries management is not easy. The natural, biological conditions are difficult enough to understand. Doing something about them is even harder. Until very recently no authority existed to enforce conservation on an international level although international agreements for particular species met with limited success. On a national level the same situation persisted. State management practices and regulation exhibit superficial as well as deep-seated differences. The economic structure of the industry--unlimited entry and no capital stake in the resource--has encouraged participants to overfish. The driving incentive has been to take what one can while the taking was good or the other fellow would. This has led to a boom and bust cycle in the United States where government subsidy and intervention is limited and fishing is likely to be a small craft entrepreneurial venture, at least in coastal waters.

While U.S. commercial fish landings have recently been rising slightly, they had remained essentially level for many years. In 1976, landings were close to 5.4 billion pounds (live weight) out of a world catch of 154 billion pounds (about 70 million metric tons). The Nation uses--for food and for industrial products--about 12 billion pounds of fish, importing the difference. Per capita consumption of fish (also rising slightly) was, in 1976, 12.9 pounds (edible meat) per person. (Iceland holds the record at 86 pounds per person, Japan is close behind at 80 pounds.) The share of U.S. fish consumption caught by U.S. fishermen fluctuates about the 50 percent mark. Because consumption as food has

been fairly constant, the fluctuation depends on the amount of industrial fish we import. That, in turn, depends on such things as soybean availability, with which industrial fish competes as feed protein. The value of fish products has, of course, gone up markedly in recent years which, if anything, puts greater pressure on the resource.

U.S. interests in the fish industry are, however, by no means monolithic and our tangled interests include many conflicting positions. For example, competition from lower priced foreign fish imports is detrimental to our fishermen, depressing the price they get for what they bring in. But lower priced imported fish is advantageous to the processors who can market their product that much more cheaply which, in turn, benefits the consumer. This kind of conflict extends beyond economics: it affects our foreign relations and was an essential factor in the earlier reluctance to extend our fishing jurisdiction as we are now doing.

Until recently the resources of the sea appeared limitless, and the occasional despair of fishermen, such as those of New England, over ruinous foreign competition seemed isolated. The competition was ruinous in the short run as a result of the higher foreign productivity born of modern equipment and production systems stemming from foreign government support and subsidy, and ruinous in the long run because of disregard for the long term health of the resource as when pulse fishing and using other devastating harvesting practices.

Within the last 2 decades, foreign fishing fleets began to appear off all our shores--Alaska, the Pacific Northwest, and the Mid-Atlantic as well as New England. The ground fish catch was declining. Salmon, which must return to spawn to the streams where they were hatched, were caught at sea before they fulfilled this reproductive function.

Pressures on fish stocks were thus increasing but the effort of the Fisheries Service to compensate by discovering new sources and underutilized species was bound to run, in time, into diminishing returns. The

race, in effect, was a losing one.

National fisheries policy was in considerable disarray. While our distant water fishermen benefited from amicable foreign fishing relations, our coastal fishermen grew hot at foreign "intrusion" into traditional fishing banks off our coast even though in international waters. Conflicting State interests caused flareups. There were oyster wars in the not too distant past between Maryland and Virginia, lobster wars still flare up between Maine and New Hampshire, salmon wars are very much on the current scene between Indian and non-Indian claimants to the fisheries. Dragnets fouled the lines of strings of bottom gear, tuna fishermen were caught in conflicting national claims with regard to territorial jurisdiction and the high seas. Sports and commercial fishermen competed for the same stocks or for stocks in different parts of the same food chain. Processors, as mentioned above, wanted an assured supply no matter where it came from or at what price, whereas those who caught the fish had to do better than break even. Meanwhile the list of depleted species grew larger.

In 1972, when NACOA was first formed, the approaches to our national fisheries problem were local, State, or at best regional, divided, short-sighted, species- and function-specific, antagonistic, and inconsistent. The fishing fleet (with the notable exception of the tuna fleet and some shrimpers) was in general old, composed of small and obsolete vessels, manned by aging crews.

To restore vigor and strength to this industry, the Committee proposed that the situation be influenced indirectly rather than directly. It proposed there be developed a sound economic environment but that actual fisheries development be left to the enterprise of those who would fish. The basic assumption on which it proceeded was that the first and fundamental requirement is to assure the resource. This would allow planning and investment on more than a year-by-year basis. To assure the resource

meant that first priority attention had to be given to conservation and biological management. On this everybody agreed. This was not a trivial agreement. One reason fisheries advocates had not previously been able to get together was that each segment was preoccupied with a different top priority. But the danger to all was apparent. To the need for conservation of the resource they could agree.

The Committee recommended that a national fisheries plan be developed on the basis that sound biologic management of fishery resources would take place. The necessary steps for this plan were to be uncovered by setting a theoretical share-of-the-market target for the U.S. fishermen, by proposing that the annual increase in fish consumption in this country, as the population grew, be supplied by increased U.S. fishing effort, and by working backwards to see what needed to be done to accomplish this aim--including the specifics of sound biologic management. The proposal was analogous to a market-penetration strategy in private industry. Set a goal, work backwards, look for choke points. Then decide whether the goal is realistic or which choke points should be dissolved. If necessary, modify the plan, then cycle through it once again.

When published, this recommendation provoked considerable discussion outside NACCOA. A good bit of the discussion concerned the realism of the target rather than what it was that prevented reaching it (or something less). As a result, the recommendation provoked little action. The Committee repeated its pressure the next year for the development of a "national" plan rather than the species-by-species approach which had characterized previous Federal efforts, taking care to give its reasoning in more detail. This time the recommendation took. NOAA formed a task force which proceeded with the monumental task of gathering ideas and proposals from all with differing viewpoints in this complex activity, weighing the alternatives, estimating the consequences, and coming to some conclusions.

A major element of the approach was to conduct a series of town meetings throughout the country. This also satisfied some of the needs of the Eastland Fisheries Survey proposed in response to a Resolution which had stimulated a grass roots review of United States fisheries problems with a view toward legislative and programmatic redress of fishing industry problems. These meetings illuminated the common and special problems to many of the participants. This allowed the task force to sense the key issues, key obstacles, desired objectives, and alternative approaches that might be used.

Congress, however, already impatient with the general stalemate in the U.N. Law of the Sea Conference, was not inclined to await the results of a study which was trying for agreement by consensus. It took advantage of the "American Assembly" effort by the task force, which resulted in an assemblage of information that proved especially valuable as background in drafting hallmark conservation legislation and enacted a law extending U.S. fisheries jurisdiction out 200 miles from our coasts covering coastal species.

The "Fishery Conservation and Management Act of 1976," P.L. 94-265, became law on April 13, 1976. The National Plan was published as an appendix to a "Marine Fisheries Program" in July of 1976.

The extended jurisdiction feature of the draft fisheries bills had been greeted with considerable reluctance by the Administration because of its exclusionary implications and possible effect on Law of the Sea negotiations. But, by now, most fisheries nations of the world, as well as the several regions of the United States, had come to agree that without management and conservation, the fishery resources of the ocean could be drawn down to dangerous lows. However, there was little immediate prospect of a treaty including fisheries management considerations emerging from the Conference. The legislation was careful in recognizing foreign need for access to fish stocks in which the U.S. catch was less than that available on a sustained basis. This was consistent with one

general approach of the LOS to fisheries matters.

Looking Ahead

Current fishery problems thus have to do with how well the management scheme is working and with an evaluation of how well the industry is doing, and what alternative solutions, if unexpected difficulties arise, would best serve the national interest. It may be early to register on such issues because the Councils were formed only a year ago and their staffs had served less than 6 months. They have much organizing and learning to do.

This retrospective will not go into specific features of the conservation legislation. It extended United States jurisdiction on fisheries matters from 12 to 200 miles off our coasts and paved the way for increasing the participation of U.S. fishermen in the permitted harvest. A significant attribute of the Act was its establishment of regional councils to develop fishery plans and to provide supporting research and implementation in partnership with the Department of Commerce. A level of management was created which was neither so Federal that it was insensitive to local differences and problems, nor so restricted that local passions would dominate with little regard for the general good. The regional approach should offer the opportunity to plan fisheries conservation measures in a way that would be practical to implement. The new NACOA may very well want to be informed, from time to time, on how things are coming out.

NACOA's role was crucial in forcing attention on the necessity of approaching fisheries problems on a national basis rather than species-by-species, and insisting that the common problems be illuminated so that common courses of action would suggest themselves. The members did agree that conservation was the matter of top priority. But they didn't agree on what was next highest. Some felt the most important issue was preferential access for U.S. fishermen (which now exists under the Act),

some that limited entry was imperative to enlist individual fishermen in the conservation and good management effort, others that the jurisdictional issues of State-Federal relations were key. Though 90 percent of commercial landings and most of the recreational catch are at present caught predominately in the territorial seas, which do not come under the Secretary's enforcement authority, the bulk of the opportunity is outside the 3-mile limit. Of these issues, only that having to do with preferential access for U.S. fishermen has gone away. State/Federal jurisdictional issues remain, as well as the dangers of overcapitalization in the U.S. share of the harvest increases. The question is whether resolution of these matters by the regional councils is working or is in some way blocked and, if so, whether that block can be removed. It is for this reason that monitoring fisheries affairs could continue to be of some importance to this Committee.

Background

NACOA First Annual Report, "Rehabilitating United States Fisheries,"
June 30, 1972, pp. 12-18.

NACOA Second Annual Report, "Fisheries Activities," June 29, 1973, pp. 38-44.

NACOA Sixth Annual Report, "Fisheries," June 30, 1977, pp. 29-33.

Entries in NACOA's Annual Reports dealing with Law of the Sea, Coastal Zone Management, the International Decade of Ocean Exploration, and Sea Grant also touch on fisheries matters.

"Fisheries of the United States, 1976," Current Fishery Statistic No. 7200,
National Marine Fisheries Service, April 1977.

"Report of the National Marine Fisheries Service of the Calendar Year 1976,"
July 1977.

"A Marine Fisheries Program for the Nation," U.S. Department of Commerce,
July 1976.

"The U.S. Fishing Industry--Present Condition and Future of Marine Fisheries," GAO Report dated December 23, 1976.

"Establishing a 200-mile Fisheries Zone," Office of Technology Assessment, May 26, 1977.

The "200-mile Limit," Oceanus, Vol. 20, No. 3, Summer 1977, pp. 7-34.
(This copy of the Woods Hole publication contains articles on the New England and the North Pacific regional councils and one on marine problems between the United States and Canada.)

"Eastland Fisheries Survey, A Report to the Congress," in response to S. Con. Res. 11 of 1973.

MARINE TRANSPORTATION

Seagoing vessels carry practically all of the cargo flow among the continents. As world commerce has grown, so too has the world's merchant marine fleet: from 80 million tons in 1948 to more than 550 million tons in 1977. It is considered likely to quadruple over the next several decades. Despite this growth, the U.S. position as a maritime power has steadily deteriorated over the past 25 years. By 1973, the U.S. fleet was carrying only 5 percent of U.S. trade and less than 1 percent of our bulk cargo. In the 25-year period from 1950 to 1975, the U.S. merchant fleet dropped from 1,900 privately-owned vessels (22 million tons deadweight) to 583 privately-owned vessels (14.6 million tons deadweight), a drop of 69 percent in the number of vessels and 34 percent in deadweight tonnage.

This deterioration has occurred in the face of U.S. policy, as expressed in the Merchant Marine Act of 1936 and subsequent amendments, to maintain a strong merchant marine capable of meeting our needs for waterborne commerce in times of peace or war.

Status

NACOA has long been disturbed by the continuing national maritime problems. Recognizing their complexity as well as their importance, NACOA recommended in its First Annual Report that the Secretary of Commerce undertake a comprehensive review and offered to help. In the absence of a

response, NACOA this last year began a reassessment of the situation. In addition to reviewing the legislative history and other documents, NACOA was briefed by leading figures involved in virtually all aspects of marine transportation. Its views, more fully developed in its Sixth Annual Report, are summarized in what follows.

The Merchant Marine Act of 1936, as amended, sets forth the present national policy:

"It is necessary for the national defense and development of its foreign and domestic commerce that the United States have a merchant marine

- (a) sufficient to carry its domestic water-borne commerce and a substantial portion of the water-borne export and import foreign commerce of the United States and to provide shipping service essential for maintaining the flow of such domestic and foreign water-borne commerce at all times,
- (b) capable of serving as a naval and military auxiliary in time of war or national emergency,
- (c) owned and operated under the United States flag by citizens of the United States insofar as may be practicable,
- (d) composed of the best-equipped, safest, and most suitable types of vessels, constructed in the United States and manned with a trained and efficient citizen personnel, and
- (e) supplemented by efficient facilities for shipbuilding and ship repair.

It is hereby declared to be the policy of the United States to foster the development and encourage the maintenance of such a merchant marine."

The Act requires the Secretary of Commerce to determine what additions and replacements are needed to enable the merchant marine to meet these objectives, and to develop a long-range program for their acquisition. It requires the Secretary to cooperate closely with the Navy Department concerning national defense needs and the speedy adaptation of the

merchant fleet to national defense requirements if needed.

NACOA's initial review led to these interim conclusions:

- the U.S. merchant marine does not at present meet the goals laid out by the Congress over 3 decades ago, nor is it realistic to expect that these goals will be met under existing legislation;
- our merchant marine is clearly not carrying a substantial part of our foreign trade;
- despite \$7 billion in Federal funds for various kinds of support for the merchant marine since 1936, it is in what appears to be an extended and continuing decline;
- the number, types, and readiness of U.S. merchant vessels appear inadequate to meet defense goals;
- the National Defense Reserve (mothball) Fleet is an important national asset, but its aging and plans for its continuation are inadequate for meeting national needs in the next 2 decades;
- reliance to any significant measure on the Effective U.S. Controlled (EUSC) Fleet* may be a high risk national policy; and
- the program for installation of national defense features on merchant ships appears inadequate to meet national defense needs.

*A fleet of U.S.-owned vessels sailing under foreign flags and subject to contractual agreements placing them under U.S. control in certain emergency situations.

In short, despite some recent progress resulting from the Merchant Marine Act amendments of 1970, NACOA views our maritime posture for the stated purposes of national security and national defense as unsatisfactory.

The merchant marine is intended to serve both the Nation's commerce and its defense, but it does not necessarily follow that its importance and value is the same in both arenas. NACOA believes that we need our own ships in time of national emergency, but it is not certain to what degree our commercial interests and peacetime national security are also put in jeopardy by the present reliance on foreign flag shipping. It may be that when assessed from a perspective that includes both, the role and makeup of the merchant marine for augmenting military transportation capabilities in times of war will turn out to be quite different, with different characteristics and priorities, from what contributes best to peacetime commercial strength and economic independence.

Addressing our current maritime objectives in light of these and other related questions is a complex matter, and NACOA has thus far made only a start. It has not specifically examined such factors as labor/management interaction, ship operating costs, and subsidies. It has to date focused primarily on the objectives of the merchant marine program and has found that the various purposes of our merchant marine are being addressed individually, but not in a way that takes full account of their cross-impacts. Priority guidelines are needed to assure a purposeful effort to meet national needs. It is necessary to deal with national maritime-related questions at a level capable of resolving incompatibilities among the many agency programs.

NACOA has felt that the authority to create a coherent policy which brings together domestic and military shipping needs, port considerations, and other similar purposes should be placed at a level high enough to relate it to the full range of national goals that are dependent on marine activities. NACOA, in its Sixth Annual Report, suggested a Cabinet-level

Marine Affairs Council chaired by the Vice President to serve as a central point of authority for coordinating the full range of marine programs now scattered among 11 Federal departments and independent agencies. Pending some such arrangement, the Committee felt that the National Security Council (NSC) is probably the most suitable body to oversee an assessment of marine programs needed for national security and defense. To assure full agency input and to sustain interest, NACOA recommended that the NSC consider establishing a standing interagency committee on Federal maritime policy to help it plan and coordinate a coherent Federal maritime program.

NACOA also urged the Congress to reexamine the premises underlying present merchant marine programs and purposes and to consider legislative remedies to our present maritime deficiencies.

Looking Ahead

Some issues that NACOA may want to examine further include the composition, condition, and readiness for activation of the National Defense Reserve Fleet (the "mothball fleet"), the reliability of the Effective U.S. Controlled Fleet for meeting our emergency logistic requirements, and the effectiveness of the program to install defense related features at Federal expense on merchant vessels.

On the commercial side, although the House voted down cargo preference legislation (H.R. 1037, the Energy Transportation Security Act of 1977) in October 1977, the subject will probably arise again. The Congress has shown a continuing concern over rebating practices in U.S. ocean commerce. Both the House and Senate have recently conducted hearings on bills which would eliminate these practices.

In March 1977, Senator Inouye, Chairman of the Subcommittee on Merchant Marine and Tourism indicated that his ". . . subcommittee will be dealing with a variety of issues concerning the Shipping Act during the course of

this Congress," including rebating. The House as well appears likely to review various aspects of merchant marine policy during the Second Session of the 95th Congress including the role and effectiveness of the Federal Maritime Commission.

Background

NACOA's Sixth Annual Report, June 30, 1977, "Marine Transportation," pp. 21-27.

Congress and the Oceans: Marine Affairs in the 94th Congress, Committee on Commerce, Science and Transportation and National Ocean Policy Study, U.S. Senate, June 1977, pp. 141-189.

The Merchant Marine Act, 1936, the Shipping Act, 1916, and Related Acts of the Merchant Marine and Fisheries Committee, U.S. House of Representatives and the Committee on Commerce, Science and Transportation, U.S. Senate; Serial No. 95-A, January 1, 1977.

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Maritime Transportation Research Board, National Academy of Sciences,
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Bread Upon the Waters; Gerald R. Jantscher, The Brookings Institution,
Washington, D.C., 1975.

A Statement of National Transportation Policy; The Secretary of Transportation,
Washington, D.C., September 17, 1965.

Essential U.S. Foreign Trade Routes, U.S. Maritime Administration,
June 1975.

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Politics, The Brookings Institution, Washington, D.C., July 1966.

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Maritime Press, Inc., 1963.

OCEAN ENGINEERING

In its first meetings, NACOA members who had been involved in the work of the earlier Marine Council informed their colleagues that the gap was widening between current capability for operations at sea and the available background information on materials, techniques, and ocean-related engineering criteria. A special panel of the Committee, after study, recommended an ocean engineering effort within the civil part of the executive branch--as distinct from the Navy--to pursue these needs. The ocean engineering section in the Sixth Annual Report is itself a retrospective of NACOA's relatively unrewarded efforts in this area, and we reprint it here with a brief note of future directions of possible interest to the new NACOA added.

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OCEAN ENGINEERING

(from NACOA's Sixth Annual Report to the President
and Congress, June 30, 1977, pages 41-43)

The sea is intolerant of man's engineering weaknesses and oversights. It is a dynamic and difficult operating environment leaving little room for technical uncertainty. The weather and the biological, physical, and chemical processes occurring within the oceans severely test structures, systems, and man himself.

The Nation is coming to realize that opportunity for enterprise doesn't stop at the shoreline, and that we must be as capable of operating in

ocean areas as we are on land. We must be able to monitor and operate within the full three-dimensional sea space for both civil and defense needs; extract resources, both living and nonliving; build structures safely within the ocean environment; perform research and conduct surveys on and under the sea; and decide where offshore facilities can be safely sited.

Federal ocean engineering expertise is distributed widely but unevenly among the executive agencies charged with marine responsibilities. The Navy clearly has by far the most advanced capability within the Federal establishment. It is the largest and most active Federal ocean-related activity pursuing engineering technology development. Its manpower and capital investment are significant, as they must be in view of the Navy's broad mission. To a lesser degree, ocean engineering capabilities reside within a number of other Federal agencies to support their in-house program needs. A major and sophisticated capability in ocean engineering is also found in various industries engaged in activities such as oil drilling, pollution cleanup, construction of ocean structures, naval architecture, ocean mining, diving, submersibles utilization, and port development.

The United States leads the world in some areas of technology such as oil recovery and deep submergence capability. But technical prominence can be short-lived. If we are to keep our advantage, the U.S. civil program should be vigorously pressing ahead with ocean technology development on a broad front. We dare not become dependent on the capabilities developed by other nations.

Some activities during the next decade that will require a stronger technical capability and a broader data base than we now have are effective and safe offshore fossil energy and mineral development, installation siting, port development, material testing, instrumentation, hardware, fishery technology, and thermal and dynamic ocean energy extractive systems. We need to strengthen our ocean engineering capability to support

these activities.

There are some encouraging signs. We find increased technical interchange and a growing cooperation (both formal and informal) between groups in the Department of Defense and the civil sector. We are encouraged by the growing use of shared test facilities. We are further encouraged by NOAA's recent creation of an Office of Ocean Engineering with duties that include attention to national ocean engineering concerns.

These encouraging signs, however, should not lead us to believe that we now have an adequate national effort in techniques, materials, and developmental programs addressing problems peculiar to engineering in the ocean environment. The 1974 NACOA report, "Engineering in the Ocean"* called for a focal point for our civil endeavors, and for an organization to serve as a catalyst in stimulating engineering R&D and advanced technology, focusing on gaps and deficiencies, fostering technical interchange, ensuring the common availability of data, enhancing interagency programs and effective use of facilities, and maintaining a continuing and mutually purposeful liaison with industry and the academic community.

NACOA believes that the Department of Commerce, with its present responsibilities in marine resources, ocean mapping, marine environmental assessment, and marine data archiving, comes closer than any other Department to being a logical Federal focus for civil marine matters to provide the needed ocean engineering leadership for the Federal and private sectors, as does DOD in defense matters. It may be that a properly mandated, structured, and funded Office of Ocean Engineering within NOAA can evolve into this role even though it is also assigned responsibility for support of NOAA's own engineering needs.

*"Engineering in the Ocean." A report for the Secretary of Commerce by the National Advisory Committee on Oceans and Atmosphere, November 15, 1974, 54 pages.

In support of a more coherent and more encompassing program, NACOA recommends that the Secretary of Commerce foster and selectively support programs within industry, the universities, and the Federal agencies, to:

- identify and correct deficiencies in civil ocean engineering and technology;
- assure the availability of technical data needed by the ocean engineering community;
- develop technical ocean engineering criteria and material assessments and standards for use by industry and the Federal Government; and
- encourage the cross-utilization of military and civil engineering laboratories and test facilities.

There ought to be a continuing close relationship between these civil ocean engineering efforts and the DOD engineering programs. The Navy, as mentioned earlier, has broad competence in ocean technology development. It possesses advanced technical and operational capabilities that would help our national civil ocean engineering effort. In addition, the Navy maintains a range of engineering and test facilities that should be applied to national tasks. Since this would be a significant departure from the Navy's primary defense mission, the Navy should be specifically authorized to undertake this task, either by Presidential directive or by legislation.

We believe that closer and more formal organizational ties between the various Federal participants will be required in the future and our present recommendations should not preclude this possibility. However, the need for strengthening the civil U.S. ocean engineering effort is immediate and our recommendation is aimed at accomplishing this promptly and with minimum disruption of present organizations.

Since the program is an interagency effort, we believe it desirable to provide an overview from a broader perspective than can be found within any particular agency. NACOA therefore recommends that the Office of Science and Technology Policy provide a comprehensive and continuing review of our Federal ocean engineering and undersea technology efforts. This review should:

- evaluate the ocean engineering and technology capabilities of the U.S. public and private sectors, and determine how they compare with those of other nations;
- identify significant technological problems in both defense and civil applications, recommend areas for improvement, and determine whether a proper focus and adequate funding are being provided; and
- result in a regular periodic report to the President on the status of ocean engineering and technology in the Nation.

* * * * *

Some NACOA members have felt strongly that the advancement of the Federal civil ocean engineering program would be more rapid if the extensive Navy capability could be applied directly to civil sector problems. The Navy without doubt has the greatest Federal ocean engineering capability, but the problem of using this capability for non-Navy purposes without adverse impact on DOD missions is not trivial. Manpower, funding, and related management problems must be resolved. As NACOA has suggested closer and more formal organizational ties between the Federal participants (including DOD) may be a necessary step. How to solve the administrative and mission problems to allow effective use of Navy capabilities for civil needs may be an issue in ocean engineering that the new Committee will wish to undertake.

S. 2224, a "National Oceanic and Atmospheric Administration Organic Act," was introduced into the Senate in October 1977 by Mr. Magnuson and Mr. Hollings. The Act addresses in part the area of ocean technology. Section 101 states that it is the policy of the Congress that:

"results of civilian and unclassified military atmospheric and oceanographic research and technology, which is supported by Federal grants, loans, or contracts, should be made promptly available to other Federal agencies, State and local governments, and the private sector in a manner which will hasten and promote the utilization of such knowledge and technology for the benefit of the United States."

Further, Section 204 includes under the responsibilities of the Administrator of NOAA:

"environmental research and development activities that are necessary to advance the Nation's ocean engineering and technology expertise, including the development and operation of manned research submersibles, underwater laboratories, data buoys, and improved instruments and calibration methods, and the advancement of undersea diving techniques;" and

"encouraging progress in ocean engineering activities, in order to implement a wide ranging program to meet basic ocean engineering needs."

A similar bill (H.R. 9708) has been introduced in the House. Although these bills do not deal directly with the ocean engineering issues as developed by NACOA, they do indicate Congressional awareness of the significance of ocean technology and engineering to the accomplishment of our national ocean purposes. The Act may serve to not only assist in interagency technical information transfer, but stimulate some required development activities in support of basic national ocean engineering needs.

Background

"Engineering in the Oceans." NACOA, November 15, 1974, 54 pages.

NACOA Fourth Annual Report, June 30, 1975, "The Institute for Engineering Research in the Ocean," pp. 26-28.

NACOA Sixth Annual Report, June 30, 1977, "Ocean Engineering," pp. 41-43.

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"Directions for Naval Oceanography," National Academy of Sciences, Washington, D.C., 1976.

"Manned Undersea Science and Technology FY 1976 Report." U.S. Department of Commerce, NOAA, March 1977.

OCEAN SCIENCE

"Oceanography," the term usually used for ocean science, is generally considered to be not so much a field in its own right as the application of a variety of disciplines--physics, chemistry, geology, biology, mathematics, and engineering--to the ocean. Recently, however, it has become evident that some of the most interesting questions about the ocean require coordinated investigations involving several disciplines or involve complex phenomena or processes falling between the traditional disciplines. The global heat balance, climate change, circulation patterns within the oceans and atmosphere, their relation to living resource productivity, the fate of CO₂ produced by our industrial society, and the role of sewage as nutriment for marine life are examples.

Working in the ocean presents a variety of problems not present on land. The saltwater environment is corrosive. Winds and waves subject vessels, structures, and crews to considerable strain. Platforms--ships and buoys--are expensive and require trained crews. Maintaining a fixed position or course requires intricate navigation and electronics equipment. Conducting an observational program requires careful planning and coordination of ships, aircraft, submersible vessels and sensors, etc. Oceanography is expensive, and it often requires a combination of facilities and expertise not normally found collected together in one place.

NACOA's concerns for meeting the Nation's long-term needs for better understanding of ocean phenomena and processes led it to direct its

attention to:

- Who sponsors American oceanography? For what purpose?
- Are adequate facilities available?
- Are suitable institutional arrangements available?
- Do the people of the Nation understand the increasing importance of knowledge and understanding of the oceans and their resources?

In addition, the Committee has studied two major ocean science programs in depth. These are NOAA's National Sea Grant Program and NSF's International Decade of Ocean Exploration (IDOE), the latter at the request of the Director of the National Science Foundation.

Navy Support for Ocean Research

The Navy--and specifically, the Office of Naval Research--has been one of the prime sponsors of ocean research since World War II (the other being the National Science Foundation). ONR support has been responsible for development of much of the ocean expertise in our universities. Yet in recent years there have been indications of a shift away from this, marked by a withdrawal of Navy funds from basic ocean science with no other sponsor being provided the funds needed to fill the gap. NACOA has been concerned, believing that long-term basic ocean research is essential to both the Nation and the Navy--whose operations, after all, are geared entirely to the oceans--and has urged the Navy to reestablish its broad ocean research base and its close ties with university researchers.

Facilities for Ocean Research

Research at sea requires ships, and moreover, ships equipped with laboratories,

winch, special navigation equipment, and other devices which make them suitable for oceanographic work. To design and build a ship for this purpose is costly and takes at least several years. Once in operation the ship's facilities must be continually maintained and upgraded, and when its useful life is ended, it must be replaced. All of this requires a coherent and systematic program to assess, plan, and fund for the basic facilities needed for ocean research. Yet this systematic approach, though its importance is understood, is lacking. The 17 universities operating government-funded oceanographic ships have formed the University National Oceanographic Laboratory System (UNOLS) to coordinate scheduling the use of the 29 ships in the academic fleet, and have an interest in assisting their Federal sponsors in developing an overall long-range capital investment plan. The sponsors, of whom the National Science Foundation is the largest followed less and less closely by the Navy, have serious problems with budget examiners when the talk turns to multi-year "commitments." NACOA has examined this problem and, notwithstanding history, recommended the assignment of lead agency responsibility and the development of a national plan for maintaining an ocean research fleet. NACOA has also urged maintaining a very special facility, the GLOMAR EXPLORER, despite the cost and the absence of an immediate need, because of the extraordinary capabilities of this unique vessel.

Institutional Arrangements

Often institutional rigidities make it difficult to develop novel programs designed to meet newly emerging needs. NACOA considered three examples involving ocean science and technology:

Ocean engineering: Civilian ocean engineering capabilities lag badly behind the need created by the increase in offshore oil drilling, the need for more deepwater ports, and the potential for tapping the ocean's thermal energy. Vast expertise resides in the Navy, but there has not been any systematic procedure for fostering the adaption of this technology to civilian purposes. NACOA has recommended a new organization to serve as a catalyst in stimulating the engineering development needed to meet our

future ocean needs. The engineering development issue has a number of special features and NACOA's involvement is described at greater length in another "retrospective."

Multidisciplinary, multi-institutional research: In developing the U.S. program for the International Decade of Ocean Exploration, the National Science Foundation chose to concentrate on long-term, expensive, multidisciplinary research programs requiring the cooperation and facilities of a number of research institutions. Before IDOE, funds to support such research were not easily obtained, since the prevailing means for supporting academic research in the United States has been through support of individual university researchers. The IDOE program developed a managerial approach for conducting such cooperative endeavors without leading to the formation of new ongoing organizations with their own rigidities, an approach that NACOA felt should be continued when the IDOE decade ended along with the multidisciplinary program growing out of the IDOE effort itself. NACOA accordingly recommended that NSF continue to provide a means by which such research projects might be supported.

Research and education to serve local needs: Education, research, and advisory services related to marine resource development are provided through the National Sea Grant Program at universities and other research institutions around the Nation. The program has successfully encouraged the cooperation of researchers, teachers, and extension agents in meeting specific and real needs perceived by local industry and government--often on a small scale, low budget basis markedly different from that discussed in the preceding paragraph. Sea Grant has proved an effective vehicle for utilizing the strength and expertise in universities large and small throughout our land, and NACOA urged its continuation with certain suggestions for improved management and greater responsiveness to nationally perceived needs.

Public Awareness of the Importance of the Oceans

With the increasing economic and environmental importance of the oceans

and the coastal regions, educators have begun to seek ways to incorporate marine-related material into both formal and informal educational programs. NACOA has identified a suitable role for the Federal Government in this endeavor, and offered suggestions for special approaches that would reach large segments of the public not easily reached through the formal education process.

Looking Ahead

The increasing pressure for development of marine resources--fish, oil and gas, seabed minerals--and the need to do so with adequate concern for the marine environment, have led to an uncomfortable awareness of the many gaps in our understanding of how the sea behaves. Concern about the possible adverse impacts of changes in climate, in which the oceans play a significant role, gives additional impetus to the drive for more basic studies of the oceans. These concerns have global implications, yet recognition of the need for global studies of the sea comes at a time when, increasingly, other nations are tending to place obstacles in the path of free and open ocean research--as manifested in the LOS negotiations. Perhaps the most significant issue facing us today in ocean science is not a scientific one, but has to do with how to persuade other nations that they stand to gain, rather than lose, by permitting and participating in marine research. It may be timely to return to a suggestion made by NACOA in its first annual report, calling for increased involvement of scientists and institutions of other nations in our oceanographic effort, at the working level, as a means of fostering increased understanding in the less-developed countries, of the realities of ocean research and development, and the growth of a better technical base to support their own development and their participation in international economic negotiations.

Background

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OCEAN AND ATMOSPHERIC POLICY, PLANNING, AND ORGANIZATION

Ocean programs pervade the Federal structure without being a driving force in any significant part of it. Some 11 departments and independent agencies have major programs, running to more than \$2 billion per year, intended to advance the national interest in such areas as marine transportation, fisheries, offshore oil and gas and other marine energy sources, deep seabed mining, ocean and coastal environmental protection, recreation, research, defense and foreign relations. Private sector marine interests contribute some \$10 billion annually to the GNP. Assuming continued U.S. access to ocean resources and to other uses of the sea, this figure is expected to increase approximately fourfold by the year 2000.

Atmospheric programs are carried out in nine departments and independent agencies and are budgeted at nearly \$1.1 billion at the present time. Of this amount, nearly \$400 million is for research and related activities, while almost \$700 million goes toward maintaining and operating the Nation's civilian and military weather services.

NACOA accepted--and broadened--the viewpoint on national policy, planning, and organization that led the Congress to establish it in 1971. Specifically, NACOA has advocated:

- centralizing the bulk of the Federal marine affairs programs in some form of lead agency under the overall policy guidance and coordination of a Cabinet-level body; and
- preserving, and to a degree increasing, the present combined

management responsibility for oceanic and atmospheric programs related to ocean and coastal engineering development, environmental technical services, and supporting research.

The possibility of a major executive branch reorganization involving marine and atmospheric programs appears more likely now than it has for several years. The next 6 months could be decisive.

Background

During the middle and late '60's, the Congress, stimulated by National Academy of Sciences and U.S. Navy studies, set in motion an effort towards the establishment of a national oceans policy and a well-coordinated Federal program to carry it out. In 1966, it initiated legislation setting up two temporary bodies--a White House-level Marine Council,* chaired by the Vice President, for overall program management and the so-called Stratton Commission** to recommend national policy and a long-range plan to carry it out. Commission recommendations led the President in 1970 to establish the National Oceanic and Atmospheric Administration (NOAA) within the Department of Commerce for ocean and atmospheric program management and the Congress a year later to establish NACOA to report to both the Congress and the executive branch its advice on policy, planning, programs, and priorities.

The NOAA that came into being was a considerably scaled down version of the independent agency that the Stratton Commission had recommended. Furthermore, there was no longer a high level body like the Marine

* Full name: The National Council on Marine Resources and Engineering Development.

**Full name: The Commission on Marine Science, Engineering, and Resources. It was chaired by Julius Stratton, President Emeritus of MIT, and then chairman of the Ford Foundation. Dr. Stratton served on NACOA from December 1971 until February 1974.

Council for policy and program coordination that could compensate for the remaining fragmentation. At the same time, the developments that had led the Commission to conclude that the "Nation's many diverse interests require a plan for national action and for orderly development of the sea" and that it was urgent "to mobilize and impart energy to the total undertaking " were if anything accelerating.

Among developments external to the program were the widespread sentiment for extending national or international jurisdiction over what had for centuries been "high seas," free for anyone's use beyond a 3-mile territorial sea, as was shown on the agenda of the then pending United Nations Conference on Law of the Sea, the evident overpressure on many valuable fish stocks, indications of a coming energy crisis, and misgivings about the adequacy and economic significance of the U.S. merchant marine.

Within the program, signs of inadequate planning and coordination were also becoming more manifest. In 1972 and 1973, NACOA noted a number. For example, the Coast Guard had had to abandon several multipurpose ocean vessel stations before NOAA was ready to replace them with buoys to carry out their important weather and ocean observation function. The Nation's civil oceanographic research fleet, for which several agencies were responsible, was headed for a 25 percent cut in FY 1974 without any overall analysis to judge the long-term impact on the Nation's future capability nor any plan to prevent undesirable consequences. Much confusion existed over where pending legislation should assign responsibility to safeguard States from adverse environmental impacts of offshore oil and gas development, the pipelines to bring it in, and refineries and associated facilities needed on shore for refining, storage, and distribution. The President's annual report to the Congress on the Federal Ocean Program, required by the same law establishing the temporary Marine Council and Commission, had gradually come to lag its due date by well over a year and was failing to serve its intended purpose of assisting debate on pending budget decisions by showing the program's balance and scope. The last time the President's budget had pulled together all the ocean

programs in a special analysis for this same purpose had been the budget for FY 1971.

Federal Initiatives

The Congress has tried to move the national marine affairs program ahead in both specific and general aspects. So far, it has been successful only in specifics. Among the legislation establishing and assigning responsibility for one or another emerging aspect of marine affairs are the Coastal Zone Management Act of 1972, the Ocean Dumping Act of 1972, the Marine Mammal Protection Act of 1972, the Ports and Waterways Safety Act of 1972, the Endangered Species Act of 1974, and the Fisheries Management Act of 1976. Most of these responsibilities were assigned to NOAA, considerably enlarging its scope and size, but the Coast Guard, the State Department, and parts of the Department of the Interior have also received added responsibilities.

More general and inclusive attempts by the Congress to overhaul the executive branch organization for marine, or marine and related, activities have not gone very far. Among the proposals have been the establishment of a Department of Natural Resources and Environment, a Department of Environment and Oceans, an Office of Marine Affairs Coordinator in the Executive Office of the President, and a revived Marine Council consisting of appropriate Cabinet members and heads of agencies to be chaired by the Vice President.

It has been more successful in laying the groundwork of understanding and information needed for a comprehensive approach to national marine affairs. The Senate established in 1973 a National Ocean Policy Study (NOPS) organization headed by Senator Hollings (D-S.C.), Chairman of the Subcommittee on Oceans and Atmosphere of the Senate Committee on Commerce led by Senator Magnuson (D-Wash.). NOPS included as members the chairmen of most of the standing Senate committees. It has published a

number of important studies and reports on subjects ranging from the economic potential of ocean resources to the apparently higher successful means used by the Shetland Islanders to deal with the shoreside impact of North Sea oil and gas development.

In the House, Congressman Breaux (D-La.), Chairman of the Subcommittee on Oceanography of the House Merchant Marine and Fisheries Committee, chaired by John Murphy (D-N.Y.), has set up an informal ad hoc group including people from both the legislative and executive branches and from outside government which he calls the House Ocean Policy Advisors Committee (HOPAC). This group meets by invitation to discuss the many aspects of ocean affairs issues of emerging importance.

There have also been executive branch proposals for major reorganization efforts involving ocean affairs, a Department of Natural Resources in 1973 and a Department of Energy and Natural Resources in 1974.

The President has this year directed the Secretary of Commerce, in cooperation with appropriate Cabinet officers and agency heads, to conduct a comprehensive ocean policy study. The study is intended to provide a basis for developing subsequent program budgetary, legislative, and organizational recommendations.

Plans have also been announced for a President's Reorganization Project study for a Department of Natural Resources and the Environment in which ocean programs are intended to play a part.

NACOA Views

NACOA's earlier views appeared in each of its annual reports. Though varying in external detail because they were addressed to the particular Federal planning and policy context at the time, they have generally held steady in fundamentals. They have focussed on (1) an oceans policy that would state national marine goals and establish the procedures or mechanisms needed for their implementation, (2) the Federal activities required

for program execution and how these activities might best be grouped for coordination purposes, and (3) identification of the agencies currently involved in these activities.

NACOA recommended that the Federal ocean program explicitly be directed towards two types of goals.

First, goals which imply the need for resolving conflicts primarily in a global or international context include:

- access to foreign sources of vital materials and markets;
- availability of marine transportation to meet our needs for world commerce;
- access to and fair-share use of marine resources;
- protection of the marine environment;
- projection of military capability overseas when required;
- protection of the United States and U.S. offshore activities from hostile action and attack;
- military marine research and engineering development efforts to avoid technological surprise in areas of military importance; and
- an informed public willing to provide the funds and support the programs needed.

Second, goals with a potential for major conflicts primarily among domestic claimants include:

- profitable use of marine resources by U.S. industry;
- public access to marine recreation;
- efficient and safe ports, waterways, and sealanes;
- waste disposal compatible with other uses;
- offshore siting of power plants and other facilities where economy and safety permit;
- environmental protection; and
- balanced, multiple-use management of coast and offshore areas.

The fundamental Federal mechanism needed for the pursuit of national ocean goals is a coordinated, comprehensive and long-range national program in marine and coastal zone affairs and in environmental science and services. For management purposes--and to provide a rationale for Federal marine and atmospheric affairs organization--NACOA found it useful to group the civil, that is non-defense, activities required of the Federal Government into four functional categories. These are:

- marine resources development, including uses of the sea for transportation and waste disposal;
- marine and coastal zone activities regulation and enforcement;
- environmental science, engineering development, and technical support services; and
- interagency planning and coordination.

These are described in some detail in NACOA's Third Annual Report. The activities involved are those currently being carried out by NOAA, MARAD, the Geological Survey, the marine and coastal zone portion of the civil planning, policy, and funding activities of the Corps of Engineers, the submerged lands management and mineral leasing program on the Outer Continental Shelf presently assigned to the Bureau of Land Management of the Department of the Interior, marine-related functions of Interior's Bureau of Sports Fisheries and Wildlife, and the U.S. Coast Guard. Three activities involving the establishment and updating of a national marine affairs plan, regulating U.S. affairs accordingly, and coordinating permit and regulatory activities for weather modification are new.

NACOA has suggested that the activities involved in the first three functions could profitably be brought together in a single agency or Department and organized in an integrated tripartite arrangement. The reason was that in the Committee's opinion "none can work to maximum effect without contact with the other two and none could work in the full public interest were any of them subordinated to the others."

If all the listed activities were collected in a single agency, other major marine activities would still exist. For example, the Navy, the State Department, NSF, the Environmental Protection Agency, the Council on Environmental Quality, and the Department of Energy would also have marine programs. Noting the limited ability of interagency coordinating committees to bring all ocean programs into a coherent policy context and to coordinate their implementation, NACOA proposed formation of a higher level body at the Cabinet level or within the White House.

What Now?

NACOA did not carry these concepts farther into the form of specific detailed organizational charts, budgets, etc. It was deemed better to provide a basis for testing the adequacy and completeness of such organizational proposals as might materialize, since there is almost certain to

be more than a single way of organizing the Federal Government to meet the purposes the Committee had in mind. The Carter Administration, as mentioned earlier, is already engaged in reorganization studies and plans at various levels involving ocean and atmospheric programs.

If the new NACOA wishes to get prepared to comment on these, it may wish to reopen questions regarding some of the fundamental assumptions NACOA has adopted in the past. For example, does it still make sense to talk about an oceans program at all? To what extent should organization by resource such as energy, food, science, etc., dominate the Federal structure? At what management level should responsibility for encouraging marine resource development and for regulating the activities involved in the light of conservation and environmental factors be brought together? How about responsibility for establishing regulations and for their enforcement? Does the Carter Administration's recently expressed preference for coordinating interdepartmental activities through the so-called Presidential Review Memorandum process rather than through White House-level coordinating bodies increase the need for a comprehensive oceans agency? To what extent and to what purpose do atmospheric and oceans programs belong together organizationally? In view of the Carter Administration's professed policy of weeding out advisory committees, does NACOA merit being an exception? Why?

Background

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WEATHER MODIFICATION AND CLIMATE CHANGE

There are dreamlike qualities to the benefits which could result from controlling weather. Rain would fall where you want it to fall, violent storms such as hurricanes would blow less strongly, the overabundance that causes floods would be lessened, hail suppression would reduce crop damage, fog dissipation would minimize delays at airports, and so on. There are associated problems of course. The amusement park and the farmer have different attitudes towards rain. Whose cloud was wrung out can be a real issue in water rights confrontations. There may be unknown side effects--an anxiety which arises whenever nature is prodded.

Nevertheless, the ability to control weather would be so welcomed by those whose fortunes would be affected, that it has tended to force experimental work in weather modification into field testing whether or not rain or snow can be produced rather than into designing experiments to increase physical understanding, step-by-step, on what happens, and why. Then the benefits and the risks could both be more accurately assessed, and the degree of control and predictability improved or the idea abandoned for good and sufficient cause.

The fact is none of these visions is clearly impossible, but the extent of control and the ability to separate the beneficial from the neutral or even harmful results, though differing from one type of weather modification to another, are far from operational practicability. Despite this, when NACOA came on the scene, the weather modification research efforts were scattered throughout the mission agencies, and there was a lack of emphasis on the research into physical understanding of the basics

so that we could ratchet forward in our knowledge.

Since those days the question of climate change, be it due to natural causes or arising from people's activities, has also grown in visibility and taken center stage. It is important to distinguish one from the other, because there is enough in common between the effects of weather modification and of climate change to cause some confusion in the way the two are treated as public policy matters. They are different, and the research required for each is different, although there is a common basis in fundamental meteorological knowledge and theory. Understanding natural fluctuations in each instance must be improved so that inadvertent modification either of weather or of climate by people's activities can be sensed and those activities modified to the extent possible and desirable.

The distinction can be put as follows: Weather is the state-of-the-atmosphere in one place at one time. Climate is the composite of all weather conditions in a region over a period of time. These simplified definitions do not clearly separate one from the other, but the distinction would be false if they did, for neither does nature. Weather and climate overlap. Weather merges into climate; climate puts bounds on weather. Weather is seasonal even though specific; climate fluctuates even though it is averaged. Thus weather and climate slide into each other. NACOA started with one and expanded into the other. To describe what went on, it would be useful to make a further distinction, in this case by example, between advertent and inadvertent weather modification, and natural and inadvertent climate change. Each of these examples is still an open book, though some may be closer to operational use than others, and the urgency may also vary (though not in the same way) for other reasons such as energy use, or food production, or for the protection of life and property.

Advertent weather modification

- Precipitation enhancement would make rain in particular regions or increase the mountain snowpack for later use in irrigation. This is part of water resource management.
- Hurricane modification would reduce the maximum force of the winds thus reducing storm damage.
- Hail suppression would reduce the size of hailstones or make them so small they would reach the ground as rain and thus crop damage would be reduced.
- Lightning suppression would reduce the number of lightning discharges from cloud to the ground and decrease the number of forest fires.
- Fog dissipation would disperse fog above airport runways, reduce air traffic delays, and increase safety.

Inadvertent weather modification

- Cloud streets have been seen forming downwind of power parks where quantities of heat and moisture are vented into the atmosphere.
- Increased rainfall downwind of cities has been observed by careful observations. Cities are heat islands and affect rainfall patterns. Their pollutants affect the quality of rainwater and make it acid.
- Smog is a byproduct of driving automobiles, burning trash, and industrial processes.

Natural Climate Change

- Records of climate in the earth's recent past are found through paleoclimatology. This, and other research to elucidate the characteristics of climatic change, and to seek its causes, have made remarkable strides in the past few years. The effort is desirable not only for its intrinsic interest, but also for establishing the basis on which to try to distinguish change due to natural causes from climate change which is man-made in origin, and to help establish an understanding of climatic patterns. The latter could lead to seasonal, year-to-year, or longer term projections to the benefit of food production, transportation, energy use, and the like.

Inadvertent Climate Change

- This is the effect of human activities, such as an increase of CO₂ in the atmosphere, the increase of dust and other particulates in the atmosphere, the increase of chlorofluorocarbon emissions on the ozone layer, and so forth. These increases affect the amount of the sun's energy which reaches the earth's surface and thus the temperature, windfall, and rainfall patterns, etc.

The state of affairs when NACOA started up in 1972 was that at least seven agencies were conducting research or were experimenting (these are not necessarily synonymous) with one aspect or another of weather modification. The scientific community felt that the work was too fragmented and uncoordinated, and so dispersed as to be below a reasonable threshold for efficiency. Their concern at that time was less with the amount of effort than with its ineffectiveness in producing scientific progress and with its unnecessary expensiveness in having field experiments by mission agencies performed in isolation, one from another.

NACOA appealed, as had the National Academy of Sciences (NAS), for the appointment of a lead agency to coordinate this research and recommended that greater emphasis be placed on understanding cloud physics, at this stage of the game, rather than on time-eating and expensive field experiments in the hope of gaining statistical assurance.

The Administration reacted indifferently at first and took the position that targeted research by each of the mission agencies was desirable in the particular aspect of weather modification with which it was concerned--such as Interior in precipitation enhancement, the FAA in fog dissipation, NOAA in severe storm modification, etc. It also felt that coordinating mechanisms existed and that agencies such as NSF could emphasize the basic research. Perhaps there was a reluctance to set up a unified weather modification juggernaut with swelling budget. At any rate, a year later Interior got the nod (if not the lead). A program NOAA had worked up for the High Plains was transferred on mission grounds, rather than being left with the agency with the greatest meteorological expertise, as NACOA had recommended. The emphasis on operations rather than research thus continued.

While this was going on, while NACOA was marshalling more arguments for research, and while efforts to develop legislation to coordinate and stimulate research in this field began to emerge in the Congress, a change in emphasis began to take place. This was due to scientific and public concern with the possibilities of inadvertent modification of climate and with the urgency of the need for improved ability to forecast climate in managing energy use and food production. In this call for urgent attention to impact assessment and forming strategies for mitigation, NACOA was one early voice. Weather, climate, or weather- and climate-related matters have appeared in each issue of its annual reports. NACOA was adding its voice to that of other advisory bodies on the need to develop a comprehensive research plan on climate. In its own right it underlined the need for greater emphasis on ocean-atmosphere interaction

as a driving force to understanding climate and a way of improving foresight.

The service of preparing a research plan was performed by ICAS, the Interdepartmental Committee for Atmospheric Sciences (an element of the old interagency Federal Council on Science and Technology) which formed an ad hoc working group. After 4 years, and feeding on the work of committees of the NAS, the American Meteorological Society, a subcommittee of the Domestic Council, and countless meetings, ICAS published a Climate Plan a few months ago which is to be used as the basis for a coordinated Federal effort in climate research. Currently, legislation whose approach is based on the U.S. Climate Program Plan, is being worked on in the Congress.

The Climate Plan may, by implication or example, help streamline the weather modification effort. But a more direct possibility is that such would occur when a report is published as required by the National Weather Modification Act of 1976 (P.L. 94-490). It is expected next June. Weather modification legislation has also been on the books for some years requiring registration and notification of cloud seeding and other weather modification activities so that the rather extensive private operations, in some cases by unlicensed operators, would be sufficiently well known that the experimental results of field experiments would not be compromised by agents entering from another area.

There is also international activity in the field. The Russians, for example, have claimed success in hail suppression for years. Stormfury, a project for reducing winds in the central part of hurricanes, quiescent for several years while improved research aircraft were acquired and instrumented, is about to recommence with a brief foray in the western Atlantic this year (if suitable storms sufficiently far from land occur). This is in preparation for a cooperative experiment with Mexico next year in the eastern Pacific where a greater number of storms occur which,

nevertheless, make infrequent landfall and are therefore suitable for experimentation.

Looking Ahead

A great deal, therefore, is and will be happening. It could very well prove useful for NACOA to keep itself sufficiently well informed of what is happening in the National Climate Program Plan so that it can be of prompt assistance either to the Congress or to the executive branch in advising on problems that crop up in this complex enterprise, especially in seeing that emphasis does not get misplaced nor parochial interests dominate.

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Staff:

Douglas L. Brooks, Executive Director
David A. Katcher, Senior Staff Assistant
John T. Willis
A. Joseph Heckelman
Robert Gary
Abram B. Bernstein
Samuel H. Walinsky

Supporting Staff:

Diane G. Smith
Louise S. Lucas
Delphenia W. Brodie
Debra L. Walker

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Laurence W. Lane ('73-'74)	Warren S. Wooster ('76-'77)
L. Jay Langfelder ('76-'77)	

