NOAA Responses to Questions Submitted by the Commission on Ocean Policy

Question 1: There seemed to be a recurring theme that our science is not sufficient to address some pressing marine issues, many of which are relevant to NOAA missions. How do you think we can best develop the knowledge base we need?

Developing the knowledge base required to address pressing marine issues must include the following key elements:

- consistent internal and external investments
- objective prioritization of needs
- coordination to avoid duplication
- technological improvements to acquire and deliver data

Consistent investments in the nation's ocean science programs, human assets, and science infrastructure are imperative to keep pace with the demand for science-based management and policy. For NOAA, this means strengthening internal science programs and expanding collaborative partnerships with academia, other governmental entities and the private sector. This dual approach will allow for the continuity of long-term marine science programs, while maintaining the flexibility to respond to shorter-term science demands.

New knowledge to address pressing marine issues will emerge faster and more economically if our investment in research is guided by an objective prioritization of science needs. NOAA must continue to use internal and external advisory bodies, including the National Academy of Sciences, to evaluate and prioritize its information requirements and identify areas where increases in research emphasis are justified. Since priorities change, sometimes quickly (such as in response to pfiesteria), NOAA will continue to interact with advisory councils, managers, policy makers and its constituents to ensure the relevance of its research efforts.

We must also ensure that public investments in ocean science are coordinated among federal, state, academic, private sector, and other programs to avoid duplication. Consistent communication among these entities to enhance information and technology transfer, to identify partnership opportunities, and to avoid program overlap will maximize returns on the Nation's science investments.

Finally, we must continue to pursue the development of improved approaches and technologies to acquire and deliver new scientific data and results. For example, recognition of the need to shift from single-species and single-issue approaches toward a more holistic, ecosystem approach is an important step in advancing our understanding and management of marine systems. Implementation of these improved approaches will require strategic planning and consistent investments into the underpinning ocean and coastal science programs.

Question 2: What is the breakdown of Science and Development funds spent in NOAA annually on oceans and fisheries versus atmospheric science and development funds? Please provide this information for in-house versus in U.S. universities, as well.

NOAA SCIENCE AND DEVELOPMENT FUNDS[1]
($ in thousands)

DISCIPLINE	In-House	External*	Total	In-	External*	Total	In-	External*	Total	Grand Total
Fisheries[2]	87,461	21,865	109,326	107,887	26,972	134,859	105,906	26,477	132,383	376,568
Ocean[3]	117,332	29,333	146,665	103,654	25,913	129,567	118,103	29,526	147,629	423,861
Atmosphere[4]	94,583	23,646	118,229	130,931	32,733	163,664	149,183	37,296	186,479	468,372
TOTAL	**299,376**	**74,844**	**374,220**	**342,472**	**85,618**	**428,090**	**373,192**	**93,299**	**466,491**	**1,268,801**

*External includes Universities and other research institutions. Funding for in-house versus external represents a ratio of 80:20 of totals for each discipline.
**FY 2002 funds are estimated.
[1]Numbers consist of the dollar amounts reported in the National Science Foundation Federal Funds Report for Research and Development.
[2]FY 2000 Fisheries numbers include Biological and Environmental Biology portions. FY 2001 and 2002 Fisheries numbers represent 77 percent of Life Science total, based on FY 2000 percentages.
[3]FY 2001 and 2002 Ocean numbers represent 38 percent of Environmental Science total, based on FY 2000 percentages.
[4]FY 2001 and 2002 Atmosphere numbers represent 48 percent of Environmental Science total, based on FY 2000 percentages.

Question 3: What is NOAA's reprogramming authority from Congress and OMB?

Section 605 of the bill providing for NOAA's annual appropriations provides for the Committee's policy concerning the reprogramming of funds. Section 605(a) prohibits the reprogramming of funds, which: (1) creates new programs; (2) eliminates a program, project, or activity; (3) increases funds or personnel by any means for any project or activity for which funds have been denied or restricted; (4) relocates offices or employees; (5) reorganizes offices, programs, or activities; or (6) contracts out or privatizes any function or activity presently performed by federal employees unless the Appropriations Committees of both Houses of Congress are notified 15 days in advance. Section 605(b) prohibits a reprogramming of funds in excess of $500,000 or 10 percent, whichever is less, that: (1) augments existing programs, projects, or activities; (2) reduces by 10 percent funding for any existing program, project, or activity, or numbers of personnel by 10 percent as approved by Congress; or (3) results from any general savings due to a reduction in personnel that would result in a change in existing programs, activities, or projects as approved by Congress, unless the Appropriations Committees of both Houses of Congress are notified 15 days in advance. The Committee has again included carryover funds under the requirements of section 605 to clarify that agencies must follow reprogramming procedures with respect to carryover funds.

Question 4: What are the advantages and disadvantages of NASA doing oceanography from space vice NOAA doing that work?

Ocean monitoring using space-based assets is a critical component in the ongoing development of global ocean observing systems. Both NASA and NOAA are contributing to our national capacity for ocean remote sensing in their respective responsibilities. Through several cooperative arrangements, NASA and NOAA are implementing NASA research-to-NOAA operations transitions. A recently initiated National Academy of Sciences study is examining methods to further improve the NASA research-to-NOAA-operations process. An *operational* global ocean observing system requires a strong research component to develop new space-based instrumentation and techniques (the NASA mission). It also requires a strong operational component to transition, build, and launch reliable instruments, ground support systems, data distribution and archive infrastructure, and interfaces to civilian operational uses ranging from numerical forecasts and long-term archives for climatology to imagery for fishing fleet operators (the NOAA mission). The advantages of coordinating NASA's research and development efforts with NOAA's operational oceanographic and meteorological systems grossly outweigh any disadvantages.

The past 20 years in satellite oceanography have been an era of instrument, technique, and technology development in each of the major conceptual areas (altimetry, scatterometry, and visible and infrared radiometry) advanced nearly 40 years ago, and it may appear that only NASA is suited to, or involved in, ocean remote sensing. Most of the ocean observing instruments have been unique systems on a discontinuous sequence of NASA (and other) research and development platforms. However, ocean parameters such as sea surface temperature, wind speed, ice concentration, and water vapor have been regularly measured and archived during these same 20 years from operational meteorological satellites built and operated by NOAA and DoD. Over these two decades, operational measurement of basic ocean parameters, coupled with continuously improving research instruments and data accuracy, have proven to be a powerful combination. NOAA end-users have become more comfortable with the reliability, interpretation, and sustained availability of remotely sensed data. Long-term use in daily applications is an essential aspect of the technology transfer process in which NOAA is regularly involved. We now see satellite data utilization in conventional oceanographic applications, growing commercial development, and improving ocean forecasting and real-time imagery.

The continuous operations of NOAA and DoD meteorological satellites flying in constellation, coupled with NOAA geostationary and international assets, have produced decadal time series of global ocean observations from a consistent set of instruments, leading to standardized algorithms and products. The price of continuity is often a programmatic and technological conservatism; therefore, ocean sensors on research platforms launched at discrete intervals offer important complements to continuous systems. Ocean sensor ground processing systems have allowed for adaptation to the rapid development of the Internet, commercialization, open systems and the anonymous user. For example, the role that NOAA's national-level data center (in this case, the

National Oceanographic Data Center) is rapidly evolving and the data centers are including online data access and automated archival operational requirements entering their day-to-day business. Also, the NOAA Coastwatch system for ocean data distribution to regional sites was an open systems design from inception and used the Internet to distribute remotely sensed ocean data five years ahead of the meteorological operations (http://coastwatch.noaa.gov/COASTWATCH). Value-added commercialization of data began with the Freedom of Information Act in 1994, and today there are regularly 6,000-8,000 registered commercial Coastwatch users.

Alternatively, incorporating new technology into current operations often occurs at the expense of standardization for a steady and known, high-volume customer base. Simply building a working satellite hardware and software system does not guarantee user support or customer satisfaction. Operational customers are often 'late adopters' and need time and training to become informed users and advocates. Thus, a close synergy is required between the research and operational development communities and today's new operations require a carefully crafted "business plan." NOAA is actively engaged in conversations with potential ocean-observing collaborators, which are becoming more frequent and are now focused on an integrated operational infrastructure that includes satellite oceanography and requirements for long-term in-situ observations.

As these designs evolve over time, the powerful combination of research satellites and associated computational platforms set within an operational framework provides an essential tool for exploring and evaluating operational concepts and training personnel. It also prepares users for new data types. In 2001, NOAA/NESDIS co-sponsored with Navy and NOAA a topical call for altimeter and scatterometer operational demonstrations with the National Ocean Partnership Program. Two supporting education measures are also being undertaken via competitive process: the establishment of a NOAA Cooperative Center for Remote Sensing led by the City University of New York (supported by a new NOAA Minority Serving Institution initiative) and a NESDIS Cooperative Center for Ocean Remote Sensing. The NESDIS Ocean Remote Sensing program is an annually announced competitive program that awards grants to academic and other institutions for ocean remote sensing research relevant to the NOAA satellite oceanography operational mission. Finally, the NASA-NOAA Joint Center for Satellite Data Assimilation was initiated to accelerate data utilization in numerical models. These activities are investments in the future critical operational activities of optimum data utilization, user interactions, and long-term education and academic tie-ins.

With NASA and other domestic and international partners, NOAA/NESDIS presently supports data acquisition and operational application of altimeters, scatterometers, radiometers, and radars. Among other parameters, these instruments deliver near real time sea surface height, wind temperature, and color, which are used very effectively with other conventional ocean data to characterize ocean features associated with important fishing stocks. Radar data are finding favor in the coastal and fisheries management communities as they offer high resolution, nearly all-weather observations of ocean wind, surface features, and hard targets such as fishing vessels.

For maximum utilization of these prototypical ocean sensors leading to operational use, NOAA is making significant investment in commercial data buys, real-time processing, telecommunications and storage technology in support of national and international access, and distribution of ocean sensing environmental satellites. Data exchange policies are being negotiated, as they are crucial for dual-use and international collaborations. NOAA is further contributing to the positive momentum for operational satellite oceanography through ongoing dialogue with potential satellite collaborators, ocean modelers, and in-situ measurement programs. Concurrent investment in the education of users and scientists is an effort to build, sustain, and improve the future of satellite oceanography.

Quasi-operational satellite oceanographic systems as offered by NASA research and development activity benefit NOAA operational development by accelerating innovations and are thus insurance against artificial conservatism.   Experimental systems often incorporate the latest computational approaches and allow operational transitions specialists and users to monitor and evaluate new products. Reliable access to a sustained source of data with adequate coverage and refresh rates, as offered by the NOAA operational community, is then necessary to entrain and hold the user community. Deliberate phasing of funds and joint risk-reduction efforts optimize transitions and capitalize on the strengths of both the NASA research and NOAA operations missions that are both necessary for a national ocean observing system.

Question 5: What is the NOAA Public Affairs total budget?

NOAA=s public affairs budget encompasses a wide variety of expenses that include, but are not limited to, salaries and benefits, travel, publications, and Web page design and support. Expenditures result in products and services that cater to the electronic and print media.

Dollars are reported in thousands:

Line Office	FTE	FY 2000	FTE	FY 2001	FTE	FY 2002 (estimated)
NOS	0	0	0	0	0	0
NMFS	0	0	0	0	0	0
NESDIS	0	0	0	0	0	0
NWS	6	503	4	420	5	450
OAR	1	106	1	90	1	94
OMAO	0	0	0	0	0	0
PS*	35	3,700	39	3,700	39	4,125
TOTAL	**42**	**4,309**	**44**	**4,210**	**45**	**4,669**

*****NOAA has 39 public affairs FTEs. Although NOAA public affairs staff work in various line offices and locations around the country, public affairs staff and funding is a NOAA headquarters function. The number of FTE provided includes all public affairs staff throughout the agency. This number includes NOAA Headquarters and headquarters public affairs support at the Weather Service, Ocean Service, Marine Fisheries, Environmental Satellite, Data and Information Service, the Office of Oceanic and Atmospheric Research. Public and Constituent Affairs office locations are in Washington, D.C., Maryland, New York, Missouri, Utah, Texas, Florida, Colorado, Oklahoma, Washington State, Alaska, and Hawaii.

The NOAA headquarters is under a cap that limits the number of public affairs staff, which limits the ability to meet additional work needs.

Question 6: What is NOAA's total Education and Outreach budget?

NOAA's education and outreach activities are coordinated through the NOAA headquarters, but most programs come from the NOAA line and staff offices around the country. Because of the cap that limits the number of staff at the Headquarters level, no additional education staff can be hired. Any additional workers must come from existing offices. Vice Admiral Lautenbacher put education into every SES performance appraisal in an effort to increase the priority of education and outreach within NOAA.

FY 2001 Education and Outreach by category:
Non-labor costs only

Teacher Conferences/Workshops/Training	$318,483
Development of Classroom and Teacher Materials	$197,479
Student Grants/Internships/Scholarships	$12,046,514
Student Conferences/Workshops and Classes	$3,109,473
Community Outreach Activities	$5,514,700
Development of Outreach Materials	$523,811
Exhibits and Development of Exhibit Materials	$3,215,200
GLOBE Program	$3,000,000
Education Partnership with Minority Serving Institutions	$15,000,000
Miscellaneous and Mixed Use	$18,305,486
TOTAL	**$61,231,146**

FY 2001 Education and Outreach by Line Office:	Total Cost, w/labor	FTE*
National Environmental Satellite, Data, and Information Service	$584,652[1]	2
National Marine Fisheries Service	$16,304,000[2]	35
National Ocean Service	$22,900,000[3]	79
National Weather Service	$1,100,000	135
Office of Oceanic and Atmospheric Research	$7,398,000	3[4]
Office of Marine and Aviation Operations	$56,220	1/2
NOAA Wide	$21,193,780	5
TOTAL	**$69,536,652**	**259.5**

[1]This amount includes $190,798 for 2 FTEs (labor and benefits). In FY 2000 the total was $555,419 (including $181,258 for 2 FTEs), and in FY 2002 the total is estimated at $613,885 (including $200,338 for 2 FTE).
[2]This total includes $2,104,000 for the 35 FTEs.
[3]This amount includes $5,400,000 for 79 FTEs.

[4]The FTEs include: 1 Seagrant, 1 Office of Global Programs, and 1 in OAR Headquarters.

***Most of the FTEs listed in this section have other primary duties, and education and outreach activities are additional duties.**

Question 7: Description of NOAA programs that address K-12 education

Most of NOAA's educational activities for grades K-12 take place in its facilities and laboratories located throughout the nation. Three NOAA programs that are congressionally mandated to provide education are the National Sea Grant Program, the National Marine Sanctuary Program, and the National Estuarine Research Reserve Program. These programs focus on teacher and student learning. They are primarily located at the designated sanctuaries and reserve sites and within the Sea Grant universities located outside of the Washington, DC, area.

NOAA has two people in the Office of Public and Constituent Affairs that work on K-12 related education activities. They receive limited support from others in the office when exhibiting at K-12 related conferences.

NOAA programs that address K-12 education can be divided into three areas: teaching the teachers; providing educational opportunities and publications for students; and supporting projects that include both teachers and students.

Teachers:

- Accepting teachers into NOAA's Teacher at Sea Program in which they work as scientific staff on board NOAA research ships.

- Developing special programs, such as the COASTeam Program from South Carolina, the INSTAR program at the Atlantic Oceanographic and Meteorological Laboratory, and the COMET (Cooperative Program for Operation Meteorology, Education and Training) Program.

    - INSTAR- NOAA's Atlantic Oceanographic and Meteorological Laboratory has supported INSTAR, a Miami-Dade science teacher institute that educates middle school teachers in themes relating to coastal and regional oceanography and environmental science. AOML scientists create modules in tropical meteorology.

    - COASTeam - COASTeam is an integrated course in which middle school teachers learn marine science concepts in geology, biology, chemistry and physics. South Carolina's coast is the "classroom" providing teachers with relevant, local examples to carry back to their classrooms. South Carolina's Sea Grant Program supports this course

    - COMET - (the Cooperative Program for Operational Meteorology, Education and Training) is supported by NOAA's NESDIS with satellite meteorology training annually. The NESDIS scientist's role is to assist in the development of new training modules. These learning modules are used worldwide and now are available in Spanish and French.

- Creating classroom activities and lessons for teachers, such as Student Activities in Meteorology, the Solar Physics for the Classroom activity book, and classroom workbooks on ocean exploration.

- Participating and exhibiting at teacher-oriented meetings, including the National Science Teachers Association, the National Marine Educators Association, the AMS Maury Project, the Presidential Awards for Excellence in Science and Mathematics, the Society for Advancement of Chicanos and Native Americans in Science, and in several different types of satellites education conferences.

Students:

- Enrolling in programs and summer camps to learn about science, such as the SOL-CO-OP Program (Student Opportunity for Learning Collaborative Opportunity Outreach Project) to learn about math, physical science, engineering, and computer technology and Project GROWS (Genetic Research on Washington Salmon), where student scientists conduct genetic research.

- Providing career information in grades 4-12 to promote math and science, such as the Career Awareness and Resource Education Program (CARE) in Boulder and the Ballard High School Biotechnology Career Academy supported by the Northwest Fisheries Science Center.

  - CARE - CARE is a community outreach program offered by the Department of Commerce's (DOC) Boulder, Colorado, laboratories to promote math and science awareness in the 4th through the 12th grades. Scientists from NOAA's National Geophysical Data Center visit 14 schools and provide information briefings on climate and natural hazards. The program is very successful and all DOC laboratories in Boulder (NOAA, NIST and NTIA) participate in the program.

  - Ballard High School Biotechnology Career Academy - The Seattle academy brings together science, mathematics, and language arts to prepare students for advanced study and possible careers in the biosciences. An essential element of the academy's success is the community partnership that provides students with "real world" experiences that prepare them for careers in science and advanced education. The program integrates student learning, science content, and professional outreach. Students learn about career path opportunities and academic relevancy while community partners help to prepare future qualified employees.

- Having educational materials created for the classroom, such as the annually produced research education classroom posters developed by OAR, the newly printed space weather comic book, and space weather posters in Spanish as well as the Biscayne Bubbles, a newspaper column that teaches about the physical and biological facts of Biscayne Bay.

- Being employed either part-time or in the summer as interns in NOAA offices.

Teachers and Students:

- Providing financial support for the JASON Project, as well as supplying ships and staff as appropriate to the annual missions. The JASON Project is a multi-disciplinary program (science, math, social studies, English-language arts and technology) that sparks the imagination of students and enhances the classroom experience. From its explorations into oceans, rain forests, polar regions, and volcanoes, the JASON Project explores planet Earth and exposes students to leading scientists who work with them to examine its biological and geological development. Dr. Robert D. Ballard began the educational project in 1989 following his discovery of the wreck of the *RMS Titanic*.

- Creating the NURP (NOAA's National Undersea Research Program) Aquanaut Program to teach field research and scientific methodology through research projects.

- Providing support for the National Ocean Sciences Bowl, which is designed and managed by the Consortium for Ocean Research and Education.

- Managing the NOAA Education Web Site: www.education.noaa.gov, which provides information to students, teachers, librarians and the general public and responding to 8,000 requests for materials and information from teachers, librarians, and students.

NOAA also reaches K-12 teachers and students at public events, such as Coast Day Delaware, Public Service Recognition week, NOAA open house events, and Bring a Child to Work days.

Question 8: Can we design and implement a more robust data archive and distribution system than the one presently in place for the U.S.?

Yes. A more robust data archive and distribution system is an essential element in the end-to-end design of an operational Ocean Observing System (OOS), both in meeting the OOS near-real time objectives such as improved weather forecasting, as well as enabling subsequent (post real time) analysis and long-range forecasting applications such as climate change research. The end-to-end OOS system design must, therefore, accommodate the sustained communications, processing, and data archive services that range from near instantaneous (order of hours) to a year time-late or more. The ocean observing system will produce information on a diverse range of physical, chemical, and potentially biological variables, and an equally diverse range of temporal and spatial sampling strategies and coverages. There will be a need to develop more sophisticated techniques for quality control of the data and product streams, many automated, than exist today. It is also important to recognize that the management of this information cannot be carried out in isolation, but must be coordinated with established, successful observing system data management practices already in use. The World Weather Watch (WWW) program, the Global Climate Observing System (GCOS), the U.S. Climate Reference Network, and other modules of the Global Ocean Observing System (GOOS) offer valuable insights into successful national and international initiatives.

The various elements of the ocean observing system will result in vast numbers of *in situ* and remotely sensed measurements, and an equally large suite of processed samples, analyses, and products. For these elements to operate cohesively over the long-term, and for each of the stages in the processing to proceed in a timely and efficient manner, the observing system must incorporate workable information exchange protocols and data distribution policies. Experience has shown that interpretation of the recent climate record is hampered due to disparate observation practices, unresolved calibration issues, observational station changes, data representation, inconsistencies in data archive and access, and non-uniform geographic coverage. An effective OOS information management system must address these issues.
The following recommendations are offered:

- The next generation ocean data archive and distribution system should be built as far as is possible and appropriate on the existing U.S. national and international infrastructure for ocean/coastal observation and data archive systems.
- Both near-real time objectives, as well as subsequent (post real time) applications must be accommodated.
- The management of oceanographic information cannot be carried out in isolation but should be coordinated with already established management practices now employed in global and national weather prediction (e.g., the elements of the WWW program, the U.S. Climate Reference Network, and NOAA's National Data Centers**).
- Quality assurance of data and products should receive high priority at the earliest point in the observational data stream in order to maximize the benefit drawn from the often difficult and expensive ocean measurements. Automation should be emphasized.

- Full, open, and timely sharing of data and information among the OOS participants and users is essential to its successful implementation and operation.
- Observing system participants should contribute data and the associated metadata voluntarily and with minimal delay to national data archival centers, which in turn should be able to provide information to users effectively free of charge.
- The Internet should be a component of the Ocean Observing System’s non-real time data distribution and management system, but is not appropriate for OOS primary real-time communications for data distribution where a non-deniable, dedicated OOS Aintranet@ (perhaps riding on or linked to the World Weather Watch Global Telecommunications System network) will be needed.
- OOS should look to the national and international telecommunications industry for useful standards and protocols capable of meeting the observing system needs.
- The Ocean Observing System archival services should take advantage of NOAA's emerging large volume data archive infrastructure investment initiative (CLASS) as a part of the national infrastructure.
- While national needs must be paramount in implementing an OOS, our international partnerships cannot be ignored and indeed offer an irreplaceable resource. For example, an early component of OOS will likely be the international, NOAA-led ARGO global oceanographic profiling buoy system consisting of 3,000 floats deployed by multiple nations. The ARGO data system already envisions international standards for quality control and data formats, and identifies data servers in foreign countries as core capabilities for data distribution to users. A broader facet is U.S. membership in the World Meteorological Organization and the International Oceanographic Commission. Those bodies have recently formed the Joint Commission on Oceanography and Marine Meteorology (JCOMM) that has responsibilities to coordinate ocean programs among member states for their mutual benefit. Ensuring that the U.S. data system capabilities are compatible with JCOMM objectives will yield dividends in terms of unrestricted access to data from foreign sources to complement our nationally funded observations. NOAA, as the U.S. representative to these bodies, is well positioned to contribute to OOS on these and other related, important matters.

***<u>NOAA's National Data Centers:</u>*

NOAA's Satellite and Information Service operates three national environmental Data Centers with responsibility for perpetual stewardship, archive, and distribution of data and information about climate, earth geophysics, and the deep and coastal oceans. The archives include data from NOAA; other federal, state, and local agencies; academia; the private sector; and foreign governments and institutions. The Data Centers serve a wide variety of customers, including community planners, scientists, policy makers, engineers and architects, national security analysts, and businesses.

NOAA has made progress in modernizing and streamlining Data Center operations. In 2000, the Comprehensive Large-data Array Stewardship System (CLASS) program was launched. CLASS will eliminate redundancy, while increasing efficiency by updating antiquated technology and modernizing connectivity, retrieval, and access capabilities in a scalable fashion to accommodate the growing advances in ocean sensor and satellite technology. Initially, CLASS will focus on large volume streams of remotely sensed data, including the NASA EOS data which will be archived by NOAA. In the future, CLASS will focus on critically important, diverse biological and chemical data sets that require much more labor-intensive processing and quality control. Increased, sustained support for the CLASS program is essential to keep pace with the vast quantities and varieties of new remotely sensed and *in situ* data streams coming online, and with the accompanying increase in customer demand for these data.

In the past two decades, NOAA's archives have increased 38-fold and user requests have grown 44-fold, while NNDC [NOAA National Data Centers] staffing has decreased by 45 percent (*The Nation's Environmental Data: Treasures at Risk*, August, 2001 - provided to the Commission Library). The following table has been updated from the *Treasures* Report:

Table 1. Trends in NOAA Data Centers' Archives, User Requests, Staffing, and Funding Levels[1]

	1979	1999	2001	2015 (projected)
Archives	20 Terabytes[2] (TB)	760 TB	1,190 TB	33 Petabytes[3] (PB)
User Requests	95,400	2,320,200 (revised)	4,200,000	16,000,000
FTE Staff	582	321	297	-------
Funding	$15.2 M	28.6 M	31.4 M	------

1. Values include all types of data within the three Data Centers
2. A terabyte = 10^{12} bytes
3. A petabyte = 10^{15} bytes

As data management capabilities fall further behind, so do the capabilities to rescue older archived data sets in danger of being lost due to aging and deteriorating storage media. There is a growing backlog of legacy data sets which are inaccessible to customers, and need to be rescued and migrated to modern storage media. Table 2 summarizes the status of this effort:

Table 2. Trends in NOAA Data Centers' Data Rescue Efforts

	pre-1999	1999	2000	2001	2015 (projected)
Backlog[1] volume	.4 PB	.5 PB	.6 PB	.7 PB	10PB
Volume rescued	1.8 TB	.2 TB	.5 TB	.5 TB-	10 TB
Funding	$21 M	10 M	15 M	15 M	--------

1. Backlog is defined here to include non-digital data and digital data on aging and deteriorating storage media.

Question 9: What should NOAA's responsibilities be in conducting ocean and coastal research in-house, relative to academic entities, in order to maximize innovation and minimize competition between government and non-government researchers?

An appropriate mix of in-house, external, and collaborative research is crucial to maintaining and maximizing NOAA's service capabilities and management responsibilities. Consistent with the management goals of the Administration, federally funded projects should be conducted efficiently, regardless of whether the work is done by internal or external researchers. While outright duplication should be avoided, scientific investigations often involve supporting different research approaches and strategies. Sometimes competition among researchers—whether they are government, academic, or private sector—maximizes innovation and effectiveness.

<u>External Research</u>
NOAA will continue to rely heavily on external research to advance the state of coastal, ocean, and atmospheric sciences. By awarding competitive grants to academic and private researchers to conduct mission-relevant, fundamental research, NOAA invests in a pipeline of scientific innovations that are applied to meeting its service and marine stewardship responsibilities. Investment in academic research also promotes the development of scientists with the expertise and intellectual capital to address NOAA's mission requirements in the future. This is especially important today because of the need to replenish the ranks in an increasingly aging workforce.

<u>In-house Research</u>
A primary responsibility of in-house researchers is to provide timely data that is required for the delivery of operational services and the fulfillment of management responsibilities. Internal research provides the capability to make sound, science-based decisions and supports strategic planning. It often results in technology transfer to the private sector. In-house research also provides the expertise and capability necessary to direct, quality control and assess the work of external research partners. Maintaining expertise also provides the capability and competence to track and take advantage of advances by other researchers, including those in academia, the private sector and in governments around the world, which helps reduce duplication.

<u>Collaborative Research</u>
NOAA conducts much of its research in collaboration with external researchers. Partnerships between NOAA and external researchers ensure the relevance of research to NOAA's missions and the ocean community needs. Collaborations are especially beneficial in oceanography because of the interdisciplinary nature of the field, and they improve efficiency and leverage limited resources. Collaborations speed the evolution of scientific advancements from the theoretical to operational and mission-related applications.

Question 10: **When trying to determine what activities to prevent rather than what activities to allow, it is extremely difficult to coordinate the various regulatory measures that are needed, because the examination of activities one many need to prevent is usually done in a piecemeal fashion rather than comprehensively examining activities that might be allowed to maintain a mission. We would appreciate your comment on this.**

National policies serve as guidelines upon which targeted actions, including regulatory actions, are taken. The challenge for regulators is to design specific measures to achieve or implement the broader policy-based objectives or directives. Specific actions can have the appearance of being piecemeal. But in many cases, regulatory actions are based on a comprehensive examination of law, science, and facts and can be traced to the broader underlying policies.

Regulation is only one of several tools that governments can employ to achieve a desired result. In addition to or in tandem with regulatory approaches, other actions include:

- Market forces
- Tax incentives/inducements
- User fees
- Mediation/negotiation/alternative dispute resolution
- Education and outreach
- Public participation and consensus building
- Partnership agreement

Also, the implementation of policy often cannot be reduced to a formula based solely on "what activities to prevent rather than what activities to allow." Often the issue is not "what" activities can or cannot take place, but rather "how" they are to be carried out. For example, an activity may be allowed, but only if it is done in a way that results in reducing or preventing risk of harm to people or the environment.

Generally, NOAA's regulatory authorities involve living marine resource management and maintaining healthy ocean and coastal ecosystems. A partial list of laws under which NOAA has regulatory authority are the:

- Magnuson-Stevens Fishery Conservation and Management Act
- Marine Mammal Protection Act
- Endangered Species Act
- Coastal Zone Management Act
- Marine Protection, Research, and Sanctuaries Act
- National Marine Sanctuaries Act
- Oil Pollution Act

Each of these laws places specific mandates on the agency. One way NOAA works to coordinate these mandates is by comprehensively examining its missions through its strategic planning process. Strategic planning requires that an agency restate its purposes first in broad terms (vision and mission) and then in increasingly more specific terms (objectives, goals, and performance measures). This process improves coordination because it requires the agency to examine its statutory and other mandates together, forging a unified vision and course of action to address them.

The larger challenge is to coordinate laws and policies governing different activities (e.g. fisheries, minerals, marine transportation, coastal development) where the responsibilities are distributed among several levels of government (federal, state, and local) and/or among different federal agencies. In recent years, significant steps have been taken to improve coordination among federal agencies and with states and local authorities. Several examples of such partnerships were provided at the Commission's recent meetings in Charleston, South Carolina, and St. Petersburg, Florida. One example of an effort to improve coordination is the Interagency Committee on the Marine Transportation System (ICMTS). One ICMTS objective is to devise local strategies that engage users and interested parties early in the decision-making process. The goal is to reach consensus and avoid litigation on issues such as dredging, preferably before the permitting process begins.

The agencies participating in the ICMTS have diverse responsibilities relating to maritime commerce. The U.S. Coast Guard has the broadest mandate and leads the effort, but other agencies also have important roles. For example, the U.S. Army Corps of Engineers leads dredging and port infrastructure projects; NOAA provides navigation information in the form of hydrographic surveys, charts, and water levels; the Environmental Protection Agency oversees most pollution-related issues; and the U.S. Customs Service collects duties on imported goods. The effort to better coordinate these activities also includes input from a non-federal advisory committee.

The approach of ICMTS to bring all agencies together to address marine transportation is a complex undertaking. Yet, it is a single-issue effort and does not provide a fully participatory or decision-making role for state or local governments. Experts generally recommend shifting from the historical single-issue strategy to a multiple use, ecosystem-based approach that balances all uses and goals. The goal is a governance system that brings all agencies and levels of government together with all interests to address all ocean uses and issues. This is a daunting task, eclipsing ICMTS by several degrees of magnitude.

The Coastal Zone Management Act is often cited as the sole example of an ocean management regime that mandates consideration and integration of all uses and goals into a single management strategy. The delegation of primary authority to the states is viewed as important for acknowledging regional differences, avoiding a "one-size-fits-all" approach, and promoting innovation. Federal approval of state plans is required to ensure that national goals are met. Federalism is also central to the Magnuson-Stevens Fishery Conservation and Management Act, which utilizes a regional approach and state-appointed fishery management councils. But, like ICMTS, it primarily governs only one ocean activity, in this case commercial fisheries.

Establishing a national ocean policy that prioritizes the nation's ocean objectives and activities is a first step for improving coordination. To the extent that existing laws are in conflict, legislative action would be required. Establishing an interagency office or forum, perhaps at the White House level, for coordinating agency activities is one governance approach. Consolidation of programs within one department or agency is another option. One criticism of these approaches is that they reflect a “top down” approach to rulemaking.

Many policy experts have instead promoted a highly participatory, “bottom up” system. It would include an ongoing opportunity for user and public involvement in the development of the “rules.” Some view this approach as essential to getting buy-in to the final plan, which would improve compliance and reduce litigation. It would provide a significant role for states and require the development of regional ocean governance committees and plans. The development of such plans could utilize a strategic planning process (perhaps similar to the process required under the Government Performance and Results Act.) The process would be guided by broad policy objectives, presumably in statute. For example, decisions might be required to be based on the best available science and be compliant with international agreements. Mandatory use of mediation or arbitration, and/or administrative appeals, might be required before using the courts.

A criticism of this approach is that the regional plans will reflect only a consensus on issues upon which the members of the regional authority could agree. There are also unresolved questions about the relationship between the regional plans and existing federal law and organizations and on who would be responsible for implementation and enforcement. Also, the regional plans would have to be submitted to and approved by some federal entity, which could range from a national council to a consolidated ocean agency. Other experts have concluded that an incremental approach is more realistic and has, in fact, been underway for several years; for example, Congress has worked to overcome conflicts between the Outer Continental Shelf Lands Act and the CZMA and between the Marine Mammal Protection Act and the MSFCMA. Those experts that support the incremental approach argue that claims of conflicts among ocean laws and regulations are exaggerated. They will admit to some overlapping responsibilities, but note that these can be addressed administratively, often without congressional action. They advocate for a close review and targeted amendment of existing laws.