REPORT OF THE EVALUATION TEAM

PHASE III OF THE NOAA SCIENCE REVIEW: LABORATORY REVIEW

APRIL 1995

ACKNOWLEDGEMENTS

The authors of this report wish to acknowledge the many NOAA employees who took time from their other important activities to provide data and information, as well as valuable insights into the organization and operation of NOAA's laboratories.

The Evaluation Team wishes to express its gratitude to the Line Office points of contact who put in many hours working closely with the team, providing valuable knowledge and perspective on the management and operation of their offices and laboratories, as well as NOAA's science organization: Judith Gray, Robert Kifer, Robert Feden, Arnold Gruber, and Gary Matlock. The authors also wish to acknowledge the assistance provided by the Office of the Comptroller, especially Ted Wolfgang.

Finally, the Evaluation Team acknowledges the support it received from the following members of The MITRE Corporation's technical staff: Linda Duncan (Project Leader), Martha Bodden, Robert Gerstein, Dabney Hart, Brant Smith, and Barron Weand.

TABLE OF CONTENTS

SECTION		PAGE
1	Introduction	1-1
1.1	Background of the Study	1-1
1.2	History, Background, and Mission of NOAA	1-2
1.3	Scope of the Study	1-3
1.4	Organization of the Document	1-5
2	Objectives and Methodology	2-1
2.1	Objectives	2-1
2.1.1	Terms of Reference	2-1
2.1.2	Other Studies	2-2
2.1.3	Related Activities	2-6
2.2	Methodology	2-7
2.2.1	Information and Data Collection	2-9
2.2.2	Information and Data Synthesis	2-11
3	Current NESDIS/ORA Mission, Structure, and Operations	3-1
3.1	Mission, History, and Structure	3-1
3.2	Research Programs of SAL and SRL	3-3
3.2.1	Satellite Applications Laboratory	3-3
3.2.2	Satellite Research Laboratory	3-5
3.3	Program Management	3-6
3.4	Financial Management	3-7
3.5	Cooperative Institutes	3-8
3.6	Customers	3-9
4	Current NMFS Mission, Structure, and Operations	4-1
4.1	Alaska Fisheries Science Center	4-4
4.1.1	Mission, History, and Structure	4-4
4.1.2	Research Programs	4-5
4.1.3	Program Management	4-7
4.1.4	Financial Management	4-7

SECTION		PAGE

4.2	Northeast Fisheries Science Center	4-8
	4.2.1 Mission, History, and Structure	4-8
	4.2.2 Research Programs	4-9
	4.2.3 Program Management	4-11
	4.2.4 Financial Management	4-12
4.3	Northwest Fisheries Science Center	4-12
	4.3.1 Mission, History, and Structure	4-12
	4.3.2 Research Programs	4-13
	4.3.3 Program Management	4-15
	4.3.4 Financial Management	4-15
4.4	Southeast Fisheries Science Center	4-16
	4.4.1 Mission, History, and Structure	4-16
	4.4.2 Research Programs	4-17
	4.4.3 Program Management	4-21
	4.4.4 Financial Management	4-21
4.5	Southwest Fisheries Science Center	4-22
	4.5.1 Mission, History, and Structure	4-22
	4.5.2 Research Programs	4-23
	4.5.3 Program Management	4-26
	4.5.4 Financial Management	4-27
4.6	National Seafood Inspection Laboratory	4-28
4.7	Customers	4-28
4.8	Academic Partnerships	4-29
5	Current OAR/ERL Mission, Structure, and Operations	5-1
5.1	Mission, History, and Structure	5-1
	5.1.1 Aeronomy Laboratory	5-1
	5.1.2 Air Resources Laboratory	5-3
	5.1.3 Atlantic Oceanographic and Meteorological Laboratory	5-3
	5.1.4 Climate Diagnostics Center	5-3
	5.1.5 Climate Monitoring and Diagnostics Laboratory	5-4
	5.1.6 Environmental Technology Laboratory	5-4
	5.1.7 Forecast Systems Laboratory	5-5
	5.1.8 Geophysical Fluid Dynamics Laboratory	5-5
	5.1.9 Great Lakes Environmental Research Laboratory	5-5
	5.1.10 National Severe Storms Laboratory	5-6
	5.1.11 Pacific Marine Environmental Laboratory	5-6
	5.1.12 Space Environment Laboratory	5-7

SECTION		PAGE

5.2	Research Program Management	5-7
	5.2.1 Environmental Stewardship	5-8
	5.2.2 Environmental Assessment and Prediction	5-9
5.3	Financial Management	5-12
5.4	Joint and Cooperative Institutes	5-13
	5.4.1 Cooperative Institute for Arctic Research	5-13
	5.4.2 Cooperative Institute for Research in Environmental Sciences	5-14
	5.4.3 Cooperative Institute for Research in the Atmosphere	5-14
	5.4.4 Cooperative Institute for Mesoscale Meteorological Studies	5-14
	5.4.5 Cooperative Institute for Limnology and Ecosystems Research	5-15
	5.4.6 Cooperative Institute for Marine and Atmospheric Studies	5-15
	5.4.7 Joint Institute for the Study of the Atmosphere and Ocean	5-15
	5.4.8 Joint Institute for Marine and Atmospheric Research	5-15
5.5	Customers	5-16
6	Findings and Recommendations	6-1
6.1	Cross-Organizational Findings and Recommendations	6-1
	6.1.1 Missions, Functions, and Activities	6-1
	6.1.2 Customers and Products	6-3
	6.1.3 Human Resources	6-3
	6.1.4 Facilities and Equipment	6-8
	6.1.5 Funding and Expenditures	6-9
	6.1.6 Organization and Program Management	6-16
6.2	NESDIS/ORA-Specific Findings and Recommendations	6-18
	6.2.1 Missions, Functions, and Activities	6-19
	6.2.2 Customers and Products	6-20
	6.2.3 Human Resources	6-22
	6.2.4 Equipment and Facilities	6-23
	6.2.5 Organization, Management, and Funding	6-23
6.3	NMFS-Specific Findings and Recommendations	6-24
	6.3.1 Missions, Functions, and Activities	6-24
	6.3.2 Customers and Products	6-28
	6.3.3 Facilities	6-29
	6.3.4 Equipment	6-31
	6.3.5 Funding and Expenditures	6-32
	6.3.6 Organization and Program Management	6-33

SECTION		PAGE

6.4	OAR-Specific Findings and Recommendations	6-36
	6.4.1 Organization and Program Management	6-36
	6.4.2 Program Planning	6-38
	6.4.3 Infrastructure	6-40
6.5	Conclusions	6-41
7	List of References	7-1
Glossary of Acronyms		GL-1
Appendix A	Terms of Reference	A-1
Appendix B	Data and Explanations	B-1

LIST OF FIGURES

FIGURE		PAGE
1-1	U.S. Department of Commerce National Oceanic and Atmospheric Administration	1-4
2-1	Information Flow	2-7
3-1	National Oceanic and Atmospheric Administration National Environmental Satellite, Data, and Information Service	3-2
4-1	National Oceanic and Atmospheric Administration National Marine Fisheries Service	4-2
5-1	National Oceanic and Atmospheric Administration Office of Oceanic and Atmospheric Research	5-2
6-1	FY94 Age Distribution of NOAA Laboratory Staff by Line Office	6-4
6-2	On-Site Laboratory Workforce: FY94 NOAA (Actual) and Non-NOAA (Estimated) FTE Work-Years Expended	6-6
6-3	FY94 Grade Distribution of Laboratory Staff By Line Office	6-7
6-4	FY94 Laboratory Direct Obligations By Source of Funds	6-11

REPORT OF THE EVALUATION TEAM

PHASE III OF THE NOAA SCIENCE REVIEW: LABORATORY REVIEW

EXECUTIVE SUMMARY

The Laboratory Review Steering Committee of the National Oceanic and Atmospheric Administration (NOAA) charged the Evaluation Team to conduct a study of the management, operations, and facilities in the science laboratories in the National Marine Fisheries Service (NMFS), the Environmental Research Laboratories (ERL) in the Office of Oceanic and Atmospheric Research (OAR), and the Office of Research and Applications (ORA) in the National Environmental Satellite, Data and Information Service (NESDIS).

Collectively, the science centers, laboratories, and field stations reviewed in this study had 2,856 Full-Time Equivalents (FTEs) in Fiscal Year 1994 (FY94). Their total FY94 expenditures were $309.3 million. Of this amount, $269.5 million was expenditures from NOAA funds; the additional $39.8 million was funded by non-NOAA sponsors for reimbursable work. The $269.5 million represented about half of the NOAA research and development expenditure and about 15 percent of the total budget of NOAA. The remainder of the NOAA research and development expenditure was apportioned to other NOAA elements that were not included in this review.

The goals of the study were to make recommendations and to identify options for strengthening the operations and management of the NOAA laboratories and the services they provide. The study also responded to requests by the Department of Commerce (DOC) and the Congress that NOAA review its laboratory systems.

The Steering Committee, chaired by the NOAA Chief Scientist, guided the study. The Evaluation Team was chaired by the NOAA Deputy Chief Scientist; members included senior scientists in the National Weather Service (NWS) and the National Ocean Service (NOS), a senior official in the NOAA Office of Administration, and a senior scientist from each of the National Aeronautics and Space Administration, the Environmental Protection Agency, and the National Biological Service. The Evaluation Team was supported by the NOAA line offices, as well as by The MITRE Corporation, independent technical consultants.

The Evaluation Team met from October 1994 through April 1995. It gathered data and information from centralized NOAA databases, from line office databases, and from site visits to over 30 facilities. In addition, members of the Evaluation Team and the consultants interviewed directors and senior staff at six Joint and Cooperative Institutes, senior managers

in headquarters, and a diverse group of customers. It is the most detailed examination ever conducted of NOAA's laboratory systems.

In this report, the Evaluation Team presents its findings and recommendations and identifies some options for implementation. Some of the findings and recommendations are common to each of the three laboratory systems and are termed "cross-cutting." Other findings and recommendations are specific to one of the laboratory systems.

Implementation of the recommendations will lead to improved efficiency and effectiveness of laboratory operations and management. Also, the data and information gathered will serve as a basis for NOAA to shape the future configuration of its laboratory systems based on program priorities, science strategies, and the availability of financial resources.

CROSS-CUTTING FINDINGS AND RECOMMENDATIONS

Investment portfolio and products. The Evaluation Team found that the science laboratories provide the technical foundations for improving the nation's weather and climate forecasting capabilities, for maximizing the use of the nation's environmental satellite capabilities and services, and for managing the nation's living marine resources. Also, the laboratories contribute greatly to, and in many cases are world leaders in, improving our understanding of the atmosphere, oceans, and coastal zones. In each of these areas, the research and development need to be continued and strengthened in order to achieve NOAA's strategic goals. The laboratories provide a broad spectrum of good- to high-quality products and services to a wide variety of customers in NOAA and in other federal agencies, state governments, the private sector, academia, the general public, and the international community.

Adaptability. The research, development, outreach, and dissemination activities conducted in the laboratories have evolved considerably since NOAA was formed in 1970. This evolution has occurred for a number of reasons, including capitalizing on research successes and addressing changing national and international needs and priorities. The directors and staff have shown remarkable leadership, resilience, and creativity in adapting to changing circumstances, especially with the erosion of base funds. For example, when appropriate, they have forged major new research initiatives, taken on appropriate work for other NOAA and non-NOAA customers, used special project funding to obtain new equipment, and even voluntarily mowed the grass and painted the offices. The decline in effective base funding and its adverse effects on laboratory operations is of great concern to the Evaluation Team.

Business practices. NOAA and the line offices are streamlining their activities and improving the way they conduct business as they implement the National Performance Review and the Government Performance and Results Act and as they respond to recommendations from previous reviews. The overarching challenge, particularly in a time of budgetary restraint, is for headquarters (NOAA and the line offices) to strengthen its oversight of the laboratories, to improve its business practices further, and to steer the laboratories into the 21st century without falling into the trap of micromanagement or stanching the flow of new ideas from the bottom up.

Quality and relevance of the research. In order to involve the laboratories more in the corporate strategic planning process and to ensure the quality and relevance of their research programs, NOAA should institute regular, standardized external reviews of ongoing and planned programs and support functions contributing to each strategic objective. This review process also will help break down barriers to program integration, strengthen system management, and increase the advocacy of science by NOAA leadership. The program reviews should be coupled with periodic laboratory reviews, which should include evaluation of the laboratories' program plans and priorities in the context of NOAA's strategic goals.

Full cost-recovery. Consistent with sound business practices and in order to ensure consistent application of existing policies and regulations, NOAA should develop and implement a simpler standardized overhead rate structure and a full cost accounting system. All actual costs should be charged to the tasks incurring the costs, except where appropriate cost-sharing arrangements have been made. Currently, cost recovery practices are highly variable and full cost-accounting is not conducted routinely at the project or program level.

Financial and program management. To provide a basis for improved financial and program management, including full cost-accounting and full cost-recovery, NOAA should develop and implement modern, user-friendly, and standardized financial and management information systems throughout the agency and in close coordination with DOC. The lack of such systems impaired progress in the study. Also, procedures should be developed and implemented at the laboratory level for tracking and charging the actual costs.

Extramural partnerships. On average, the laboratories outsource about 24 percent of their work, including 13 percent in the form of grants and cooperative agreements. In order to formalize and strengthen these vital extramural partnerships, NOAA should review all its contracts, grants, cooperative agreements, and operating procedures to ensure that practices are consistent with federal, DOC, and NOAA policies and regulations on the use of outside assistance. A working group of DOC grant policy, DOC General Counsel, and NOAA grant and contract staff could focus directly on these issues. Further, NOAA and DOC should build

on the recent progress and continue to streamline the processing of grants, cooperative agreements, and contracts.

Critical mass. Strong linkages have been forged among a few related programs that are conducted in different laboratories, but many programs lack coordination or integration across the laboratories or the line offices. In order to increase the efficiency and effectiveness of programs, the Evaluation Team recommends improved research coordination and integration. With modern computers and electronic communications, the virtual consolidation of programs is feasible and attractive. Examples of programs that are likely to benefit from improved research coordination and integration include species identification, Pacific salmon work, Pacific pelagic work, the evaluation of alternative strategies for the management of marine resources, habitat research, habitat restoration, ecosystem modeling, aquaculture, climate services, weather research, and remote sensing. Related programs within and across line and program offices should be better coordinated: for example, Sea Grant fisheries programs in OAR should be more closely connected to NMFS programs, and coastal ecosystem and non-point-source pollution programs in NOS should be more closely connected to related programs in NMFS, ERL, and Sea Grant.

Facilities. Overall, the Evaluation Team found that the current configuration of the laboratories is fairly consistent with program needs. Largely because of strong constituencies in the Congressional districts in which the laboratories are situated, NOAA does not have a successful record of closing laboratories. The physical condition of the facilities varies. The condition of a handful of old facilities has deteriorated to the extent that they pose significant threats to human health and safety; there is, for example, a backlog over $20 million in uncompleted facilities maintenance and environmental compliance projects, including over $8 million to address the highest priorities that put the health and safety of NMFS employees and visitors at risk. At the same time, however, NOAA continues to receive funds for the construction of new facilities, some of which do not address top program priorities. The Evaluation Team recommends that NOAA establish an agencywide strategic planning process for existing and new facilities based on program requirements and priorities. Also, NOAA should work aggressively to eliminate the facilities improvement backlog, especially where the health and safety of employees and visitors are involved. Further, proposed construction projects that do not address top program priorities should be eliminated.

NESDIS OFFICE OF RESEARCH AND APPLICATIONS

Vision and planning. The prime customer for ORA products and services is and should continue to be the NWS. In addition, other offices in NOAA and organizations in other parts of the country exhibit increasing demands for satellite products and services. In view of these

large demands for products and services, the Evaluation Team recommends that ORA, in coordination with NESDIS and other NOAA elements, identify requirements for civilian remote-sensing products and services, set priorities, and use these to shape its future in applied science. ORA should place more emphasis on ground-truthing and validation in order to ensure the quality and accuracy of its products.

Efficiency. It is important for customers that ORA develops satellite products (e.g., algorithms for deriving geophysical variables from satellite observations) in a timely and efficient manner. However, there have been some significant delays in ORA applying new products after they have been developed. The Evaluation Team recommends that ORA develop and implement a more efficient process to expedite the transition from development to application of satellite products.

Management and organization. The Evaluation Team found that the laboratory functions did not match the organizational structure, that clear lines of authority and responsibility were not evident, and that the management of contractor support could be improved. Therefore, the Evaluation Team recommends streamlining the management of ORA by combining the two laboratories, establishing an organizational structure that is consistent with the functions of the office, establishing clear lines of authority and responsibility, and increasing the efficiency of management of contractor support.

Science coordination in NESDIS. In order to strengthen the coordination and technical leadership of programs and scientific activities, NESDIS should establish a Senior Scientist position.

NATIONAL MARINE FISHERIES SERVICE

Conceptual model. The Evaluation Team did not find a commonly accepted model of NMFS mission. Some managers, mainly in headquarters, regard NMFS primarily as a regulatory and resource management agency and others, mainly in the science centers, emphasize the long-term understanding of coastal and marine ecosystems. This time-scale issue is reflected in an approximate 50-50 split between stock assessment work and longer-term research. Although many NMFS scientists work on both activities, the current accounting and management systems do not separate the two functions. The Evaluation Team concludes that including all the stock assessment work as research can have some detrimental effects, including an inflation of NOAA's official research numbers, the masking of the FTE needs for assessment, and the blurring of research that could be competed extramurally. Therefore, the Evaluation Team recommends that the stock assessment work be classified as tactical or operational, in contrast to the strategic nature of the longer-term research. Also,

the Evaluation Team recommends that NMFS should develop a shared vision and one conceptual model to provide a unified framework for research planning, management, and resource allocation in the agency. The Evaluation Team notes that the NMFS Charter Teams are already addressing many of the challenges identified in this report.

Science management. NMFS and NOAA leadership should formalize, institutionalize, and strengthen control of science activities in the agency, including the establishment of a process and organization for the more effective insulation of strategic research (e.g., exploring new management paradigms, and improving biological and ecological knowledge) from the tactical research (e.g., stock assessments). Furthermore, the Evaluation Team recommends that the tactically applied science be integrated more effectively with regulatory operations. Implementation options include (1) giving the Regional Office Directors control of tactical resources, (2) the Regional Office Directors and the Science Center Directors jointly developing five-year tactical and strategic research plans, (3) competing more of the strategic research extramurally, and (4) establishing Centers of Excellence for strategic research, in cooperation with other NOAA offices.

Resource limitations and imbalances. A number of factors have combined to cause a situation in which a high percentage of line office funds are consumed in fixed costs: in FY94, 71 percent of NMFS-funded task obligations went to salaries and benefits. The reasons include a substantial decline in the purchasing power of base funds over the past decade and increasing salaries and benefits of an aging and, until recently, expanding work force. As a result, there is little funding flexibility for operations, equipment, travel, supplies, and other necessary working capital requirements. Only about 6 percent of all funding is distributed as extramural grants; the use of outside expertise from academia is much less than in ERL, for example. Another symptom of resource limitations is the backlog in repair and maintenance of some older facilities, mentioned above; about $8 million is needed to remedy the highest-priority problems relating to imminent danger or known risk of catastrophic failure.

In contrast to these and other facility problems, new facilities are being planned and built. There is empty space in the well-equipped James J. Howard Laboratory in Sandy Hook, New Jersey; plans are continuing for a new facility in Lafayette, Louisiana, for which the Inspector General and the Evaluation Team found insufficient justification. Most of the laboratories have the instrumentation and equipment they need to do credible research, due in large measure to the innovation of the laboratory directors.

These are examples of considerable resource imbalances across the agency, which need to be addressed in a systematic way. Old facilities can be modernized and new facilities can be populated and equipped with additional financial resources. In the absence of significant budget increases, solutions to the problems rest in combinations of reducing the number of

federal employees (as identified in the NOAA Streamlining Plan) and moving others, closing some older and smaller laboratories, refraining from building new facilities, and eliminating lower-priority programs. The above recommendation to develop a NOAA facilities planning process applies most strongly to NMFS.

OAR ENVIRONMENTAL RESEARCH LABORATORIES

Extramural partnerships. About 20 percent of ERL funds are obligated as grants. This level of extramural support, mainly to universities, helps ensure the vitality of ERL research and development. The Joint Institutes are a vital cornerstone of the partnership with academia.

Consolidation. Recent changes in the structure of OAR, especially the move of ERL headquarters from Boulder, Colorado, to Silver Spring, Maryland, is a significant step toward the goal of reducing management layering. The Evaluation Team recommends that OAR study the feasibility of further consolidating the OAR and ERL administrative and management levels and functions.

Support for OAR Organizational Review Team Recommendations. Independently, the Evaluation Team has arrived at conclusions similar to those of the OAR Organizational Review Team. It supports the Review Team's recommendations relating to the development of an ERL (and OAR) mission statement and strategic plan, leadership, marketing ERL programs and services in order to enhance partnerships and create new opportunities, and organizing OAR headquarters to meet future challenges. One of the recommendations of the OAR Organizational Review Team is for OAR to sign Memoranda of Understanding with other line offices for the development of joint programs in specific areas. The Evaluation Team recommends that OAR/ERL aggressively implement the recommendations made by the OAR Organizational Review Team.

Climate research and services. ERL has contributed much to the understanding and prediction of climate variations and climate change. Some of the ERL laboratories are world leaders in climate research and in international assessments of global change. An end-to-end framework for identifying research priorities, products, and services has yet to be developed within NOAA. Offices in NOAA, including NWS, NOS, and the Office of Global Programs, are strengthening their climate research and service activities, and steps to develop a cohesive NOAA climate plan have begun. Therefore, the Evaluation Team recommends that the ERL laboratories work with other NOAA offices to expedite the development of composite plans for defining and coordinating climate research and services in NOAA. The plans should

identify specific services and end-points, as well as the roles and responsibilities of each office and laboratory.