A Report by a Panel of the

NATIONAL ACADEMY OF PUBLIC ADMINISTRATION

For the U.S. Department of Commerce,
National Oceanic and Atmospheric Administration
and the U.S. Congress

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Building Strong for Tomorrow: NOAA Climate Service

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FOREWORD

Every day, public officials, business leaders and private citizens are making decisions that depend on understanding how climate will change over the course of the next 5, 10, 100 years and beyond. Decisions about land use, disaster preparedness, construction at ports, investments in heat- and pest-resistant crops, and energy infrastructure requirements will all benefit from improved understanding of likely changes in climate and its effects on water resources, public health, energy demands, and agriculture. The National Oceanic and Atmospheric Administration (NOAA) plays a pivotal role in our understanding of climate, climate variability and change. For decades, NOAA and its federal, state, local, tribal, academic and private sector partners have provided climate data and information essential to policy development, planning, and decision-making.

The idea of organizing NOAA's climate activities predates the passage of the 1978 National Climate Program Act. As understanding of climate has grown, so has demand for climate information and services, for better and more comprehensive information to assist governments at all levels as they consider options and make decisions about infrastructure, natural and managed ecosystems, and communities.

Standing up a NOAA Climate Service is the beginning of the journey, not the final destination. NOAA's climate research, observations, data stewardship, modeling and predictions are the foundation for a NOAA Climate Service. Tough challenges will be faced as NOAA aligns its critical climate functions to improve its research and services, its relationships with other federal partners, and ultimately the nation's ability to sustain environmental quality, minimize risks to life and property, and maintain economic strength.

The National Academy was privileged to conduct this review for Congress, the Department of Commerce, and the National Oceanic and Atmospheric Administration. We are grateful to the National Academy Panel for its excellent and diligent work and to the study team for its significant contributions. In addition, we wish to acknowledge the vital assistance provided by the Deputy Under Secretary for Operations and her staff, the NOAA line offices, and the Climate Program Office. Finally, our sincere appreciation goes to the many individuals, federal, state and local government partners, and other important stakeholders who provided information and contributed their insights through interviews, roundtables, and the online dialogue. Their engagement, knowledge, and dedication to meeting our nation's climate-related needs are truly remarkable.

Jennifer L. Dorn
President and Chief Executive Officer

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ACRONYMS

Academy	National Academy of Public Administration
CPC	Climate Prediction Center
CPO	Climate Program Office
CSD	Chemical Sciences Division
DOD	Department of Defense
ESRL	Earth System Research Laboratory
FEMA	Federal Emergency Management Agency
FY	Fiscal Year
GCRP	U.S. Global Change Research Program
GFDL	Geophysical Fluid Dynamics Laboratory
GMD	Global Monitoring Division
GOOS	Global Ocean Observing System
HCN-m	Historical Climate Network-Modernization
IOOS	Integrated Ocean Observing System
IPCC	Intergovernmental Panel on Climate Change
NASA	National Aeronautics and Space Administration
NCDC	National Climatic Data Center
NESDIS	National Environmental Satellite, Data, and Information Service
NGDC	National Geophysical Data Center
NIDIS	National Integrated Drought Information System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NODC	National Oceanographic Data Center
NOS	National Ocean Service
NWS	National Weather Service
OAR	Office of Oceanic and Atmospheric Research
PMEL	Pacific Marine Environmental Laboratory
PPI	Office of Program Planning and Integration
PSD	Physical Sciences Division
RCC	Regional Climate Center
RISA	Regional Integrated Sciences and Assessments
SAB	NOAA Science Advisory Board
SES	Senior Executive Service
TAO	Tropical Atmosphere Ocean

EXECUTIVE SUMMARY

This Executive Summary lays out the purpose and method of this report, introduces core recommendations and discusses some of the major success factors needed to ensure an effective launch for the proposed National Oceanic and Atmospheric Administration (NOAA) Climate Service.

SCOPE OF WORK

The U.S. Congress asked an expert panel of the National Academy of Public Administration (the Academy) to assist NOAA with "a study and analysis of organizational options for a National Climate Service within NOAA, emphasizing maximum effectiveness and efficiency."[1] Five specific areas of focus were identified by the Conference Committee report. Specifically, the Panel was asked to assess how to:

1. provide information at the global, regional, and state levels over varying timescales.

2. support interaction among the government and various users, stakeholders, researchers, and information providers of climate information in both the private and public sectors.

3. develop and distribute products and information that will support decision-making to better prepare the Nation for climate variability and climate change.

4. coordinate and align existing programs and resources internal and external to NOAA to reduce duplications and leverage existing climate-related resources.

5. provide estimates on projected funding levels.

Further, NOAA formally asked the Panel to: provide an independent assessment of how NOAA should organize its climate capabilities; assess NOAA's proposed organizational structure in light of our independent assessment; and make recommendations for a Climate Service line office structure that will integrate NOAA's climate science and research with service delivery.[2]

It is important to understand how the Panel approached this undertaking. The Congressional report language calls for a study of a "*National* Climate Service within NOAA," and it requested the Panel's view about aligning "existing programs and resources *internal and external* to

[1] U.S. Congress, House, *Conference Committee Report to Accompany Consolidated Appropriations Act, 2010* 11th Cong. 1st sess., 2009, Report 111-366 (Washington: GPO) p. 636.

[2] Throughout this text the word "service" is used repeatedly, of course even in the title of the proposed new organization: the NOAA Climate Service. This report will discuss below both what NOAA has recommended as its basic service offerings and what the Panel suggests may be manageable service objectives. The Panel encourages the new NOAA Climate Service to focus its services especially on providing impartial, scientific findings as requested by public officials who must make policy and investment decisions affected by climate variability and change.

NOAA" (emphasis added). The current Administration supports creating a NOAA Climate Service. The Administration has *not*, however, proposed a *National* Climate Service that would reorganize or transfer assets existing in other organizations into NOAA.

The contractual scope of this study does *not* include making recommendations about the internal structure of research and/or service organizations other than NOAA. ***The Panel strongly supports the creation of a NOAA Climate Service to be established as a line office within NOAA.*** From our perspective, it would be desirable that this office be titled the *National Climate Service*.[3]

The Panel recommends that the federal government substantially expand its delivery of regular, impartial and authoritative climate information services to state, local and tribal governments and to the public, by: (1) providing more robust and finer-grain information about possible impacts of climate variability and change to guide government and private sector decisions about adaptation; and (2) assisting others to access and effectively use models for understanding how mitigation efforts can avert or reduce climate change.

To be effective, a NOAA Climate Service should be a leader, working with other federal agencies to coordinate the gathering, stewardship and availability of climate information by all appropriate federal agencies as well as states, local governments, tribes, other nations and international bodies. Creation of a NOAA Climate Service vested with a strong mandate will not only strengthen NOAA's science and service deliverables, but it will likely also accelerate the work of making the broader federal climate enterprise more focused, cohesive and effective.

ADMINISTRATION SUPPORT NEEDED FOR THE NEW NOAA CLIMATE SERVICE

Interagency Coordination. The Panel acknowledges that substantial work and iteratively stronger coordination is taking place across the federal government (especially through the White House Office of Energy and Climate Change's working group on Climate and Energy, the National Science and Technology Council, its Committee on Environment and Natural Resources, the Interagency Climate Change Adaptation Task Force and the U.S. Global Change Research Program) as well as within and between particular Departments and agencies.

Capabilities of the federal government regarding climate should, however, be further integrated and strengthened on two interdependent but distinct levels: at the *strategic and policy level;* and at the *operational level*, where research, data collection and service delivery take place.

Without prejudice to existing dual-agency or multi-agency working-level mechanisms, a more senior-level federal interagency coordination mechanism with a broader mandate would be enormously valuable. ***The Panel recommends that the Administration strengthen and expand interagency coordination structures tasked with aligning Executive Branch climate resources. Specifically, the Panel recommends that the President empower a senior interagency group – led at the White House and convened at the Deputy Secretary or Secretary level – to provide***

[3] The report does not use the National Climate Service title throughout the document, instead uses NOAA Climate Service for consistency and statement of work compliance.

the President annually with a strategic plan for management of federal climate research and service delivery.

This group should be tasked with assessing the adequacy of ongoing federal climate research and service delivery efforts, recommending appropriate budget priorities and resolving as needed any interagency conflicts or policy issues associated with climate research or service delivery. This coordination role would most effectively be conducted through an established interagency policy council or other broad-based interagency body led by a senior Administration official (for example, at the rank of Assistant to the President).

In addition to its climate research and service delivery activities, the Executive Branch has an already large and growing climate change policy agenda (tax policy, legislative strategy, regulatory decisions, and other strategic policy and investment decisions). Although such matters are beyond the scope of this study, the Panel simply notes that the same senior interagency group needed to coordinate federal climate research and service delivery ideally could be configured to support the overarching Executive Branch climate policy agenda. This would likely bring beneficial synergy and focus on what is needed to support policy *and* operational decision-making.

Lead Federal Agency Designation. At the operational level, allocation of scarce federal resources for research, data collection and services should be managed aggressively to prioritize efforts that will have the greatest positive impact. ***It is not necessary, nor would it be wise, to force into a single organization all of the federal assets that might contribute to strengthening climate science or climate services.***

Nonetheless, it would be extremely valuable, indeed the Panel considers this essential, to have one federal agency designated to be the center of gravity for aggregating and rigorously providing an authoritative roadmap or portal to the best available science that can be harnessed to support public policy decision making.

Certainly no single agency could conduct all federal climate research. Nor will one agency have all the assets needed to support all constituencies or to deliver all services regarding climate. But somewhere in the federal government, the public needs an authoritative entity to identify what is known and what is not. It should be able to know what is being studied and by whom, what needs more study, who is developing what end-user products, and how or whether the federal government can help map resources and capabilities to specific needs. Similarly, international partners should not be compelled to shop among federal agencies when seeking to coordinate climate research or services.

In short, there is a much-needed role for one agency to serve as a day-to-day integrator of the overall federal effort regarding climate science and services. This is a job for an agency that can serve as a convener, a guide to valid science, an inveterate dot-connector that probes the interstices between climate-related disciplines, and a repository for the inventory of available federal services offered by the full list of federal climate service providers. This lead agency should embrace a decidedly non-bureaucratic culture of continuous innovation and impartiality. It should harness world-class technology and recruit expert analysts and communicators who can

assess needs and foster collaboration among researchers and policy makers in the public and private sectors. It will need a field liaison structure guided by boundary-spanning staff that can assist the lead agency to understand better and work more effectively with state and local officials.

After extensive consultation, ***the Panel concludes that a NOAA Climate Service, properly configured and implemented, would be uniquely qualified to serve the public and private sectors as a lead federal agency for climate research and services, and to provide an ongoing accessible, authoritative clearinghouse for all federal science and services related to climate.*** There is ample precedent for the President to make such a "lead agency" designation either by issuing an Executive Order or through less formal means. Of course, Congress could also ratify and make this designation permanent at some juncture through legislation.

Acceptance of this recommendation does *not* mean that NOAA would direct, conduct or archive all federal climate science. Nor does it mean that NOAA would be the exclusive federal provider of all climate services. NOAA would *not* usurp or replace other agency authorities, relationships or missions.

In no case should deliberation about authorizing such a "lead agency" status delay the stand-up of a NOAA Climate Service. NOAA Administrator Jane Lubchenco spoke to the Panel about her commitment to the essential first-order task at NOAA of "getting our house in order" regarding climate services, while working "in close partnership with other federal agencies."

Indeed, the new NOAA Climate Service deserves to know from the beginning the full scope and direction of its mission. ***An appropriately tailored lead federal agency designation would generate indispensable momentum for the new NOAA Climate Service. Moreover, it would simplify and accelerate federal efforts to harmonize, coordinate and strengthen overall climate research and service activities.***

STRUCTURE OF A NOAA CLIMATE SERVICE

NOAA's leadership has proposed, at least initially, to focus the NOAA Climate Service on five societal challenges, harnessing three core sets of existing NOAA capabilities. While it has not shared with the Panel a proposed organizational chart, NOAA has identified the components it proposes to transfer into the NOAA Climate Service.

Although the Panel was *not* constrained to consider only the approach the Administration has advanced, after considerable independent analysis the Panel is ***largely in agreement with the Administration about the core elements that should constitute a NOAA Climate Service.***

The design of this proposed line office logically begins with consideration of desired outcomes, outputs and program activities required to achieve these outcomes. Any reorganization must resist the temptation to focus excessively on existing organizational units, considering what can be built from them, rather than starting with desired outcomes and aggressively shaping institutions to deliver those outcomes.

The Panel finds that the new Climate Service should be organized around its principal desired outcomes and proposed deliverables – climate research and services. The new Climate Service must certainly be more than the sum of existing NOAA parts. The new line office should magnify and extend NOAA's contributions to climate science and services, creating a unified and nimble organization with broader reach than can be achieved today within NOAA's existing structure.

As depicted in Figure 1, the Panel proposes that the new line office be headed by a career Assistant Administrator, supported by a relatively small, but essential front-office team. Chapter 4 of this report addresses NOAA Climate Service organization issues in more detail.

START-UP CONSIDERATIONS

Balancing Mission Objectives. Managing any significant organizational change is challenging. Particularly during its start-up phase (the first 12-18 months), establishment of a NOAA Climate Service will present stiff challenges, some of which are unique to the federal operating environment.

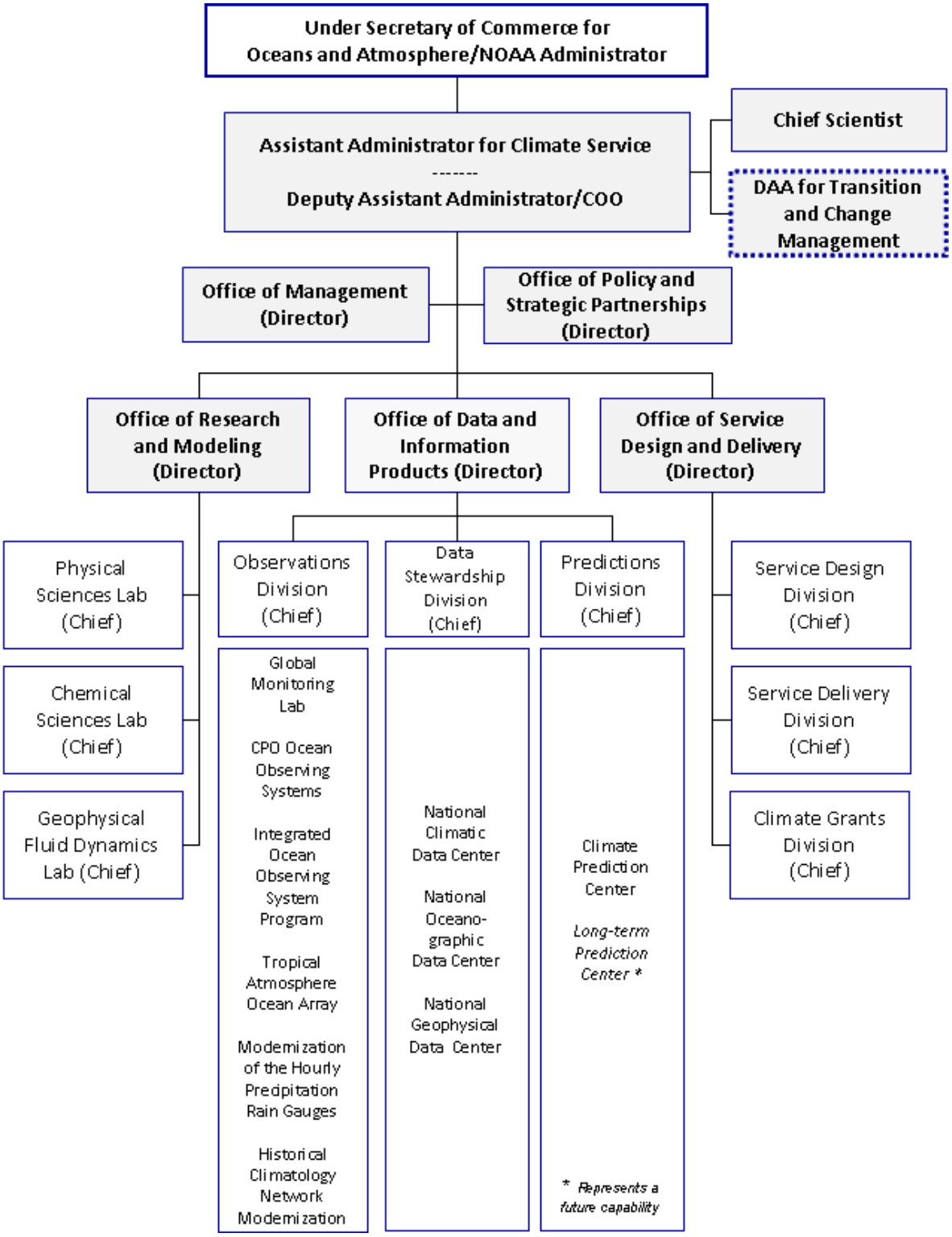
NOAA's deep reservoir of employee experience, professionalism and commitment to climate research and services is a strength upon which the new NOAA Climate Services organization can be built with confidence. It is difficult, however, to overestimate the importance of selecting the right Associate Administrator and senior management team to lead this new organization. ***In addition to the permanent leadership team, the Panel recommends that NOAA hire a term-limited, Deputy Assistant Administrator for Transition and Change to provide a full-time, systematic focus on managing start-up issues at the new line office.***

Presumably a large part, even the largest part, of the new senior management team may be selected from within NOAA. Nonetheless, ***the Panel recommends that senior management positions for the NOAA Climate Service be largely, if not exclusively, selected on the basis of open competition.***

In addition, the Panel recommends that each member of the senior management team have as their primary base of operations – at least for the initial year – the Washington, DC area headquarters facility. The importance of forging a cohesive management team is extraordinarily important; it is impossible to do so by telephone.

A thorny challenge for the new organization takes the form of an apparent contradiction: NOAA must be at once decidedly ambitious, yet cautious. On the one hand, it should be constructively impatient to deliver on a bold, innovative plan for what the new line office can accomplish. On the other hand, it must be careful about appearing to promise more than NOAA can deliver with its roughly 700 full-time employees and available budget.

Figure 1
Academy Panel's Recommended Structure for a NOAA Climate Service



NOAA's staff has shared with the Panel its provisional thoughts about the new agency's implementation strategy. This includes embracing an aspirational vision to support "an informed society anticipating and responding to climate and its impacts" and a mission statement for the NOAA Climate Service to "improve understanding and anticipation of changes in climate, and to promote a climate-resilient society and environment."[4]

The Panel recommends that NOAA's external and internal communications be clear about the fact that its new organization will grow steadily and progressively, yet more slowly than many would like. It will not be possible in the early months and years to satisfy all of NOAA's own ambitions, much less the many expectations of its external partners and service users. It will be essential that NOAA impose upon itself rigorous and systematic internal discipline to prioritize new research and service offerings.

For these reasons, ***the Panel recommends that the NOAA Climate Service place its highest priority on assisting government executives and managers at the federal, state, tribal and local levels, and on meeting the high priority needs of its federal climate enterprise partners.*** If the new agency tries to serve all possible stakeholders with equal focus in the earliest stages of its operations, it will likely serve none adequately.

From the outset, NOAA also should pay particular attention to how this new organization can best be configured to serve the information needs of the Congress. It may be obvious, but it is essential to the nation – and to the success of a NOAA Climate Service – that the NOAA Climate Service's external communications with Congress be especially transparent, routine and impartial. NOAA must also be candid about agency successes, failures and challenges.

The Panel recommends that the NOAA Climate Service utilize every practical strategy available to attract a diverse set of employees and partners to help with standing up the new agency and expanding its reach.

Despite the difficulty of working with so many diverse constituencies, the fact that NOAA has ambitious goals is a true virtue. Especially during its start-up phase, nurturing this ambition with a systematic focus on change management is essential to the success of a NOAA Climate Service. The new line office will need the strong support of the Secretary of Commerce and his senior management team, as well as that of other Cabinet and White House colleagues. Chapter 5 recommends a number of change management tools that have been used effectively in other large federal start-ups and mergers.

Budget Considerations. ***The Panel is skeptical that current funding levels (even as augmented at levels consistent with the President's FY 2011 budget request) will adequately sustain public and private sector expectations for climate services and research in the years ahead.***

It would be impossible for this Panel to propose a precise budget for this new Climate Service based on the limited information available to us, and choices still to be made by NOAA. Nonetheless, by its design and because of growing needs, the NOAA Climate Service can

[4] Information provided to the Panel by NOAA. The Panel recognizes this language is subject to change.

reasonably be expected to take on a great deal more than its current workload in the years ahead. It will have to prioritize its new research and service deliverables with tenacious discipline.

Certainly NOAA and Department of Commerce leadership should start with asking this blunt question: What is being done today within NOAA or the Department that might be stopped or dialed back in order to make possible a higher priority investment? As the NOAA Climate Service grows, the Congress and the Office of Management and Budget should allow the Secretary of Commerce maximum discretion to steer funds generated by cost avoidance measures at the Department of Commerce to nurture the fledgling NOAA Climate Service. Where fair and practical, NOAA should explore assessing fees for its climate services.

The Panel recommends that NOAA make general-use climate data and information products freely available, but that it consider charging fees for customized products and services to cover delivery costs. NOAA should also identify opportunities to refer requests for specialized services to non-government providers with the aim of stimulating the development of private capacity to provide value-added climate products. This matter may require further assessment by the Executive Branch and Congress and authorization of fee-for-service arrangements.

Even assuming extraordinary financial stewardship, it will be quite challenging to align performance expectations with today's federal budget resources. This budget challenge, we wish to make clear, would be a poor reason to oppose creation of the new NOAA line office. Instead, the new organization must rigorously assess trade-offs for how best to use all funds that Congress and the Administration make available. ***Managing scarce resources and making choices among competing priorities is likely to be one of the new organization's most difficult management challenges.***

ORGANIZATION OF THIS REPORT

This report has five chapters and a number of appendices that provide additional background about the Panel's work and recommendations. The five chapters are structured as follows:

- *Chapter1 – Introduction.* This chapter contains an overview of NOAA's vision for its Climate Service, summarizes the mandate given to the Panel and explains the method the Panel has employed to assess options and make recommendations.

- *Chapter 2 – Current Structure and NOAA's Climate Service Plan.* This chapter assesses NOAA's recent history and current capabilities regarding climate science and services. It summarizes NOAA's basic proposal regarding creation of a NOAA Climate Service.

- *Chapter 3 – Planning for Success.* This chapter contains the Panel's observations and recommendations regarding the larger federal climate enterprise, identifies key elements of support needed by the NOAA Climate Service and stresses the importance to the new organization of a clear strategic plan and a comprehensive implementation plan.

- *Chapter 4 – Recommended Organizational Structure*. This chapter presents the Panel's recommendations regarding how best to structure the NOAA Climate Service.

- *Chapter 5 – Change Management Challenges.* This chapter offers observations and suggestions regarding institutional change management in the federal sector, identifies several management recommendations for stand-up of the proposed agency and speaks to challenges regarding operational priorities and budget.

- *Chapter 6 – Recommendations.* This final chapter contains a concise recapitulation of Panel recommendations.

CHAPTER 1
INTRODUCTION

1.1 NOAA'S VISION FOR ITS CLIMATE SERVICE

The Conference Report conveying NOAA's FY 2010 appropriations guidance states, "the conferees provide additional support for activities appropriately conducted by a national climate service and direct the agency [NOAA] to accelerate its current efforts towards the creation of such an entity."[5] Pursuant to the Conference Report, and as further described in the Executive Summary above, in March 2010 NOAA contracted with the Academy to conduct "a study and analysis of organizational options for a National Climate Service within NOAA."

The contractual scope of this study does *not* include making recommendations about the internal structure of research and/or service organizations other than NOAA.

Climate variability and change present compelling challenges for our nation and the global community. Creation of a Climate Service at NOAA has been actively considered for a number of years and has been supported by the current and the prior Administration. On February 8, 2010, U.S. Commerce Secretary Gary Locke formally announced the Department's intent "to create a NOAA Climate Service line office dedicated to bringing together the agency's strong climate science and service delivery capabilities."[6]

Reduced to its essence, the Panel concludes that NOAA's plan consists of three imperatives: (1) consolidate existing NOAA assets associated with climate to create a new line office, the NOAA Climate Service; (2) provide authoritative and more comprehensive climate science and services to assist public and private sector adaptation and mitigation decisions;[7] and (3) support more systematic federal interagency collaboration to improve research and services needed to meet the nation's climate challenges.

The first of these imperatives is an organizational and instrumental objective. It is intended to facilitate the two other imperatives, both of which are core mission-centered objectives.

NOAA's vision of its future climate service mission builds upon three core capabilities:

1. *Observing Systems, Data Stewardship, and Climate Monitoring.* NOAA collects and preserves the historical record of the global environment for continuous climate monitoring and periodic assessments in support of climate services. This readily

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[5] U.S. Congress, House, *Conference Committee Report to Accompany Consolidated Appropriations Act, 2010* 11th Cong. 1st sess., 2009, Report 111-366 (Washington: GPO) p. 636.

[6] U.S. Department of Commerce, "Commerce Department Proposes Establishment of NOAA Climate Service," press release, February 8, 2010 accessed at www.noaanews.noaa.gov/stories2010/20100208_climate.html.

[7] NOAA's draft *NOAA Climate Service: Implementation Strategy* (July 27, 2010) defines adaptation as the "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities." Mitigation is defined as "human intervention to reduce or eliminate the sources of human-caused changes in climate." The Panel recognizes that this is a draft and subject to change.

accessible long-term archive serves the Nation's need for trusted climate-related data and information about the current and changing state of the climate system. This provides the foundation for understanding the climate system and evaluation of climate and earth system models.

2. *Understanding and Modeling.* NOAA advances the understanding and prediction of climate variability and change, and informs climate mitigation and adaptation options. This capability delivers a comprehensive understanding and description of the current and future state of the climate system, and characterizes the uncertainties in our ability to measure and predict changes, natural variability and impacts.

3. *Integrated Services Development and Decision Support.* NOAA provides regional and global decision makers with timely and relevant climate information. NOAA supports partnerships to facilitate scientists and decision makers developing a shared understanding of changing climate conditions and using those insights to inform adaptation decisions and climate policy. NOAA also delivers data and information streams from which climate service providers can develop and deliver decision support tools and other applications.[8]

The third of these core capabilities, Integrated Services Development and Decision Support, is arguably the area that will require the most innovation. It is the element of the new organization's mandate that will stretch its historic capabilities the most. NOAA has repeatedly noted that its plans presuppose that other federal agencies will continue to play essential roles in all three areas outlined above. The NOAA Climate Service expects to integrate with and depend upon the larger pool of federal climate activities that delivers climate science and services, an enterprise that also must be strengthened collectively.

The agency's publicly stated timetable for standing up the new organization points to a formal launch in the upcoming Fall/Winter period. Supported in small measure by this study, and by its own extensive outreach and planning, NOAA expects to complete its organizational design and implementation strategy for the new organization in the weeks ahead, to consult with Congress, and then submit appropriate reprogramming requests to the Congress needed to move forward.[9]

1.2 ACADEMY PANEL REPORT – METHOD OF APPROACH

The Academy convened a ten-member panel – nine Academy Fellows and one additional subject matter expert suggested by NOAA – to review NOAA's plan for a Climate Service and offer recommendations to the Congress and NOAA. Some Panel members bring first-hand experience in federal, regional, state and local government; others have considerable scholarly expertise in fields directly related to this topic. Together they represent experience as senior executives, change management leaders and climate science experts. Appendix A provides biographical sketches for the Panel members and lists the Academy study team.

[8] The language of these three bullets is quoted directly from draft language provided to the Academy by NOAA. The Academy recognizes that this formulation is subject to change.

[9] See: www.noaa.gov/climate.html, accessed September 1, 2010.

The Panel met seven times as a group over the course of its six-month engagement (three formal meetings in Washington and four teleconferences). In addition, members provided numerous individual consultations with the study team. A significant part of each in-person Panel meeting was open to the public, at which Congressional staffs, NOAA leaders and others were invited to participate. Secretary Gary Locke, NOAA Administrator Jane Lubchenco, NOAA Deputy Under Secretary Mary Glackin, Transitional Director for the NOAA Climate Service Thomas Karl, and numerous other NOAA senior staff actively engaged with the Panel and study team members. With assistance from the Academy study team, the Panel refined its work plan, engaged extensively in the information gathering of the group, crafted recommendations, assisted with report drafting and approved this report.

Since there has been discussion of the idea of creating a Climate Service at NOAA almost from its inception in 1970, the study team began by reviewing an extensive collection of relevant historical documents and reports. These documents describe previously proposed ideas about the need for climate science and services work by NOAA and the larger federal community.

NOAA's external stakeholder community is large, and the Panel considered it important to engage as much as reasonably possible with these parties. The Panel employed three basic approaches for this outreach. First, the study team conducted interviews with NOAA staff, current and former government officials and external stakeholders. These interviews, which included over 40 persons, were conducted on a not-for-attribution basis. The results were aggregated into thematic observations and presented to the Panel. See Appendix C for a list of these participants.

Second, three roundtable discussions were held with key NOAA climate constituents: (1) federal agency partners; (2) state and local government leaders; and (3) academics and other subject matter experts. The roundtables, which included over 50 participants, were conducted on a not-for-attribution basis. The results were aggregated into thematic observations and presented to the Panel. For additional details see Appendices D, E, F and G.

Third, from June 14 to 28, 2010, the Panel conducted a national Online Dialogue that solicited ideas about how to structure and operate a NOAA Climate Service. This outreach, which was publicized widely to NOAA's staff and external partner organizations, used an Academy-designed online tool that presented information about the NOAA Climate Service proposal, and allowed participants to offer ideas and/or to comment on other participants' ideas. The Dialogue registered 3,353 total visits (1,342 unique visitors) and 134 individuals voluntarily registered to provide formal comments. Dialogue participants were not required to provide personal information. The results were aggregated into thematic observations and presented to the Panel. For additional details see Appendix H.

Collectively, this outreach generated a wealth of useful information about the state of climate science and services and valuable insights about NOAA and the needs of its partners. Table 1 contains a summary of notable observations and recommendations gleaned from this outreach. The Panel agrees with many of the comments that were received and is indebted to the participants.

Table 1
Summary of the Academy Panel's Outreach

VENUE	OBSERVATIONS / RECOMMENDATIONS
STAKEHOLDER INTERVIEWS	**1. Mission Requirements:** The NOAA Climate Service should organize to support transparency, accountability and collaboration.
	2. Proposed Structure: Some stakeholders expressed concerns that NOAA's proposed plan excludes key NOAA components that should be part of a climate service line office. Others thought the proposed inclusion of some components could threaten other NOAA missions. Some suggested that the NOAA proposal is organized too much around individuals and existing entities.
	3. User Needs and Engagement: The NOAA Climate Service must develop a systematic approach to engaging users at the regional, state and local levels. It should build capacity to adapt existing climate information and products to meet the needs of multiple users.
	4. Partnership and Coordination: The NOAA Climate Service must coordinate efforts by third parties for service development and delivery, improve coordination with federal partners, and both leverage and strengthen existing partnerships.
	5. Single Climate Voice: Lack of a single, authoritative voice on climate information too often compels users to struggle to assess the credibility of available information.
	6. Meaningful Access: The NOAA Climate Service should have a single entry point for users to access climate information, even if ultimately populated by multiple entities.
FEDERAL ROUNDTABLE	**1. Mission Alignment:** The NOAA Climate Service's mission must be aligned with the roles and responsibilities of other agencies within the interdependent federal climate enterprise. It should be structured to minimize disruption of existing partner relationships and services.
	2. Existing Partner Relationships: Given the role of other federal agencies regarding climate research and services, strong partner relationships between NOAA and other agencies will be a critical factor in determining the success of the Climate Service. The federal government has existing relationships to build upon to meet climate needs.
	3. Opportunities to Strengthen Partner Relationships: To promote stronger partner relationships, NOAA should work to remedy existing administrative impediments and cost-sharing impediments while instituting additional practices designed to foster collaboration.
	4. Future Climate Needs: Federal partner agencies have significant unmet needs in the areas of climate science, data, products and services to support their missions. Also, federal partners need to add capacity to be able to use this information.
STATE & LOCAL ROUNDTABLE	**1. Improving Access:** State and local governments do not always know how to access NOAA climate information and services. Development of a robust NOAA Climate Service web portal and establishing an adequate NOAA regional and state liaison staff will improve access.
	2. Coordination of Federal Climate Activities: State and local government participants believe that climate activities across the federal government are not effectively coordinated and that NOAA should also improve coordination of its internal climate activities.
	3. Establishing Standardized Models and Improving Data Usability: State and local representatives believe that the federal government provides useful climate data on many subjects. The most critical current needs are to: (1) establish standardized national models into which other levels of government can plug their specific regional, state and local data; and (2) increase the usability of existing climate data by, for example, making it more widely available online and "downscaling" it to the local or zip code level.

VENUE	OBSERVATIONS / RECOMMENDATIONS
(cont.)	**4. Tailoring the NOAA Climate Service to External Needs:** State and local representatives reported high regard for NOAA's technical expertise, but were unclear which federal agency is best suited to provide climate adaptation information services to state and local governments.
ACADEMIC/ EXPERTS ROUNDTABLE	**1. Improve External and Internal Communications:** NOAA has key roles as a science broker, and as a translator for climate issues. It needs to define and prioritize its climate goals and activities, establish a clear organization to support that direction, define a path for collaboration and communicate these decisions broadly.
	2. Focus on Users/Stakeholders at the Regional Level: Decisions about adaptation and mitigation must be made at the regional and local levels, because these areas face different climate stresses. NOAA's climate service should be driven by this reality and develop services to help regional and local decision-makers prepare for the range of likely climate scenarios.
	3. Assess and Capitalize on Effective Partnerships: NOAA has a role as an integrator for research organizations. NOAA must define its path in this regard and work to foster true collaboration to accomplish its mission and effectively leverage its limited resources.
	4. Provide Best Practices for Climate Data and Services: Some roundtable participants believe that NOAA can add true value by providing decision-makers with "best practices" or legally defensible certified data and models, with appropriate acknowledgment of uncertainties. This NOAA-provided data could help inform risk-management decisions and set a standard for how climate data and information are collected and presented.
	5. Develop a Modern Climate Structure and New Competencies: Roundtable participants believe that the new NOAA Climate Service needs to be broad, deep, innovative, flexible and evolutionary. Within this new structure, federal-university and other partnerships will be critical as will a host of new and enhanced competencies.
ONLINE DIALOGUE	**1. National Climate Enterprise:** The NOAA Climate Service's mission and activities must be aligned with the roles and responsibilities of other agencies within the interdependent national climate enterprise. The organization should be structured to minimize disruption of existing partner relationships and services with other federal, state and local agencies, academia and the private sector.
	2. Maintain and Foster Partnerships and Collaboration: A distributed climate enterprise requires partnerships and collaborations among public, private, academic and non-profit sectors. The NOAA Climate Service should maintain and strengthen existing partnership efforts and foster new ones to improve the provision of climate data, products and services.
	3. Single Climate Voice: NOAA Climate Service should be the authoritative voice on, and repository for, climate data, information and analysis.
	4. User Needs: NOAA Climate Service needs to conduct science to meet user needs. This requires sustained two-way communication to understand what users need and how they will use climate information.
	5. Meaningful Access to Data: NOAA Climate Service should provide easy access to climate data, and organize and present it in a manner that is useful to users at multiple scales.
	6. Data Management: NOAA Climate Service should become an effective clearinghouse for climate data.
	7. Communications: There is a critical need for "translation" services or better communications to bridge existing gaps between providers and owners of climate-related information and users, as well as between research and operations as it relates to climate

VENUE	OBSERVATIONS / RECOMMENDATIONS
(cont.)	change.
	8. Climate Literacy: The NOAA Climate Service must build climate literacy within NOAA's workforce and the public.
	9. NOAA Climate Service Structure: Dialogue participants had specific concerns and comments about what components NOAA has proposed to transfer into its Climate Service, and how these decisions would impact current and future operations across NOAA.

Most of the issues summarized above are discussed further in this report. Many recommendations surfaced in stakeholder outreach sessions are embraced in some form or another. Themes that the Panel heard often and found compellingly stated were: strong support for the concept of creating a NOAA (or a National) Climate Service; the need to improve federal interagency coordination of resources and service delivery; the importance of partnerships with the public and private sectors; a need for more localized and more accessible research; the potential positive impact of using innovative service delivery technologies and tools; and the importance of supporting a user community that is large and diverse.

* * *

Chapter 2 describes a growing demand for climate research and services, explains how NOAA has managed existing assets and summarizes NOAA's proposal to create a NOAA Climate Service.

CHAPTER 2
CURRENT STRUCTURE AND NOAA'S CLIMATE SERVICE PLAN

2.1 CURRENT STATE OF NOAA CLIMATE SCIENCE AND SERVICES

Historical Growth of Climate Science and Services. The United States has been recording and archiving weather and climate data for over a century. These data serve as the foundation for climate research and services, and allow for analysts to determine patterns and trends.

Since its inception in 1970, NOAA has been engaged in a significant range of climate-related activities. Over time, NOAA has added more complex research activities, and modeling and observation systems using satellite, ground, air and ocean sensors. These efforts have been complemented by a number of services to help public sector decision makers incorporate climate data and modeling in support of adaptation and mitigation decision making. Today these activities are spread across a multiplicity of NOAA offices and separate budget accounts.

NOAA identifies its core capabilities supporting its climate mission as: (1) understanding and modeling; (2) observing systems, data stewardship and climate monitoring; and (3) integrated services development and decision support (see Table 2). These are also core capabilities central to other NOAA line offices and other NOAA missions.

Table 2
NOAA's Core Climate Capabilities[10]

Understanding and Modeling	Observing Systems, Data Stewardship and Climate Monitoring	Integrated Services Development and Decision Support
• Process-based research and understanding • Adaptation research • Applied research • Attribution • Earth system analysis • Modeling • Predictions • Projections	• Observations • Monitoring • Data mining • Data stewardship • Analysis	• Scientific assessments • Information assessments • Forecasting • Decision support • Quality assurance standards • Evaluation and improvement • Information access management • Delivery coordination

[10] Based on Accenture, *Climate Services: Final Compilation Report*, December 2008 (provided to Panel by NOAA). This list has been modified to incorporate NAPA analysis.

NOAA's climate research and its staff are highly regarded and sought after by public and private sector entities seeking climate information and assistance, domestically and abroad. [11] NOAA reports that it is experiencing growing demands for application of solid climate science to solve problems at sub-regional to local levels and to provide data on a more granular scale. These demands include information to support senior federal officials, local and regional public employees, natural resource managers, and the owners and operators of critical infrastructure affected by climate variability and change.

An issue raised by numerous parties advising the Panel concerned communication skills: how to take increasingly complex analyses of basic climate data and make them intelligible for users who lack advanced training in climate science. The Panel heard from many parties that they need clear, impartial and accurate "translations" of the best available climate science. The challenge for NOAA is that these demands are outpacing NOAA's ability to make existing research available in a user-friendly format, and its ability to conduct new research to answer questions at the scale and scope being requested. Certainly, not all of the climate services needed by the public from the federal government are best developed or delivered by NOAA.

NOAA's substantial work is, first of all, part of a larger federal community that supports, conducts and consumes climate research and services. It is also supported by and supports academic and private sector researchers and users. Clearly, the growing demand for climate science and services extends to a large number of federal agencies. The full extent of this federal climate work is commonly referred to as the *federal climate enterprise*. The Panel itself has used this expression, though we do so with some reluctance, noting that the federal climate enterprise is still today more aspirational than it is coherent, cohesive and systematic.

Discussion about how best to organize and optimize NOAA's work as part of the federal climate enterprise began early after the agency's formation and has become more focused and widespread over the last decade.[12] Support for a major reorganization and enhancement of climate science and services at NOAA has come from both the current and prior Administrations.

Integration Through Matrix Management. NOAA has used matrix management to coordinate its climate mission within the agency. A March 2000, Academy Panel study found that NOAA's overall "planning, budget formulation, and execution processes are not effectively integrated."[13]

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[11] Sixty-four percent of federal scientists contributing to the 2001 IPCC Assessment and seventy-three percent of federal scientists contributing to the 2007 IPCC Assessment were from NOAA. Data provided by NOAA: NOAA Science Advisory Board, Review of the *Climate Observations and Analysis Program*, Climate Working Group (May 20, 2007); NOAA Science Advisory Board, *Climate Research and Modeling Program Review*, Climate Working Group (October 23, 2008); NOAA Science Advisory Board, *Climate Information Products and Applications Program Review*, Climate Working Group (November 17, 2009).

[12] Three early documents of note are: Federal Coordinator for Meteorological Services and Supporting Research, *Federal Plan for National Climatic Services* (Washington: January 1974); National Research Council, *A Climate Services Vision: First Steps Toward the Future* (Washington: 2001); and NOAA, *A Strategy for the Development of Climate Information Services* (Washington: 2007). See Appendix B for other literature assessing options for how best to support climate research and services at NOAA.

[13] National Academy of Public Administration, *Improving the NOAA Budget and Financial Management Processes*, (Washington: March 2000).

In 2002, the then NOAA Deputy Under Secretary led a program review team comprised of line office and staff office deputies. That review concluded that there was not sufficient integration across NOAA's programs and proposed implementation of certain matrix management structures.

Matrix management at NOAA began with a few programs involving activities that spanned multiple line offices. "Climate Research and Services" was one of the original programs, as users and producers of climate data, products and services were organizationally dispersed throughout the agency. NOAA's "Goal Teams" are comprised of multiple programs – some matrixed, some located entirely within a single line office – that work together towards a common set of specified "mission goals."

As an extension of this matrix management approach, in 2003 NOAA created a Climate Goal Team, assigned to work across all NOAA's entities to identify strategies needed to achieve NOAA's climate mission goal, which is defined thusly: to "understand climate variability and change to enhance society's ability to plan and respond."[14] This goal is being refined as part of the development of NOAA's Next Generation Strategic Plan and also as part of the internal NOAA planning process guiding establishment of a NOAA Climate Service. The Climate Goal Team is composed of three programs, each of which is matrixed: (1) climate observations and monitoring; (2) climate research and modeling; and (3) climate information services.

A major challenge of the Climate Goal Team has ultimately been its lack of consolidated management control of personnel and budgets, and an understandable competition among various NOAA mission priorities for resources and management attention. This has limited NOAA's ability to meet strategic climate objectives, and the agency has cited it as an important reason for why it proposed creation of a Climate Service. NOAA's Deputy Under Secretary stated "NOAA's existing framework for climate was established before climate services were recognized as essential, [it] . . . is not optimized for climate service delivery."[15] A similar judgment can fairly be rendered about NOAA's research and other climate activities.

The introduction of matrix management and the creation of the Climate Goal Team were thoughtful and significant investments to respond to demand by improving performance across NOAA's distributed network of climate activities. Matrix management has helped improve alignment across a range of activities and organizational stovepipes. But based on its own assessments, and upon reviews from various outside bodies, NOAA and Department of Commerce leadership rightly concluded that the Climate Goal Team provided an incremental improvement, but that matrix management is not sufficient to meet current needs.[16]

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[14] NOAA, *National Oceanic and Atmospheric Administration Strategic Plan FY 2009-2014*, at www.ppi.noaa.gov.

[15] Presentation to the NOAA Science Advisory Board's Climate Working Group meeting by Deputy Under Secretary for Operations Mary Glackin, April 7, 2010.

[16] See especially: NOAA Science Advisory Board, Review of the *Climate Observations and Analysis Program*, Climate Working Group (May 20, 2007); NOAA Science Advisory Board, *Climate Research and Modeling Program Review*, Climate Working Group (October 23, 2008); and NOAA Science Advisory Board, *Climate Information Products and Applications Program Review*, Climate Working Group (November 17, 2009).

2.2 OVERVIEW: NOAA'S PROPOSED CLIMATE SERVICE

On February 8, 2010, U.S. Commerce Secretary Gary Locke announced the Department's "intent to create a NOAA Climate Service line office dedicated to bringing together the agency's strong climate science and service delivery capabilities."[17] The proposed reorganization is designed to integrate better NOAA's climate activities and to make them more accessible. The proposed NOAA Climate Service would have equivalent organizational standing with NOAA's other divisional structures, such as the National Weather Service, the National Ocean Service and the National Marine Fisheries Service.[18] These line offices have budget and personnel authority for greater accountability, operational flexibility and focus.

To refine its plan and prepare for its implementation, NOAA created a transition team led by its Deputy Under Secretary and supported by NOAA senior managers. The team has engaged in substantial internal and external consultation, both before and after the Secretary's February 2010 announcement. NOAA generously shared its vision and provisional plans with the Panel.

The NOAA team has drafted various presentations and other collateral material. It proposes to strengthen considerably a public-facing web page to support the new organization (www.climate.gov), explaining that "our goal is for the Portal to become the 'go-to' website for NOAA's climate data, products, and services for all users."[19] The NOAA team drafted and is iteratively polishing a NOAA Climate Service *Implementation Strategy*, a draft of which was presented to the Panel.

NOAA is finalizing its plan for how the new Climate Service line office will be organized and resourced. The Panel did not receive a detailed budget proposal for the new line office nor a draft of the budget amendment request that the Administration would submit to launch the Climate Service.

NOAA's current articulation of the "implementation architecture" for the NOAA Climate Service presents an organization focused on research and service. Its draft mission statement is "to improve understanding and anticipation of changes in climate, and to promote a climate-resilient society and environment."[20] Its core capabilities are as described in Table 2. NOAA advocates that the Climate Service "focus on achieving four interdependent strategic objectives." Since the new organization cannot at once be everything to everyone, it must focus resources and efforts. Therefore, it is the provisional intent of NOAA to build on the organization's core capabilities, focusing its own early research functions and service offerings particularly on meeting five "societal challenges."

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[17] NOAA, "Commerce Department Proposes Establishment of NOAA Climate Service" press release (February 8, 2010) at www.noaa.gov/climate.html, accessed August 26, 2010.

[18] For further analysis of divisional, functional and administrative structures at NOAA, see Appendix I.

[19] See www.climate.gov/about.html, accessed August 26, 2010.

[20] The information in this paragraph and Table 3 was provided to the Academy by NOAA. The Panel recognizes that this language is subject to change.

Table 3 offers a high level summary of NOAA's "implementation architecture" for the new organization, a plan that is intended to align existing NOAA capabilities.

Table 3
NOAA's Proposed Climate Service Implementation Architecture

ELEMENT	DETAIL
MISSION STATEMENT	To improve understanding and anticipation of changes in climate, and to promote a climate-resilient society and environment.
FOUR CORE OBJECTIVES	1. Improved understanding of the changing climate system and it impacts
	2. Integrated assessments across current and future states of the climate system that identify potential impacts and inform science, services, and decisions.
	3. Mitigation and adaptation choices supported by sustained, reliable, and timely climate services.
	4. A climate-literate public that understands the vulnerabilities to a changing climate and makes informed decisions.
MEETING FIVE SOCIETAL CHALLENGES	1. Sustainability of marine ecosystems.
	2. Coasts and climate resilience.
	3. Climate impacts on water resources.
	4. Changes in the extremes of weather and climate.
	5. Informing climate mitigation options.
BY BUILDING ON CORE NOAA CAPABILITIES	1. Understanding and modeling.
	2. Observing systems, data stewardship and climate monitoring.
	3. Integrated services development and decision support.

NOAA intends for the Climate Service to be an impartial, rigorous research and professional services organization. The draft mission statement, which subsumes many existing activities, allows the Climate Service to grow and evolve. NOAA's mission statement is also predicated on numerous relevant federal agencies successfully coordinating and strengthening their climate research capabilities and service delivery offerings.

2.3 ORGANIZATIONAL BUILDING BLOCKS FOR A CLIMATE SERVICE

NOAA has identified the existing NOAA organizational assets it proposes to move to the Climate Service, although it has not shared with the Panel an organization chart. As described by NOAA, the Climate Service will bring together many of the agency's existing climate assets including research laboratories, climate observing systems, modeling programs and integrated monitoring systems. It will incorporate certain other service delivery assets of the larger organization.[21]

Under NOAA's implementation timetable, the agency has time to receive the Panel's report before making final decisions about the structure of a Climate Service. Table 4 presents NOAA's proposed organizational "building blocks" for a Climate Service line office.

[21] Climate Service Q&A, August 18, 2010. See: www.noaa.gov/climateresources/qa.html#1.1, accessed August 27, 2010.

Table 4
NOAA's Proposed Climate Service Building Blocks[22]

NOAA "CONTRIBUTING" ORGANIZATIONS		
Office of Oceanic and Atmospheric Research	**National Environmental Satellite, Data, and Information Service**	**National Weather Service**
• Climate Program Office • Geophysical Fluid Dynamic s Laboratory • Earth System Research Laboratory (ESRL), Office of the Director • ESRL, Global Monitoring Division • ESRL, Chemical Sciences Division • ESRL, Physical Science Division	• National Climatic Data Center • National Oceanographic Data Center • National Geophysical Data Center -	• Tropical Atmosphere Ocean (TAO) Array • Historical Climate Network Modernization (HCN-m) • Modernization of the Hourly Precipitation Rain Gauges -

What follows provides a high level description of the components that are listed in Table 4 and proposed by NOAA for transfer to the Climate Service.

Office of Oceanic and Atmospheric Research

- Climate Program Office – funds and manages the competitive research program for high-priority climate science *(Silver Spring, MD).*
- Geophysical Fluid Dynamic Laboratory – develops and uses models and computer simulations to improve our understanding and prediction of the behavior of the atmosphere, the oceans and climate *(Princeton, NJ).*
- Earth System Research Laboratory (ESRL), Office of the Director – provides management and administrative support *(Boulder, CO).*
- ESRL, Global Monitoring Division – conducts sustained observations and research related to global distributions, trends, sources and sinks of atmospheric constituents that are capable of forcing change in the climate of the Earth *(Boulder, CO).*
- ESRL, Chemical Sciences Division – undertakes research concerned with discovering, understanding and quantifying the processes that control the chemical makeup of Earth's atmosphere *(Boulder, CO).*
- ESRL, Physical Science Division – conducts weather and climate research to observe and understand Earth's physical environment and to improve weather and climate predictions on global-to-local scales *(Boulder, CO).*

[22] NOAA, "NOAA Climate Service" www.noaa.gov/climateresources/resources/noaaclimateservice_org.pdf, accessed August 18, 2010.

National Environmental Satellite, Data, and Information Service

- National Climatic Data Center – the world's archive of weather and climate data. NCDC also operates the World Data Center for Meteorology and World Data Center for Paleo-climatology *(Asheville, NC).*
- National Oceanographic Data Center – operates the World Data Center for Oceanography, National Coastal Data Development Center and NOAA Central Library *(Silver Spring, MD).*
- National Geophysical Data Center – operates the World Data Center for Glaciology, World Data Center for Geophysics and Marine Geology and World Data Center for Solar-Terrestrial Physics *(Boulder, CO).*

National Weather Service

- Tropical Atmosphere Ocean (TAO) Array – consists of approximately 70 moorings in the Tropical Pacific Ocean. The array is a major component of the El Niño/Southern Oscillation Observing System, the Global Climate Observing System and the Global Ocean Observing System *(Seattle, WA).*
- Historical Climate Network Modernization – a sub-network of the Cooperative Observer network consisting of more than 1,200 stations that make a suite of climate measurements, e.g. temperature, precipitation and soil moisture *(Asheville, NC).*
- Modernization of the Hourly Precipitation Rain Gauges – a program to modernize hourly rain gauges that are part of the Cooperative Observer network *(Silver Spring, MD).*

*** * ***

This chapter has summarized management and organization matters that NOAA has presented to the Panel to inform the Panel's study. The next three chapters present the results of the Panel's study. The first of these, Chapter 3, contains the Panel's observations and recommendations regarding the larger federal climate enterprise, identifies key elements of support needed by the NOAA Climate Service and stresses the importance to the new organization of a clear strategic plan and a comprehensive implementation plan.

CHAPTER 3
PLANNING FOR SUCCESS

3.1 PART OF A LARGER ENTERPRISE

Climate variability and change will likely continue to require U.S. public and private sector leaders to make increasingly complex decisions. As our collective knowledge about climate variability and change gains greater certainty and predictive force, demand will grow for more research. Such authoritative, credible science will have to be delivered efficiently through many and diverse channels to support decisions regarding climate adaptation and mitigation.

The proposal to create a NOAA Climate Service is a product of the broader federal assessment of how federal roles and responsibilities regarding climate research and services should be shaped and supported. Today a large and loosely coordinated mix of climate research and services are being conducted or supported by numerous federal departments and agencies. Seeking context for our assessment of a new NOAA Climate Service, the Panel necessarily made an effort to map other federal climate activities with which a NOAA Climate Service must, in some way or another, interact. We identified at least eight other Departments, five agencies and six offices within the Executive Office of the President that have a climate research, services or policy role.[23]

The aggregation of activities and organizations active in this space has come to be known as the *federal climate enterprise*. This *enterprise* is not a unitary and focused enterprise, in the way that, for instance, a chain of local hardware stores or a complex multinational corporation is a true enterprise. The federal government has for several decades executed and supported a myriad of activities related to climate research and services. Still, the federal climate enterprise is, at best, in its infancy. [24]

The Panel recommends that capabilities of the federal government regarding climate need to be strengthened considerably on two interdependent but distinct levels: at the* strategic and policy level*; and at the* operational level*, where research, data collection and service delivery takes place. The NOAA Climate Service mandate would be focused on the latter category – operational activity related to research, data collection and services.

The Panel recommends that the federal government substantially expand its delivery of regular, impartial and authoritative climate information services to state, local and tribal governments and to the public, especially by: (1) providing more robust and finer-grain information about possible impacts of climate variability and change to guide local decisions

[23] See Appendix D for a high level graphic produced by the Academy study team to illustrate at a high level the range of entities that constitute the federal climate enterprise. Although not formally vetted, it does capture a sense of the complex federal environment in which the NOAA Climate Service would operate.

[24] A recent National Academy of Sciences report suggests that existing coordination mechanisms have not adequately integrated the range of scientific disciplines to address adaptation and mitigation challenges. It identified needs for more comprehensive climate observation networks, stronger modeling and predictive capabilities, and better methods for providing climate information to decision makers. National Research Council, *Restructuring Federal Climate Research to Meet the Challenges of Climate Change* (Washington: 2009).

about adaptation; and (2) assisting others to access and effectively use models for understanding how mitigation efforts can avert or reduce climate change. The NOAA Climate Service would do such work, along with other federal partners.

The Panel strongly supports the creation of a NOAA Climate Service to be established as a line office within NOAA. In making specific recommendations about the Climate Service organization structure (see Chapter 4), we aim to satisfy the physician's maxim: first, do no harm. The Panel is convinced that the structural recommendations we make can be implemented without undermining NOAA's baseline performance regarding any other part of its mission.

The NOAA Climate Service should play a strong leadership role in working with other federal agencies to coordinate the gathering, stewardship and availability of climate information by all appropriate federal agencies as well as states, local governments, tribes, other nations and international bodies. This new NOAA organization would *not* absorb other federal department or agency responsibilities or assets. Rather, it would continue to be part of and help lead a larger enterprise.

A significant possible upside to consider is this: a NOAA Climate Service, vested with a strong mandate, can both strengthen its own science and service deliverables, and it can help accelerate the work of making the broader federal climate enterprise more focused, cohesive and effective. Federal agencies recognize this potential for doing even more together. A study co-authored by four federal agencies with natural resource responsibilities (U.S. Geological Survey, U.S. Army Corps of Engineers, Bureau of Reclamation and NOAA) describes the relationship among the four as "a symbiotic relationship, where the operating capabilities required by one agency may drive the direction of science inquiries for another, which in turn may result in improved knowledge and processes for operations. Similarly, the data collected and compiled by one agency for a specific purpose can be used by another agency to supplement other data and information for an entirely different purpose."[25]

The Panel concludes that, if properly resourced and supported, creation of the NOAA Climate Service can also ignite and then help sustain systemic improvements in a broad array of federal climate research and services. For this to happen, the NOAA Climate Service must respectfully and systematically seek such a role. It must make raising the bar for itself and its federal partners a core mission objective.

This would begin by NOAA asking how it can best help its other federal partners succeed. Doing this successfully will present compelling challenges, yet perhaps extraordinary opportunities in the near-term to achieve transformational and cost-effective successes for the new line office and the larger federal climate enterprise.

[25] U.S. Department of the Interior, U.S. Geological Survey, *Climate Change and Water Resources Management: A Federal Perspective*, Circular 1331(Reston, VA: 2009).

3.2 ADMINISTRATION SUPPORT NEEDED FOR THE NOAA CLIMATE SERVICE

Interagency Coordination. The NOAA Climate Service cannot be an effective agent for helping to coordinate climate research and services across the federal government unless the President and his senior team support such a role for the new agency. NOAA will need assistance along the way to achieve and sustain consensus, for example, about resource coordination and mission de-confliction. This is not a task that any one agency or Cabinet Department can be expected to manage.

The Panel acknowledges that substantial work and iteratively stronger coordination is taking place across the federal government (especially through the White House Office of Energy and Climate Change's working group on Climate and Energy, the National Science and Technology Council, its Committee on Environment and Natural Resources, the Interagency Climate Change Adaptation Task Force and the U.S. Global Change Research Program) as well as within and between particular Departments and agencies.

Without prejudice to existing dual-agency or multi-agency working-level mechanisms, a more senior-level federal interagency coordination mechanism with a broader mandate would be enormously valuable. ***The Panel recommends that the Administration strengthen and expand interagency coordination structures tasked with aligning Executive Branch climate resources. Specifically, the Panel recommends that the President empower a senior interagency group – led at the White House and convened at the Deputy Secretary or Secretary level – to provide the President annually with a strategic plan for management of federal climate research and service delivery.***

This group should be tasked with assessing the adequacy of ongoing federal climate research and service delivery efforts, recommending appropriate budget priorities and resolving as needed any interagency conflicts or policy issues associated with climate research or service delivery. This coordination role would most effectively be conducted through an established interagency policy council or other broad-based interagency body led by a senior Administration official (for example, at the rank of Assistant to the President).

In addition to its climate research and service delivery activities, the Executive Branch has an already large and growing climate change policy agenda (tax policy, legislative strategy, regulatory decisions, and other strategic policy and investment decisions). Although such matters are beyond the scope of this study, the Panel simply notes that the same senior interagency group needed to coordinate federal climate research and service delivery ideally could be configured to support the overarching Executive Branch climate policy agenda. This would likely bring beneficial synergy and focus on what is needed to support policy *and* operational decision-making.

Lead Federal Agency Designation. At the operational level, allocation of scarce federal resources for research, data collection and services should be managed aggressively to prioritize efforts that will have the greatest positive impact. ***It is not necessary, nor would it be wise, to force into a single organization all of the federal assets that might contribute to strengthening climate science or climate services.***

Nonetheless, ***the Panel recommends that it would be extremely valuable, indeed we consider this essential, to have one federal agency designated to be the center of gravity for aggregating and rigorously providing an authoritative roadmap or portal to the best available science that can be harnessed to support public policy decision making.***

Somewhere in the federal government, the public needs an authoritative entity to identify what is known and what is not. It should be able to know what is being studied and by whom, what needs more study, who is developing what end-user products, and how or whether the federal government can help map resources and capabilities to specific needs. Similarly, international partners should not be compelled to shop among federal agencies when seeking to coordinate climate research or services.

In short, there is a much-needed role for one agency to serve as a day-to-day integrator of the overall federal effort regarding climate science and services. This is a job for an agency that can serve as a convener, a guide to valid science, an inveterate dot-connector that probes the interstices between climate-related disciplines, and a repository for the inventory of available services offered by the full list of federal climate service providers. This lead agency should embrace a decidedly non-bureaucratic culture of continuous innovation and impartiality. It should harness world-class technology and recruit expert analysts and communicators who can assess needs and foster collaboration among researchers and policy makers in the public and private sectors. It will need a field liaison structure guided by boundary-spanning staff who can assist the lead agency to understand better and work more effectively with state and local officials.

After extensive consultation, ***the Panel recommends that a NOAA Climate Service, properly configured and implemented, would be uniquely qualified to serve the public and private sectors as a lead federal agency for climate research and services, and to provide an ongoing accessible, authoritative clearinghouse for all federal science and services related to climate.*** There is ample precedent for the President to make such a "lead agency" designation as proposed for the NOAA Climate Service either by issuing an Executive Order or through less formal means. Of course, Congress could also ratify and make this designation permanent at some juncture through legislation.[26]

Acceptance of this recommendation does *not* mean that NOAA would direct, conduct or archive all federal climate science. Nor does it mean that NOAA would be the exclusive federal provider of all climate services. NOAA would *not* usurp or replace other agency authorities, relationships or missions.

In no case should deliberation about authorizing such a "lead agency" status delay the stand-up of a NOAA Climate Service. NOAA Administrator Lubchenco spoke to the Panel about her commitment to the essential first-order task at NOAA of "getting our house in order" regarding climate services, while working "in close partnership with other federal agencies."

[26] This recommendation regarding lead agency status for research and federal service delivery is not to be confused with leadership regarding the Administration's overarching climate policy strategy or federal policies regarding adaptation and mitigation, which is the responsibility of the President and senior Administration officers. The NOAA Climate Service would, however, be a source for authoritative, impartial science to support all Administration and Congressional policy makers.

Indeed, the new NOAA Climate Service deserves to know from the beginning the full scope and direction of its mission. The NOAA Climate Service and the rest of its federal partners need clarity about whether and to what extent any one agency is tasked with leading the day-to-day details of exacting better unity of effort across the breadth of the federal climate science and services enterprise. Whether a NOAA Climate Service is given the mandate to be first among equals at the federal table is not an esoteric triviality. Rather, it is a necessary precondition for gaining and sustaining better coordination among federal departments and agencies responsible for climate for research and services.

The Panel suggests that an appropriately tailored lead federal agency designation would generate indispensible momentum for the new NOAA Climate Service. Moreover, it would simplify and accelerate federal efforts to harmonize, coordinate and strengthen its overall climate research and service activities.

3.3 ADOPTION OF STRATEGIC AND IMPLEMENTATION PLANS

Considerable planning and organizational discipline is needed to move from proposing the new organization to launching a NOAA Climate Service. The start-up phase (12-18 months) will set the table for long-term success. ***The Panel recommends that prior to the start-up of the new organization NOAA should complete and formally adopt two core plans of record for the new organization: (1) a strategic plan; and (2) an implementation plan.*** Properly constructed, these will bring discipline and focus to the new organization.

NOAA is working toward adoption of a strategic plan for the entire NOAA organization, the *Next Generation Strategic Plan*. In a video prepared for employees and the public, NOAA Administrator Lubchenco describes the NOAA strategic plan in this way: "We will reset the course for the agency. The plan will reassess and renew our mission, our vision and goals. And this, in turn, will drive our work and our partnerships."[27] NOAA has also put in place a considerable planning process to guide the launch of its new Climate Service. The Climate Service implementation team has drafted and is refining a *NOAA Climate Service Implementation Strategy*, which has been briefed to the Panel.

The Panel has been favorably impressed with the rigor and discipline that is reflected in NOAA's draft *Implementation Strategy*. This provisional document combines virtually all the work needed to complete a NOAA Climate Service strategic plan. It contains some elements of an *implementation plan*, but is incomplete.

There is a difference between an *implementation strategy* (a strategic plan) and an *implementation plan*. It's the difference between knowing where you want to go and what you want to do, versus having a detailed roadmap on how you will get there, to include the resources and sequence of events that ensure a successful journey. It may be premature to expect that NOAA already have a refined implementation plan, as an actual start-up likely is still months

[27] Panel transcription of video at www.ppi.noaa.gov/ngsp.html, accessed August 27, 2010. A draft of NOAA's *Next Generation Strategic Plan* is available at this site.

away. Nonetheless, it may be helpful to examine the scope and purpose of these two planning documents needed for start-up.

Strategic Plan. ***The Panel finds that NOAA has brought strong focus to the core elements of a strategic plan.*** Chapter 2, above, summarizes core elements of the nascent strategic plan for the NOAA Climate Service, including a mission statement, as well as the four objectives that will steer the agency to help meet five societal challenges using its three core capabilities. The implementation team's work has focused on goals, outcomes, requirements, capabilities and deliverables or potential services.

A strategic plan should give precision to assessing and prioritizing needs, expectations and investments. It will facilitate working effectively with NOAA's domestic strategic partners, its key stakeholders and the larger public. NOAA's primary focus will be providing services within the U.S., but its strategy will continue to acknowledge the significance of substantial interaction with international researchers and service providers.

Implementation Plan. ***NOAA should expand current planning efforts to craft a detailed implementation plan to guide effective stand-up of the Climate Service.*** While this recommendation certainly verges on stating the obvious, completing this task effectively is vital and doing so well is no simple matter.

Crafting the implementation plan for the NOAA Climate Service can be done in stages, allowing the organization first to nail down *what must be done*, then with increasing layers of detail identifying options for *how* to do it. Such planning and later implementation should be led by the Climate Service's management team, supported by the NOAA and Department of Commerce executive team. Particularly important will be the new line office's Assistant Administrator, its principal Deputy Assistant Administrator (chief operating officer) and the Deputy Assistant Administrator for Transition and Change Management. See Chapters 4 and 5 for further discussion of these roles and of change management in the new organization.

The initial focus should emphasize the *process* by which NOAA will organize itself to manage the predictably large number of implementation issues. This earliest focus is less about the organization chart, more about building the new organization's brain trust and start-up leadership, and putting them to work on the most compelling implementation priorities. The team that is responsible for drafting the NOAA Climate Service implementation plan should be in one place, devoted full time to these tasks well in advance of the actual start-up.

It would be most effective to start with a simple inventory of the major clusters or "buckets" of responsibilities, such as: recruiting and hiring key staff (including interagency detailees); planning external and internal communications; maintaining effective Congressional liaison; assessing budget needs; promoting federal partner outreach (to create seamless, coordinated service delivery plans); introducing climate portal enhancements; evaluating facility utilization issues; architecting stakeholder engagement; managing press relations; formalizing legal authorities associated with the reorganization; identifying data collection, storage policies and priorities; aligning grant programs to priorities; establishing performance measurement metrics for the organization; evaluating pay-for-service arrangements; creating financial and resource

agreements among federal climate agencies to facilitate mission coordination; and literally dozens of other matters large and small.

In short, NOAA must create a management issues "bucket list," one with a results-oriented focus. Populating the buckets with specific assignments and plans can be facilitated through disciplined change management tools. Service delivery should be a particular focus of innovation. How will the agency customize its products and services? What are the primary channels for service delivery? What role will technology play in service delivery – now and in the medium-term? What types of employee skills must NOAA secure to make the Climate Service a success? How will NOAA translate or make useable complex climate data and predictive models?

The Panel offers specific recommendations regarding two technology-related issues worthy of near-term NOAA scrutiny. In both cases, innovative, state-of-art expertise is found largely in the private sector. NOAA should, therefore, proactively seek informal and voluntary counsel from private sector businesses about these matters. ***The Panel recommends that: (1) NOAA should continue the development of its climate portal, and plan for investments necessary to operate a virtual clearinghouse for federal climate information; and (2) NOAA should prioritize opportunities for using state-of-art information technology to expand participation by partners and users in the development of climate products and services, both to leverage its own investments and to produce more robust products and services.*** These two buckets of work may in fact be barrel-sized, but innovation here can yield transformational tools for the new agency.

*** * ***

Chapter 4 contains the Panel's recommendations regarding the structure of a NOAA Climate Service and discussion about each of the main components of the new organization.

CHAPTER 4
RECOMMENDED ORGANIZATIONAL STRUCTURE

Form follows function. Our recommendations for the design of a NOAA Climate Service follow the function of the organization's mission – providing climate research and services.

The Panel's recommended structure would achieve a high degree of internal alignment by establishing three operating units that reflect NOAA's existing capabilities and anticipated deliverables. For example, the Panel proposes gathering into a single office all of the service design and delivery personnel under one Director, regardless of the employee's physical location. This is intended to help NOAA connect these essential user-facing functions, while accommodating co-location with other Climate Service functional teams. Such a structure should reinforce closer working relationships across all offices and increase unity of purpose within the new NOAA Climate Service.

NOAA is not building a new Climate Service from scratch. If it were, the bulk of the NOAA Climate Service assets might easily be located on a single campus. The Panel does not suggest, however, any significant relocation of assets, given the extensive inventory of physical and intellectual capital already in place. A lack of physical proximity will, however, require NOAA Climate Service leaders to communicate especially well with the entire workforce. The new organization has been in the incubation stage for a protracted period, and as opening day approaches consistent and candid communication with employees is essential. NOAA must be cognizant of what it takes to build a unified team and common culture among a highly technical and dispersed workforce. Doing so requires engaged, cohesive leadership that is decisive yet collegial.

The proposed organization would have a relatively flat management structure, one that aligns quite closely but not identically with what has been proposed by NOAA. The organization's senior management team would be comprised of nine key individuals who must work extraordinarily well together for the effort to succeed. The team would include the Assistant Administrator, two Deputy Assistant Administrators, a Chief Scientist and the lead executive of each of the organization's five office-level components (Management; Policy and Strategic Partnerships; Research and Modeling; Data and Information; and Service Design and Delivery).

This design is intended, as much as possible, to facilitate a cohesive operating environment. It should reinforce already strong professional interdependencies among the three primary operational units. Each part of the organization builds upon and must be synchronous with the others. What is learned by the service design and delivery team from stakeholders must, for example, systematically animate development of the research planned. Contacts by the research and modeling team with other experts at home and abroad will, in turn, suggest possibilities for new service delivery tools. These two Climate Service organizations must collaborate continuously and rely upon each other. A similar partnership must be built between the Climate Service's data and information product professionals and the researchers and customer service specialists to promote the pass-off of strong, comprehensible and practical science. This creates a dynamic environment where collaboration creates value for all.

As a NOAA Climate Service is created, this same strong partnership internal to the NOAA Climate Service must also be aggressively nurtured among the multiple line offices within NOAA. Each NOAA line office depends upon other NOAA line offices. If nurtured, these relationships can greatly magnify what a single line office can achieve alone. Particularly important in the days leading up to formal creation of a NOAA Climate Service will be a need to make sure that the role of NOAA's Office of Oceanic and Atmospheric Research – a key incubator of new science and common-use tools for all of NOAA – is reinforced and widely understood. This line office provides particularly important institutional glue to support innovation across NOAA.

In recommending an organizational structure, the Panel was guided by a conviction that the new organization should join together all significant climate-related functions inside NOAA to provide for unity of climate focus, but to do so without adversely impacting other NOAA organizations. In other words, do all that was needed, nothing more. In the end, we asked these questions: Which essential elements should be brought together? What architecture would be practical to maintain? What design would be flexible enough to grow over time?

The Panel recommends aligning the Offices of the NOAA Climate Service around an outcome-based grouping of three core capabilities, which, like NOAA's own proposal, reflects the core capabilities from existing NOAA line offices that do climate work. For the Climate Service to succeed, the Panel finds that it is essential to include all three core capabilities in the new line office. ***Our recommendation is for a Climate Service with four primary organizational structures: (1) headquarters leadership and support functions; (2) an Office of Research and Modeling; (3) an Office of Data and Information Products; and (4) an Office of Service Design and Delivery.*** This Chapter explains each of these four organizational groupings.

Table 5 summarizes the Panel's recommendations regarding which offices from within NOAA should be migrated to the new NOAA Climate Service.

Table 5
Academy Panel's Proposed Climate Service -- Organizational Components

NOAA Assets Proposed for Inclusion with the NOAA Climate Service*	Current NOAA Location	Proposed Location in NOAA Climate Service
1. Earth System Research Lab (ESRL) Director's Office	OAR	Research & Modeling
2. ESRL, Physical Sciences Division	OAR	Research & Modeling
3. ESRL, Chemical Sciences Division	OAR	Research & Modeling
4. Geophysical Fluid Dynamics Laboratory	OAR	Research & Modeling
5. ESRL, Global Monitoring Division	OAR	Data & Info Products
6. Climate Program Office, Ocean Observing Systems	OAR	Data & Info Products
7. Integrated Ocean Observing System	*NOS*	*Data & Info Products*
8. Tropical Atmosphere Ocean Array	NWS	Data & Info Products
9. Modernization of the Hourly Precipitation Rain Gauges	NWS	Data & Info Products
10. Historical Climatology Network Modernization	NWS	Data & Info Products

NOAA Assets Proposed for Inclusion with the NOAA Climate Service*	Current NOAA Location	Proposed Location in NOAA Climate Service
11. National Climatic Data Center	NESDIS	Data & Info Products
12. National Oceanographic Data Center	NESDIS	Data & Info Products
13. National Geophysical Data Center	NESDIS	Data & Info Products
14. Climate Prediction Center	*NWS*	*Data & Info Products*
15. Regional Climate Liaison staff	NESDIS	Service Design & Delivery
16. Climate Program Office, Communications & Education staff	OAR	Service Design & Delivery
17. Regional Integrated Science Assessments program	OAR	Service Design & Delivery
18. National Integrated Drought Information System program	OAR	Service Design & Delivery
19. Cooperative Institutes program	OAR/NESDIS	Service Design & Delivery
20. Climate services staff from the three data centers	NESDIS	Service Design & Delivery
21. Regional Climate Centers	NESDIS	Service Design & Delivery
22. Climate Program Office, Grants and Contracts program	OAR	Service Design & Delivery

*Legend: OAR – Office of Oceanic and Atmospheric Research; NESDIS – National Environmental Satellite, Data & Information Service; NWS – National Weather Service; and NOS – National Ocean Service. Blue text italic = NOAA organization recommended by the Panel for inclusion within the Climate Service, but not included with the NOAA Proposal.

Presented from a different perspective, Figure 2 presents a proposed organization chart for aggregating and organizing NOAA Climate Service assets consistent with the Panel's recommendations regarding the basic organization structure.[28] What follows in this chapter is a discussion of the four primary organizational components.

4.1 HEADQUARTERS ORGANIZATION

Headquarters Leadership. ***The Panel recommends that the head of the NOAA Climate Service have rank, title and compensation equivalent to the heads of the other NOAA line offices. We further recommend that this individual, the Assistant Administrator, be selected from among the ranks of the career Senior Executive Service (SES) or be a candidate who can qualify for an appointment as a career SES executive.***[29] Looking forward, having a distinguished and experienced career Assistant Administrator will reinforce public confidence in the impartiality and authoritativeness of the NOAA Climate Service's work products. This will also provide for needed continuity and stability during future Administration transitions. As the proposed organization chart makes clear, the Assistant Administrator would be responsible for an eight-person senior management team: the principal Deputy Assistant Administrator; the Deputy Assistant Administrator for Transition and Change Management; the Office of Management; the Office and Policy and Strategic Partnerships; the Chief Scientist; the Office of

[28] Organization levels and titles are based on NOAA Administrative Order 200-7, *Procedures for Initiating and Processing Organizational Changes*. For clarity in reporting chains, the alternate title (Chief) for head of a division or laboratory is used. This chart does not convey structural recommendations below the division level.

[29] The SES includes most senior managerial, supervisory, and policy positions in the Executive Branch. Five of the current NOAA line office heads (Assistant Administrators) are career SES appointees, and one (National Marine Fisheries Service) is a political appointee. The head of NOAA is a Presidential appointee confirmed by the Senate. The Panel concluded that, as with the preponderance of other NOAA line offices, the Climate Service would be best served if its senior executive were a career status appointee rather than a political appointee.

Research and Modeling; the Office of Data and Information Products; and the Office of Service Design and Delivery.

The principal Deputy Assistant Administrator should be the NOAA Climate Service's Chief Operating Officer. Like his or her boss, the chief operating officer would have only a small staff, including one or two public affairs specialists. As chief operating officer, the principal Deputy should have direct line authority over the three operational offices: Research and Modeling; Data and Information products; and Service Design and Delivery. ***To balance the leadership team, the Panel suggests that at least one of the top two leadership positions be filled with an individual familiar with the culture and operation of NOAA, as well as the culture and history of the component pieces coming into the Climate Service.***

The headquarters team will account for six of the nine total senior management positions that would lead the new organization. Chapter 5 of this report offers further observations and recommendations about the NOAA Climate Service's senior management team – their recommended qualifications, responsibilities and selection – and on change management. Having touched on the top two positions, this section also elaborates briefly on the four other senior executives managing headquarters functions.

Deputy Assistant for Transition and Change Management. The Climate Service transition agenda should be developed in accord with an implementation plan containing detailed timelines, deliverables and performance objectives. ***The Deputy Assistant Administrator for Transition and Change Management should closely supervise the transition agenda on behalf of the Assistant Administrator and the senior management team.*** This is contemplated as a temporary, transitional position (12-24 months); additional recommendations regarding the position are contained in the next chapter of this report.

Chief Scientist. The Climate Service should include a Chief Scientist as a Career SES or what is known in the federal government as a Scientific or Professional position.[30] ***The Chief Scientist should be responsible for providing technical and scientific advice to the Climate Service, and NOAA leadership. He or she should be responsible for ensuring that the Climate Service's scientific activities are scrupulously objective, scientifically disciplined, transparent, collaborative and responsive to the needs of NOAA and its stakeholders.*** The Chief Scientist should be well positioned to help: the Assistant Administrator weigh competing demands from within the Climate Service and across NOAA; assess the scientific basis for proposed research; integrate various streams of climate research into products and services; and prioritize investments associated with climate science.

Office of Management. The Director for Management would oversee finance and budget matters, administrative functions and human resource responsibilities. A career SES appointment, this person would report to the Assistant Administrator through the Deputy Assistant Administrator/Chief Operating Officer.
This office will have close working relationships with NOAA's Chief Financial Officer, and other NOAA management offices. It must be designed to respect the appropriate line

[30] For details about federal Scientific or Professional (ST) positions see: www.opm.gov/ses/recruitment/stpositions.asp.

office/NOAA headquarters divisions of labor. ***The Panel recommends that the Office of the Director of Management have overall finance and budget responsibilities for all financial management and budget activities relating to the programs and operations of the Climate Service, including annual budget development.*** [31]

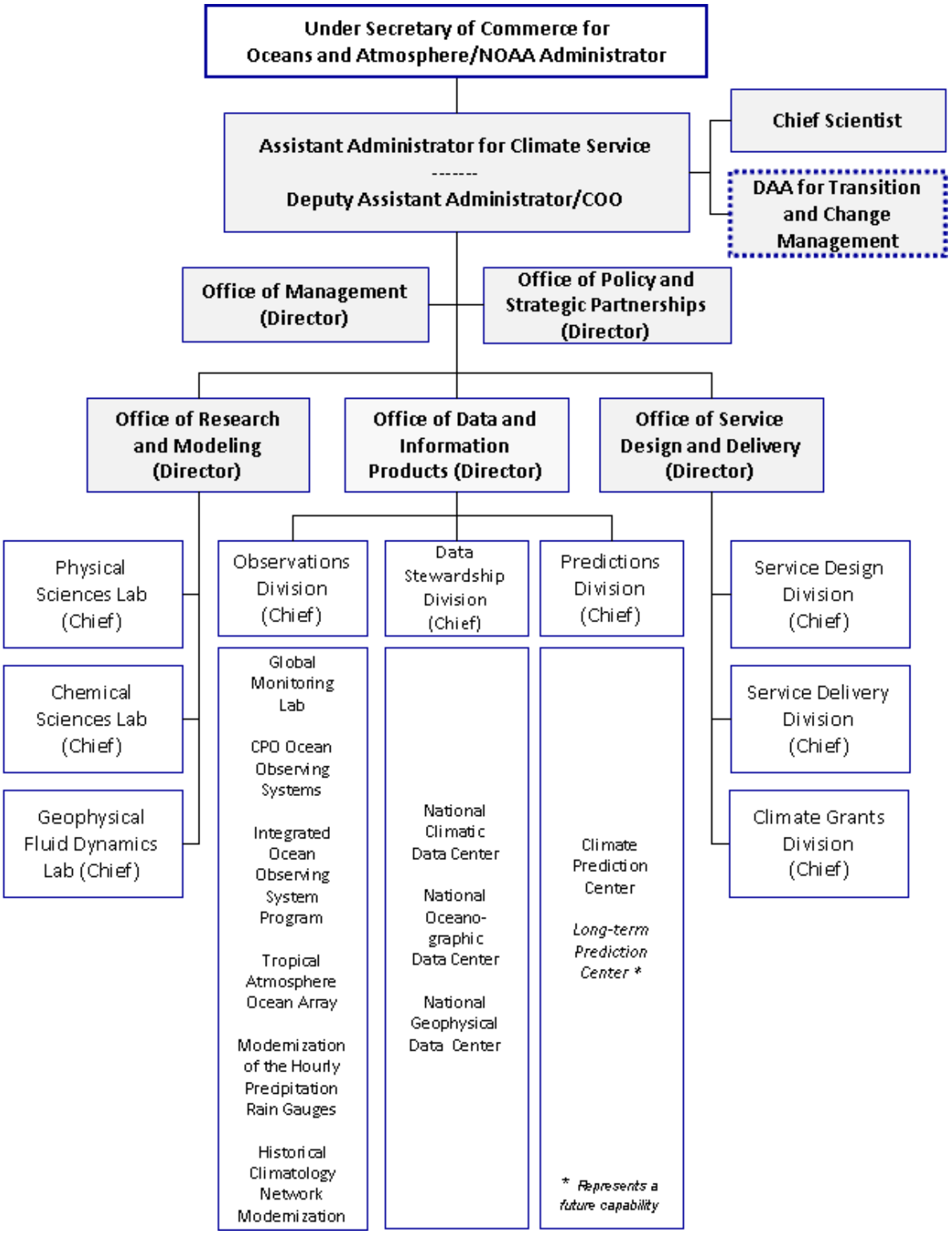
NOAA has proposed an arrangement whereby the NOAA Chief Information Officer would directly manage all information technology software and hardware acquisition, network security and maintenance functions for the Climate Service. The NOAA Chief Information Officer currently supports the NOAA staff offices. Unlike other NOAA line offices, the Climate Service would therefore not have a Chief Information Officer. If adequately resourced and responsive, this approach strikes the Panel as cost-effective, likely to ensure better network performance and therefore worth a try. If the NOAA Chief Information Officer is not given adequate resources, this approach will fail.

Office of Policy and Strategic Partnerships. ***The Director for Policy and Strategic Partnerships would oversee headquarters-level policy management, development and support for strategic partnerships (especially to architect robust federal interagency partnerships) and international affairs.*** A career SES appointment, this person would report to the Assistant Administrator through the Deputy Assistant Administrator/Chief Operating Officer.
This office would be responsible for *strategic* policy issues associated with federal, state, tribal and local governments. It would engage other agencies to define effective roles and responsibilities for climate functions, including negotiation of formal interagency cooperative agreements. A priority focus should be strengthening federal interagency partnerships. Careful delineation of duties assigned to this office would, however, be essential. This is especially true in relation to the Office of Service Design and Delivery. The Panel believes that day-to-day relationships with state and local officials would be handled best by the Service Design and Delivery team. The Office of Service Design and Delivery should, for example, be the institutional home for the Climate Service Liaisons as described in Section 4.4.

Primary responsibilities for international affairs activities should reside in this office. It would coordinate with appropriate international agencies (World Meteorological Organization and the Intergovernmental Panel on Climate Change, for instance) on collaborations and bilateral agreements involving the line office or its assets. This office would routinely draw on Climate Service program-level staff and would support NOAA's International Affairs Office as needed.

[31] The Panel assumes that the head of this line office would serve as the Climate Service CFO.

Figure 2
Academy Panel's Recommended Structure for a NOAA Climate Service



4.2 OFFICE OF RESEARCH AND MODELING

The Director of Research and Modeling would be responsible for managing the NOAA Climate Service's climate research enterprise, including priority research investments within the line office and contracted research from elsewhere within NOAA or outside NOAA. A career SES appointment, this person would report to the Assistant Administrator through the Deputy Assistant Administrator/Chief Operating Officer.

The Panel recommends that four existing NOAA components be incorporated into a proposed Office of Research and Modeling: (1) the Earth System Research Laboratory (ESRL) Director's Office; (2) ESRL, Physical Sciences Division; (3) ESRL, Chemical Sciences Division; and (4) the Geophysical Fluid Dynamics Laboratory (GFDL). The three ESRL assets are located in Boulder, Colorado; the GFDL is located in Princeton, New Jersey.

Research Functions. Credible and authoritative scientific research provides the foundation for making sound decisions about climate adaptation and mitigation. As science regarding climate variability and change gains greater certainty and predictive force, so too will it become more complex. Climate research will continue to rely on experienced scientific professionals, incorporate greater amounts of data, utilize increasingly robust analytical tools and research models, become more granular and localized in its focus, and continue to require access to high-performance computing.

NOAA has advanced the understanding of climate systems over the past 40 years through a combination of its own research and directed external research, which awards contracts and grants to its research partners. Today NOAA's climate research activities are dispersed across multiple NOAA organizations.

Typically, applied research yields tangible products or makes possible specific services. So too in the case of climate: research will enable development of many new products and services. Climate modeling is itself a research activity and is closely connected to other climate service research. Providing access to climate research is what a NOAA Climate Service is all about. From a functional perspective, a robust research capability concentrated within the NOAA Climate Service line office is essential. From a management perspective, having budget and personnel authority for these assets provides accountability for climate research choices.

The proposed Climate Service would incorporate a significant portion of NOAA's climate research capacity into an Office of Research and Modeling, the key elements of which are currently part of the Office of Oceanic and Atmospheric Research (OAR). Specifically, the Physical Sciences Division and the Chemical Sciences Division of the Earth System Research Laboratory (ESRL) conduct applied research that directly supports climate monitoring, modeling and services. These two OAR divisions (labeled as Labs on Figure 2) concentrate on atmospheric work. Although they are not wholly dedicated to climate, these are predominantly focused on climate matters.

The Panel finds that bringing the Physical Sciences Division and the Chemical Sciences Division into the Climate Service will allow the new line office to manage NOAA climate

research that is indispensable to success of the new enterprise. It would undermine the whole concept of an integrated NOAA Climate Service if these research assets were not an integral part of the new line office.

Two additional NOAA labs require discussion. OAR has two marine laboratories that also contribute to NOAA's climate science mission: the Pacific Marine Environmental Laboratory (PMEL) and Atlantic Oceanographic and Meteorological Laboratory (AOML). Both perform significant climate research work, yet both conduct a preponderance of non-climate work. The Panel concluded that it would be too disruptive to other NOAA missions, and to OAR's core mission within NOAA, to transfer these two organizations to the new NOAA Climate Service. As is discussed below (section 4.5), the Panel evaluated and rejected the idea of merging all OAR assets into a new Climate Service. Doing so would serve neither the interests of NOAA overall nor those of the Climate Service. The management challenge, therefore, is this: how to ensure that these two laboratories focus their climate-related activities in ways that contribute effectively to a seamless research function within NOAA regarding climate science. How should NOAA create the right incentives for integration of effort without merging these organizations into the Climate Service?

By NOAA's own experience, mere matrix management does not seem adequate. ***The Panel recommends to Congress and the Administration that all funds to support NOAA climate research – including climate research to be performed by PMEL and AOML – be appropriated annually to a single climate research budget account within the NOAA Climate Service.*** The Assistant Administrator would, in effect, annually purchase those research deliverables of PMEL and AOML that the Climate Service required. In this way the Climate Service would have greater discretion to fund NOAA's highest climate research priorities, irrespective of organizational boundaries within NOAA. PMEL and AOML would retain hiring authority and full management control of all their current personnel. Any research projects at PMEL and AMOL that would be commissioned and funded by the Climate Service would require approval and oversight by OAR's management. Early on, the Climate service should develop template memoranda of understanding or other appropriate agreements with OAR and other NOAA line offices to facilitate routine collaboration of this sort.

If a given OAR or Climate Service office could best provide a high priority climate research deliverable, that office could, with this approach, be more readily funded. If, on the other hand, a given stream of research is completed, other research priorities could then be more easily funded. If contracted research better satisfies priority needs, the Climate Service could invest accordingly. This important budget discipline would greatly strengthen accountability and would appropriately encourage systemic, effective cooperation among NOAA's assets devoted to research regarding climate.

Modeling Functions. The ability to model climate and to explain how it might change over time is an integral part of the Climate Service's research capabilities. Climate models cover shorter to longer timeframes, from days or weeks to years, from decades to centuries. Climate modeling experts help shape research and translate research findings into outputs that can be understood and used more readily by end-users. These functions are, by and large, more operational in nature, and result in the creation of operationally usable products. Aligning

climate modeling functions directly with climate research work will forge from the very outset of research design a closer integration of *what* is being learned with *how* it will be shared and utilized for practical decision making.

The Panel recommends incorporating the Geophysical Fluid Dynamics Laboratory (GFDL) into the Office of Research and Modeling. This organization has a high degree of interdependency with the work of the Physical Sciences Lab and the Chemical Sciences Lab. Climate stakeholders told the Panel that the episodic yet protracted periods when GFDL provides large-scale modeling runs to support the Intergovernmental Panel on Climate Change absorb an enormous amount of senior researcher time and GFDL computing resources. These commitments bring much of the Lab's ongoing modeling work to a virtual halt for months at a time, hampering research work and external collaboration. Finding a way to support national and international assessments without detracting from ongoing modeling research and development would be a good assignment for the new Climate Service leadership team. The solution may have future organizational structure implications.

4.3 OFFICE OF DATA AND INFORMATION PRODUCTS.

The Director of Data and Information Products would be responsible for managing NOAA Climate Service operational activities associated with climate observations, data stewardship and predictions – an integral set of capabilities that will help adapt the best science to support design and delivery of effective service offerings. A career SES appointment, this person would report to the Assistant Administrator through the Deputy Assistant Administrator/Chief Operating Officer.

The Panel recommends that ten existing NOAA components be incorporated into a proposed Office of Data and Information Products: (1) ESRL Global Monitoring Division; (2) Ocean Observing Systems (currently funded by the Climate Program Office); (3) National Ocean Service Integrated Ocean Observing System Program; (4) Tropical Atmosphere Ocean Array; (5) Modernization of the Hourly Precipitation Rain Gauges; (6) Historical Climatology Network Modernization; (7) National Climate Data Center; (8) National Oceanographic Data Center; (9) National Geophysical Data Center; and (10) Climate Prediction Center. These components are proposed to be organized into three divisions: an Observations Division; a Data and Information Products Division; and a Predictions Division. These components are managed out of Boulder, Colorado; Silver Spring, Maryland; Seattle, Washington; and Ashville, North Carolina.

Climate observations, data stewardship and predictions are closely aligned operational functions. To some degree their relation to each other is linear. Climate observation data is first gathered, then stored and formatted for ready access, finally assembled using authoritative research and climate models to yield predictions. Those predictions form the basis of climate services for end-users. The Office of Data and Information Products would aggregate data- and product-centered activities of the NOAA Climate Service. These activities should be aligned and managed collectively as each is informed by the needs of the other, and in some cases requires completion of activities by one before another can move forward. Their work is a bridge

between climate research and services, its mission supported by and supporting both other Climate Service operational Offices.

The Data and Products Division will be geographically dispersed and decidedly operational. They will also support other NOAA line offices. The leadership contingent must organize quickly to forge a cohesive, responsive team inside the new line office.

Observations Division. Numerous observation systems capture long-term trends in climate regarding air, land and sea climate variation and change. NOAA has a distributed array of observing systems used to gather a wide variety of climate and weather data. ***The Panel recommends that there should be an organizational unit within the Climate Service that manages climate observing assets, staff and budget.*** NOAA's proposed building blocks for this element of a new line office include: the Ocean Observing Systems (currently funded by the Climate Program Office); Tropical Atmosphere Ocean Array; Modernization of the Hourly Precipitation Rain Gauges; and Historical Climatology Network-Modernization.

We agree with NOAA that these assets should move to a Climate Service. The Panel proposes that one additional NOAA asset be moved to the Climate Service and housed within the Observations Division: the Integrated Ocean Observing System (IOOS) program.

IOOS is the U.S. contribution to the Global Ocean Observing System. IOOS was conceived to combine both open-ocean and coastal components. Over time NOAA has located the management for ocean observations across several NOAA line offices. These Ocean observing assets are essential to the mission of the Climate Service, although they also collect important non-climate data. NOAA has proposed to consolidate its open ocean observation assets and move them into the new Climate Service. The Panel agrees with this proposal***. The Panel further recommends that NOAA take advantage of this reorganization to consolidate more climate-related observation assets by moving into the Climate Service not just NOAA's open ocean observation components, but also its coastal observation components. To achieve this, the Panel recommends that NOAA move IOOS coastal observing assets currently managed by the National Ocean Service to the Climate Service Observations Division.***

Moving IOOS from National Ocean Service into the Climate Service should not have a negative impact either on the National Ocean Service or on cooperative relationships with the ocean observing Regional Associations. This move does have the potential to improve effectiveness by providing better observations and monitoring from multiple assets. Efficiency would be enhanced by consolidating management of related data collection and stewardship functions. Inclusion of IOOS provides the Climate Service with the full spectrum of marine and atmospheric observations. To the extent that observation and monitoring assets are also used for non-climate functions, the Climate Service will have to ensure that these observing platforms continue to serve well all NOAA missions.

NOAA has proposed to incorporate the Global Monitoring Division (GMD) of ESRL into the Climate Service and suggests it should be bundled with the Office that contains the research and modeling assets. ***The Panel agrees GMD should be included in the Climate Service, but***

recommends it be housed within the Observations Division with other observing and monitoring assets and programs.

GMD (called the Global Monitoring Lab, Figure 2) conducts atmospheric research, observation and monitoring activities. GMD also conducts applied research intended to improve GM's own observation and monitoring capabilities. The Panel finds GMD to be largely operational in nature, producing monitoring data and systems, and it will perform best if a part of the unit responsible for these other operational observation activities.

Data Stewardship Division. Data Stewardship, or what many in NOAA refer to as "data monitoring," includes multiple activities. Data stewardship includes archiving observational data sets from multiple sources – satellites, gauges, buoys, surveys and the like. Data stewardship also entails quality control and quality assurance regarding both current and historical datasets to be archived. These archives must be widely accessible and interoperable in order to conduct analyses that can identify patterns and trends across data sets that are of interest to researchers and decision makers.

NOAA's three data centers – the National Climatic Data Center, National Oceanographic Data Center and National Geophysical Data Center – conduct data stewardship activities and analyses. According to NOAA, the National Climatic Data Center conducts a variety of essential climate functions and is responsible for the stewardship of almost all of NOAA's archived data. The Panel concludes that it makes sense to include this organization within the Climate Service. For the sake of efficiency, the three data centers should continue to be managed in a single line office. There may be additional opportunities to streamline their policies, procedures and management. As all three data centers provide both climate and non-climate services, NOAA will need to institute business practices to make sure non-climate mission requirements are still fully met. These data centers also have dedicated climate services staff that will be discussed further under the Office of Service Design and Delivery.

Climate Predictions Division. Observation and monitoring activities allow us to know what is happening now. Decision makers need to understand what might happen over a longer time horizon, including certainly multi-decadal horizons. The nation needs authoritative short-term and long-term climate predictions and projections focused on all levels where adaptation and mitigation decisions are made – at the local, state, regional, national and global levels. The NOAA Climate Service needs to bring together and strengthen NOAA's climate prediction capabilities. [32]

[32] ***Climate prediction*** is the result of an attempt to produce an estimate of the actual evolution of the climate in the future, for example, at seasonal, inter-annual or long-term time scales. Since the future evolution of the climate system may be highly sensitive to initial conditions, such predictions are usually probabilistic in nature. ***Climate projection*** is an estimate of the climate system to emission or concentration scenarios of greenhouse gases and aerosols, or radiative forcing scenarios, often based upon simulations by climate models. Climate projections are distinguished from climate predictions in order to emphasize that climate projections depend upon the emission/concentration/radiative forcing scenario used, which are based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized and are therefore subject to substantial uncertainty. See: www.ipcc.ch/publications_and_data/ar4/wg1/en/annex1sglossary-a-d.html.

The Panel recommends that the cornerstone of the NOAA Climate Service Predictions Division be the National Weather Service's Climate Prediction Center. NOAA had not proposed that this asset be transferred to the new line office. The Climate Prediction Center (CPC) focuses on forecasts and predictions typically covering a period from two weeks to two years. These include such products as seasonal outlooks for temperature, precipitation and sea surface temperatures. These are applied to address issues such as drought, flooding, soil moisture and El Niño and La Niña cycles. CPC produces a number of periodic assessments, including Global Ocean Assessments, Hazard Assessments and Drought Assessments. CPC is the only NOAA organizational unit with these climate capabilities.

A large number of individuals interviewed by the Panel shared their concerns about the exclusion of CPC from NOAA's Climate Service proposal. CPC is a critical contributor to NOAA's climate efforts, and should be included in the Climate Service. CPC connects to the regional delivery infrastructure of the National Weather Service (NWS) through the NWS Climate Services Division.[33] The Panel carefully considered whether moving the CPC to the Climate Service would disrupt timely delivery of climate products to NWS users or imperil essential collaboration. The Panel is strongly convinced that CPC can more easily continue to meet its mission support commitments to NWS while operating from within the Climate Service than it could meet essential mission needs of the Climate Service operating from within NWS.

As part of the Climate Service, CPC would be a treasured and essential component of the new organization's success. As part of NWS, CPC would remain a valued component within a much larger and established structure, but comparatively less integral to NWS's success. Having CPC inside the Climate Service will underscore strongly that NOAA's leadership expects the Climate Service to meet important service objects both external to the line office and internal to NOAA. From the very beginning, inclusion of this asset within the Climate Service will oblige its leadership team to work even more closely with the NWS, and to prove it can be an excellent partner and manager of assets important to multiple NOAA line offices.

Finally, NOAA does not currently have an organizational component that is routinely and exclusively devoted to generating long term (beyond a two-year period) climate predictions. The Panel was told that NOAA's needs for such longer-term predictions have typically been met by assembling ad-hoc teams on an as-needed basis. Our assessment indicated a strong external demand for predictions and projections for the decadal, multi-decadal and even centennial timeframes at the appropriate scale.[34] ***The Panel recommends that in time, and subject to the availability of adequate resources, the Predictions Division create a new unit dedicated to long-term operational climate predictions and projections.***

[33] This division delivers CPC products to the Climate Focal Points at each Weather Forecast office for local dissemination. It provides feedback on how they are being used in the field and identifies areas where improvements are warranted. This relationship is symbiotic, as NWS is dependent on CPC's products, and CPC is dependent on NWS' field organization to deliver and help refine its products.

[34] NOAA has discussed creating an "Environmental Change Center" to meet these needs.

4.4 OFFICE OF SERVICE DESIGN AND DELIVERY.

The Director of Service Design and Delivery would be responsible for efforts both internally and externally with end-users to design and deliver innovative, effective climate services (including management of a climate portal that includes a roadmap to all federal climate services) to support adaptation and mitigation decisions nationwide. A career SES appointment, this person would report to the Assistant Administrator through the Deputy Assistant Administrator/Chief Operating Officer.

The Panel recommends that the following NOAA program offices be incorporated into the Service design and Delivery Office: (1) the Regional Climate Liaison staff;[35] (2) the Climate Program Office's Communications and Education staff; (3) Regional Integrated Sciences and Assessments; (4)National Integrated Drought Information System; (5) the Cooperative Institutes program; (6) the Regional Climate Centers; (7) the climate services staff currently associated with the National Climatic Data Center, National Oceanographic Data Center and the National Geophysical Data Center; and (8) all the Grants and Contracts units currently housed in the Climate Program Office. These assets are managed by offices in: Ashville, North Carolina; Boulder, Colorado; and Silver Spring, Maryland.

Today NOAA produces and offers a multiplicity of valuable climate services. They provide a good foundation for the new services organization, but the existing NOAA suite of climate services needs strengthening, modernization and expansion. Internal and external stakeholders have made a strong case that the new NOAA line office can be an invaluable aid to making decisions at all levels of society regarding climate adaptation and mitigation – if it can manage to raise the bar for service delivery performance not only by the new NOAA Climate Service, but also by the larger community of federal departments and agencies active in this space.

As proposed, the Office of Service Design and Delivery includes components for: (1) service design; (2) service delivery; and (3) a climate grants division to manage grant programs for external stakeholders and partners. This is the Climate Service office that would arguably have the most interaction with the largest number of climate partners and stakeholders in both public and private sectors. It will be comprised of a relatively small band of outward-facing staff and programs. Its team will drive the design and delivery of a new, more targeted and more robust suite of services. They will work with a toolkit that will certainly not be exclusively of NOAA's own design and execution. Yet this group can be the center of gravity for enormous creativity and innovation in leading a broad collection of actors that will work together to meet societal needs regarding climate. Their core mission is to make tangible the promise implicit in the new organization's title: to be a NOAA Climate *Service*.

Service Design and Service Delivery Divisions. Creation of truly effective Service Design and Service Delivery business units will require building teams that are unusually creative, consultative, responsive and non-bureaucratic. These individuals will often offer to the outside world the most visible face of the new line office. Their collective efforts will provide a constant pulse about Climate Service performance and stakeholder needs. These two divisions will be a switching point for timely information about what works and what does not. They should not

[35] Currently six individuals located within NWS offices and titled as Regional Climate Directors.

seek to "own" external relations in any way that limits access by the Climate Service's larger team to the consultative network that this office would mange on behalf of the line office.

The toolkit of services that the Service Design and Service Delivery divisions will help develop and deploy will certainly not be exclusively NOAA's work. Equally important is the role this team should play in helping to make the nascent federal climate enterprise more robust. Especially if the NOAA Climate Service obtains the lead federal agency role for climate research and services, as advocated by the Panel, this office will have a special obligation to help nurture a deeper portfolio of available services offered from across the federal climate enterprise. And it will have to develop and constantly maintain a comprehensive inventory of federal climate tools available for users at all levels.

This office will need to burnish existing relationships and create others to leverage multiple service distribution channels and networks. Obtaining the greatest value from the federal climate research and services enterprise is the most obvious focus, one that offers early opportunities for success. But strengthening helpful partnerships with state climate officials is also essential. So is continuing successful academic relationships can extend the reach and refine the focus of the Climate Service. Additionally, the Climate Service should invest serious energy to figure out how to help the private sector to access authoritative climate science, models and data so it can directly assist as many climate services users as possible.

The Climate Service need not re-invent the wheel when it comes to already successful ways of interacting with and supporting key stakeholders. It should leverage programs managed from within the new line office, from other NOAA line offices and, of course, from numerous other federal agencies. Just a few examples of such existing programs could include the Sea Grant program, State Climatologists, NWS's Climate Focal Points program, the Office of Ocean and Coastal Resource Management and the U.S. Department of Agriculture's Cooperative Extension agent program, among many others. The Climate Service must rely on partners to meet part of its mission requirements; it will have to dedicate staff to manage these relationships to ensure accurate, timely and consistent delivery of climate products and services.

It is not the intent of this Panel to offer excessively detailed organizational recommendations for this or any other Climate Service office. Although we have made clear which assets the Panel recommends for these two divisions, we have not herein sought to suggest a distribution of these assets within the two divisions. Some flexibility will be needed to balance size, budgets and organizational needs. Just a few additional observations may be helpful regarding certain NOAA assets that the Panel has recommended be incorporated into these two divisions.

In its first days, the Climate Service should act decisively to allocate resources to strengthen relationships with climate executives at the state and local levels. NOAA recently hired six Regional Climate Directors, co-located with the six NWS Regional Offices, to begin the regional engagement. This is a very sensible start, and an initiative that merits early expansion. (Chapter 5 also discusses the role of these individuals, and recommends expanding and refining this force).
If properly hired, trained, empowered and deployed, these individuals will provide an invaluable channel for feedback about what works and what is needed. They should have an important role

in assessing existing and proposed climate products designed for field deployment. Management will need to ensure that there are no gaps in coverage, but geographic assignments will likely flex as the new organization better maps itself to working with its external partners. As they are not *directing* climate activities within a fixed region, we recommend that these individuals have a title that somehow reflects their consultative role, such as *Climate Service Liaison.*

As discussed in Chapter 5, the Panel recommends an early and comprehensive look at the existing Federal Advisory Committee structures that the Climate Service might inherit. We suggest that the Climate Service should re-charter and tailor these tools to fit current needs. The Office of Service Design and Delivery would be an obvious home to manage these structures on behalf of the Climate Service. This might entail replacing or reconfiguring some of the current functions of the NOAA Science Advisory Board.

These engagement efforts should be augmented with more traditional communications, outreach and education efforts. ***The Panel has recommended that the front office have a small communications staff whose head reports to the Chief Operating Officer.*** The Office of Service Design and Delivery would coordinate with and support as needed those front-office capabilities.

The Climate Program Office's Communication and Education Program would be an integral asset of the Service Design and Delivery team. Their role should include public affairs activities aimed at traditional and non-traditional media. This group, with appropriate NOAA approvals, would facilitate climate-related communications across the Climate Service, as well as across NOAA's line offices. This Communications and Education unit also would include informal and formal education efforts, such the design and delivery of climate literacy materials, curricula standards and teaching materials, and support for professional development opportunities for NOAA employees. This division would be an obvious candidate to manage the content if not the network tools needed to support the line agency's web portal, www.climate.gov. The portal is intended to provide easy access to the climate data archived by the Data Stewardship Division and other information resources. Should the Climate Service be given a broader mandate to serve as a clearinghouse for all federal climate data and information, as recommended by this Panel, existing resources would have to be devoted to meeting these expectations.

The Climate Service will need boundary-spanning communications professionals who understand both the science and the user needs. They will need the capability to translate foundational products into audience-appropriate language and format, creating new products and services to meet stakeholder needs while maintaining scientific integrity. NOAA has a number of such professionals within the data centers, NIDIS program, and other parts of NOAA such as the Coastal Services Center. Additional staff with these skills will probably be needed over time to support stakeholder engagement efforts. Some of that new capacity should reside within the Climate Service, and some will reside in the other line offices.

The Panel recommends that the customer service employees at its three data centers be moved into this office. These individuals have experience working directly with customers to identify relevant data, provide data sets, package data sets and produce data products on request. They also provide active outreach to determine what data products NOAA can provide to government and business sectors. The Panel finds that these professionals are already providing climate products and services, and should add to core staff for delivery of climate services. Additionally, these staff will provide a strong bridge between the Service Design and Delivery Office and the Data and Information Products Offices.

The management of collaborations, such as the Regional Integrated Science Assessments (RISAs) and NIDIS programs, should be housed in the Service Delivery Division. RISAs provide region-specific products and climate services. NIDIS is a prototype that responds to the specific need for drought information. Both support stakeholder needs for specific information and ongoing, direct support.

NOAA has proposed that the Climate Service have the capacity to conduct at least three types of assessments on an ongoing basis: International and National Climate Science Assessments; Thematic Problem-focused Assessments; and Climate Information Stakeholder Needs Assessments.[36] The Panel finds that these assessments will enhance NOAA's ability to provide climate services that meet stakeholder needs. The assessments will draw upon experts from across the Climate Service and NOAA, as well as other federal climate professionals. ***The Panel recommends these climate assessment activities should be managed at least in part by Service Design Division professionals who can help guide these assets to ensure that the final products are responsive to user needs.*** Some of these assessments will be used to identify and deliver relevant climate information to support information policy, planning and decision-making; others would be used to inform the Climate Service's strategic plan, annual operating plans and priorities for future activities.

Climate Grants Division. NOAA has a strong history of partnering to supplement its own capacity. Ongoing collaborations occur, for example, through the Cooperative Institutes, the Regional Integrated Science Assessments and the Regional Climate Centers. The NOAA Climate Service would manage what today is already a substantial annual competitive grant program, supporting many parties external to NOAA with climate-related funding.

The Panel recommends that all competitive grant programs related to climate be administratively managed from a single Climate Grants Division located within the Office of Service Design and Delivery. This entity would be the manager for all Climate Service grant programs for external recipients. It would have the obligation to make sure that all appropriate financial discipline, independence and program integrity is maintained. Consistent with Congressional funding mandates, the grant program priorities would be developed and approved in conjunction with relevant Climate Service leaders and other NOAA subject matter experts.

The Climate Grants Division should be resourced to manage a disciplined and ethically scrupulous grant making *process*, not to substitute its views about program *priorities or substantive requirements* for those of the Climate Service leadership or Climate Service subject

[36] Information provided to the Academy by NOAA. The Academy recognizes that this is a draft subject to change

matter experts relevant to a given grant program. Climate Service management would be responsible for providing program funding priorities to the Climate Grants Division. After an award is made, for example under the Cooperative Institute program, a program office within the Office of Research and Modeling, would assume the lead programmatic support role for successful awardees. Not a substantial departure from current practice, this would assist the Climate Service in effective interaction with Cooperative Institute program participants. In other cases, a lead liaison role within the Climate Service might be assumed by a service team or a component of the Office of Data Information and Partnerships. In all cases, any issues associated with pure grant administration issues would be resolved by the Climate Grants Division.

The Climate Service competitive grant programs are not to be confused with internal resource allocation decisions made at the Climate Service. The Climate Service will presumably continue and may enlarge opportunities for its employees to pitch ideas that support multi-discipline collaboration across different organizational elements of the line office. This activity should, however, be accommodated as part of the annual budget cycle planning, and through other resource allocation mechanisms with the Climate Service as deemed relevant during the course of the year. No such resource allocation or contractual authority would be the responsibility of the externally-facing Climate Grants Division. Instead, such issues would be managed by the Office of Management.

4.5 OTHER OPTIONS CONSIDERED AND DISMISSED

The Panel did *not* find itself in any way constrained to consider only the Climate Service organizational structure that the current Administration has proffered (i.e., build a freestanding line office within NOAA). As part of our deliberations, the Panel considered several other conceptually distinct approaches to managing NOAA's climate research and service mission. Each had fundamental flaws. Three rejected concepts are worth mentioning briefly.

First, the Panel assessed whether the existing NOAA matrix management approach to supporting climate research and services was fundamentally effective, necessitating only incremental modifications. We rejected this notion, for many of the same reasons NOAA rejected this option, and as discussed in more detail in Chapter 2, above.

Second, the Panel assessed whether it might be desirable to establish a NOAA Climate Service through some type of merger with the National Weather Service (NWS) – a National Weather and Climate Service. The NWS is a mature organization with a long history and a rigorous operational pace. That pace is crucial to ensure that governments and the public get emergency warnings as quickly as possible to protect lives and property. The bulk of NWS energies are directed towards coordinating data and information from its field offices to produce operationally meaningful near-term weather forecasts, warnings and assessments.

The Panel concluded that weather services and climate services require fundamentally distinct research, operational focus, field structures, timeframes for delivery and professional skills. The user needs for each are vastly different. The NWS has extensive, effective partnerships with a

mature community of stakeholders, both government and for-profit. The proposed Climate Service must forge fundamentally more systematic and deeper partnerships with an expanded and quite different network of stakeholders. The Panel concluded that a forced marriage of weather and climate missions would serve neither well. The weight of NWS history and size would likely dilute and retard success that otherwise can be achieved with a Climate Service that is built as a freestanding line office. Yet clearly, there will be a strong need for close collaboration between the NWS and the proposed Climate Service.

Third, the Panel also assessed whether it might be desirable to establish a NOAA Climate Service through some type of merger with the Office of Oceanic and Atmospheric Research (OAR). This approach would have had the new line office focused on the development and delivery of climate products and services based perhaps largely on research conducted by OAR. OAR conducts world-class research on ocean and atmospheric systems, and research to advance the nation's understanding of the continuum of weather to climate. OAR does not, however, have compelling operational, production or service delivery assets/capabilities needed to support the climate research and service mission.

Again, the Panel concluded that a decision to combine these assets into one line office would serve neither OAR nor the primarily climate-related NOAA assets well. Compelling and thoroughly reasonable demands to strengthen climate research and services would, in this case, over time likely dilute and diminish OAR's unique abilities to support multiple NOAA line offices, including a NOAA Climate Service. All parts of NOAA benefit from OAR's work to incubate fundamentally new approaches to mission-centered science, a capability best sustained by maintaining a nimble, freestanding OAR line office.

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Chapter 5 contains observations and suggestions regarding institutional change management in the federal sector, identifies several management recommendations for stand-up of the proposed line office, and speaks to challenges regarding budget and setting operational priorities.

CHAPTER 5
CHANGE MANAGEMENT CHALLENGES

Managing any significant organizational change in the federal sector presents unique challenges. Establishment of a NOAA Climate Service is a good idea that, like any other organizational change, will present stiff demands during the new organization's start-up phase and in the early years. This chapter is intended to frame a few observations and recommendations that may be of use to NOAA as this new organization is formally launched.

5.1 CHANGE MANAGEMENT IN THE FEDERAL SECTOR

All start-ups have unique attributes and conditions for success. In the Panel's experience, ***three variables disproportionately drive the success of any significant start-up or merger by the federal government.***

First, the idea of the proposed organization has to make excellent sense to a broad public and private constituent base. The new organization has to fulfill an important need. The Panel agrees that the proposed NOAA Climate Service passes this threshold test.

Second, the organization and its mission must have unambiguous support from the Administration and the Department's top leadership team. The Panel is persuaded that the proposed NOAA Climate Service can likely meet this test as well. Yet we note that a number of recommendations presented herein – such as the lead agency designation – will test the degree to which the Administration considers this start-up an important priority. The most visible indication of Administration commitment will be found in the annual budget submissions for the agency. The Secretary of Commerce, the Deputy Secretary of Commerce, and the NOAA Administrator can make a tremendous difference by showing unwavering support and substantial personal commitment to helping the NOAA Climate Service succeed.

Third, the new organization itself must have capable leaders who can work together as a cohesive team to manage creatively the myriad of management challenges that go along with the start-up phase. Managing effectively the critical first weeks and the first year at the NOAA Climate Service can generate a strong reserve of good will to support future success. The team must communicate clearly and relentlessly, both internally and externally, and achieve highly visible, if incremental, successes.

The Panel recommends that the U.S. Department of Commerce leadership team study carefully recent government reorganizations and start-ups to absorb best practices and lessons learned regarding change management. This review should inform: (1) a rigorous NOAA Climate Service implementation plan; and (2) disciplined change management plans needed to stand-up and nurture the new NOAA line office.

Reorganizations within large federal Departments are not uncommon. In the last decade, however, three unusually large federal civilian organizations were created. Two were built from

scratch and one was a massive reorganization: (1) the Transportation Security Administration (created in 2001 to 2002); (2) the Department of Homeland Security (created in 2003); and (3) the Office of the Director of National Intelligence (created in 2005). The Department of Defense (DOD) also executed a number of significant reorganizations during this period, including stand-up of the United States Northern Command (created in 2002 to provide command and control of DOD homeland defense efforts and to coordinate defense support for civil authorities) and the United States Joint Forces Command (created in 1999 to focus on transformation of U.S. military capabilities).[37]

All five of these efforts were much larger and more complex than the proposed NOAA Climate Service. Yet each offers valuable lessons that will shed light on management challenges likely to face the new NOAA Climate Service. Why? Like the proposed NOAA Climate Service, all five stand-ups mentioned above were responsive to high-profile, important national needs. Like the proposed NOAA Climate Service, each of the five required creating a culture of continuous innovation, of iterative and progressive improvement in services. Not everything needed got done on day one. Like the proposed NOAA Climate Service, each of the five was animated by a widely shared sense of urgency regarding the core mission. This was internalized where it mattered most – at what the Coast Guard, Navy or NOAA mariners would call the deckplate level, namely, among the employees who make things happen in the enterprise on a daily basis. Finally, like the proposed Climate Service, each of the five was consciously designed to have extensive formal and informal coordination among numerous other public sector entities.

These five examples are drawn from relatively recent national security and homeland security agencies. It would also be valuable to seek lessons learned from other significant organizational efforts relating to natural resource and research agencies. Two suggestions from Panel members in this regard were the creation of the Environmental Protection Agency (1970) and the National Institutes of Health, which grew from ten components in 1960 to 27 institutes and centers by 1998.

Change management challenges are seldom new or terribly unique. They are, however, terribly important. If NOAA is puzzling through an organizational or management challenge, typically others have puzzled though the same or a similar dilemma. Scouring the recent history related to organizational change and interviewing current and former executives responsible for these agencies would be instructive.

5.2 MANAGING THE STAND-UP AT NOAA

This section offers a few observations to spur thought about how to institutionalize change management at the new line office, especially during the first 12-18 months.

Picking the Team. The Panel has confidence in the NOAA team helping to create the NOAA Climate Service, many of whom will be a part of the proposed new organization. NOAA's deep

[37] Defense Secretary Gates recently proposed to eliminate the U.S. Joint Forces Command as a cost containment measure. This suggests that this organization's history might yield a potentially rich source of management lessons learned, rather than the opposite.

reservoir of employee experience, professionalism and commitment to climate research and services is a strength upon which the new NOAA Climate Services organization can be built with confidence.

Selecting the right management team to lead this new organization is of paramount importance. Presumably a large part, even the largest part, of the new senior management team will be selected from within NOAA. Nonetheless, ***the Panel recommends that senior management positions for the NOAA Climate Service be largely, if not exclusively, selected on the basis of open competition.***

The senior management team should be drawn from the ranks of the career Senior Executive Service, with the exception perhaps of one limited term appointee (Deputy Assistant Administrator for Transition and Change), as discussed below. Doing so will reinforce public confidence regarding the impartiality and authoritativeness of the NOAA Climate Service's work products. The Panel emphasizes how important it is that filling each of these key positions not be an implied entitlement, but in each case awarded to the very best available candidate. It is imperative that each member of the senior management team must be a root-and-branch supporter of the new organization and its mission.

In addition, the Panel recommends that each member of the senior management team have as their primary base of operations – at least for the initial year – the Washington, DC area headquarters facility of the Climate Service. The importance of forging a cohesive management team is extraordinarily important. Certainly each such executive will have extensive travel commitments. But a high value should be placed on having a substantial part of each week available for the team to work together in person on the critical start-up activities. This is work that sets the pace and nature of the organization's future. It is impossible to forge a cohesive team by telephone.

Selection of the Assistant Administrator – the new organization's leader – is critical. ***The Panel simply underscores the need to appoint for the Climate Service an inspired and inspiring leader with terrific management skills.*** In the Academy's view, this person need not necessarily be selected from the ranks of current NOAA employees, but clearly this individual must have substantial experience as an executive, with luminous credentials as a climate expert.

The principal Deputy Assistant Administrator should have chief operating officer duties. This person will be equally important to the organization's success. It might make roles more clear if this position was simply titled "Chief Operating Officer." His or her management and professional credentials should be on a level equal to those of the Assistant Administrator. Clarity about the division of labor between the two top executives is vital, but the Deputy must have the unqualified confidence of the Assistant Administrator and an authoritative mandate to make key operational decisions, and have those decisions stick.

As discussed in Chapter 4, ***the Panel recommends that NOAA should hire a term-limited, Deputy Assistant Administrator for Transition and Change to provide a full-time, systematic focus on managing start-up issues at the new line office.*** This individual should, if possible, be

hired in advance of the launch date and in no case should this individual have any line management responsibilities other than change management at NOAA.

The Deputy Assistant Administrator for Transition and Change should closely supervise the transition agenda on behalf of the Assistant Administrator and the senior management team. This transition agenda must be developed in accordance with a strategic agenda for the line office, and an implementation plan with detailed timelines, deliverables and performance objectives.

This Deputy Assistant Administrator should be a seasoned manager of substantial renown from the private or public sector, having at least some senior federal leadership experience. He or she must have ready access to and enjoy the confidence of the head of the new Service, the NOAA Administrator, and other NOAA leaders. This executive need not be a climate science expert. If successful, this person will gracefully intrude into all parts of the new Service as an innovator, excellent communicator, coach, advisor, nudge, enforcer, performance scorekeeper and bureaucratic obstacle-crusher. It will take considerable personal skill and self-effacing confidence to succeed in this role.

This person should have a small staff, augmented by transition go-teams as described below. The staff should include high performance federal detailees from within the new Climate Service or from other parts of the Commerce Department or the Executive Branch. The Panel has represented this office on our proposed organizational chart (Figure 2) with a dotted-line box to convey our conviction that this should be a temporary appointment (probably hired as a term appointment) that disappears altogether sometime during the second year after the start-up.

In addition to the Assistant Administrator and two Deputy Assistant Administrators discussed above, the new organization's senior management team as proposed by the Panel would include six other executives: the Chief Scientist, and the lead executive of each of the organization's five Office-level components (Management; Policy and Strategic Partnerships; Research and Modeling; Data and Information; and Service Design and Delivery).

The Panel recommends that the NOAA Climate Service utilize every practical strategy available to attract a diverse set of employees and partners to help with standing up the new line office and expanding its reach. The Climate Service will in short order need some employees with new and substantially different experience and skills than may be found inside NOAA today. In building a workforce for the future, the Climate Service should aggressively cast a wide recruitment net.

For example, the Panel recommends that the Secretary of Commerce ask fellow Cabinet members and select governors or mayors active in the climate arena to detail one or more employees to NOAA on a temporary basis. The potential for NOAA of building a long-term program of such loaned executives is considerable. In time, serving a stint at the NOAA Climate Service should be viewed by federal and state climate scientists and senior managers as a career-enhancing and personally satisfying objective, not unlike the value of a joint forces assignment for military officers. Such persons can facilitate, for example, creation of a more robust portal

for aggregating and disseminating information about climate and they can help design federal climate service offerings or constituent liaison tools. [38]

Similarly, the agency should consider recruiting temporarily loaned executives from private sector firms with the technical and management skills needed to accelerate the design of core services. NOAA's Climate Service can achieve a significant boost by extending and diversifying an already rich employee base with new people and assets, especially those needed for the services design functions.

The Climate Service will need a field staff structure that can assist it to understand better state and local climate service needs. NOAA has made a good start by hiring a small cadre of field coordinators, the Climate Service Liaisons described above. ***The Panel recommends expanding the number of the field liaisons to include at least a dozen highly capable, entrepreneurial and mobile representatives. These personnel should focus particularly on meshing the needs of state and local climate officials or public sector users of climate data with the capabilities of the NOAA Climate Service and those of its federal partners.***

Focusing on building the NOAA team obviously entails much more than getting the organization chart right and hiring strong leaders. It is a truism, but nonetheless true, that the organization's employees are the linchpin of future success and that any significant change should be accompanied by extensive, candid and persistent communication with employees. A 2003 study by the Government Accountability Office on federal mergers and transformation put it this way:

> *At the center of any serious change management initiative are the people. Thus, the key to a successful merger and transformation is to recognize the "people" element and implement strategies to help individuals maximize their full potential in the new organization.*[39]

Tools for the Team. Many proven tools or techniques are readily available to the NOAA team to facilitate communications with employees and stakeholders. Looking externally toward its stakeholders, both formal and informal advisory structures will have value for the new organization.

The NOAA Climate Service should take a close look at any formal advisory committees it may inherit and require all formal advisory structures to be re-chartered, starting with a clean slate and fresh charters designed to fit the needs of the new organization. Then they should actively use such committees. This might entail replacing or reconfiguring some of the current functions of the NOAA Science Advisory Board.

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[38] The still-new National Counterterrorism Center has successfully embraced such a program involving key partners, and now routinely brings high performing intelligence community personnel, homeland security experts and federal and state law enforcement officers to the Center for rotational assignments that leverage the Center's workforce and its intellectual gene pool.

[39] U.S. Government Accountability Office, *Results Oriented Cultures: Implementation Steps to Assist Mergers & Organizational Transformations*, GAO-03-669 (Washington: GAO, July 2003), first page (no pagination).

In addition to formal advisory structures, an essential part of the successful launch will be conducting wide-ranging, informal sessions among employees, with federal partners and with NOAA Climate Service partners and stakeholders. These must be planned systematically and executed openly, with results and ideas appropriately captured and shared regularly with the new organization's senior staff.

Structured outreach should include discussions with exceptional leaders from public agencies and private businesses not directly tied to NOAA's mission, such as business executives who might contribute suggestions about relevant information technology or service design and delivery. It is not enough for NOAA to talk with people who have expertise or substantial interest in climate. For example, a small series of brainstorming sessions might be hosted by the Secretary of Commerce to engage technology luminaries and management experts in support of the line office's external communications mission. An objective for the Climate Service leadership team should be to take a portion of every day to support the start-up and help plan for the line office's future evolution.

It is vital to the success of a NOAA Climate Service that its external communications with Congress be especially transparent, routine and candid about line office successes, failures and challenges. Authorizers and appropriators in both chambers will rightfully expect as much. Department and NOAA leadership must make a special effort to make sure that this Congressional outreach occurs on a routine and bipartisan basis. In the years ahead it seems highly likely that Congress will increasingly need to access the best, most comprehensive state-of-art science regarding climate variability and change. ***In short, from the outset, NOAA should pay particular attention to how this new organization can best be configured also to serve essential needs of the Congress as a key stakeholder in its work.***

In its beginning months, the new line office will be compelled to work its way through a myriad of issues related to human resources policy, communications, technology, procurements, mission definition, investment priorities, portal design, partnership agreements and the like. One tested method that has worked with other federal-start-ups has been to create a series of short-term go-teams that orchestrate deep dives into specific decisions and challenges facing the new organization.

Such teams can be chartered to identify and assess options and to structure decision support data. They should be staffed by subject matter experts within the Department of Commerce, with short-term support from other agencies and even with help from private sector volunteers. They should be appointed for a specific task and then disband upon completion (typically lasting no more than four to six weeks).

In the first six months of the stand-up at the U.S. Transportation Security Administration, for example, some fifty such teams were commissioned, completed their tasks and submitted decision options memos to senior management. This process can be structured to use a common report format. The go-teams require only minimal overhead to manage an impressive array of activity. It is essential, however, that each team start out with clear charter, have rigorous milestone reporting obligations and conduct at least a mid-point progress brief with senior management.

The Panel recommends that the NOAA Climate Service make good use of temporary go-teams to help manage start-up issues and options. By spreading some of the work of the start-up in this way, the leadership team can directly involve its employees in the work of shaping the new enterprise. This will build upon the considerable good work already conducted by the NOAA implementation team. One matter ripe for consideration will be how best to preserve among components transferred to the Climate Service a number of important non-climate capabilities that support other parts of NOAA. These include but are not limited to, modeling by the Geophysical Fluid Dynamics Laboratory, geophysical data stewardship by the National Geophysical Data Center or coastal observations by the Integrated Ocean Observing Systems organization.

Absent management tools and techniques such as described above, the array of decisions that will face a relatively small team of NOAA leaders will make those leadership assignments seem like nothing less than a frenzied game of whack-a mole.

5.3 SETTING PRIORITIES AND MANAGING EXPECTATIONS

Balancing Mission Objectives. A significant challenge for the new organization takes the form of an apparent contradiction: NOAA must be at the same time ambitious, yet cautious. On the one hand, it should be constructively impatient to deliver on a bold, innovative plan for what the new line office can accomplish. On the other hand, it must be cautious about appearing to promise more than it can deliver with its existing staff of roughly 700 full-time employees and existing budget.

NOAA's staff has shared with the Panel its provisional thoughts about the new line office's implementation strategy. This includes an ambitious vision of supporting "an informed society anticipating and responding to climate and its impacts" and a mission for a NOAA Climate Service that can significantly help "improve understanding and anticipation of changes in climate, and to promote a climate-resilient society and environment."[40]

The Panel recommends that NOAA's external and internal communications be clear about the fact that its new organization will grow iteratively and progressively, yet more slowly than many would like. It will not be possible in the early months and years to satisfy all of NOAA's own ambitions, much less the many expectations of its external partners and service users. It will be essential that NOAA impose upon itself rigorous and systematic internal discipline to prioritize new research and service offerings.

For these reasons, ***the Panel recommends that the NOAA Climate Service place its highest priority on assisting government executives and managers at the federal, state, tribal and local levels, and on meeting the high priority needs of its federal climate enterprise partners.*** If the new line office tries to serve all possible stakeholders with equal focus in the earliest stages of its operations, it will likely serve none adequately.

[40] The Panel recognizes that this language is subject to change.

This last recommendation may be easily misunderstood. It does not suggest that the NOAA Climate Service suspend or downgrade existing partnerships and cooperative relationships. ***Early focus on strengthening "wholesale" distribution channels for NOAA climate services, as opposed to asset-absorbing "retail" distribution channels, will extend the line office's reach earliest. Such a strategy also will stimulate the private markets to use NOAA data and information to develop commercial climate applications.***

5.4 BUDGET CONSIDERATIONS

Budget Considerations. ***The Panel is skeptical that current funding levels (even as augmented at levels consistent with the President's FY 2011 budget request) will adequately sustain public and private sector needs for climate services and research in the years ahead.***

It would be impossible for this Panel to propose a precise budget for the new Climate Service based on the limited information available to us, and choices still to be made by NOAA. Nonetheless, by its design and because of growing needs, the NOAA Climate Service can reasonably be expected to take on a great deal more than its current workload in the years ahead. It will have to prioritize its new research and service deliverables with tenacious discipline.

Certainly NOAA and Department of Commerce leadership should start with asking this blunt question: What is being done today within NOAA or the Department that might be stopped or dialed back in order to make possible a higher priority investment? Where fair and practical, NOAA should explore assessing fees for its climate services. As the NOAA Climate Service grows, the Congress and the Office of Management and Budget should allow the Secretary of Commerce maximum discretion to steer funds generated by cost avoidance measures at Department of Commerce to nurture the fledgling NOAA Climate Service.

NOAA should determine whether and to what extent it can or should charge for climate products and services. Foundational or general-use products should be considered public goods and made freely available to encourage their use in scientific research and the development by private sector parties of value-added climate products and services. To the extent climate service products are substantially customized to the needs of particular users, they may be considered semi-private goods and some level of user fee may be charged.

The Panel recommends that NOAA make general-use climate data and information products freely available, but that it consider charging fees for customized products and services to cover at least the delivery costs. NOAA should also identify opportunities to refer requests for specialized services to a roster of qualified non-government providers with the aim of stimulating the development of private capacity to provide value-added climate products. This matter may require further assessment by the Executive Branch and Congress and authorization of fee-for-service arrangements.

Even assuming extraordinary financial stewardship, it will be quite challenging to align performance expectations with today's federal budget resources. This budget challenge, we wish to make clear, would be a poor reason to oppose creation of the new NOAA line office. Instead,

the new organization must rigorously assess trade-offs for how best to use all funds that Congress and the Administration make available. ***Managing scarce resources and making choices among competing priorities is likely to be one of the new organization's most difficult management challenges.***

CHAPTER 6
PANEL RECOMMENDATIONS

The Academy Panel makes the following recommendations in service of informing the organizational design and implementation support of the NOAA Climate Service.

PLANNING FOR SUCCESS

PART OF A LARGER ENTERPRISE (3.1)

1. The Panel recommends that capabilities of the federal government regarding climate need to be strengthened considerably on two interdependent but distinct levels: at the *strategic and policy level*; and at the *operational level*, where research, data collection and service delivery takes place. The NOAA Climate Service mandate would be focused on the latter category – operational activity related to research, data collection and services.

2. The Panel recommends that the federal government substantially expand its delivery of regular, impartial and authoritative climate information services to state, local and tribal governments and to the public, especially by: (1) providing more robust and finer-grain information about possible impacts of climate variability and change to guide local decisions about adaptation; and (2) assisting others to access and effectively use models for understanding how mitigation efforts can avert or reduce climate change.

3. The Panel strongly supports the creation of a NOAA Climate Service to be established as a line office within NOAA.

ADMINISTRATION SUPPORT NEEDED FOR THE NOAA CLIMATE SERVICE (3.2)

4. The Panel recommends that the Administration strengthen and expand interagency coordination structures tasked with aligning Executive Branch climate resources. Specifically, the Panel recommends that the President empower a senior interagency group – led at the White House and convened at the Deputy Secretary or Secretary level – to provide the President annually with a strategic plan for management of federal climate research and service delivery.

5. The Panel recommends that it would be extremely valuable, indeed we consider this essential, to have one federal agency designated to be the center of gravity for aggregating and rigorously providing an authoritative roadmap or portal to the best available science that can be harnessed to support public policy decision making.

6. The Panel recommends that a NOAA Climate Service, properly configured and implemented, would be uniquely qualified to serve the public and private sectors as a lead federal agency for climate research and services, and to provide an ongoing accessible, authoritative clearinghouse for all federal science and services related to climate.

ADOPTION OF STRATEGIC AND IMPLEMENTATION PLANS (3.3)

7. The Panel recommends that prior to the start-up of the new organization NOAA should complete and formally adopt two core plans of record for the new organization: (1) a strategic plan; and (2) an implementation plan.

8. The Panel recommends that NOAA should expand current planning efforts to craft a detailed implementation plan to guide effective stand-up of the Climate Service.

9. The Panel recommends that: (1) NOAA should continue the development of its climate portal, and plan for investments necessary to operate a virtual clearinghouse for federal climate information; and (2) NOAA should prioritize opportunities for using state-of-art information technology to expand participation by partners and users in the development of climate products and services, both to leverage its own investments and to produce more robust products and services.

RECOMMENDED ORGANIZATIONAL STRUCTURE

RECOMMENDED ORGANIZATIONAL STRUCTURE (4.0)

10. The Panel recommends aligning the Offices of the NOAA Climate Service around an outcome-based grouping of the organization's three core capabilities, which, like NOAA's own proposal, reflects the core capabilities from existing NOAA line offices that do climate work.

11. The Panel recommends a Climate Service with four primary organizational structures: (1) headquarters leadership and support functions; (2) an Office of Research and Modeling; (3) an Office of Data and Information Products; and (4) an Office of Service Design and Delivery.

HEADQUARTERS ORGANIZATION (4.1)

12. The Panel recommends that the head of the NOAA Climate Service have rank, title and compensation equivalent to the heads of the other NOAA line offices. We further recommend that this individual, the Assistant Administrator, be selected from among the ranks of the career Senior Executive Service (SES) or by a candidate who can qualify for an appointment as a career SES executive.

13. To balance the leadership team, the Panel suggests that at least one of the top two leadership positions be filled with an individual familiar with the culture and operation of NOAA, as well as the culture and history of the component pieces coming into the Climate Service.

14. The Panel recommends the following regarding headquarters leadership positions:
    - The principal Deputy Assistant Administrator should be the NOAA Climate Service's Chief Operating Officer.

- NOAA should hire a term-limited Deputy Assistant Administrator for Transition and Change to provide a full-time, systematic focus on managing start-up issues at the new line office (see section 5.2).
- The Chief Scientist should be responsible for providing technical and scientific advice to the Climate Service, and NOAA leadership. He or she should be responsible for ensuring that the Climate Service's scientific activities are scrupulously objective, scientifically disciplined, transparent, collaborative and responsive to the needs of NOAA and its stakeholders.
- The Office of the Director of Management shall have overall finance and budget responsibilities for all financial management and budget activities relating to the programs and operations of the Climate Service, including annual budget development
- The Director for Policy and Strategic Partnerships would oversee headquarters-level policy management, development and support for strategic partnerships (especially to architect interagency agreements that will support robust federal interagency partnerships) and international affairs.

OFFICE OF RESEARCH AND MODELING (4.2)

15. The Panel recommends that four existing NOAA components be incorporated into a proposed Office of Research and Modeling: (1) the Earth System Research Laboratory (ESRL) Director's Office; (2) ESRL, Physical Sciences Division; (3) ESRL, Chemical Sciences Division; and (4) the Geophysical Fluid Dynamics Laboratory.

16. The Panel finds that bringing the Physical Sciences Division and the Chemical Sciences Division into the Climate Service will allow the new line office to manage basic NOAA climate research that is indispensable to success of the new enterprise.

17. The Panel recommends to Congress and the Administration that all funds to support NOAA climate research – including climate research to be performed by PMEL and AOML – be appropriated annually to a single climate research budget account within the NOAA Climate Service.

18. The Panel recommends incorporating the Geophysical Fluid Dynamics Laboratory into the Office of Research and Modeling.

OFFICE OF DATA AND INFORMATION PRODUCTS (4.3)

19. The Panel recommends that ten existing NOAA components be incorporated into a proposed Office of Data and Information Products: (1) ESRL Global Monitoring Division; (2) Ocean Observing Systems (currently funded by the Climate Program Office); (3) National Ocean Service Integrated Ocean Observing System Program; (4) Tropical Atmosphere Ocean Array; (5) Modernization of the Hourly Precipitation Rain Gauges; (6) Historical Climatology Network Modernization; (7) National Climate Data Center; (8) National Oceanographic Data Center; (9) National Geophysical Data Center; and (10) Climate Prediction Center. These components are proposed to be organized into three divisions: an

Observations Division; a Data and Information Products Division; and a Predictions Division.

20. The Panel recommends that there should be an organizational unit within the Climate Service that manages climate observing assets, staff and budget. The Panel further recommends that NOAA take advantage of this reorganization to consolidate more climate-related observation assets by moving into the Climate Service not just NOAA's open ocean observation components, but also its coastal observation components.

21. The Panel agrees GMD should be included in the Climate Service, but recommends it be housed within the Observations Division with other observing and monitoring assets and programs.

22. The Panel recommends that the cornerstone of the NOAA Climate Service Predictions Division be the National Weather Service's Climate Prediction Center. NOAA had not proposed that this asset be transferred to the new line office.

23. The Panel recommends that in time, and subject to the availability of adequate resources, the Predictions Division create a new unit dedicated to long-term operational climate predictions and projections.

OFFICE OF SERVICE DESIGN AND DELIVERY (4.4)

24. The Panel recommends that the following NOAA program offices be incorporated into the Service Design and Delivery Office: (1) the Regional Climate Liaison staff; (2) the Climate Program Office's Communications and Education staff; (3) Regional Integrated Sciences and Assessments; (4) National Integrated Drought Information System; (5) the Cooperative Institutes program; (6) the Regional Climate Centers; (7) the climate services staff currently associated with the National Climatic Data Center, National Oceanographic Data Center and the National Geophysical Data Center; and (8) the Grants and Contracts unit currently housed in the Climate Program Office.

25. The Panel recommends that the customer service employees at NESDIS' three data centers be moved into the Office of Service Design and Delivery.

26. Panel recommends these climate assessment activities should be managed at least in part by Service Design Division professionals who can help guide these assets to ensure that the final products are responsive to user needs.

27. The Panel recommends that all competitive grant programs related to climate be administratively managed from a single Grants Division located within the Office of Service Design and Delivery. This entity would be the manager for all Climate Service grant programs for external recipients.

CHANGE MANAGEMENT CHALLENGES

CHANGE MANAGEMENT IN THE FEDERAL SECTOR (5.1)

28. The Panel recommends that the U.S. Department of Commerce leadership team study carefully recent government reorganizations and start-ups to absorb best practices and lessons learned regarding change management. This review should inform: (1) a rigorous NOAA Climate Service implementation plan; and (2) disciplined change management plans needed to stand-up and nurture the new NOAA line office.

MANAGING THE STAND-UP AT NOAA (5.2)

29. The Panel recommends that senior management positions for the NOAA Climate Service be largely, if not exclusively, selected on the basis of open competition.

30. The Panel recommends that each member of the senior management team have as their primary base of operations – at least for the initial year – the Washington, DC area headquarters facility of the Climate Service.

31. The Panel recommends that the NOAA Climate Service utilize every practical strategy available to attract a diverse set of employees and partners to help with standing up the new line office and expanding its reach. For example, the Panel recommends that the Secretary of Commerce ask fellow Cabinet members and select governors or mayors active in the climate arena to detail one or more employees to NOAA on a temporary basis. Similarly, the agency should consider recruiting temporarily loaned executives from private sector firms with the technical and management skills needed to accelerate the design of core services.

32. The Panel recommends expanding the number of the field liaisons [Regional Climate Directors] to include at least a dozen highly capable, entrepreneurial and mobile representatives. These personnel should focus particularly on meshing the needs of state and local climate officials or public sector users of climate data with the capabilities of the NOAA Climate Service and those of its federal partners.

33. The NOAA Climate Service should take a close look at any formal advisory committees it may inherit and require all formal advisory structures to be re-chartered, starting with a clean slate and fresh charters designed to fit the needs of the new organization.

34. It is vital to the success of a NOAA Climate Service that its external communications with Congress be especially transparent, routine and candid about line office successes, failures and challenges. From the outset, NOAA should pay particular attention to how this new organization can best be configured also to serve essential needs of the Congress as a key stakeholder in its work.

35. The Panel recommends that the NOAA Climate Service make good use of temporary go-teams to help manage start-up issues and options. By spreading some of the work of the start-up in this way, the leadership team can directly involve its employees in the work of shaping the new enterprise.

SETTING PRIORITIES AND MANAGING EXPECTATIONS (5.3)

36. The Panel recommends that NOAA's external and internal communications be clear about the fact that its new organization will grow iteratively and progressively, yet more slowly than many would like.

37. The Panel recommends that the NOAA Climate Service place its highest priority on assisting government executives and managers at the federal, state, tribal and local levels, and on meeting the high priority needs of its federal climate enterprise partners.

38. The Panel recommends that early focus on strengthening "wholesale" distribution channels for NOAA climate services, as opposed to asset-absorbing "retail" distribution channels, will extend the line office's reach earliest. Such a strategy also will stimulate the private markets to use NOAA data and information to develop commercial climate applications.

BUDGET CONSIDERATIONS (5.4)

39. The Panel recommends that NOAA make general-use climate data and information products freely available, but that it consider charging fees for customized products and services to cover at least the delivery costs. NOAA should also identify opportunities to refer requests for specialized services to a roster of qualified non-government providers with the aim of stimulating the development of private capacity to provide value-added climate products.

APPENDICES

APPENDIX A
PANEL AND STAFF

ACADEMY PANEL

Michael P. Jackson,* *Chair* **–** President, Firebreak Partners, LLC; Former Deputy Secretary, U.S. Department of Homeland Security; Senior Vice President, AECOM Technology Corporation; Deputy Secretary, the U.S. Department of Transportation; Chief Operating Officer, Lockheed Martin IMS Transportation Systems and Services; Member, the Board of Directors, Amtrak; Chief of Staff to the Secretary of Transportation; Special Assistant to the President for Cabinet Liaison, the White House; Senior Vice President, American Trucking Associations; Visiting Assistant Professor, University of Georgia; Researcher, the American Enterprise Institute; lecturer, Georgetown University.

Mortimer L. Downey* **--** Chairman, PB Consult, Inc and President of Mort Downey Consulting, LLC. Former Deputy Secretary, U.S. Department of Transportation. Former positions with Metropolitan Transportation Authority (New York): Assistant Executive Director for Management and Budget; Deputy Executive Director for Capital Programs; Executive Director; Chief Financial Officer. Former Assistant Secretary for Budget and Programs, U.S. Department of Transportation; Budget Priorities Analyst, Committee on the Budget, U.S. House of Representatives; increasingly responsible positions with the Port Authority of New York and New Jersey.

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DeWitt John* **--** Director, Environmental Studies Program and Lecturer in Government Bowdoin College. Led three broad studies of the Environmental Protection Agency - management, mission, and relationships with states and regulated parties-at the direction of the appropriations committees of Congress. The third study, Environment.gov: Transforming Environmental Protection for the 21st Century. National Governors' Association Policy Studies Director for Economics, Trade, and Agriculture, 1985-89. State of Colorado Director, Governor's Office of Policy, 1984-85. Assistant to the Director, Colorado Department of Natural Resources, 1979-84. Represented the state in dealings with federal land management and energy development agencies.

Jerry Melillo – Director Emeritus, The Ecosystems Center at the Marine Biological laboratory in Woods Hole, Massachusetts. Professor of Biology, Brown university; Honorary Professor, Institute of Geophysical Sciences and Natural Resources Research, Chinese Academy of Sciences. Former President: The Ecological Society of America; Scientific Committee on Problems of the Environment (SCOPE). Associate Director for Environment, US President’s Office of Science and Technology Policy, 1996-1997; Fellow, American Academy of Arts and Sciences. Board of Directors: University Corporation for Atmospheric Research; H. John Heinz III Center for Science, Economics and the Environment. Lead author, Intergovernmental Panel on Climate Change, 1990 and 1995.

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APPENDIX B
INFORMATION SOURCES

Accenture. *Climate Services*. Final Compilation Report to NOAA. Washington D.C., December 17, 2008.

Climate Change Adaptation Task Force. *Interim Progress Report*. Washington, D.C.: Council on Environmental Quality, March 16, 2010.

Climate Change Science Program. *Revised Research Plan for the U.S. Climate Change Science Program.* Washington D.C.: Subcommittee on Global Change Research, May 2008.

Climate Science Watch. "Recommendations to the OSTP Transition Team on the Global Change Research Program and Climate Change Preparedness," January 15, 2010.

Coastal States Organization, Climate Change Work Group. *The Faces of Climate Change Adaptation: The Need for Proactive Protection of the Nation's Coasts.* Washington, D.C., May 2010.

Coastal States Organization, Climate Change Work Group. *The Role of Coastal Zone Management Programs in Adaptation to Climate Change.* Washington, D.C., September 2007.

Coastal States Organization, Climate Change Work Group. *The Role of Coastal Zone Management Programs in Adaptation to Climate Change*. Washington, D.C., September 2008.

Coastal Services Center. *Local Strategies for Addressing Climate Change*.: Special edition of *Coastal Services* magazine. Charleston, S.C.: National Oceanic and Atmospheric Administration, February 2009.

H.Rept. No. 111-366, page 636 (2009) (Conf. Rep.).

Department of Commerce. Department Administrative Order: *Department Organization Order Series. DAO 200-7*. Washington D.C., December 7, 1983.

Department of Commerce. Department Organization Order: *Under Secretary of Commerce for Oceans and Atmosphere and Administrator of the National Oceanic and Atmospheric Administration. D0O 10-15*. Washington D.C., May 28, 2004.

Department of Commerce. Department Organization Order: *National Oceanic and Atmospheric Administration. D0O 25-5*. Washington D.C., July 14, 2010.

Dilling, Lisa. "Creating Usable Science in an Uncertain World," presentation at the Center for Science and Technology Policy Research - Consortium for Science, Policy & Outcomes Briefing Workshop. Washington D.C., April 12, 2010.

Elbert W. Friday, Jr., Rapporteur. National Research Council. *Communicating Uncertainties in Weather and Climate Information: A Workshop Summary.* Washington D.C.: National Academies of Sciences, 2003.

Ernst and Young. *Action amid uncertainty: The Business Response to Climate Change.* 2010

Federal Coordinator for Meteorological Services and Supporting Research. *Federal Plan for National Climatic Service.* Washington D.C.: National Oceanic Atmospheric Administration, January 1974.

Federal Leadership In Environmental, Energy, and Economic Performance. Executive Order 13514, October 5, 2009.

Glackin, Mary M. "NOAA Climate Service: Science Serving Society," presentation to the Climate Working Group. Washington D.C., April 7, 2010.

Glackin, Mary M. "NOAA Climate Service: Science Serving Society," presentation to the National Academy of Public Administration Panel. Washington D.C., May 4, 2010.

Glackin, Mary M. "NOAA Climate Service: Science Serving Society," presentation to the American Association of State Climatologists. Washington D.C., July 13, 2010.

Global Change Research Act of 1990. Public Law 101–606; November 1990. Print.

Goodrich, David. "Climate Service FY 10-20 Priorities Climate Observations and Monitoring," to the Climate Working Group. Washington D.C., April 8, 2010.

Goold, Michael and Campbell, Andrew. "Do You Have a Well-Designed Organization?" Harvard Business Review, R0203K, March 2002.

Government Accountability Office. *Climate Change Research: Agencies Have Data-Sharing Policies but Could Do More to Enhance the Availability of Data from Federally Funded Research.* GAO-07-1172. Washington D.C., September 2007.

Government Accountability Office. *Results Oriented Cultures: Implementation Steps to Assist Mergers & Organizational Transformations*. GAO-03-669. Washington, D.C., July 2003.

General Accounting Office, Accounting and Financial Division. *The Chief Financial Officers Act: A Mandate for Federal Financial Management Reform.* GAO/AFMD-12.19.4. September 1991. p 8-10.

Herring, David. "NOAA Climate Services Portal Prototype: A collaborative, NOAA-wide prototyping initiative featuring CPC, CPO, CSC, and NCDC," presentation to the Climate Working Group. Washington D.C, April 7, 2010.

Hirn, Richard. General Counsel and Legislative Director, National Weather Service Employees Organization. *Testimony before the Subcommittee on Energy and the Environment of the Committee on Science and Technology.* U. S. House of Representatives. Washington D.C., May 5, 2009.

Intergovernmental Panel on Climate Change. Online glossary, accessed August 18, 2010, http://www.ipcc.ch/publications_and_data/ar4/wg1/en/annex1sglossary-a-d.html

Karl, T.R., Ravishankara, A.R, Ramaswamy, V., and Shea, E. "Integration of Science and Services (External and Internal)," presentation to the Climate Working Group. Washington D.C., April 7, 2010.

Karl, Thomas R. "Climate Science & Services 101: A case study about climate science in service to coastal communities," presentation to the National Academy of Public Administration Panel. Washington D.C., May 3, 2010.

Karl, Thomas R. “Climate Science & Services 101: A case study about climate science in service to communities facing drought & water issues,” presentation to the National Academy of Public Administration Panel. Washington D.C., May 3, 2010.

Karl, Thomas R. “NOAA Climate Service: Working with Business,” Webinar presentation. April 13, 2010.

Karl, Thomas R. “NOAA Climate Service (NCS) Private Sector Relations: Principles and Guidelines,” presentation to the Climate Working Group. Washington D.C., April 7, 2010.

Klimavicz, Joseph F. “NOAA High Performance Computing Strategy for FY 2010-2015,” presentation to the Climate Working Group. Washington D.C., April 8, 2010.

Koblinsky, Chet. “An Overview of 2010-2020 Climate Goal Priorities,” presentation to the Climate Working Group. Washington D.C., April 8, 2010.

Locke, Gary F. Secretary of the Department of Commerce. Climate Services: *Solutions From Commerce to Communities.* Before the Committee on Commerce, Science, and Transportation, U.S. Senate. Washington D.C., July 30, 2009.

Logar, Nat. “Federal Institutions for Usable Science and Technology,” presentation at the Center for Science and Technology Policy Research - Consortium for Science, Policy & Outcomes Briefing Workshop. Washington D.C., April 12, 2010.

Lubchenco, Jane. Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator. *Expanding Climate Services at the National Oceanic and Atmospheric Administration (NOAA): Developing the National Climate Service.* Before the Subcommittee on Energy and Environment, Committee on Science and Technology, U.S. House of Representatives. Washington D.C., May 5, 2009.

Maricle, Genevieve. “Usable Science in Practice? A Contrast of Earthquake and Hurricane Research,” presentation at the Center for Science and Technology Policy Research - Consortium for Science, Policy & Outcomes Briefing Workshop. Washington D.C., April 12, 2010.

McNie, Elizabeth, Pielke, Roger A., and Sarewitz, D, editors. *SPARC Reconciling Supply and Demand Workshop: Climate Science Policy: Lessons from the RISAs*, Workshop Report. Scholarly Publishing and Academic Resources Coalition. January 26, 2007.

McNie, Elizabeth. “Reconciling the supply of scientific information with user demands: an analysis of the problem and review of the literature.” *Environmental Science & Policy* 10, no. 1 (2007): 17-38.

McNie, Elizabeth. “Delivering Usable Science: The Case of Climate Services,” presentation at the Center for Science and Technology Policy Research - Consortium for Science, Policy & Outcomes Briefing Workshop. Washington D.C., April 12, 2010.

Miles, E.L., Snover, A.K, Whitley Binder, L.C., Sarachik, E.S., Mote, P.W., and Mantua, N. “An approach to designing a national climate service.” *Proceedings of the National Academies of Sciences* 103 (2006) 19616-19623.

Moore III, Berrien, Rosen, Richard D., Rosenberg, Andrew A., Spinrad, Richard W., Washington, Warren M., and West, Richard D. *Review of the Organization and Management of Research in NOAA: A Report to the NOAA Science Advisory Board*. Washington D.C., August 6, 2004.

National Academy of Public Administration, *Improving the NOAA Budget and Financial Management Processes*. Washington, D.C., March 2000.

National Centers for Environmental Prediction. *Strategic Plan: FY 2009-2014.* Washington D.C.: National Oceanic Atmospheric Administration.

National Climate Program Act. Public Law 95-367, September 1978, as amended through Public Law 106–580; December 2000. Print.

National Oceanic and Atmospheric Administration, "Building Blocks of Proposed NOAA Climate Service," accessed August 18, 2010, http://www.noaa.gov/climateresources/resources/noaaclimateservice_org.pdf.

National Oceanic and Atmospheric Administration, "Climate Service Q&A," accessed August 18, 2010, http://www.noaa.gov/climateresources/resources/noaaclimateservice_org.pdf.

National Oceanic and Atmospheric Administration, "Commerce Department Proposes Establishment of NOAA Climate Service," press release, accessed March 2010, http://www.noaanews.noaa.gov/stories2010/20100208_climate.html

National Oceanic and Atmospheric Administration. *Program Review Report.* Washington D.C., May 22, 2002.

National Oceanic and Atmospheric Administration Science Advisory Board. Review of the *Climate Observations and Analysis Program.* Climate Working Group, Washington D.C, May 20, 2007.

National Oceanic and Atmospheric Administration Science Advisory Board. *Engaging NOAA's Constituents: A Report from the NOAA Science Advisory Board*. Extension Outreach and Education Working Group, March 18, 2008.

National Oceanic and Atmospheric Administration Science Advisory Board. *Climate Research and Modeling Program Review*. Climate Working Group, October 23, 2008.

National Oceanic and Atmospheric Administration Science Advisory Board. *Climate Information Products and Applications (CIPA) Program Review*. Climate Working Group, November 17, 2009.

National Oceanic and Atmospheric Administration Science Advisory Board. *Options for Developing a National Climate Service.* Climate Working Group, June 5, 2009.

National Oceanic and Atmospheric Administration. *Advancing NOAA's Priorities through Regional Collaboration.* Washington D.C, March 2007.

National Oceanic and Atmospheric Administration. *Budget Estimates Fiscal Year 2011 Congressional Submission*. Washington D.C., February 2010.

National Oceanic and Atmospheric Administration. *Climate Goal FY11-15 Program Plan*. Washington D.C., October 29, 2008.

National Oceanic and Atmospheric Administration. *Climate Goal Team Program Operating Plan: Research and Modeling Fiscal Year 2011*. Washington D.C.

National Oceanic and Atmospheric Administration. *Climate Goal Team Program Operating Plan: Observations and Monitoring Fiscal Year 2011*. Washington D.C.

National Oceanic and Atmospheric Administration. *Climate Goal Team Program Operating Plan: Service Development Fiscal year 2011*. Washington D.C.

National Oceanic and Atmospheric Administration. *NOAA Administrative Order Series: Initiating and Processing Organizational Changes,* NAO 200-7. Washington D.C., March 10, 2009.

National Oceanic and Atmospheric Administration. *NOAA Climate Service: Proposed to Meet Essential National Needs*. Washington D.C., March, 2010.

National Oceanic and Atmospheric Administration. NOAA Decision Memorandum: *Decisions and Actions from the August 3, 2007, Joint NEP/NEC*. Washington D.C., August 28, 2007.

National Oceanic and Atmospheric Administration. *NOAA'S Next-Generation Strategic Plan*, Version 4.0. Washington D.C., June 23, 2010.

National Atmospheric and Oceanic Administration. *Program Charter for Climate Observation and Monitoring Program*. Washington D.C., June 16, 2009.

National Oceanic and Atmospheric Administration. *Program Charter for Climate Research and Modeling Program*. Washington D.C., June 16, 2009.

National Oceanic and Atmospheric Administration. *Program Charter for Climate Service Development*. Washington D.C., June 16, 2009.

National Oceanic and Atmospheric Administration. *A Strategy for Climate Information Services*. Washington D.C., July 10, 2007.

National Oceanic and Atmospheric Administration. *Strategic Plan FY 2009-2014*. Washington D.C.

National Parks Service. The Inventory and Monitoring Program, Climate Change Monitoring Briefs, accessed March 2010, http://science.nature.nps.gov/im/index.cfm

National Research Council. *A Climate Services Vision: First Steps Toward the Future.* Washington DC: National Academies of Sciences, 2001.

National Research Council. *Fair Weather: Effective Partnerships in Weather and Climate Services.* Washington DC: National Academies of Sciences, 2003.

National Research Council. *Informing Decisions in a Changing Climate*. Washington D.C.: National Academies of Sciences, 2009.

National Research Council. *Restructuring Federal Climate Research to Meet the Challenges of Climate Change*. Washington D.C., National Academies of Sciences, 2009.

National Research Council. *Adapting to the Impacts of Climate Change.* Washington D.C.: National Academies of Sciences, 2010.

National Research Council. *Advancing the Science of Climate Change.* Washington D.C.: National Academies of Sciences, 2010.

National Research Council. *Informing an Effective Response to Climate Change*. Washington D.C.: National Academies of Sciences, 2010.

National Research Council. *Limiting the Magnitude of Future Climate Change.* Washington D.C.: National Academies of Sciences, 2010.

Nohria, Nitin. "Note on Organization Structure," Harvard Business School Note 491-083, Rev. June 30, 1995.

Phillips, Brady and Koch, Louisa. "Engagement Strategy on Climate and Communications," presentation to the Climate Working Group; Washington D.C., April 8, 2010.

Ramaswamy, V. "Climate Service FY 10-20 Priorities Climate Research and Modeling," presentation to the Climate Working Group. Washington D.C., April 7, 2010.

Sea Grant Association. *NOAA Sea Grant's Role in Understanding and Preparing for Climate Change Along America's Coast.* November 3, 2007.

Shea, Eileen. "Climate Service FY 10-20 Priorities Climate Regional Services," presentation to the Climate Working Group. Washington D.C., April 8, 2010.

Smith, J .B., Vogel, J. M., Cruce, T. L., Seidel, S.; Holsinger, H. A. *Adapting to Climate Change: A Call for Federal Leadership.* Arlington, VA: Pew Center on Global Climate Change, March 2010.

Solomon, Susan, Dole, Randall, Feely, Richard, Held, Isaac, Higgins, Wayne, Payne, Jeff, Shea, Eileen, Varanasi, Usha, Westley, Marian. *A Vision For Climate Services In NOAA.* Washington D.C.: National Oceanic and Atmospheric Services, 2009.

U.S. Department of the Interior, U.S. Geological Survey, *Climate Change and Water Resources Management: A Federal Perspective,* Circular 1331, Reston, VA: 2009.

U.S. Global Change Research Program. *Our Changing Planet: The U.S. Climate Change Science Program for Fiscal Year 2010.* Washington D.C.: Subcommittee on Global Change Research, October 2009.

U.S. Global Change Research Program. *Program Overview,* accessed March 2010, http://www.globalchange.gov/about

APPENDIX C
PARTICIPATING INDIVIDUALS AND ORGANIZATIONS

The project team has conducted 40+ stakeholder interviews (through formal interviews, client update sessions, and focus group discussions) to gain a strategic understanding of the current state of NOAA's climate related activities and services.

- Ackerman, Thomas P.: Director, Cooperative Institute-Joint Institute for the Study of the Atmosphere and Ocean
- Andrews, Kacky: Chief, Coral Reef Conservation Division, National Ocean Service
- Armstrong, Thomas: Senior Advisor for Climate Change, Department of the Interior
- Atlas, Robert: Director, Atlantic Oceanographic and Meteorological Laboratory
- Avery, Susan: President: Woods Hole Oceanographic Institution
- Babick, Kristen: Executive Assistant: ICLEI-Local Governments for Sustainability
- Bailey, Jon: Director of Marine and Aviation Operations and NOAA Corps
- Baker, Charlie: Deputy Assistant Administrator, National Environmental Satellite, Data, and Information Service
- Balstad, Roberta: Special Research Scientist, Institute for Coastal Science and Policy; Center for Research on Environmental Decisions; Columbia University
- Behar, David: Deputy to the Assistant General Manager, San Francisco Public Utility Commission
- Benjamin, Georges C.: Executive Director, American Public Health Association
- Bernard, Eddie: Director, Pacific Marine Environmental Laboratory
- Brewer, Jennifer: Assistant Professor/Assistant Scientist, Institute for Coastal Science and Policy
- Brown, Mark: Chief Financial Officer, Oceanic and Atmospheric Research
- Brown, Otis: Director, Cooperative Institute for Climate Services; Ashville, NC
- Brown, Shanna: D.C. Representative, Western Governors' Association
- Brown, Tim: Director, Western Regional Climate Center
- Buja, Lawrence: Director, Climate Science and Applications Program; University Corporation for Atmospheric Research
- Burkett, Virginia: Chief Scientist for Global Change Research; U.S. Geological Survey
- Butler, Jim: Director, Global Monitoring Division, National Oceanic and Atmospheric Administration,
- Carter, David: DNREC, Delaware Coastal Program
- Collins, Dan: Meteorologist, Climate Prediction Center; National Weather Service
- Cooper, Anne: Professional Staff Member, U.S. House of Representatives Committee on Science and Technology
- Daniels, Amy: Climate Change Specialist, Office of Research and Development; Department of Agriculture
- Davidson, Margaret: Director, NOAA Coastal Services Center, National Ocean Service; and Program Manager for Climate Service Development
- DeCola, Phil: Former Senior Policy Analyst, White House Office of Science and Technology Policy; Current Chief Science Officer, Sigma Space Corporation
- Doesken, Nolan: Former President, American Association of State Climatologists; Current President, Colorado Climate Center
- Doremus, Paul: Acting Deputy Assistant Administrator and Director, Strategic Planning, Office of Program Planning and Integration
- Eubanks, Kari Lyons: Climate Change Workgroup Member; Denver Environmental Public Health Department

- Fleming, Paul: Manager of the Climate and Sustainability Group; Seattle Public Utilities
- Fletcher, Kristen: Executive Director, Costal States Organization
- Foley, Gary: Earth Observation Systems Executive, Office of the Science Advisor; Environmental Protection Agency
- Fox, Chris: Director, National Geophysical Data Center
- Fraser, Gerald: Chief, Optical Technology Division; National Institute of Standards and Technology
- Frizzera, Dorina: Environmental Scientist, Coastal Management Office, Commissioner's Office of Policy, Planning and Science; New Jersey Department of Environmental Protection
- Furgione, Laura: Assistant Administrator, Program Planning & Integration
- Glackin, Mary: Deputy Under Secretary for Operations
- Grape, Laura: Senior Environmental Planner and Coastal & Chesapeake Bay Program Manager; Northern Virginia Regional Commission
- Gregg, Margarita: Director, National Oceanographic Data Center
- Halpert, Mike: Deputy Director, Climate Prediction Center, National Weather Service
- Hausman, Scott: Acting Director, National Climatic Data Center
- Hayes, Jack: Assistant Administrator, National Weather Service
- Hazlewood, Catherine: Professional Staff Member, Senate Committee on Commerce, Science, and Transportation
- Higgins, Wayne: Director, Climate Prediction Center, National Weather Service
- Hiza Redsteer, Margaret: Project Chief, U.S. Geological Survey
- Hohenstein, William: Director, Climate Change Program Office; Department of Agriculture
- Horsfall, Fiona: Director, Climate Test Bed, Climate Services Division, National Weather Service
- Hooke, William: Senior Policy Fellow and Director, American Meteorological Society.
- Iseman, Tom: Program Director, Water Policy and Implementation; Western Governors' Association
- Jacobs, Katharine: Assistant Director for Climate Adaptation and Assessment, Energy and Environment Division, Office of Science and Technology Policy, Executive Office of the President
- Jessup, Christine: Science & Technology Policy Fellow, American Association for the Advancement of Science
- Johnson, Zoe: Maryland Department of Natural Resources
- Karl, Tom: Transition Director, NOAA Climate Service; Chair of the Subcommittee on Global Change Research
- Kennedy, David: Assistant Administrator for Ocean Services, National Ocean Service
- Kicza, Mary: Assistant Administrator, National Environmental Satellite, Data and Information Service
- Klimavicz, Joseph F.: Chief Information Officer, Office of the Chief Information Officer/High Performance Computing and Communications
- Koblinsky, Chet: Transitional Assistant Director, NOAA Climate Service; and Director, Climate Program Office
- Krauthamer, Judy: Executive Director, Mid-Atlantic Coastal Ocean Observing Regional Association
- Kulungara, Abraham: Director, Environmental Health; Association of State & Territorial Health Officials
- Lautenbacher, Conrad: Former Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator; Current Vice President for Science Programs, CSC Corporation
- Lawson, Linda: Director, Office of Safety, Energy, and Environment; Department of Transportation
- Levenbach, Stuart: Program Examiner, Commerce Branch; Office of Management and Budget
- L'Heureux, Michelle: Meteorologist, Climate Prediction Center; National Weather Service
- Lindstrom, Eric: Program Scientist, Oceanography; Earth Science Division: Physical Oceanography; National Aeronautics and Space Administration
- Locke, Gary: Secretary of Commerce, United States Department of Commerce

- Lohrenz, Steven: Co-Chair, Board on Oceans and Atmosphere, Association of Public and Land Grant Universities; and Chair, Department of Marine Science, University of Southern Mississippi
- Long, Craig: Meteorologist, Climate Prediction Center; National Weather Service
- Lubchenco, Jane, Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator
- Lulloff, Allen: Senior Project Manager; Association of State Floodplain Managers
- Lyon, Randy: Chief, Commerce Branch; Office of Management and Budget
- MacDonald, Sandy: Director, Earth System Research Laboratory; and Deputy Assistant Administrator for Research Laboratories and Cooperative Institutes, Office of Oceanic and Atmospheric Research
- Manous, Joe: Office of the Assistant Secretary of the Army for Civil Works; and Future Directions Team Leader for the Institute for Water Resources, US Army Corps of Engineers
- McBride, Blake: Arctic Affairs Officer, Task Force Climate Change; Department of the Navy
- McLean, Craig: Assistant Administrator (Acting), Oceanic and Atmospheric Research
- Miller, Jerry: Senior Policy Analyst, Energy and Environment Division; Office of Science and Technology Policy
- Mo, Kingtse: Senior Phys. Scientist, Climate Prediction Center, National Weather Service
- Murawski, Steve: Scientific Programs Director and Chief Science Advisor, National Marine Fisheries Service
- Murray, Jim: Deputy Director, National Sea Grant College Program
- Neff, Bill: Director, Physical Sciences Division
- Noakes, Scott: Assistant Research Scientist, The University of Georgia Center for Applied Isotope Studies
- Ortner, *Peter: Director*, Cooperative Institute *for Marine and Atmospheric Studies*
- Overpeck, Jonathan: Co-director, Institute of the Environment; and Professor of Geosciences/ Atmospheric Sciences, University of Arizona.
- Pulwarty, Roger: Director, National Integrated Drought Information Service Program Office
- Quintrell, Josie: Executive Director, National Federation of Regional Associations for Coastal and Ocean Observing
- Ramaswamy, Venkatachalam: Director, Geophysical Fluid Dynamics Laboratory, Office of Oceanic and Atmospheric Research
- Ravishankara, A.R.: Director, Chemical Sciences Division, Earth System Research Laboratory
- Rector, Lisa: Senior Policy Analyst, Northeast States for Coordinated Air Use Management
- Ribas, Eduardo: Senior Advisor to the Deputy Under Secretary, Workforce Management Office
- Rosen, Rick: Senior Advisor for Climate Research, Climate Program Office
- Rothschild, Tara: Professional Staff Member, U.S. House of Representatives Committee on Science and Technology
- Salt, Terrence “Rock”: Principle Deputy Assistant Secretary of the Army, US Army Civil Works
- Sarri, Kris: Former Professional Staff Member, Senate Committee on Commerce, Science, and Transportation; Current Deputy Director, Office of Policy and Strategic Planning, Office of the Chief of Staff; United States Department of Commerce
- Schwab, Eric: Assistant Administrator, National Marine Fisheries Service
- Shafer, Steven: Deputy Administrator, Natural Resources and Sustainable Agricultural Systems, Agricultural Resource Services; U.S. Department of Agriculture
- Shea, Eileen: Chief, Climate Services Division, National Climatic Data Center
- Spinrad, Richard, Former Assistant Administrator, Office of Oceanic and Atmospheric Research; Current Vice President for Research at Oregon State University
- Swallow, Danielle: Regional Coordinator for National Climatic Data Center, NOAA Climate Service Implementation Team
- Thomas, Gregg: Climate Change Workgroup Member; Denver Environmental Public Health Department

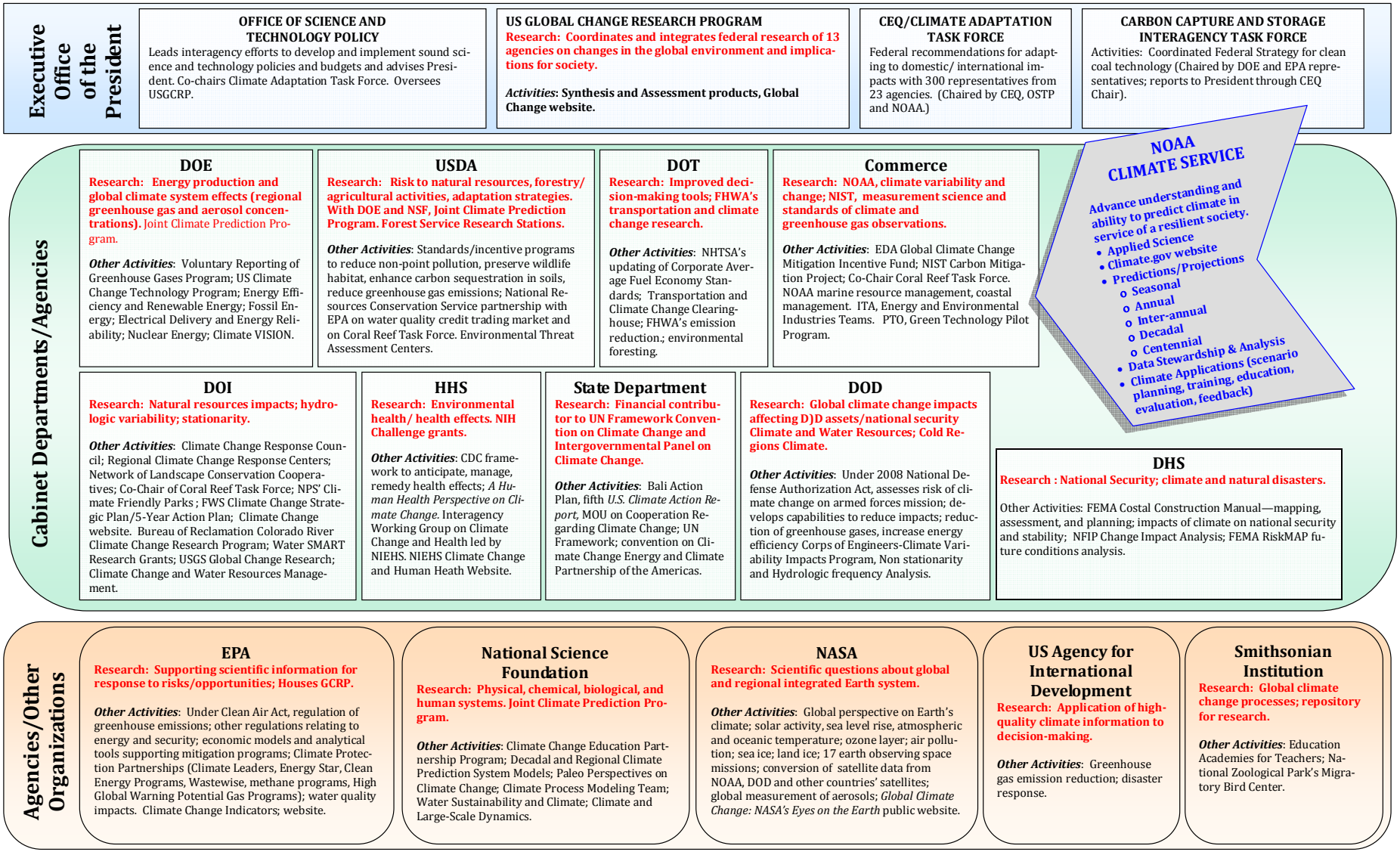
- Wake, Cameron: Research Associate Professor, Institute for the Study of Earth, Oceans, and Space; University of New Hampshire
- Walsh, Margaret: Ecologist, Climate Change Program Office, U.S. Department of Agriculture
- Weirich, Jeremy: Professional Staff Member, Senate Committee on Appropriations; Subcommittee on Commerce, Justice, Science, and Related Agencies
- Welling, Leigh: Climate Change Coordinator, National Park Service
- White, Kathleen: Civil Engineer, U.S. Army Corps of Engineers
- Williams, Shimere: Professional Staff Member, U.S. House of Representatives Committee on Science and Technology
- Willis, Zdenka: Director, Integrated Ocean Observing System, National Ocean Service
- Wylie, Maureen: Chief Financial Officer, Office of the Chief Financial Officer, National Oceanic and Atmospheric Administration
- Xie, Pingping: Research Meteorologist, Climate Prediction Center, National Weather Service
- Zborel, Tammy: Senior Program Associate, Sustainability, Research & Innovation; National League of Cities

APPENDIX D
FEDERAL CLIMATE NETWORK

Many of the stakeholders consulted by the Panel emphasized how difficult it was to understand *who* at the federal level was doing *what* regarding climate – at the operational level and at the overarching policy level. Stakeholders find it difficult to understand clearly which Departments or agencies might be able to offer real help with climate adaptation change and mitigation decisions. In its 2010 report, *Informing an Effective Response to Climate Change*, the National Academy of Sciences stated that "the federal response is difficult to evaluate as there is no clear, accessible, and coordinated roadmap on federal responsibilities and policies" (Report In Brief, page 1).

Figure 3 was drafted by the Academy study team in order to give the Panel a high-altitude graphic that captures key participants in the federal climate enterprise. It has not been reviewed by any of the agencies for accuracy and is offered simply to capture provisionally the scope and locus of work being done at the federal level.

Figure 3. Illustrative Representation of the Federal Climate "Network"



APPENDIX E
FEDERAL ROUNDTABLE SUMMARY

FEDERAL ROUNDTABLE ON THE NOAA CLIMATE SERVICE

On June 24, 2010, the National Academy of Public Administration hosted a two-hour roundtable with federal users and providers of climate information to determine:

- How they currently partner with NOAA in the areas of research and modeling, observations and monitoring, and service development and delivery.
- How they assess their current relationship with NOAA in each of these areas.
- What they need from a NOAA Climate Service in each area.

Sixteen people participated from eight federal departments/agencies:

1. Environmental Protection Agency
2. National Aeronautics and Space Administration
3. National Institute of Science and Technology
4. U.S. Department of Agriculture
5. U.S. Department of Defense
6. U.S. Department of the Interior
7. U.S. Department of Transportation
8. White House Office of Science and Technology Policy

This discussion yielded major observations, each of which is discussed in more detail below.

OBSERVATION 1—Mission Alignment:
The NOAA Climate Service's mission must be aligned with the roles and responsibilities of other agencies within the interdependent federal climate enterprise. The organization should be structured to minimize disruption of existing partner relationships and services.

The NOAA Climate Service is part of a larger network providing climate science, data, products, and services to the nation. Federal partners indicated that it was important for NOAA to "plug into" this existing network, not re-create it. Other federal agencies often have a dual role; they are users of NOAA services, as well as active contributors to climate science and providers of climate information. Given this interdependence, federal partners are especially concerned about the "boundaries" of the NOAA Climate Service—its mission, priorities, and intended services. Other agencies desire more information about NOAA's intended role to understand how they fit within this larger enterprise. By taking full account of other agencies' existing climate activities, NOAA will be able to develop its niche and minimize duplicative efforts across the federal government.

Federal partners need additional clarity on the NOAA Climate Service's primary focus. Will it concentrate primarily on services, or will it have a broader set of responsibilities? What products and services will NOAA be responsible for developing? What will be the responsibility of other agencies? Since NOAA has widely recognized expertise in the areas of oceans and coastal communities, should it play a more limited role in addressing inland climate issues? Federal partners acknowledged that NOAA

should have a leadership role within the broader climate enterprise, but expressed concerns about NOAA attempting to provide science and services for the broader ecosystem, especially since no components from the National Marine Fisheries Service are slated to be moved into the new line office.

At the same time, federal partners acknowledged that it will not be easy to define NOAA's mission because climate is an "emerging space" from a scientific and policy standpoint. There is tension between the desire to define the mission with great specificity and the need to ensure that it is flexible enough to evolve over time to meet new needs. Partners emphasized that development of a NOAA Climate Service will be an "evolutionary process."

From an organizational standpoint, federal partners expressed concerns about how moving NOAA components into this new line office will impact existing partner relationships and services. Particular concerns were that the Office of Oceans and Atmospheric Research may be left with significantly diminished capacity, which, in turn, may adversely affect existing federal partners. Similarly, there were concerns that moving NESDIS data centers may hinder NOAA's ability to consider climate requirements in satellite development.

Because some federal partners said it was not always clear what NOAA is authorized to do under existing statutes, they suggested it may be useful for Congress to provide specific statutory authorization for the NOAA Climate Service. This would allow Congress to weigh in on the mission of the new line office, provide it with specific authorities, and ensure that it has the legitimacy to perform its mission effectively.

OBSERVATION 2—Existing Partner Relationships:
Given the role of other federal agencies in generating climate data and providing products and services, strong partner relationships between NOAA and other agencies will be a critical factor in determining the success of the Climate Service. NOAA and its federal partners have existing relationships that can be built upon and further developed to meet climate needs.

As noted in Observation 1, other federal agencies besides NOAA have significant climate roles and responsibilities. These agencies have long had strong relationships with NOAA's National Weather Service in the area of weather impacts and forecasting. As an emerging field, some federal partners noted that relationships with NOAA's climate organizational units and personnel are still under development.

Several specific examples of existing relationships were cited at the roundtable:

- The U.S. Department of Transportation's Federal Highway Administration is working with NOAA to begin translating climate science for surface transportation providers.
- The U.S. Geological Survey works with NOAA on the ocean-inland interface, reporting that two agencies have worked to develop seamless mapping for Tampa Bay and have done a lot of joint coastal services work in Charleston.
- The U.S. Department of the Interior manages more than 25 percent of the land mass in the conterminous 50 states. As an agency within Interior, the National Park Service works with NOAA in research and modeling, observations and monitoring, and services.
- The U.S. Army Corps of Engineers operates on the regional and local scale. It has relied on NOAA for weather, climate and some hydrology information to help support decisions for its civil works and military programs missions.
- In the wake of the Deepwater Horizon disaster, USGS and NOAA not only have had conference calls about efforts in the Gulf of Mexico, but also conduct joint planning sessions. Additional coordination is needed at the ocean-inland interface between NOAA and USGS to ensure a healthy dialogue exists between the two agencies and prevent duplicative efforts.

- The U.S. Department of Agriculture and NOAA have strong existing partnerships. One example of a successful partnership cited was a Joint Agriculture-NWS facility. Although this is housed at Agriculture, NWS employees are co-located.

In supplemental written information provided to the Panel prior to the roundtable, one federal agency said NOAA has challenges in several key areas:

- Understanding user needs and overcoming the "if we provide it, they will come" mentality of some NOAA staff.
- Ensuring there is continual engagement between researchers and decision-makers to ensure that climate information and services are relevant.
- Administrative hurdles to true partnership development (discussed in more detail in Observation 3).

Some federal partners indicated that they need a clearly defined entry point or points to access the NOAA Climate Service.

OBSERVATION 3—Opportunities to Strengthen Partner Relationships:
To promote further partner relationships, NOAA should work to remedy existing administrative impediments and cost-sharing impediments while instituting additional practices designed to foster collaboration.

Federal roundtable participants emphasized the critical importance of establishing *meaningful collaboration* between them and the NOAA Climate Service on key decisions on climate research and development. Despite the significant effort required to establish meaningful collaboration, the federal partners said it pays significant dividends by ensuring a more seamless connection among agencies' activities.

In the future, some participants said they would like a shift in communications, with users coming to deliverers to identify their needs. It will be important for the NOAA Climate Service to have strong field-based connections and an understanding of its users operational needs. The following additional practices to foster collaboration were suggested:

- **"Umbrella contracts" to streamline administrative processes and decision-making.** Federal partners reported that it is difficult and time-consuming to transfer funds to NOAA components; this has completely derailed some agency partnerships. Administrative problems must be resolved to ensure that federal partners can interact effectively with NOAA for climate information and services. One or more "umbrella contracts" acceptable to NOAA and the partnering agency were suggested as a way to ensure that NOAA components have the authority needed to develop and implement agreements for specific tasks.
- **Co-location of NOAA Climate Service employees with federal partners.** In the past, the Environmental Protection Agency had nearly 100 NWS meteorologists working on-site in laboratories. This helped establish a two-way exchange of information: the agency learned more about NWS' capabilities; the meteorologists developed a greater understanding of user needs. Over time, the number of meteorologists on-site kept declining until it reached zero. As a way to establish meaningful collaboration, the NOAA Climate Service should consider co-locating some staff with their federal partners.
- **Integration of federal partner personnel on an interim basis with the NOAA Climate Service.** It was suggested that NOAA not only engage in "listening sessions" and high-level agency meetings, but also integrate other agency staff who receive the services, possibly on a part-time or rotating basis.

OBSERVATION 4—Future Climate Needs:
Federal partner agencies have significant unmet needs in the areas of climate science, data, products, and services.

To meet the nation's needs, federal partners believed that existing climate data must be improved. Although climate products and services will differ from weather, federal partners reported that the NOAA Climate Service could emulate NWS in the sense of providing usable information, but on a larger scale. Current climate information often is inconsistent across datasets/regions and not accessible in a user-friendly manner. Improvements should be made to the data systems by incorporating geospatial access and providing improved manuals to help users with utilization and navigation.

Federal partners reported that data services are "uneven" and strongest at the regional level; some regions provide more services than others. Climate services currently are largely delivered through soft money projects, not the base federal budget, hindering service development and capacity building.

Climate science and data must be translated for decision-makers. Especially in the vast western part of the nation, federal partners said data often are provided at a high level (such as for an entire state or region); this approach obscures the actual climate impacts (for example, drought or flooding) that individuals experience in their local communities. One federal partner said existing datasets were "too coarse for decision-making at the local level."

Over time, critical data and knowledge gaps must be filled. The U.S. Army Corps of Engineers needs more research on coastal hazards from a historical perspective, especially in the area of climate change impacts. It also needs improved ecological and biological observations. The Navy needs modeling on sea level rise impacts, precipitation, storms, tropical cyclones, Arctic sea ice, ocean circulation, temperature and salinity, and aerosols. This will require observational datasets and model projections on regional and sub-regional spatial scales (on the decadal and seasonal temporal scales), as well as advanced physics and data assimilation techniques. This information will be an input into mission planning, force structure and infrastructure investments, platform/personnel safety, and energy efficiency enhancements. Another federal partner cited wind erosion information as a critical need.

APPENDIX F
STATE AND LOCAL ROUNDTABLE SUMMARY

On July 15, 2010, the National Academy of Public Administration hosted a two-hour roundtable with NOAA's state and local partners in the climate service arena to determine:

- What climate information their organizations need.
- How they get this information.
- If they are getting the information in the most useful form.
- What the most optimal engagement with NOAA would be regarding climate service products/services.
- If their organizations would find it useful to have a single authoritative source for climate service products.

A total of eighteen people participated (six in person, twelve by phone) representing 16 organizations, including representatives of state, county and city governments and umbrella organizations. They were:

1. American Public Health Association
2. Association of State and Territorial Health Officials
3. Association of State Floodplain Mangers
4. California Air Resources Board
5. Denver Environmental Public Health Department
6. ICLEI-Local Governments for Sustainability
7. Maryland Department of Natural Resources
8. National League of Cities
9. National Association of County and City Health Officials
10. New Jersey Department of Environmental Protection
11. Northeast States for Coordinated Air Use Management
12. Northern Virginia Regional Commission
13. San Francisco Public Utility Commission
14. Seattle Public Utilities
15. Western Governors' Association
16. Western States Water Council

The discussion yielded several major observations, which are discussed in more detail below.

OBSERVATION 1—Improving Access to Federal Climate Information:
State and local governments do not always know how to access NOAA climate information and services. Developing a NOAA Climate Service web portal and establishing regional/state coordinators could improve access.

State and local roundtable participants recounted how they access NOAA data; many commented that they typically rely on past relationships, Internet searches and referrals. Depending on the level of government at which they work, they might go to a state agency, academic partner, RISA center, for which they generally have high regard, or a federal official they believed "owns" an issue. Some participants characterized the search for climate information as a "scavenger hunt" across the federal government and expressed a desire for a "single point of entry." Roundtable participants were not aware of a mechanism that assessed their needs. Although participants acknowledged the growth of regional services, particularly for fish and wildlife issues, neither NOAA nor other federal agencies have a state or regional officer to help with state or local climate information needs or challenges. Public health officials said they typically would go first to state officials and then to the federal level, but found NOAA lacking in ability to integrate public health issues with climate. Some regional officials noted that local decision-makers want state-sanctioned data and found state-customized data more useful in state-level decision-making.

State and local officials recognized that NOAA does not have a mandate to manage or control all federal climate information, but the participants agreed that the existing federal climate network lacks a sufficient institutional approach. The group recognized that other federal agencies besides NOAA have significant climate roles and responsibilities. Many have long-standing relationships with the Department of the Interior and Army Corps of Engineers. Several preferred an improved climate service web portal, hosted by NOAA and including historical data.

Participants supported a NOAA regional coordinator concept, where each region of the country would have a dedicated NOAA facilitator.

The regional coordinator could serve a multi-faceted role as it might:

- Facilitate the needs of states and local governments in their regional domain.
- Learn issues important to that region.
- Help customize models to meet local needs—and thus help state or local officials convert and apply NOAA's science to on-the-ground climate adaptation management.
- Become an important conduit for soliciting input from the region.
- Elevate regional concerns or new issues to NOAA management.
- Develop robust relationships that facilitate transmission of NOAA changes in priorities, new or improved products and services or quality assurance issues.
- Serve as a logical point of contact and coordination for regional activities of federal climate partners and thus improve effectiveness.

The NOAA reorganization proposal calls for a Regional Climate Coordinator in each NWS Regional Office, but it appears that the official's initial function would be to inventory regional climate information and develop a list of regional contacts. Participants desired a "circuit rider" to visit state and local counterparts, but the discussion included a reality check in terms of limited budgets. If budget and organizational structure did not permit, the geographic location of the officer might be less important than the ability to understand and assist in state or local climate issues.

OBSERVATION 2—Increasing Coordination of Federal and NOAA Climate Activities:
State and local government participants believe that climate activities across the federal government are not effectively coordinated and that NOAA also should improve coordination of its internal climate activities.

In this evolving space, participants noted the lack of coordination for state and local partners. In the federal climate network, there is little cross-agency coordination of services, as well. For example, NOAA funds numerous grants and projects from multiple sources, with frequent overlap and duplication. State and local officials said they communicate with each other informally and try to understand existing federal climate opportunities, but they believe improved NOAA coordination would add tremendous value and efficiency. One example was the need for federal coordination related to the Federal Emergency Management Agency's role in pre-disaster hazard mitigation plans; state officials noted that these plans do not integrate the potential impacts of future threats and conditions related to climate change.

In establishing the NOAA Climate Service, state and local participants urged the agency to not "just move the boxes," but rather make meaningful changes in business practices to:

- Increase internal NOAA coordination.
- Broaden outreach to governmental customers.
- Capitalize on NOAA's science strengths to make regional or local data collection, analysis and decision-making more science-based and consistent across the country.

A NOAA Climate Service line office would be a logical step in improving internal and external coordination, as would the coordinator concept, noted in Observation 1.

OBSERVATION 3—Establishing Standardized Models and Increasing the Usability of Existing Climate Data:
State and local representatives believe that NOAA and the federal government provide ample climate data on many subjects. The most critical current needs are to establish standardized national models into which other levels of government can plug specific regional, state and local data; and increase the usability of existing climate data by, for example, making it more widely available online and "downscaling" it to the local/zip code level.

NOAA and other federal agencies have a significant amount of climate data, but they often are collected inconsistently across the nation and not always readily usable for decision-making and planning. Although a large number of climate tools and approaches are available, users do not universally understand them. Existing climate change models have not been fully tested in the states. Because there is no consistency across the nation, cross-state analyses "compare apples to oranges." States want to know that neighboring states are using the same models (for example, in sea level rise). More instruction about the use of those tools would add significant value.

Ultimately, the state level needs:

- consistent, valid mathematical models into which they can plug regional and local data
- consistent standards for data collection—for example, they rely on some datasets from 20 years ago collected annually; others have data from 100 years ago collected monthly
- guidance on the appropriate way to use models. Given variations in regulations across states, it is most important for NOAA to provide sound and tested models to adapt to local variations, but sound enough to facilitate comparison and national analysis.

Participants said they need more explanation of, and two-way communication about the data, and they identified "data intermediation" as a major NOAA gap. Climate data should be accessible, transparent, free of technical jargon and translatable into actionable items for state and local jurisdictions. One participant characterized the need for a "reiterative quality"—that is, the ability to update data and replicate models to track trends in a manner that yields consistently higher quality data analysis. They asked for increased transparency of the science behind the data and sources and requested integration of data with Geographic Information Systems and hydrological models.

Examples of data needs include:

- data that cross-walk human health issues with environmental data for health practitioners
- presentation of data that state and local governments can use to plan for economic impacts and take needed actions
- explanation of data and data gaps to highlight what is important and how it can be useful to state and local governments
- routine updates to make climate predictions more iterative, not a "one-off" event
- updated FEMA models for estimating future flood flows. Current models predict the future based on past experience, but do not take into account the likely impact of climate change on the future of rainfall intensity, for example.
- "down-scaled" precipitation and other data to the local/zip code level

Based on this conversation, participants differed somewhat on the extent to which a federal entity, such as a NOAA Climate Service, should be involved in working directly with state/local officials to translate climate data. Some believed that NOAA needed to help states and local governments, particularly municipal planners, synthesize data and factor in future predictions. Others said states, not the federal government, should convert science into useable information for state decision-makers.

OBSERVATION 4—Tailoring the NOAA Climate Service to Existing Agency Expertise:
State and local representatives reported high regard for NOAA's technical expertise, but were unclear about which federal agency is best suited to provide climate adaptation services to state and local governments.

NOAA is a highly regarded source of technical expertise, particularly for weather and climate information. Participants see NOAA's ideal role as promoting fuller and more consistent state and local understanding of current science. Its most significant asset is its state-of-the-art science, which can be used to develop sound and tested climate models for use by state/local officials, RISAs and academic institutions. State and local governments can rely on this "trust factor" in seeking climate data they will use as the foundation for their decision-making. The participants were very supportive of the existing RISAs because they bring governmental stakeholders and academic partners together. Although NOAA is a credible source for certain information, it is not the best source for such issues as the public health impacts of heat waves.

Participants respect NOAA's science expertise, but they questioned whether the existing NOAA workforce has the skills set necessarily to provide significant "services" to state and local governments. Although they recognize that a federal entity should help states with climate adaptation, they were not certain that NOAA was the optimal agency to perform this role. They specifically mentioned the U.S. Department of the Interior—which is establishing Regional Climate Centers and Landscape Conservation Cooperatives across the country—as a likely candidate to fill this role. One participant did a Google search for "climate adaptation" and discovered that NOAA did not show up within the first four pages of results.

No matter the organizational structure, a federal climate service will operate within a context of significantly varying state and local capabilities:

- Some states need assistance in data analysis, while others have sufficient skills and resources to accomplish data analysis independently.
- Some local governments are very comfortable reaching out directly for federal data and working with it, while others do not have this capability.
- Some local government entities, such as emergency preparedness personnel, do not understand how climate change affects them. The federal government could help develop training explaining why climate change should be a focus for disaster preparedness and how it should be addressed.

Given these varying levels of capability, NOAA could leverage its resources to build state and local capacity. Some participants mentioned the desirability of NOAA webinars on key topics to help them update and develop broader and deeper skill sets. Currently, there is no central federal funding for state and local government capacity building, which is especially problematic given state budget challenges.

APPENDIX G
ACADEMIC ROUNDTABLE SUMMARY

On July 27, 2010, the National Academy of Public Administration hosted a two-hour roundtable with NOAA's academic partners in the climate service arena to determine:

- How these partners assess their relationships with NOAA in climate activities, such as what works well and what presents challenges.
- What academic partners need from NOAA with regard to research and modeling, observations and monitoring, and service development and delivery.
- What they believe academia's role should be in supporting a NOAA climate service.

Seventeen people participated (four in person, thirteen by phone) representing 21 organizations, including CIs, RCCs, the Sea Grant program, RISAs and umbrella organizations. In some instances, individuals wore multiple hats; for example, some spoke on behalf of both their university affiliation and a parallel organization. The organizations represented were:

1. American Association for State Climatologists
2. Association of Public and Land Grant Universities
3. Center for Research on Environmental Decisions, Columbia University
4. Climate Science and Applications Program
5. Climate Assessment for the Southwest
6. Colorado Climate Center
7. Cooperative Institute for Climate Applications and Research
8. Cooperative Institute for Climate and Satellites
9. Cooperative Institute for the North Atlantic Region
10. Cooperative Institute-Joint Institute for the Study of the Atmosphere and Oceans
11. Institute for Coastal Science and Policy
12. Institute for the Study of Earth, Oceans and Space
13. Mid-Atlantic Coastal Ocean Observing Regional Association
14. National Federation of Regional Associations for Coastal and Ocean Observing
15. Regional Integrated Science and Assessments
16. University of Arizona
17. The University of Georgia Center for Applied Isotope Studies
18. University of New Hampshire
19. Washington Department of Ecology
20. Western Regional Climate Center
21. Woods Hole Oceanographic Institution

OBSERVATION 1—Improving External and Internal Communications:
NOAA has a key role as a science broker, a translator for climate issues. It needs to define and prioritize its climate goals and activities, establish a clear organization to support that direction, define a path for collaboration, and communicate these decisions broadly.

Roundtable participants believed that lack of focus is a key part of NOAA's communications challenge. Internally, NOAA must first decide what it can do well. Then it needs to communicate its product and service commitments and priorities internally and externally. It must be clear and specific about what it can and will deliver and what it will not address in the foreseeable future.

From an **external** perspective, the participants observed that:

- Climate communication between NOAA and the public is lacking. Climate literacy, particularly at the regional level, is essential to public engagement. Participants believed that an important part of NOAA's mission is to educate the public and stakeholders about climate issues and create and prepare the next generation climate workforce.
- Communication with NOAA can be challenging for stakeholders and partners. Participants believed that this difficulty may be exacerbated by multiple sets of NOAA partners and what they perceive as strategic confusion within the agency about relationships, purpose and work processes. Participants expressed the desire for more substantive, data-driven, informal and less bureaucratic communications. They cited the re-competition process as an example of their frustration.
- Academics need primary liaisons within NOAA to facilitate communications. NOAA must frame research findings and disseminate them effectively.
- At the project level, external communication with partners is quite good.
- Higher level NOAA communications with stakeholders and partners are more challenging.

From an **internal** perspective, the participants observed that:

- NOAA needs to share information on what is working well. It is not capitalizing on its intelligence assets. For example, climate and inundation models work well in some states, but NOAA does not broadly or effectively communicate that information.
- Significant internal stovepipes lead to fragmented communications. It appears that parts of NOAA do not speak to each other and that, like in many bureaucracies, its "left hand does not know what its right hand is doing."

OBSERVATION 2—Focusing on Users and Stakeholders at the Regional Level:
Although global climate change is obviously a significant issue, decisions about adaptation and mitigation must be made at the regional and local levels, because these areas face different climate stressors. The organization and operation of NOAA's Climate Service should be driven by this recognition and have the capability to help local decision-makers prepare for a range of likely climate scenarios.

Climate information needs are broad and often poorly defined. Local decision-makers do not necessarily identify the information they need as being about climate, but rather about some other changing parameter (e.g. sea level rise, precipitation, wildfires). The knowledge about downscaling data and modeling output information from the large scale to the local and regional scale is relatively immature. Both physical and social scientists are necessary. To be successful, NOAA must make a long-term commitment to an ongoing dialogue between providers and users, focus on their climate service needs and help them cope with inevitable uncertainties. Participants urged NOAA to get out of the "linear loading-dock mentality" and co-generate knowledge.

OBSERVATION 3—Assessing and Capitalizing on Effective Partnerships:
NOAA has a role as an integrator for research organizations. It must define its path in this regard and foster true collaboration to accomplish its mission and effectively leverage its limited resources.

In its reorganization, NOAA must demonstrate that it has fully evaluated what has worked and what has not and to reorganize around its successes, strengths, regional needs and perhaps most important, climate stressors, not pre-existing organizational structures or individuals. Roundtable participants urged NOAA to focus on the delivery mechanism, not the bureaucracy.

Over the last 25 years, NOAA has had a long history of positive relationships with a diverse web of partners. However, participants stated it has become more complicated to work with NOAA over the last five to ten years. All parties must work collectively to bring regional efforts into context, with seamless data sharing and NOAA leading the critical data management and integration.

Among NOAA's partners are the RISAs, CIs, state climatologists and federal agencies. Roundtable participants shared their observations on these various partners:

- **RISAs:** The highly regarded RISAs pioneered local and regional dialogue and have proven to be very successful, even with limited funding. Their flexible and project-oriented workforce is a perfect match for NOAA's evolving climate mission. One roundtable participant noted that NOAA is not learning systemically from its RISA experiences.
- **State Climatologists:** The state climatologist network already exists. While this functional shift from federal to state responsibility resulted from a 1970s federal funding cut, the states found they were effective in this service delivery function geared to the local/personal level. Although highly variable from state to state, many offices do a very effective job disseminating climate data and products tailored to state needs and have the capability to provide data spanning a range of space and time scales, with a focus on climate variability and climate change. NOAA's climate structure needs to leverage this existing framework, increase regional collaboration, and avoid duplication of effort and expense.
- **Cooperative Institutes**: CIs were developed and intended to be the primary academic research partnership for NOAA, especially in the basic science of climate, atmosphere and ocean. Participants believed the relationship has deteriorated in the last few years, with NOAA using these institutes as a "contracted resource" rather than vital intellectual resources. These perceived changes have impacted negatively Cooperative Institute effectiveness and their ability to be responsive to NOAA's needs.
- **Federal Agencies**: Without a single national climate research center, NOAA's role as an integrator and interface between existing centers and federal agencies is critical. Participants observed the following:
  - NOAA's structure must be based on effective interagency partnership and the ability to work with multiple partners at all levels simultaneously.
  - NOAA should partner with other federal agencies through the US Climate Research Program to develop and maintain a vigorous research program associated with climate services and continually improve down-scaling methods and results.
  - NOAA is to be commended for identifying its climate reference network of 114 surface stations and including routine measurements of surface fluxes. However, it must expand this network in conjunction with other agencies, such as the U.S. Department of Energy.
  - NOAA must be part of climate collaboration. As an example, there was an earth systems modeling call among federal entities. NOAA did not participate.
  - Other federal agencies are key NOAA climate service customers; they need quality-assured, locally scaled data.

OBSERVATION 4—Providing Best Practices for Climate Data and Services:
Some roundtable participants believed that NOAA can add true value by providing decision-makers with best practices or legally defensible certified data and models, with appropriate acknowledgment of uncertainties. These NOAA-provided data could help inform risk-management decisions and set a standard for collecting and presenting climate data.

Global models are necessary to understand overall changes in the Earth's climate system. U.S. decision-makers, however, need NOAA to provide regional multi-model ensemble approaches, high resolution regional models and coupling model systems for sector decision support. One roundtable participant characterized the current climate data environment as the "Wild West," with a wide array of actors, including private sector consultants, peddling information to decision-makers. Within this context, it is challenging to determine which data and models are valid and reliable.

NOAA can provide observation baselines and information, identify the information sources, quantify and communicate major uncertainties associated with its data, and determine which products will be provided, at what intervals and with what metrics. Decision-makers need jargon-free, clear, and actionable data on the likely three- to five-year climate impacts. Users need higher resolution outputs—that is, more locally-based information to make on-the-ground, front-line decisions. NOAA is not providing data on the scale needed by those making expensive decisions for their regions. Participants also saw a role for NOAA in connecting existing public and private sector data and decision networks.

Within the academic community, participants noted a cultural shift in how climate services are viewed. In the past, climate service was a "bad word" because academics were expected to do climate science and research. More recently, the academic community has begun to place great value on climate services as a way to translate research into meaningful applications.

OBSERVATION 5—Developing a Modern Climate Structure and New Competencies:
Roundtable participants believed that the NOAA Climate Service must be broad, deep, innovative, flexible and evolutionary. Within this new structure, federal, university and other partnerships will be critical as will a host of new and enhanced competencies.

The NOAA Climate Service should be developed as a partnership where NOAA provides large-scale information—including data, model output, and interpretive guidance—to a national network of local partners. Many partners would be associated with academic institutions responsible for providing local down-scaling and interpretive guidance for local users. Although NOAA has made strides in leveraging partner resources, it should at a minimum work through the RCCs for more customized product development. At this point, NOAA is not widely using local scale data given the difficulties and expense. An important first step is to understand what is needed locally in terms of variability and seasonality.

NOAA also must build bridges between its highly valued research and operations. NWS has had success in translating its research and models into operations because they are very established and widely accepted. This has been more difficult in the climate arena because this field's science, research and models are at an earlier stage of development. NOAA is increasingly supporting knowledge-to-action networks and trending toward more integration across physical, biological, and social sciences. Yet, roundtable participants believed that it lacks a cohesive vision for how climate efforts come together.

When asked for feedback on the structuring of the NOAA Climate Service, roundtable participants had several comments:

- The structure should be driven by the needs of stakeholders and users, not existing NOAA organizations and personnel.
- It should move toward contextualizing climatological predictions within integrated/trans-disciplinary understanding of less predictable human-environment systems and have the capability to explain a range of likely climate scenarios.
- Some believe that NOAA's use of the existing NWS regional structure for climate is inappropriate. The Climate Service's regional boundary lines should be defined by the major climate stressors.

For example, the NWS regional office cannot effectively serve the needs of the Intermountain West and Pacific Coast from Canada to Mexico in terms of climate variability or projected climate change.

- The proposed structure does not adequately recognize that the academic community does most down-scaling and communication with the user community.
- Given the magnitude of the data delivery and data management climate service plan, it is appropriate to incorporate the NESDIS data centers in the new organization. However, the new organization also should include the NWS Climate Prediction Center to avoid disconnects in NOAA's climate modeling capabilities.
- NOAA's reorganization proposal should make clear that the long-term archiving of NASA satellite data is a priority. Roundtable participants were concerned that NOAA perpetuates the existing problem that NOAA satellite measurements primarily are devoted to weather goals and only tangentially to climate measurements.

Roundtable participants also identified workforce issues that NOAA must address as it develops the Climate Service:

- NOAA employees must be able to think more entrepreneurially, transfer technology to other sectors and develop strong stakeholder partnerships.
- Natural scientists must collaborate with social scientists and non-academic partners to make their work useful; this requires boundary-spanning, mutual learning and willingness of bio-physical scientists to accept the validity of qualitative, sociological findings.
- NOAA has developed strong expertise in ocean and coastal issues, but does not have the same level for atmospheric issues. To perform its climate mission, NOAA must develop additional internal expertise or leverage the expertise of federal and non-federal partners.
- The workforce must be flexible and project oriented, and shift rapidly as stakeholder needs evolve. Because academic institutes already function this way, they can be a useful partner in providing the necessary agility.
- Climate service employees need different education and training than weather service employees. Support staff would benefit from public sector and science backgrounds.
- NOAA does not have sufficient in-house resources to do the required product and service development for climate; employees need additional organizational and process skills to foster relationships and translation skills to ensure that climate science becomes usable information for decision-makers and the public.
- Additional interdisciplinary skills are needed. Partners do not make decisions on climate science alone, so NOAA must develop or leverage expertise in areas like social science, ecosystem issues, water issues, policy analysis, economics, law, and decision-science.
- NOAA employees must conduct multi-faceted assessments within an ongoing, iterative process and need to draw on local expertise on regional climate dynamics and influences.

APPENDIX H
ONLINE DIALOGUE SUMMARY

From June 14-28, 2010, the National Academy of Public Administration hosted an online dialogue with climate information users and providers to determine how the NOAA Climate Service should engage them.

Individuals across the nation discussed and recommended ideas, tools and approaches for how the Climate Service can best engage stakeholders over time to meet the need for climate information and services. Several questions were posed to participants to stimulate discussion on engagement, including:

- What is driving your need for climate information or services?
- What climate information and services do you find most useful currently and why? Who provides them?
- How could your access to climate information and services be improved?
- What mechanisms would you recommend to enable ongoing communication of your climate information and service needs to NOAA?
- How should the NOAA Climate Service engage with other providers of climate information and services to meet your information needs?

This discussion yielded several major observations discussed below.

OBSERVATION 1 - National Climate Enterprise:
The NOAA Climate Service's mission and activities must align with the roles and responsibilities of other agencies within the interdependent, national climate enterprise. The organization should be structured to minimize disruption of existing partner relationships and services with other federal, state, and local agencies, academia and the private sector.

The NOAA Climate Service is part of a larger network providing climate science, data, products, and services to the nation. Participants recommended that the Climate Service be integrated into this larger effort. They had various opinions about what this might mean, including:

- Agencies with existing expertise and capacity to collect, analyze and disseminate data, information, and services should continue to conduct these activities.
- Other agencies should have leadership roles with respect to their sectors. It was unclear what participants meant by sector in this context. It may be for an activity, such as a specific data collection effort or interaction with a specific group, such as an established relationship with states for certain issues.
- NOAA should not set mitigation policy, but can facilitate the infrastructure needed to produce greenhouse gas emissions and removal data.

Several participants emphasized the importance of clearly defining agency roles and responsibilities to avoid unnecessary duplication. This is critical for a system of various agencies to produce data sets, products and services in an integrated manner to meet user needs. Protocols and a system for quality assurance and quality control are needed to ensure that each partner meets its obligations, information can be aggregated regardless of source and decision-makers can have the confidence they need to use the outputs of the enterprise.

Additional roles for government agencies included maintaining and expanding observational platforms; maintaining data centers that archive and provide access to data; and providing services to end users that make use of the best available data and decision support systems. It was not clear whether these were to be a leadership role for the Climate Service or shared by the broader suite of agencies within the climate enterprise.

To have a cost-effective climate enterprise, participants indicated that public and private organizations must work together to provide value-added climate information, products and services. These would be provided to paying customers, saving taxpayers money and providing an opportunity for economic growth. There is a robust weather enterprise that already produces weather and climate products and services. To foster growth within this sector, it was suggested that NOAA open access to data, model predictions and other climate information in a manner similar to what already exists for weather.

OBSERVATION 2 - Maintaining and Fostering Partnerships and Collaboration:
A distributed climate enterprise requires partnerships and collaborations among public, private, academic and non-profit sectors. The NOAA Climate Service should maintain and strengthen existing partnership efforts and foster new ones to improve the provision of climate data, products and services.

As noted in Observation 1, the national climate enterprise is composed of a cross-section of federal, state and local government agencies working collaboratively with each other and with academia, non-profits and the private sector. Many participants indicated that these collaborations were critical. One stated that the NOAA Climate Service must be flexible, entrepreneurial and opportunistic in its approach to take advantage of opportunities as they arise. It also was recommended that resources be put in the hands of those working on problems at the ground level. Local governments were considered to be on the frontlines of climate change mitigation and adaptation efforts.

Another participant stated that there are major opportunities to increase cooperation to target important practical problems and issues. This will reduce inefficiencies that arise due to inadequate levels of cooperation and coordination. Several issues were mentioned as areas that would benefit from additional collaboration, including water resource management, agriculture, forest management, land use, pollutants, energy use and mapping of illness distribution.

It was suggested that NOAA go beyond traditional partnerships and seek strategic ones with affected sectors. It must make more compelling cases to encourage these non-traditional partners to engage. It also was suggested that NOAA leverage partners that people may relate to on a personal and community level, such as public gardens.

Several specific examples of existing partners or opportunities for new partners were cited in the dialogue:

- Other NOAA Components—NWS, NWS Storm Spotter Networks, Climate Prediction Center, Weather Forecast Offices, National Marine Fisheries Service, NOS, National Centers for Coastal Ocean Science, Office of Ocean and Atmospheric Research
- Sea Grant Extension
- Regional Integrated Science Assessments
- International Research Institute for Climate and Society
- Regional Climate Centers
- Cooperative Institute for Research in Environmental Sciences
- U.S. Climate Change Science Program/Adaptation Task Force
- National Institutes of Health
- Public Health Service
- U.S. Geological Survey
- NASA
- National Science Foundation
- U.S. Department of the Interior
- Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Department of Agriculture
- U.S. Department of Transportation
- U.S. Department of Defense
- National Estuaries Program
- Cooperative Extension
- State Climate Offices
- State Agencies
- Southeast Climate Consortium
- Non-Government Organizations
- Cultural institutions, such as the American Public Gardens Association
- Private Sector
- Universities

OBSERVATION 3 - Single Climate Voice:
The NOAA Climate Service should be the authoritative voice on, and location for, climate data, information and analysis.

Dialogue participants said the NOAA Climate Service should be the single location for historical and predictive climate information; the authoritative voice on climate for the U.S. climate enterprise for regional and global scales; and the lead agency for collection and dissemination of climate information. One argued that NOAA should be the home of a National Climate Service given its "long track record providing climate information and significant institution capacity." Another stated that there should be no single voice, but multiple federal voices and approaches. Still another argued that climate forecasts are not reliable enough to warrant their continuation and establishment of a Climate Service.

One participant described the current U.S. climate enterprise as a "patchwork quilt" of uncoordinated effort and information by federal, state, local and non-government organizations. At the federal level, the "extent of climate information is overwhelming and often duplicative." One participant suggested a federal consolidation of climate activities and cessation of others to save money and improve climate information. Establishing a single voice and source would improve researchers' and decision-makers' ability to understand and communicate about climate.

OBSERVATION 4 - User Needs:
The NOAA Climate Service must conduct science to meet user needs. This requires sustained two-way communication to understand what users need and how they use the information.

Many participants emphasized the importance of ongoing interactions with people in their regions. Building this relationship takes time and commitment; it begins not by telling users what they need to know, but asking them about their goals, issues, concerns and values and understanding their motivation.

Climate Service services should be demand driven, with a robust two-way communication with end users and particular emphasis on the customer at the regional, state and local levels. Participation is not a one-time event; it is an ongoing dialogue—an essential feedback loop—about user needs for climate information, services and decision support at relevant scales. This feedback, coupled with formal evaluations, will enable the Climate Service to improve its science and service for users. Some municipalities will be very sophisticated, while others will need easily accessible data with a minimum of specific expertise interpretation.

Using existing infrastructure will be less expensive and more efficient than developing a new delivery system. This will allow climate services to make an immediate impact by taking advantage of trusted, existing relationships and partnerships. Additionally, it avoids the burden of stakeholders attending additional meetings with new people with whom they have no previous experience. Examples of existing partnerships and delivery mechanisms include the NWS Weather Forecast Offices, National Climatic Data Center, Regional Climate Centers and the State Climate Offices.

Meeting the users' needs will require the NOAA Climate Service to improve its knowledge of climate science. This includes strengthening its understanding of complex climate systems, enhancing climate models and improving the resolution of data at the scale and scope that decision makers need with specific emphasis on regional and sub-regional scales. It was suggested that NCS pursue research on the variability of climate impacts on diverse socioeconomic, racial/ethnic, age and gender groups; and the effects on these groups resulting from public and private planning for and response to climatic events.

OBSERVATION 5 - Meaningful Access to Data:
The NOAA Climate Service should provide easy access to climate data, and organize and present them in a useful manner to users at multiple scales.

Many participants believed that the NOAA Climate Service should provide easy and on-hand access to climate data, information and analysis. The data should include NOAA's efforts, as well as those of its partners and collaborators. Participants stated that data sets should be made available in standard formats where possible; however, others noted that standardization is challenging given the needs and parameters of individuals or groups. A common theme of the Dialogue was that the Climate Service provide "knowledge products," not just data tailored to users. For example, a participant suggested that it provide more web-based, visual products like NWS and National Hurricane Center.

OBSERVATION 6 - Data Management:
The NOAA Climate Service should become an effective clearinghouse for climate data.

The NOAA Climate Service should provide data that are credible, robust, unbiased, verified, timely and consistent over time. It should have clear quality assurance data standards for itself and its partners. Discussions about its role in the management of climate data varied. One participant felt that a Climate Service should lead the coordination of data information systems across the U.S. climate enterprise. Another focused more narrowly, stating that one should own all of the climate data within NOAA because it is currently fragmented across the organization. There was another suggestion that NOAA establish a single information technology solution for data archiving under the NOAA Chief Information Officer. NOAA should improve upon its "slow quality check out process" for releasing data.

OBSERVATION 7 - Translation:
There is a critical need for "translation" to bridge the gaps between providers and owners of climate-related information and those who need them; as well as between research and operations as they relate to climate change.

There is the need to provide a systematic approach, driven by user requirements, to sharing climate change science research and analysis that enable decision-makers to address adaptation and mitigation with valid, scientific data. However, many climate science data are in the "science domain", and the hands of academics and researchers in universities and government laboratories. Participants identified the need to translate science research into formats that are accessible and relevant to decision-makers. Understanding the needs of policy- and decision-makers, as well as behavioral responses to threats and consequences of climate events, have lagged behind the progress in forecasting and contributed significantly to this gap. The NOAA Climate Service should work with the non-science community to convert the data, models and information resources into knowledge in action for the benefit of society.

The Climate Service can help researchers and experts better communicate their research "how they know what they know" and demystify the science process. They can engage with communities through trusted sources, making climate science and solutions relevant and accessible in a local and regional context. Researchers can engage stakeholders by partnering with such boundary organizations as Cooperative Extension, Sea Grant Extension and appropriate NGOs. Investigators in the regions can work directly with boundary organizations to use climate information provided by NOAA and translate it to meet stakeholder needs, which differ among sectors.

OBSERVATION 8 - Climate Literacy:
The NOAA Climate Service must build climate literacy within NOAA's workforce and the public.

The NOAA Climate Service should increase its agency's climate literacy. Most NOAA program staff do not have adequate training in basic climate science, climate change impacts on natural resources their program manages, or climate resources that NOAA has developed for partners and the public. NOAA and the Climate Service should develop literacy training for all programs and regions, with emphasis on the human and environmental resources for each one.

To be effective, the Climate Service should spend as much time communicating how science can tell us as much about the solutions as it can the problems. Increasing climate literacy among decision-makers and the public will enhance their ability to understand and act on these issues. The Climate Service should expand "climate literacy" concepts to include approaches to address climate impacts on energy, transportation, food production, human systems and, architecture. By sharing potential solutions and suggesting actions to alleviate environmental stresses, it will inspire stewardship, not instill frustration or apathy.

Climate literacy can be achieved partly through education. Education, outreach and communication are a continuum that runs from formal to informal education, to outreach by scientists, to institutional communications. Participants offered examples of how this could work in practice. One suggested that educational efforts embrace best available practices in community education and social marketing. Another stated that state-level educators must be engaged in training efforts so that climate science and solutions can be shared in a more distributed fashion. The education efforts of federal climate partners should be coordinated. Finally, one argued for leveraging existing programs, such as the Storm Spotter Network, to raise awareness of climate change impacts and mobilize a mitigation and stewardship response.

OBSERVATION 9 - NOAA Climate Service Structure:
Dialogue participants had specific concerns and comments about what NOAA has proposed to include in its Climate Service and the impact on current and future operations across NOAA.

Climate activities crosscut every NOAA's line office. A concern was that these offices are "stove-piped" and historically have interacted poorly with each other. It was suggested that serious matrix management of climate activities would be preferable to establishment of a Climate Service, which only does pieces of

the job and inhibits the rest of the organization due to its construction. Others thought this reorganization logically should flow from various line office missions. The Climate Service should develop liaisons for all NOAA line offices that would coordinate within their respective lines. Finally, a Climate Service must be distributed, not located entirely inside the beltway.

Several participants had specific comments about what NOAA has proposed to include in the Climate Service and the resulting impact on NOAA's other components. Among them:

One said, much of NOAA's research—OAR—is fundamentally climate oriented, yet is being split in an arbitrary way. This could damage OAR in ways that cannot be compensated. The Climate Service should derive from all parts of NOAA, not primarily from OAR (40 percent of OAR's overhead costs).

It should be noted that much of the essential observational work is not slated to be part of the Climate Service. In particular, NOAA's Ocean Observations for Climate are done at Atlantic Oceanographic and Meteorological Laboratory and Pacific Marine Environmental Laboratory—neither of which are slated to transition to the Climate Service. However, the OAR Climate Program Office, which provides funding for observations, is proposed to move. Others were concerned about what happens to the remainder of OAR once half its programs and budget moves to the Climate Service. One suggested that unless OAR is disbanded and "ocean" programs are integrated into other line offices (an expensive proposition), there will be more government infrastructure.

Several participants were concerned that the Climate Prediction Center (CPC) is not included in the NOAA proposal. CPC is a well-known provider of science-based climate information, predictions and outlooks with an established set of products, customers and linkages to other government organizations and academia. Not including CPC in the Climate Service may result in cross-line office bureaucracy and a less effective research-to-operations process for weeks-to-seasons research. One suggested that CPC should move to the new line office, but remain physically co-located with the NWS at the National Centers for Environmental Prediction; this might serve as an efficient bridge between the two.

Whatever the structure, participants were concerned that a new line office was unrealistic absent new funding. One participant offered that additional monetary support of regional and local climate service providers would improve the level of service to stakeholders.

ONLINE DIALOGUE ENGAGEMENT AND PARTICIPATION ANALYSIS

More than 1,300 people visited the Dialogue site, and 134 people registered to participate. Of those registered participants, 45 people submitted 52 ideas and 117 ratings, and offered 72 comments related to those ideas. The Panel targeted a wide range of stakeholders, including both NOAA employees and those external parties. Participants self selected to engage in the Dialogue. This analysis focuses on two broad categories of metrics:

- ***Engagement metrics*** measure the amount of overall traffic to and activity on the site, including Unique Visitors, Total Visits and Page Views. An additional metric is the "bounce rate" – a measure indicating the "percentage of single-page visits or visits in which the person left [the] site from the entrance (landing) page."[41] The Dialogue team used a free Google Analytics tool to collect this information.

- ***Participation metrics*** measure active involvement in the Dialogue. Participation metrics collected here included registered users[42], users who submitted ideas, and those who participated by voting or commenting on another's idea.

Engagement Analysis

As Table 6 shows, the Dialogue website saw more than 2,300 visits from more than 1,300 unique visitors over the 15 days it was live. On average, visitors spent six minutes on the site and viewed about six pages per visit. The site's bounce rate was 35 percent, indicating that the majority of visitors clicked through the site to at least one additional page.

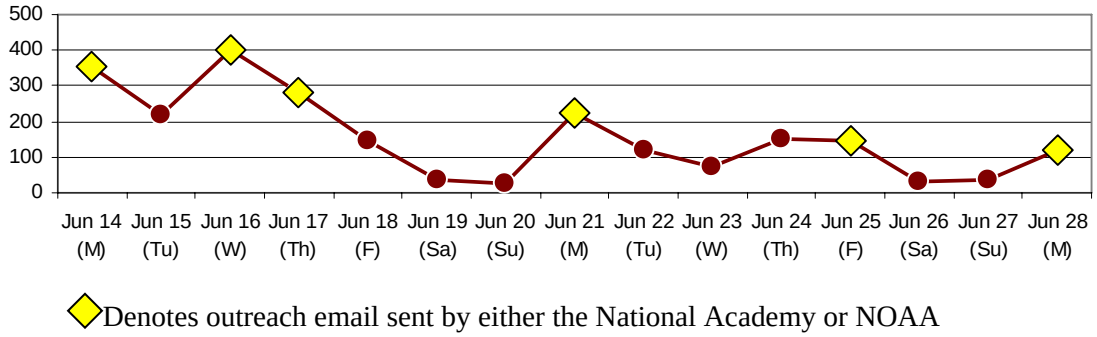
Table 6. Engagement Metrics

Dialogue on a NOAA Climate Service	
Live Dates	6/14/10 – 6/28/10
Visits	2,353 (157 per day)
Unique Visitors	1,342 (89 per day)
Page Views	13,729 (915 per day)
Avg. Page Views	5.83
Bounce Rate (%)	35.15%
Avg. Time on Site	5:39
Direct Traffic	1,971 (83.77%)

Benchmarking this Dialogue against past National Academy efforts suggests similar levels of engagement. The average page views and time on site are in line with past, public-facing dialogues. However, the low bounce rate indicates that the community was highly interested in the subject matter; this is not surprising given the narrowness of the topic.

[41] "What does Bounce Rate mean?" Google Analytics. http://www.google.com/support/analytics/bin/answer.py?hl=en&answer=81986 July 6, 2010.
[42] A registered user is any individual who creates a unique username on the Dialogue site; this step is necessary in order to submit, rate, or tag an idea, or to explore other users' profiles.

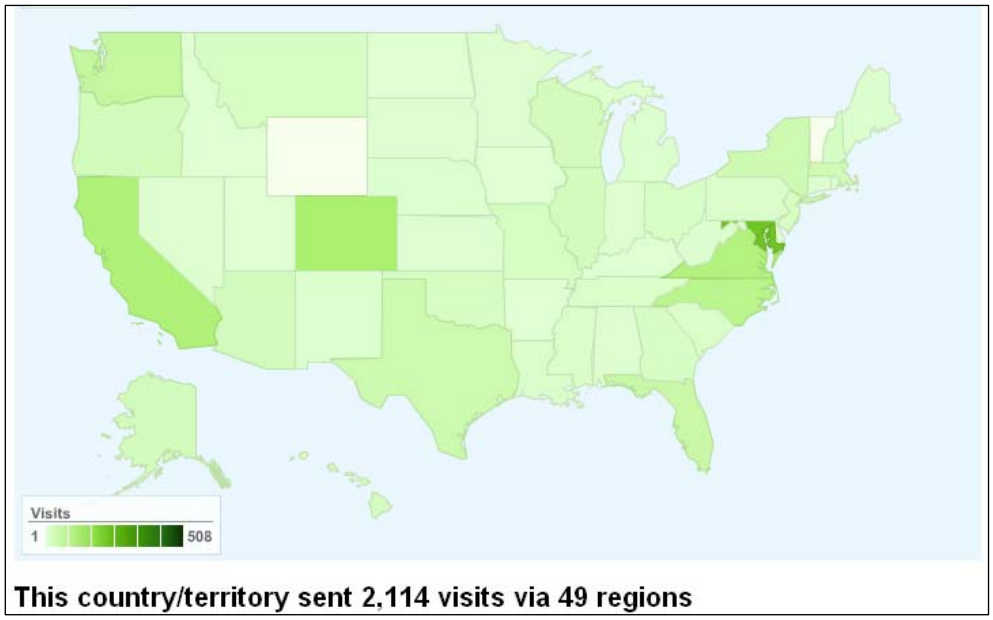
Figure 4. Visits to the Dialogue Site by Day



◆Denotes outreach email sent by either the National Academy or NOAA

As shown in Figure 4, visits to the site gradually decreased over the two-week span of the Dialogue, a pattern consistent with other National Academy efforts. As expected, visits decreased substantially over weekends and peaked after outreach e-mails were sent. Although there is a relationship between outreach and site traffic, a certain volume of visits undoubtedly came from word-of-mouth referral, such as e-mail forwards, among NOAA employees and other stakeholders. These are not traceable, but this "viral" outreach generally is a significant contributor to interest and site traffic.

Figure 5. Visits by U.S. State



The 2,353 visits to the Dialogue site came from 29 countries/territories, the vast majority of which were from the United States. As seen in Figure 5, the site received visits from 49 U.S. states and territories, including the District of Columbia. The largest source of visitors was the Mid-Atlantic region around Washington, DC, representing nearly one-half of all U.S. visits. Other states with large numbers of visits included Colorado, California, North Carolina, Washington, and Florida, all home to NOAA offices, research institutions or partners.

Participation Analysis

Table 7 illustrates the level of user participation in the Dialogue on a NOAA Climate Service. As shown in Table 2, the Dialogue site had 1,342 unique visitors. Nearly 10 percent of these registered to participate, a conversion rate in line with past National Academy Dialogues.

Forty-five of the 134 registered users authored an idea, a rate consistent with past efforts. These users offered 52 ideas for how a Climate Service can engage users and providers of climate information and services. Users then responded to ideas with comments, ratings and tags. As indicated in Table 4, there were less than ten responses to ideas per day.

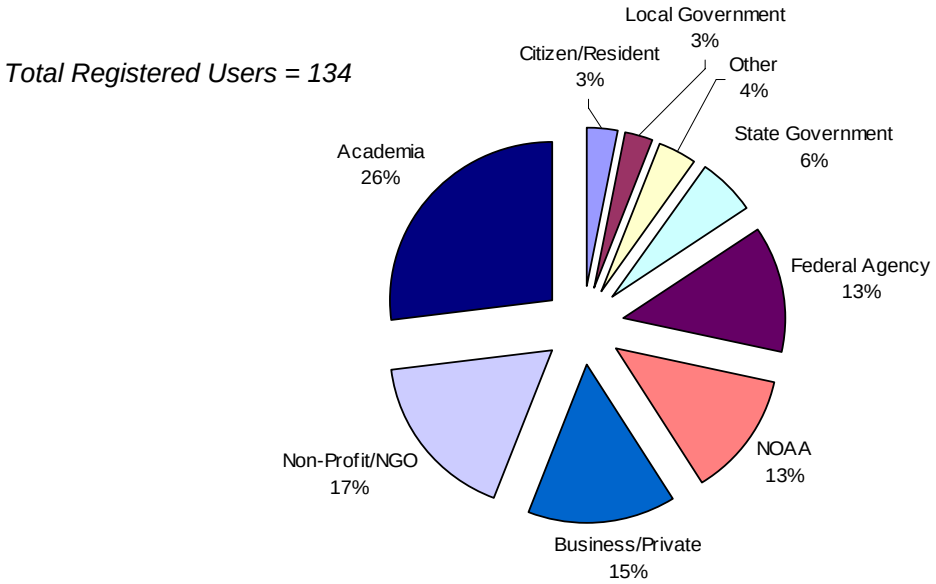
Table 7: Participation Metrics

Participation in the Dialogue	
Live Dates	6/14/10 – 6/28/10
Registered Users	134 (9 per day)
As Percent of Unique Visitors*	9.99%
Unique Ideas	52 (3 per day)
Users who posted an idea	45
Comments	72 (5 per day)
Ratings	117 (8 per day)
Tags	59 (4 per day)

*Percent of Unique Visitors is calculated by dividing the number of Registered Users by the number of Unique Visitors. This "conversion rate" is an indicator of what proportion of people saw enough value in the Dialogue to register, or to go from being "browsers" to "buyers."

Upon registering, users provided their sector (e.g., NOAA, federal government, academia) and primary areas of interest (e.g., environmental, public policy, science) for the purposes of analyzing the user population. Figure 6 displays the breakdown of registered users on these two questions.

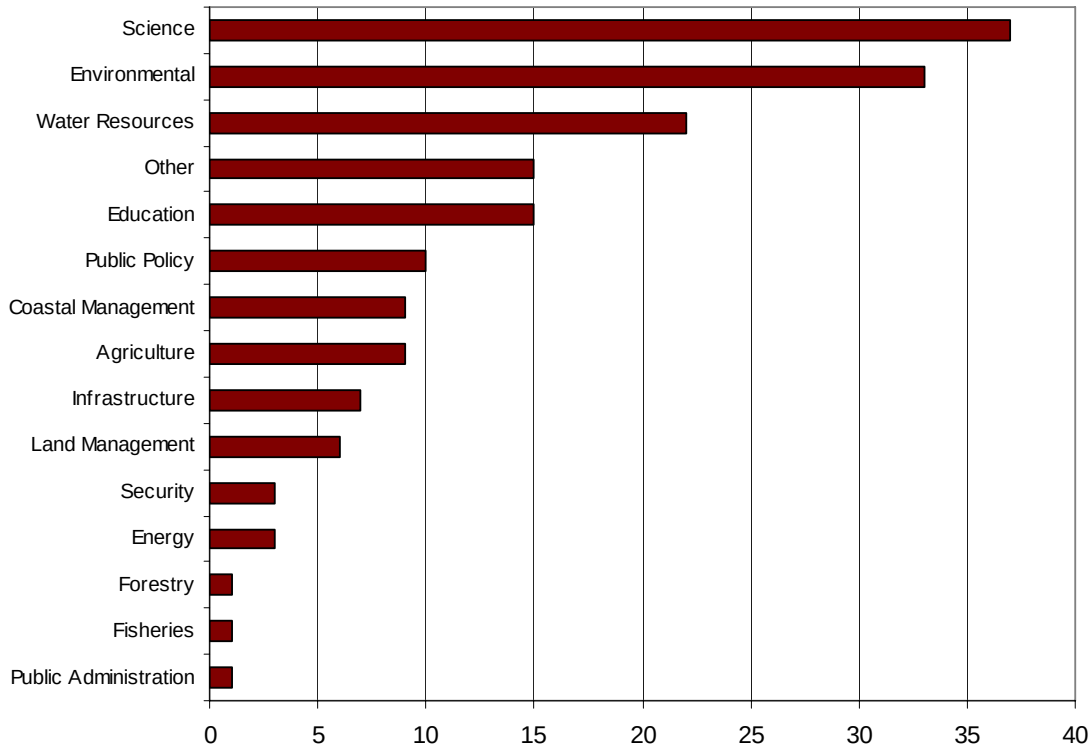
Figure 6. Registered Users by Sector



Not surprisingly, large portions of users came from academia (26 percent), the non-profit sector (17 percent), and the business sector (15 percent)—all of which have interest in creation of a Climate Service. NOAA employee participation was low. Seventeen users claimed NOAA as their sector; eight additional users registered with NOAA email accounts but identified federal government as their sector. When combining these groups, NOAA employees amount to 19 percent of registered users

Users also provided their top two primary areas of subject matter interest, the results of which are displayed in Figure 7.

Figure 7. Primary Areas of Interest



Note: "Other" responses included: Adaptation (3), Atmospheric (2), Climate and climate change (4), Communications and public engagement (2), Data management and information technology (4), Emergency management (3), Food security, GHG Monitoring, Intelligent Transportation Systems, Land use (2), Observations, Professional development

Not surprisingly, the Dialogue saw the greatest volume of participation from those in fields related to climate issues, namely the scientific, environmental and water resources areas. However, users identified with a wide variety of other areas as well, such as public policy, education and security.

APPENDIX I
NOAA'S ORGANIZATIONAL APPROACHES

The Study Team examined NOAA's organizational and operational approaches to gain an understanding of how NOAA is organized and operates. The Study Team sought to:

- Identify what and how many operating models exist across NOAA's Line offices.
- Analyze core capabilities and key support requirements across line offices.
- Understand the "inventory" of climate activity across line offices.

The first concept was whether line offices had specific functional or divisional areas of focus, and whether that characteristic makes them more similar than different. Figure 8 represents NOAA's major organizational categories. The red boxes group similar line office and headquarters functions and demonstrate that NOAA is operating multiple organizational models.

The Administration category represents the agency's executive and governance functions and includes the agency's leadership, chief support functions and selected programmatic leadership. This category is relatively standard in government organizations; it will continue to operate in its current state. It has little, if any, impact on the design of a NOAA Climate Service line office, except to the extent that certain functions need not be duplicated in the line office.

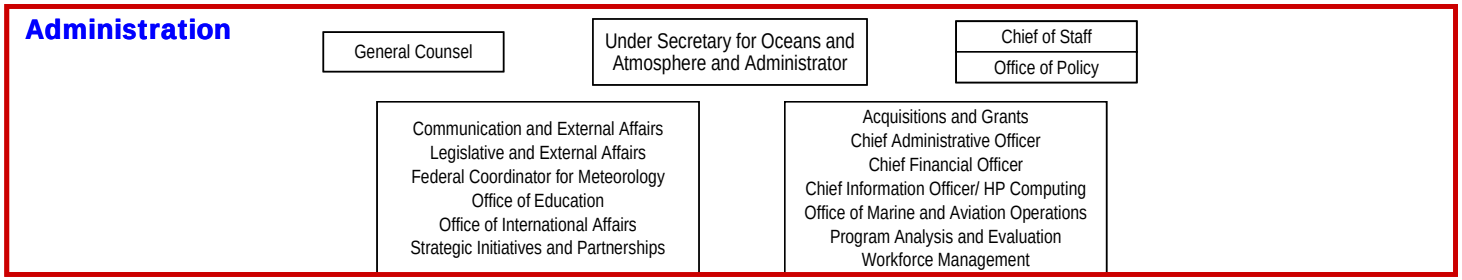
The two principal types of structures are "divisional" and "functional," neither one constructed or operating in a classic organizational design[43]. The two are differentiated or departmentalized, across a "product/market"—weather, oceans and fisheries or a "process"—data collection, analysis and planning.

Divisional Structures include NWS, NOS, and National Marine Fisheries Service (NMFS). Each line office is relatively large, geographically dispersed and/or produces wide range of services related to the overarching focus of its "market." Each is, first and foremost, accountable for the outcomes of its own office.

Functional Structures are high-level groupings that provide processes or capability to the rest of NOAA. The National Environmental Satellite, Data, and Information Service (NESDIS), and OAR, provide specific functional support to the divisional line offices; they also have broader mission sets and independent deliverables. The Program Planning and Integration (PPI) line office was established to integrate NOAA's divisional and functional structures into a cohesive agency. NOAA has proposed merging PPI with the Office of Program Analysis and Evaluation as a headquarters staff office, and eliminating it as a stand-alone line.[44]

[43] Nitin Nohria, "Note on Organization Structure", Harvard Business Review, February 1995.
[44] Pre-decisional, based on information provided to the NAPA study team by NOAA.

Figure 8. Representation of NOAA's Major Organizational Categories



"Divisional" Structures

National Weather Service (NWS)

- Climate, Water, and Weather Services
- Science and Technology
- Hydrologic Development
- Operational Systems
- National Centers for Environment Prediction
  - Aviation Weather Center
  - Climate Prediction Center
  - Environmental Modeling Center
  - Hydrometeorological Prediction Center
  - NCEP Central Operations
  - National Hurricane Center
  - Ocean Prediction Center
  - Space Weather Prediction Center
  - Storm Prediction Center
- National Centers
- National Specialized Centers
- CFO/CAO
- CIO
- Strategic Planning
- EODM

National Ocean Service (NOS)

- Coastal Survey
- National Geodetic Survey
- Ocean and Coastal Resource Management
- Response and Restoration
- National Centers for Coastal Oceans Science
- National Marine Sanctuary
- NOAA Coastal Services Center
- Center for Operational Oceanographic Products and Services
- Integrated Ocean Observing System Program
- International Programs
- Management and Budget

National Marine Fisheries Service (NMFS)

- Regulatory Programs
  - Habitat Conservation
  - Protected Resources
  - Sustainable Fisheries
  - Regional Offices
- Operations
  - Law Enforcement
  - Seafood Inspection
  - CIO
  - Policy
  - Management of Budget
- Scientific Programs
  - Science and Technology
  - Regional Science Centers
- Constituent Services
- International Affairs

"Functional" Structures

National Environmental Satellite, Data, & Information Service (NESDIS)

- Satellite Operations
- Satellite Data Processing and Distribution
- Center for Satellite Applications and Research
- Systems Development
- National Climatic Data Center (NCDC)
- National Oceanographic Data Center (NODC)
- National Geophysical Data Center (NGDC)
- Space Commercialization
- GOES-R Program
- National Polar-orbiting Operational Environmental Satellite System (NPOESS)
- Commercial Remote Sensing Compliance and Monitoring Program (CRSCMP)
- International & Interagency affairs
- CIO
- CFO

Oceanic and Atmospheric Research (OAR)

- Climate Program
- National Sea Grant College Program
- Ocean Exploration & Research
- Weather and Air Quality
- Science Advisory board
- Air Resources Laboratory
- Atlantic Oceanographic & Meteorological Laboratory
- Earth System Research Laboratory
  - Global Monitoring Division (GMD)
  - Physical Sciences Division (PSD)
  - Chemical Sciences Division (CSD)
  - Global Systems Division (GSD)
- Geophysical Fluid Dynamics Laboratory
- Great Lakes Environmental Research Laboratory
- National Severe Storms Laboratory
- Pacific Marine Environmental Laboratory
- Policy, Planning, & Evaluation
- CFO/CAO
- CIO
- Communications
- International Activities

Program Planning and Integration (PPI)

- Strategic Planning
- Policy Integration
- Program Integration
- Performance Evaluation

CORE CAPABILITIES

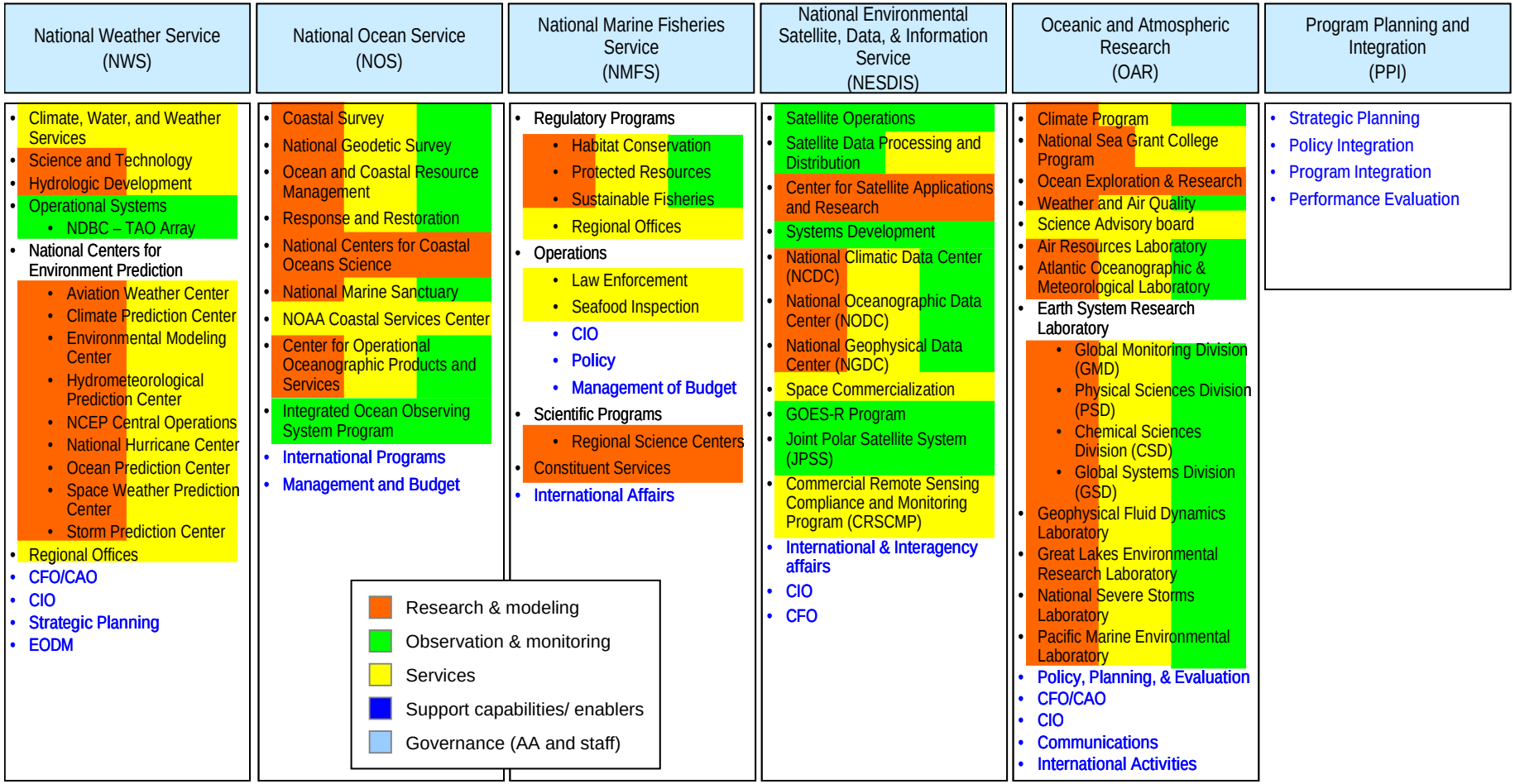
NOAA identifies its core capabilities for climate as Research and Modeling; Observations and Monitoring; and Service Development. These core capabilities also exist across NOAA's line offices in support of different goals. Figure 9 illustrates[45] where these capabilities reside across the organization and demonstrates that they are not the responsibility of any one group within NOAA, but core to the mission of every line office. The figure reflects only that a capability is present or absent.

SUPPORT CAPABILITIES

All line offices share common support capabilities, including Finance and Administration; Information Technology; Planning and Policy; Communications; and International Activities. Although each line office's primary mission responsibilities differ, they appear to have a high level of consistency of support capabilities. This is illustrated by the blue text in Figure 9.

[45] "Figure 11: Illustrative Representation of Core Capabilities" is purely illustrative and intended to show only that the capabilities are present across the entire organization. The chart does not express the degree to which of the offices do these programs.

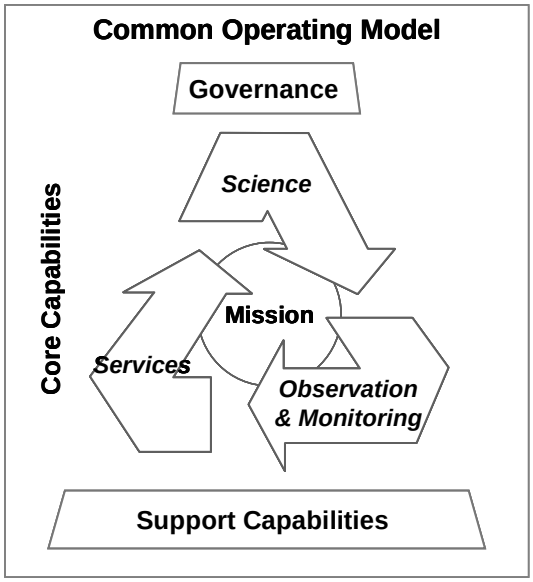
Figure 9. Illustrative Representation of Core and Support Capabilities Across NOAA



NOAA LINE OFFICE COMMON MODEL

NOAA has a generic line office model although the specifics of any one line office are tailored to its mission.[46] The generic model is not comprehensive, but it informs organizational design options by identifying major categories for consideration. All line offices include three broad components: governance, core capabilities and support capabilities.

Figure 10. NOAA's Common Operating Model



"Governance" is defined by leadership functions that provide guidance and direction that drive the execution of the organization's mission, including its operations and decision-making processes. Governance positions across each line office are fairly consistent, each with an Assistant Administrator (AA), one or two Deputy Assistant Administrators (DAA) and other staff responsible for the executive management and guidance of the execution of the line office's missions.

The Core Capabilities generate the desired outcomes through the production and/or delivery of products and services. Support Capabilities are the tools, processes and people that enable the operation of the organization—the organization essentials that fund, procure, plan, administer and link the organization's structure to function.

Users and producers of climate data, products and services reside throughout the agency. The organizations highlighted in red represent users and producers of climate information, and are presented to demonstrate the breadth of climate-related activities across NOAA. This is shown in Figure 11.

[46] The operating model is a visual description of how NOAA line offices operate at a high-level. It includes a description of core capabilities needed to fulfill their missions, and provides an approach to how an organization may need to work. This is not an organizational design, nor a comprehensive description of how every part of the organization fits together.

Figure 11. Inventory of NOAA Climate Activities

General Counsel

Under Secretary for Oceans and Atmosphere and Administrator

Chief of Staff

Office of Policy

FY11 Requested FTE & Budget($ million)

Communication and External Affairs
Legislative and External Affairs
Federal Coordinator for Meteorology
Office of Education

Office of International Affairs
Strategic Initiatives and Partnerships
Acquisitions and Grants
Chief Administrative Officer

Chief Financial Officer
Chief Information Officer/ HP Computing
Office of Marine and Aviation Operations
Program Analysis and Evaluation
Workforce Management

National Weather Service (NWS) ORF $902 PAC $100 FTE 4649	National Ocean Service (NOS) ORF $500 PAC $34 FTE 1259	National Marine Fisheries Service (NMFS) ORF $907 PAC $0 FTE 2882	National Environmental Satellite, Data, & Information Service (NESDIS) ORF $190 PAC$2018 FTE 835	Oceanic and Atmospheric Research (OAR) ORF $454 PAC $10 FTE 773

• Climate, Water, and Weather Services
• Science and Technology
• Hydrologic Development
• Operational Systems
  • NDBC – TAO Array
• National Centers for Environment Prediction
  • Aviation Weather Center
  • Climate Prediction Center
  • Environmental Modeling Center
  • Hydrometeorological Prediction Center
  • NCEP Central Operations
  • National Hurricane Center
  • Ocean Prediction Center
  • Space Weather Prediction Center
  • Storm Prediction Center
• Regional Offices
• CFO/CAO
• CIO
• Strategic Planning
• EODM
	• Coastal Survey
	• National Geodetic Survey
	• Ocean and Coastal Resource Management
	• Response and Restoration
	• National Centers for Coastal Oceans Science
	• National Marine Sanctuary
	• NOAA Coastal Services Center
	• Center for Operational Oceanographic Products and Services
	• Integrated Ocean Observing System Program
	• International Programs
	• Management and Budget
		• Regulatory Programs
		  • Habitat Conservation
		  • Protected Resources
		  • Sustainable Fisheries
		  • Regional Offices
		• Operations
		  • Law Enforcement
		  • Seafood Inspection
		  • CIO
		  • Policy
		  • Management of Budget
		• Scientific Programs
		  • Science and Technology
		  • Regional Science Centers
		• Constituent Services
		• International Affairs
			• Satellite Operations
			• Satellite Data Processing and Distribution
			• Center for Satellite Applications and Research
			• Systems Development
			• National Climatic Data Center (NCDC)
			• National Oceanographic Data Center (NODC)
			• National Geophysical Data Center (NGDC)
			• Space Commercialization
			• GOES-R Program
			• Joint Polar Satellite System (JPSS)
			• Commercial Remote Sensing Compliance and Monitoring Program (CRSCMP)
			• International & Interagency affairs
			• CIO
			• CFO
				• Climate Program
				• National Sea Grant College Program
				• Ocean Exploration & Research
				• Weather and Air Quality
				• Science Advisory board
				• Air Resources Laboratory
				• Atlantic Oceanographic & Meteorological Laboratory
				• Earth System Research Laboratory
				  • Global Monitoring Division (GMD)
				  • Physical Sciences Division (PSD)
				  • Chemical Sciences Division (CSD)
				  • Global Systems Division (GSD)
				• Geophysical Fluid Dynamics Laboratory
				• Great Lakes Environmental Research Laboratory
				• National Severe Storms Laboratory
				• Pacific Marine Environmental Laboratory
				• Policy, Planning, & Evaluation
				• CFO/CAO
				• CIO
				• Communications
				• International Activities

Climate-related research & modeling, observations & monitoring, and services activities

APPENDIX J
PROJECT MANAGEMENT