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NOAA Annual Guidance Memorandum

for

FY 2011 - 2015

NOAA's Vision: An informed society that uses a comprehensive understanding of the role of the oceans, coasts, and atmosphere in the global ecosystem¹ to make the best social and economic decisions.

NOAA's Mission: To understand and predict changes in the Earth's environment² and conserve and manage coastal and marine resources to meet our Nation's economic, social, and environmental needs.

The National Oceanic and Atmospheric Administration (NOAA) Strategic Plan³ articulates NOAA's long term vision and establishes the overarching goals and strategies required to realize that vision. Each year, NOAA's planning processes provide an opportunity to assess our strategic direction, accommodate new trends and challenges within and outside NOAA, and adjust our corporate priorities to ensure progress toward our strategic goals. This Annual Guidance Memorandum (AGM) identifies the most urgent and compelling NOAA-wide programmatic and managerial priorities for FY 2011-15, reflecting input from NOAA's stakeholders as well as our own assessment of external trends and drivers, mission requirements and program capabilities, and strategic imperatives facing each of NOAA's strategic Goal Teams and the organization as a whole. It recognizes that NOAA's vision and mission are global in scope and therefore require both domestic and international engagement to achieve NOAA's priorities.

¹ An "ecosystem" is a geographically specified system of organisms, the environment, and the processes that control its dynamics. Humans are an integral part of an ecosystem.

² The "environment" is the biological, chemical, physical, and social conditions that surround organisms.

³ *New Priorities for the 21st Century - NOAA's Strategic Plan for FY 2006 - 2011*, available at:

<http://www.ppi.noaa.gov/>

Introduction

The AGM identifies a select number of high-level programmatic and managerial priorities that represent issues that are NOAA-wide in nature (e.g., interdisciplinary, inter-organizational challenges), that require significant and sustained financial or managerial resources and effort, and that have a singular impact on NOAA's ability to achieve its long-term strategic goals. It is recognized that the AGM, as a single document intended for planning future organizational efforts, cannot explicitly reference all program and managerial efforts NOAA will need to pursue over the planning period to successfully execute its mission requirements. The priorities identified in the AGM respond to strategic trends and challenges that can be met only through the concerted efforts of NOAA's Goal Teams, Programs, Line Offices, and Councils.

During recent planning cycles, NOAA's Goal Teams and Programs have rigorously specified their requirements drivers and have detailed the significant and generally increasing gaps between current program resources and those required to fully address all programmatic requirements. While these requirements gaps continue to grow, the overall federal fiscal and policy environment is becoming increasingly constrained. NOAA's planning priorities, as described in this document, must balance pressures to change with the imperatives of continuously maintaining a broad array of current research, operational, and partnership commitments and responding efficiently to legislative mandates. Deterioration of capital assets is occurring faster than the growth of NOAA capabilities to respond. In developing plans, programs, and budgets for its annual PPBES cycle, "plans of future" have to be reconciled with the "realities of now."

The AGM identifies a limited number of high-level, high-impact, high visibility, NOAA-wide priorities that require significant and sustained financial or managerial resources and effort.

NOAA's External Environment

External pressures to change are continuous, as societal demands for NOAA's capabilities continue to evolve, as the state of science and technology changes, and as NOAA's requirements are modified by Congress and the Administration. This AGM reviews the most urgent and compelling of these external pressures, identifies NOAA's programmatic and organizational priorities in response, and provides the framework for more detailed strategies to be developed within the agency – at the Program-, Goal Team-, and corporate-level. This section briefly describes some of the more comprehensive external changes that have shaped this AGM.

Awareness and acceptance of the scientific basis for climate change

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), released in 2007, established with very high confidence (>90 percent) the anthropogenic warming influence on climate and documented the substantial progress over the past six years of research on climate change and its fundamental causal factors. NOAA scientists were an instrumental part of the 20 years of work that led to a Nobel Peace Prize for the IPCC organization.

A heightened public awareness of climate change and acceptance of its scientific basis presents NOAA with important questions concerning its role and priorities in the Nation's climate enterprise. NOAA is a lead agency in the science of climate variability and change, and has distinctive observational assets, assessment and prediction expertise, and service delivery capabilities. NOAA has a broad suite of capabilities for addressing current and future climate impacts related to water resources and drought, coastal management and planning, extreme events, ecosystem impacts, and loss of sea ice in the Arctic.

A heightened public awareness of climate change naturally leads to a growing demand for relevant, reliable and authoritative climate information. NOAA intends to meet these demands by leveraging its strong research portfolio, monitoring capacity, and operational infrastructure, along with the capabilities of its partners, to expand the federal climate service portfolio. This will allow NOAA to further improve its climate forecasts, improve their scope and applicability, and work with stakeholders to communicate climate impact information tailored to specific regional needs. If society is to realize benefits from NOAA's information, measuring and forecasting the impacts of climate change on ecosystems and community and transportation infrastructures must become a part of NOAA's formal portfolio.

Global attention is increasing in particular on the impacts of climate change in the Arctic and Antarctic, with consequent expectations for a US government engagement and support for programs in the two regions. The Administration's efforts are currently underway to update US Arctic policy. The US will also be hosting the 50th Anniversary of the Antarctic Treaty consultative meeting in Baltimore in 2009.

In the Antarctic, large masses of sea ice are collapsing and breaking away from the continent, which may possibly contribute to sea level rise. Sea ice retreat in the Arctic is occurring far more rapidly than the IPCC report had predicted, spurring increases in

coastal erosion, growth of Arctic marine transportation, homeland security needs, energy resource exploration, and northward movement of important commercial fisheries. Changes in vessel traffic – both in volume and location – levy increased requirements for marine forecasts, charting resolution and frequency, and incident response. In addition, deadlines for submitting data to support claims for an Extended Continental Shelf are fast approaching.

Expansion and complexity of requirements for ocean and coastal⁴ ecosystem management

Recent Administration and Congressional actions indicate that ocean issues will continue to remain a high priority in FY 2011-15. The FY 2009 President's Budget requested increased resources for implementing the President's Ocean initiative by ending overfishing, protecting natural resources, and furthering ocean research and integrated ocean observations. The Administration is also proposing legislation to create a NOAA Organic Act, a National Offshore Aquaculture Act, and to reauthorize both the National Marine Sanctuaries Act and the Coastal Zone Management Act.

Congressional interest on ocean issues is highlighted by progress made to reauthorize the Coral Reef Conservation Act and the Hydrographic Services Improvement Act and to pass the Ocean and Coastal Exploration and NOAA Act, which includes the National Ocean Exploration Programs Act and the Ocean and Coastal Integration Mapping Act. This interest is further highlighted by the introduction of the National Sea Grant College Program Amendments Act; the Oceans Conservation, Education, and National Strategy for the 21st Century Act; the Integrated Ocean Observing System (IOOS); reauthorization of the Harmful Algal Bloom and Hypoxia Research and Control Act; and the Ocean and Coastal Mapping Integration Act. In 2006, Congress also passed the Marine Debris Research, Prevention, and Reduction Act, which directs NOAA to take action to protect ocean and coastal ecosystems from marine debris through prevention, removal, and research activities.

On January 12, 2007, the President signed the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA), opening a new chapter in NOAA's stewardship of the Nation's living marine resources. The MSRA reinforces NOAA's mandate to end overfishing, increases our use of market-based management programs, calls for improved science (especially our ability to monitor recreational fishing), requires NOAA to produce annual catch limit forecasts for all regulated species, supports our enforcement efforts, authorizes NOAA to regulate impacts on deep coral communities, and aids our efforts to curtail illegal, unreported, and unregulated (IUU) fishing on the high seas. The MSRA reinforces a future expectation for NOAA as a leader of cooperative conservation that is embodied in Executive Order 13352 on Facilitating Cooperative Conservation, in the US Ocean Action Plan, and in the proposed NOAA Organic Act.

Efforts to implement MSRA are underway but there is still the need to expedite full implementation of its new requirements since the act imposes strict deadlines to end overfishing in the United States and to rebuild stocks under time-definite rebuilding plans. Complying with MSRA's requirements requires additional investments in science,

⁴ This document follows the convention used in the Ocean Action Plan and other government documents where the phrase "ocean and coastal" includes the Great Lakes.

management activities and enforcement of management measures. The MSRA, the Marine Debris Research, Prevention, and Reduction Act, and the many pieces of pending legislation noted above, broaden NOAA's core mission requirements in ocean and coastal ecosystem management.

National priorities for ocean research

The interagency Joint Subcommittee on Ocean and Science Technology (JSOST) released the national Ocean Research Priorities Plan and Implementation Strategy⁵ (ORPP) in January 2007. This plan identifies three critical elements – ocean observations, forecasting key ocean and ocean-influenced processes and phenomena, and scientific support for ecosystem based management – supported by twenty national priority areas. NOAA has important capabilities and assets related to many of these areas, spanning near- and long-term research challenges. The Implementation Strategy highlights the need for execution of the ORPP to be accomplished through extensive partnerships and interagency collaboration, coordinated through the federal ocean governance structure.

No one group is expected to address the priorities alone. In the near-term, however, NOAA has been specifically tasked to contribute a significant share of the activities needed on four priorities: forecasting the response of coastal ecosystems to persistent forcing and extreme events, Comparative Analysis of Marine Ecosystem Organization (CAMEO), sensors for marine ecosystems, and assessing the Atlantic Meridional Overturning Circulation (MOC) variability and its implications for rapid climate change. The ultimate success of the ORPP is tied to the successful implementation of these four projects. NOAA's support of the near-term priorities will continue to be critical throughout FY 2011-15.

Understanding the impact of climate variability and change on the physical and biogeochemical properties of the ocean and implications for its ecosystems is among the priorities that the Plan lays out for the longer term. This understanding will be a focal point for NOAA research over the next 5 years, especially as we seek to understand the implications of ocean acidification and changes to ocean circulation patterns.

Pending legislation, and continued OMB support in the FY 2009 Presidential Budget, envisages NOAA as the lead agency in the United States' ocean and coastal mapping efforts, which extend from traditional hydrography to habitat characterization, as suggested in the ORPP. Mapping activities are intended to include the areas and the resources of the outer continental shelf, beyond the Exclusive Economic Zone (EEZ).

Coastal community growth, vulnerability, and environmental impact

At the nexus of land and sea, our nation's coastal states represent 22 percent of the land area of the United States and support 82 percent of the US population. Coastal counties are most heavily populated with 183 persons per square mile compared with 33 persons per square mile in the rest of the US. As such, our nation's coasts directly

⁵ 'Charting the Course for Ocean Science in the United States for the Next Decade - An Ocean Research Priorities Plan and Implementation Strategy', NSTC JSOST, January 26, 2007 (http://ocean.ceq.gov/about/sup_jsost_prioritiesplan.html)

support the ecological, economic, and cultural well-being of the US and provide societal benefits that reach beyond the shorelines.

Continued population growth, coastal development, watershed runoff, and climate change are increasing the pace and scale of impacts to coastal systems. In many regions of the country, stresses in ecosystem function are appearing such that 44 percent of tested US estuaries and 12 percent of ocean shoreline waters are considered unfit for uses such as swimming, fishing, and supporting aquatic life.

Recognizing these changing conditions, including natural hazards, coastal managers are requesting information to help assess the changing demands in their regions. In September 2007, the Coastal States Organization released a report expressing interest in "...decision-support tools that compile historical shorelines, geomorphology, socioeconomic data, and model projections."

These expressed priorities dovetail with the priority needs of regional alliances which include: water quality, wetland and coastal restoration, environmental education, habitat characterization and change, nutrient impact and reduction, hazard response and resiliency, maritime security, ecosystem-based management, sustainable development, invasive species, and reduction of point and non-point pollutants. OMB has requested that NOAA clarifies its strategic response to these major challenges.

High-impact events and improved operational forecasts

There is broad concern over improving NOAA's strategy for operational forecasts of high-impact events such as hurricanes, tornadoes, solar storms, fire weather, damaging wind, tsunamis, and poor air quality. For example, the Hurricane Intensity Research Working Group (HIRWG) of the NOAA Science Advisory Board (SAB) reported its findings in July 2006 on the "state of the science" and current research and development (R&D) activities in NOAA and elsewhere with respect to hurricane intensity.

As a result, it recommended an agenda of R&D activities directed to improve National Weather Service skill in forecasting intensity and structure, and, in particular, rapid changes in intensity in hurricane-strength storms. The HIRWG set an overarching goal for NOAA R&D (in terms of reduction of the error in 48-hour intensity forecasts) that the group recognized as ambitious, but attainable with the engagement of the full hurricane research community and with adequate funding for a minimum of five years.

To achieve this goal, the HIRWG provided a set of recommendations to focus research on the inner core of the hurricane. These include development and validation of hurricane forecasts at a resolution (1 km) much finer than operationally feasible, without the acquisition of new, or reprioritization of existing, computing system capability. The HIRWG also identified the need for organizational changes to (i) attain critical mass in the presently limited resources both for in-house hurricane modeling capabilities, and for interfacing with the wider research community, and (ii) accelerate the transfer of research results to operations.

The work of the NOAA SAB HIRWG, combined with the Hurricane Research assessment of the National Science Board (NSB), has a strong bearing on NOAA's overall strategy to respond to the broader demand for operational forecasts of high-impact events. The strategy needs to address the service gaps that exist in the delivery of weather and water information, forecasts, and warnings, which are a growing foundation of many

decisions by individuals, industry, and those charged with preparing and responding to high impact events, whether natural or man made.

Freshwater availability and managing droughts and floods

The drought of 2006 and 2007 in the Southeast has brought to the frontlines the spreading of water availability problems from the semi-arid Western states to the Midwest, East and South. The Western Governors' Association estimates that economic losses arising from the current drought in the West are billions of dollars. New scientific analyses suggest that the West could be drier than has been traditionally believed, because previous projections for drought trends may have been based upon a non-representative climatology.

In the West, water allocation decisions have historically faced competing demands among agriculture, energy generation, municipal uses, and water flow necessary to recover endangered species and support important commercial and recreational fisheries and their habitats. Water availability and flow is a critical factor in restoring naturally functioning river ecosystems that can provide for all of these uses. Precipitation patterns may change as a result of changing climate patterns which in turn could impact the available water supply at some localities or cause flooding in others. NOAA's National Weather Service has determined that floods were the number-one natural disaster in the US during the 20th century. Floods in the US account for about \$5.2 billion in losses and cause an average of 80 deaths per year.

In response to the National Integrated Drought Information System (NIDIS) Act of 2006, NOAA has taken the lead of an interagency approach for better drought monitoring, forecasting, and early warning. The vision for NIDIS is a dynamic and accessible drought risk information system that provides users with the ability to determine the potential impacts of drought, and the decision support products needed to better prepare for and mitigate the effects of drought.

Accurate forecasting of weather and climate can provide information to decision makers on the impacts of droughts and floods to their areas of interest. Through its research and hydrology programs, and through its partnerships around the world, NOAA has a broad suite of capabilities to address this need.

Impacts to the US economy and the environment from increasing pressures on US transportation systems infrastructure

Escalating external demands continue to drive NOAA to improve the accuracy and frequency of its products and services geared toward safe and efficient movement of people and commerce on the Nation's roads, rails, waterways and in the air. For example, the Administration's new emphasis on the Next Generation Air Transportation System (NextGen), echoed by strong interest in Congress, will significantly alter our National Airspace System by 2025. The expected tripling of air traffic will require dramatic improvements to the aviation weather system. Because 70 percent of today's air traffic delays are weather related, there are key questions for NOAA to consider as its role in NextGen and in improved forecast services evolves.

Similarly, the Cabinet-level Committee on the Marine Transportation System (MTS) is considering far-reaching policy changes and improvements to the MTS in anticipation of the projected doubling of demand by 2020 for space on our waterways and in our ports for commercial movement of goods and people.

Natural pressures, too, are having impact on transportation, for better or worse. For example, loss of Arctic sea ice presents new avenues to marine transportation along with increased risk of environmental damage, even as rising temperatures and thawing permafrost create surface transportation challenges on slumping ice roads. Our transportation system is an economic engine for the nation, connecting us to the global economy. NOAA can help to restore the resilience of this system to short- and long-term impacts with information and infrastructure adaptation and mitigation strategies.

Increasing requirements for globally integrated Earth observations

Continuity of satellite earth observations is important for the advancement of climate and severe weather research, prediction, and monitoring, all required for improved understanding of the earth-climate interactions and impacts. Continuity is a growing concern, particularly with respect to rising operational costs related to inflation, expanding user requirements, international cooperation, and increasing demand for operational satellite products and services - demands which originate both within NOAA to support other services and beyond NOAA from our partners in the public, private, and academic sectors. Consistent with the national Strategic Plan for the U.S. Integrated Earth Observation System, NOAA has continued its national and international efforts to develop the Global Earth Observation System of Systems (GEOSS) and will strive to integrate its observing systems and associated data management systems under the GEOSS framework.

Last year the Space Studies Board of the National Research Council (NRC) released its first decadal survey on Earth science and applications from space, commissioned under contract with NOAA, the National Aeronautics and Space Administration (NASA), and the US Geological Survey (USGS). This report calls on NOAA, NASA, and USGS to greatly expand the number of planned earth science missions, their capabilities, and interagency coordination, in the context of increasingly severe challenges to the health of the earth science enterprise in the United States. Combined with the outcome of the Nunn-McCurdy decision on the National Polar-orbiting Operational Environmental Satellite System (NPOESS), and related follow-on efforts and reconfigured capabilities of the Geostationary Operational Environmental Satellite-R Series (GOES-R), the Decadal Survey has raised significant issues for NOAA's priorities for its observation infrastructure.

Responding to regional stakeholder demands

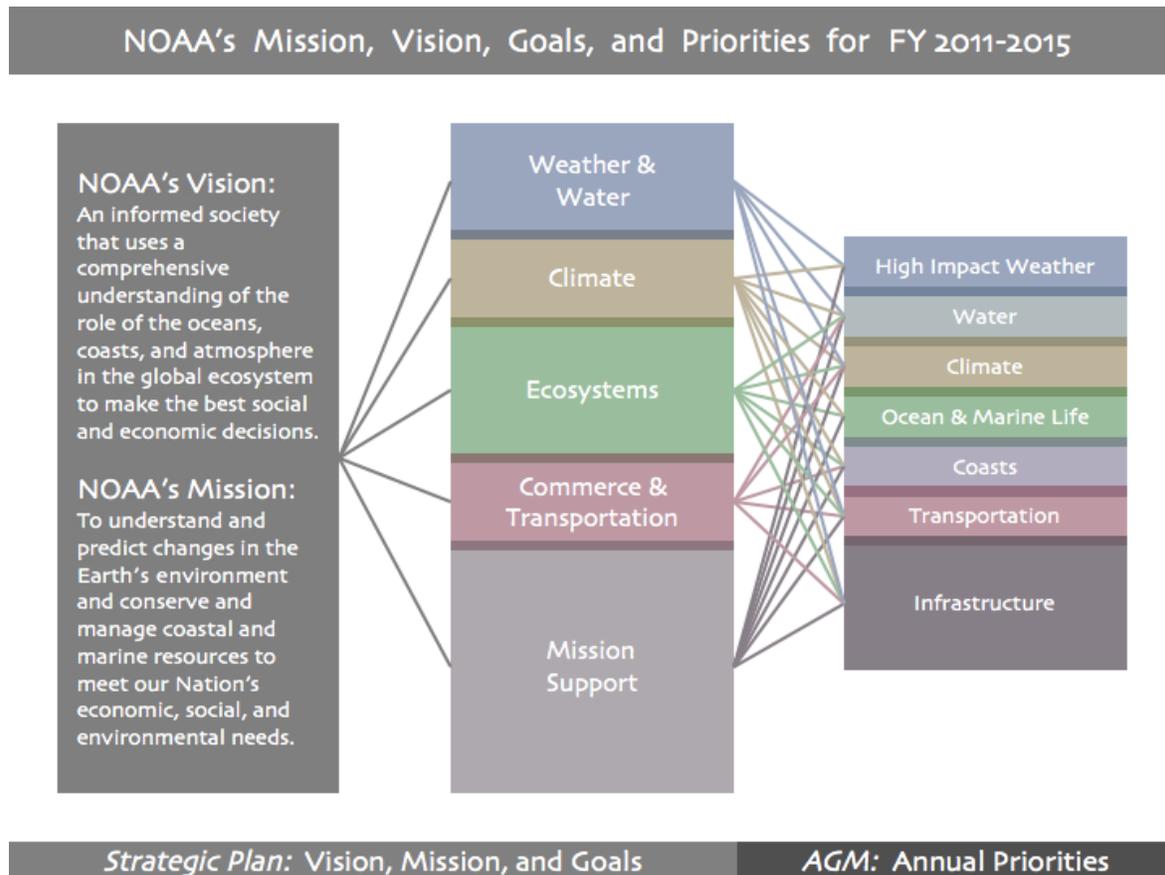
In the past few years, there has been increasing attention on the relevance of Federal science agencies and their ability to address the changing needs of their stakeholders, customers, and partners. Reports of the NOAA Science Advisory Board and the US Commission on Ocean Policy recognize that ecosystem-based management is most effective and efficient when conducted at regional scales. The Marine Protected Area networks, regional climate assessments, and other organizational constructs have also

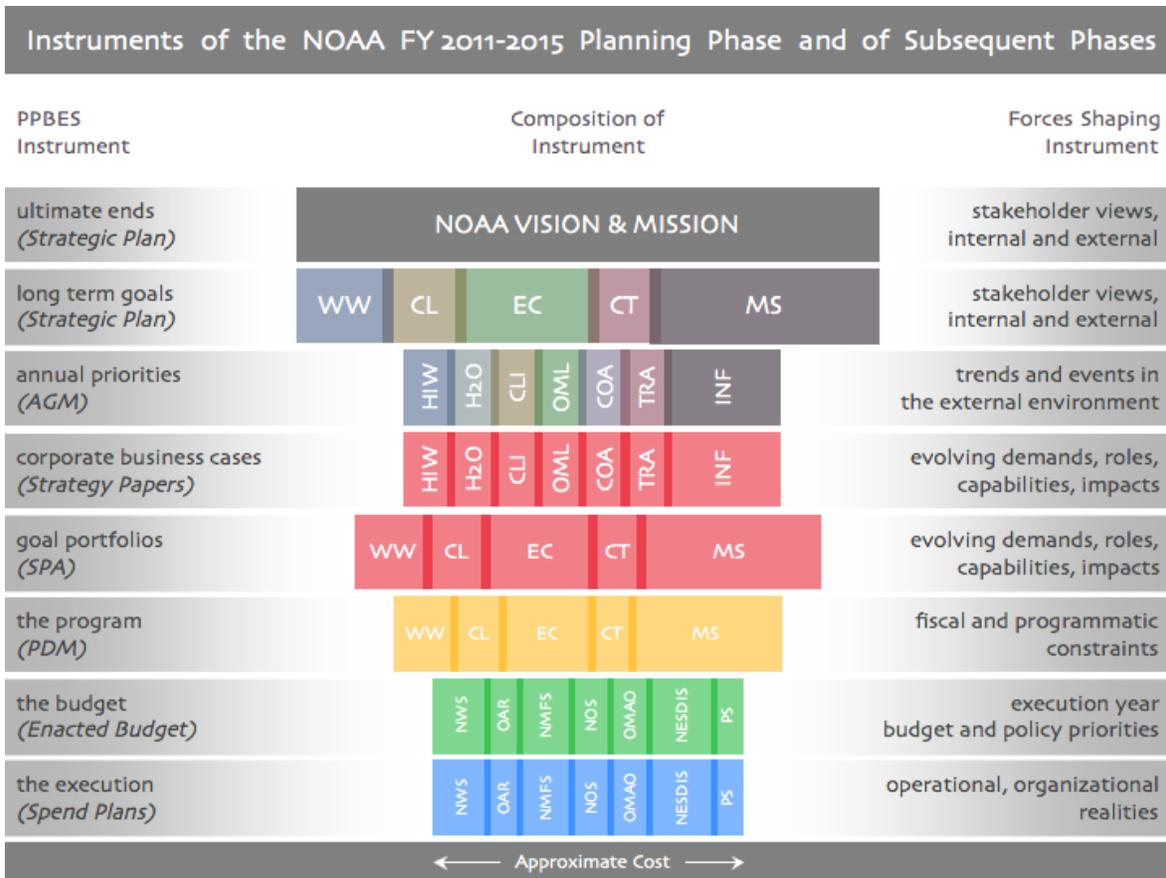
adapted their products to benefit stakeholders at the regional scale. Recently the bill presented as H.R. 21: The 'Big Oceans Bill' also addressed the need for science that is conducted on a regional scale to meet the needs expressed by stakeholders and partners. Regional associations of coastal states in the continental US have recently formed, and some have set science priorities that are regionally focused and center the Federal science effort on the needs of constituents at the state and regional scale. NOAA, along with other agencies, has made efforts to respond to these needs through the formation of regional collaboration networks. These networks are designed to work internally and externally to identify regional science needs, create partnerships across traditional organizational constructs, and work in the execution year to bring NOAA products and services to the state and regional level. Input regarding regional demand that NOAA is receiving through these networks reinforces our understanding of corporate priorities and the need to reevaluate, in particular, NOAA's portfolio in the climate, coastal and water arenas.

NOAA's Annual Priorities

This document provides scope for the near-term adjustments that are needed for NOAA to achieve its long-term strategic goals. It establishes a framework for Goal Team and Program-level planning, Council deliberations, and ultimately the Programming phase of NOAA's Planning, Programming, Budgeting, and Execution System (PPBES). By further developing corporate strategies that address annual priorities, by developing corporate business cases for NOAA action on these priorities, and by conducting strategic analyses of the Goal portfolios with respect to these priorities, NOAA will best prepare itself for the future – from 2011 to 2015 and beyond.

In light of the external pressures identified in the previous section and the current set of capabilities on which NOAA relies to achieve its long-term strategic goals, NOAA's vision for the future is embodied within the following seven annual priorities: **Climate**, **Oceans and Marine Life**, **Coasts**, **High-Impact Weather**, **Water**, **Transportation**, and **Infrastructure**. The figure below illustrates how NOAA's Vision, Mission and strategic Goals (as laid out in the NOAA Strategic Plan) relate to these annual priorities. As you can see, there are extensive linkages connecting NOAA's long term Goals to its short-term priorities.





The figure above builds upon that of the previous page, incorporating the Strategic Plan and the AGM with the PPBES instruments of subsequent phases. Following this AGM – and completing the Planning phase – are the Strategy Papers that will be developed for each annual priority and the comprehensive Strategic Portfolio Analyses (SPAs) that will account for the planned portfolio of each Goal Team. The figure above also accounts for the composition of each PPBES instrument, as well as the approximate cost (and focus) of its contents. Further, it specifies the forces that shape the composition of each instrument. This AGM, and the following set of seven annual priorities, have been shaped by trends and events in the external environment, as referenced in the previous section of this document.

In what follows, you will find a description of each priority that provides scope to these particular arenas of NOAA activity. These are arenas in which NOAA plays, has played, and will continue to play a distinct role over and beyond the planning horizon. Please keep in mind that while NOAA is a necessary component of the efforts in each of these areas, it is often not sufficient. Partners at every level of government, in private enterprise, in colleges and universities, in the non-profit sector, and in institutions around the world are all integral to the accomplishment of the NOAA Mission.

CLIMATE

Climate variability and change profoundly influence economic prosperity, human health, and national security. Evidence of global climate change — multi-year droughts, warmer global surface temperatures, sea level rise, decreasing Arctic sea ice, retreating glaciers, changing ocean chemistry, and shifts in ecosystems — demonstrates the need to support the Nation’s capabilities to plan and adapt.

The demand for relevant, reliable and authoritative climate information is growing, and the federal government needs a commensurate effort to meet evolving national needs. In recent years, constituents have voiced a growing concern about the impacts of climate on their specific geography or industry. They need sustained access to reliable climate information products and services to understand how climate change will affect their specific sectors and applications. NOAA is unique in its position to collaborate with other federal agencies and lead the requisite coordination and communication of the Nation’s climate information inventory to meet these stakeholder demands.

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NOAA has a long-standing mandate to provide climate information in support of policy decisions in the government and the private sector. Understanding the human and natural causes of climate change, as well as its social, economic, and ecological impacts, will enable the development of sound adaptation and mitigation strategies that can be shared regionally and globally to build technical and management capacity. The benefits of more accurate climate predictions and of decision-support tools that weigh competing demands for adaptation and mitigation strategies will contribute to improved preparation for and response to heat waves, poor air quality, drought, forest fires, coastal inundation, changes to ecosystem structure and function, and other phenomena and from the stimulation of private sector technologies and applications.

OCEANS AND MARINE LIFE

Conserving, protecting, managing, and restoring our ocean and living marine resources and the habitats that support them is critical to the vitality of the US economy. Fishing alone is a multi-billion dollar industry. Our nation’s coral reefs, marine sanctuaries, and non-consumptive uses of the oceans (e.g., whale watching) contribute billions of dollars of economic value annually through recreation and tourist dollars.

NOAA has a specific mandate from Congress to be a lead Federal agency in conservation, management and restoration efforts for ocean resources. Recent and emerging legislative changes have broadened this mission for NOAA, with mandates such as the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA). In addition,

NOAA’s marine stewardship responsibilities must meet the challenges posed by cumulative impacts of human use of our oceans and climate change impacts.

NOAA's marine stewardship responsibilities must meet the pressing challenges posed by climate change impacts and cumulative impacts of human use of our oceans. Emerging opportunities must also be addressed, such as the Nation's strategic interests in mapping the Exclusive Economic Zone (EEZ) and potential US extensions of the continental shelf beyond 200 miles, as allowed under the Law of the Sea Convention.

To achieve balance among ecological, environmental, and social needs, NOAA has adopted an ecosystem approach to management, a concept that is central to the recommendations of the 2004 report of the US Commission on Ocean Policy and the Administration's response to it, the US Ocean Action Plan. Implementation of this concept requires a scientific basis in exploration, basic research, ocean monitoring, and integrated ecosystem assessments (IEAs) supporting management and enforcement actions. These actions need to address the complexity of ecosystem issues at spatial scales appropriate to the management questions and to the mix of natural and human-caused mechanisms affecting marine ecosystems.

COASTS

Continued population growth, coastal development, watershed runoff, and emergent climate change are increasing the pace and scale of numerous impacts on the world's coasts, and the US is no exception. In most regions, stresses in ecosystem structure and function are increasingly visible in reduced water quality, loss and degradation of habitats and species, reduced fisheries stocks, increased costs of storms, erosion and other hazards on coastal communities. The financial and human health risks of these impacts continue to rise. Independent and fragmented management regimes complicate the federal role in meeting these challenges and current approaches are failing to keep pace with cumulative impacts.

Coastal managers are requesting information and decision-support tools to help assess and respond to the changing demands in their regions.

NOAA maintains significant capacity to address coastal challenges and, like the complexity of coastal ecosystems, these capabilities are located throughout NOAA's programs, each focused on its individual priorities. The agency is in the unique position to lead the Nation in a concentrated effort to address the highest priorities given its breadth of programmatic, scientific and infrastructure capabilities, distinctive leadership role in administering unique authorities such as the Coastal Zone Management Act, and its strong and diverse partnerships with states, academia, and the private sector.

HIGH IMPACT WEATHER

US residents face a range of high-impact, environmental hazards, including tornadoes, hurricanes, large hail, damaging wind, lightning, winter storms, floods, wildfires, poor air quality, and drought. At any time, our nation could also suffer the effects of a solar geomagnetic storm or a devastating tsunami. These events have major economic, health, and safety impacts. The annual value of improving daily weather forecasts in

terms of accuracy, geographic detail, and frequency of updates was found to be \$1.73 billion per year.⁶

NOAA is the sole US government authority for issuing official weather and water warnings for life-threatening events and plays a key role in the Nation's disaster response planning. NOAA's forecasts, warnings, and the associated emergency responses result in a \$3 billion savings in a typical hurricane season.⁷ Despite the thousands of warnings issued by NWS forecasters, an average of 600 Americans per year lose their lives in weather-related catastrophes.⁸ To meet the demands

of an increasingly sophisticated society, and to avoid unnecessary loss of life, NOAA must continue to improve the forecasts of high-impact events and deliver the information the public needs, when they need it, and in a way they can understand it.

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Advanced warnings are beneficial only if they lead to public responses that move people out of harm's way and provide time to protect their property. NOAA has made extraordinary advances in providing decision-makers with the lead time needed to respond to an impending high-impact event. Outlooks for winter storms, extreme temperature events, fire danger, and flooding are issued days in advance. Warnings of severe thunderstorms and tornadoes provide the time people need to take protective action.

There is, however, still a large gap between NOAA's current ability to deliver accurate, meaningful weather information and where its ability ought to be. For example, when a tornado warning is issued, a tornado actually occurs only about 20 percent of the time. Unnecessary evacuations or sheltering have tremendous economic costs. NOAA intends to meet this challenge by infusing new scientific and technical capabilities into weather and water forecast operations to improve the predictability of the onset, duration, and impact of extreme weather events and to better communicate the degree of certainty of these events with increased lead time.

WATER

New and growing challenges created by population growth, agricultural change, energy demand, and emergent climate change are placing increased stress on our Nation's freshwater availability. Drought has become more commonplace, spreading from the semi-arid Western states to the Midwest, East, and South. Conflicts over water allocation have expanded, and financial and human health risks associated with coastal storms and flooding continue to rise. Changing climate patterns will affect the availability of water regionally, and compound the challenges of managing for drought and flood.

⁶ Lazo, J. and Chestnut, L., Economic Value of Current and Improved Weather Forecasts in the U.S. Household Sector, report prepared for NOAA's Chief Economist by Stratus Consulting, Boulder, CO, November 2002.

⁷ Willoughby, Hugh, HRD/AOML, Costs and Benefits of Hurricane Forecasts, minutes of 55th Interdepartmental Hurricane Conference, 5-9 March 2001, Orlando, FL.

⁸ NWS Office of Climate, Water, and Weather Services. <http://www.nws.noaa.gov/om/hazstats.shtml>.

America's water managers require significantly more predictive information than currently provided. Water forecasts must be produced in high-resolution gridded format. Additional forecasts of water resource variables such as soil temperature, soil moisture, and evaporation are needed. While the Nation maintains significant capacity to measure and retrospectively analyze water availability, there remains a significant gap in capabilities to forecast water availability for the water resource management and emergency management communities.

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In addition, water scarcity issues will become an increasingly important consideration in US foreign policy as the lack of water resources may drive social unrest and border conflicts in many regions of the world.

NOAA's services to provide water information are growing in importance as water becomes a scarcer commodity in America and around the world. Water quantity forecasting is the critical, unique contribution NOAA makes to the federal, state, local, and private sector water enterprise in the US and demonstrates NOAA's potential for international leadership. Given NOAA's distinctive role in precipitation and flood forecasting, many of its existing lines of business already support emerging needs for water prediction information.

TRANSPORTATION

Safe, efficient, and environmentally sound transportation systems are uniquely important to the Nation's economic and national security. In 2005, transportation-related goods and services directly accounted for more than 10 percent – over \$1.3 trillion – of US Gross Domestic Product. Only three sectors – housing, health care, and food – contributed a larger share of GDP than transportation.⁹

Economic growth and the Nation's position in the global marketplace, however, are overwhelming our aging air, surface and marine transportation infrastructures, resulting in congestion delays, accidents and higher costs passed on to the consumer. These conditions are exacerbated by environmental impacts such as weather, which exacts a staggering toll on the Nation's economy.

Escalating economic and environmental pressures are overwhelming our aging air, surface and marine transportation infrastructures, resulting in congestion delays, accidents and higher costs passed on to the consumer.

NOAA's transportation-specific weather, navigation, positioning, and emergency response products and services can help mitigate these impacts. NOAA must also be responsive to the emerging threats and opportunities presented by imperatives such as climate change-induced sea level rise and Arctic ice loss. These escalating natural and economic pressures are forcing service overhauls across government, leading to key national initiatives for every transportation mode, which include the Next Generation

⁹ US Department of Transportation, Bureau of Transportation Statistics, 2006.

Air Transportation System, Committee on the Marine Transportation System efforts, and the Clarus initiative to improve surface weather for road safety. A major player in all of these, NOAA must improve its own service delivery so that our transportation systems are resilient and secure, with increased capacity to efficiently move more people and commerce on the Nation's roads, rails, waterways and airways, while reducing the risk of accident to life, property and the environment.

INFRASTRUCTURE

NOAA's unique infrastructure plays a major role in the agency's impact on American society and is the foundation for future success. Unique to NOAA's mission are the environmental data from satellite systems, ships, aircraft, buoys, and other observing systems; these, along with high-performance computing and associated facilities form the basis for NOAA's current and future performance.

As the demand for NOAA products and services increases, the demands for this unique infrastructure increases as well. NOAA's Climate, Oceans and Marine Life, Coasts, High Impact Weather, Water, and Transportation priority areas have clearly defined the importance of providing continuity of the current capabilities and the improvements required for the future. NOAA's scientific services, information, and predictions are key in the formation of National Policy and economic performance.

Severe weather advisories and warnings directly affecting life and property, and climate predictions are in highest demand, along with daily and longer-term forecasts. Not only is this data of high value to the general public, it is also critical for farming; aviation; surface and marine transportation systems; power companies; and federal, state, and local emergency management officials.

Observing systems, both remote and in-situ, provide broad geographic and regional coverage. Each type is essential for monitoring weather patterns, atmospheric changes, and the status and trends of our ocean and coastal environment to support critical decision-making at all government levels.

Improvements in data acquisition, processing, modeling, and delivery methods will enable NOAA to provide more accurate and timely forecasts, assessments, and warnings. For example, increasing hurricane model resolution to 1 km requires 5,500 times more computational power. The increasing complexity of climate system modeling will require the use of high-resolution coupled models using nearly 800 times the current computing capability. Climate will also need capacity greater than 1,000X to meet the demands of customers at municipal, state, private, and regional levels. Complementary computing infrastructure will also be needed for software engineering, data processing and analysis, graphics, archive and access, and networking.

The alignment, sustainment, restoration, and modernization of the facilities supporting NOAA's programs must provide a solid foundation for cost-effective continuity and

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growth. NOAA's labs are aging and are reliant upon aging technology. Inadequate facilities restrict the agency's ability to effectively meet its mission. Thus, investment in capital equipment beyond satellites and ships is critical. Continued investments are needed to maintain the facilities and the equipment that are necessary to meet the mission.

CROSSCUTTING PRIORITIES

The priority areas mentioned above share certain fundamental activities that are critical for any operation. The following priorities are equally applicable across every aspect of NOAA's mission.

Strategic workforce management

The success of NOAA's mission relies, in part, on the agency's diverse workforce, which includes federal employees, contractors, uniformed services officers, grantees, and cooperators. NOAA's most critical asset in accomplishing its mission is the excellence of its workforce. NOAA must ensure the agency continues to have the scientific and technical expertise necessary to sustain NOAA's mission and maintain a cadre of professionals to address its financial, acquisition and business challenges. It must also ensure that its workforce reflects the population it is striving to serve.

The aging of the federal workforce is one major driver for a strategic approach to managing the NOAA workforce. In the coming years NOAA will have to accommodate the retirement of a significant number of employees and maintain a level of expertise sufficient to carry out the agency's mission. This will present particular challenges to NOAA as a science and technology agency. Recent declines in the number of math, science, and engineering graduates may affect the market for the kind of analytically-focused labor that NOAA depends upon.

At the same time, as NOAA's management responsibilities increase, NOAA sees a need for greater expertise in the human dimensions of ecosystems and greater integration across disciplines. Given the growing gap between NOAA's resources and requirements, as well as the growing need to establish governance structures in marine and coastal management, there will also be an increased need to partner with other organizations (public, commercial, non-profit) and other governments (international, tribal, state, local). Hiring and training to manage NOAA's alliances and networks of expertise is instrumental to developing a workforce effective in building partnerships domestically and internationally.

Strategic use of information technology

As an information provider in the 21st century, NOAA must make strategic use of information technology. NOAA must optimize its information system investments to improve product and service quality, enhance access to a wider range of integrated observational data and information services, and to lower internal operational costs. This means balancing the needs to have adequate information security with the needs to provide our partners and customers with a service-oriented architecture.

Fulfilling NOAA's mission involves implementing a single enterprise wide-area network, IT security controls across all systems, and a fully-modernized IT infrastructure for corporate NOAA.

Management and integration of observation data

NOAA's mission increasingly demands advanced data management processes, including standards based data integration and assimilation, to achieve archived, interoperable, accessible, and readily usable observations data. These management and integration functions are essential for NOAA to maximize the utility of NOAA's observing systems infrastructure, and to leverage the capabilities of international, federal, regional, state, local and private sector partners.

Once a data point is created by a sensing device, there is still a long chain of processes that must occur before it is available for use by a NOAA modeler or an external consumer. These processes of data transmission, storage, quality control and validation, integration, and assimilation, as well as sensor calibration, are often not fully considered in the cost of the observing system and thus tend to be under-funded, limiting the availability of system data to a wide range of models and products developed by NOAA and its partners. Efficiencies in the system as a whole can be increased by insuring fully integrated observation and data management systems.

Environmental literacy and decision support

Underlying NOAA's mission goals is the development of an environmentally literate public and the direct support of public and private sector decisions. NOAA seeks to improve societal knowledge of ecological issues to support its strategic goals.

The agency could not achieve its mission if it did not provide the consultation, advice, education and training that accompany its more tangible outputs. Information only has value if it can change behavior. By supporting the immediate decisions of our partners and customers and by educating them for future decisions, NOAA makes real the potential value of its information.

Reports from the IPCC call for a climate literate public that understands the issues of concern and is capable of making informed decisions. The NIDIS Act of 2006 calls for a system that effectively communicates forecasts, conditions, and drought impacts to decision makers, the private sector, and the public.

The success of this system depends on the ability of our partners and customers to understand, utilize, and act upon the information provided. As hurricane Katrina demonstrated, accurate forecasts or warnings are only effective if the recipients of the information understand them and take appropriate action. Success also depends upon NOAA's ability to understand and engage its customers and partners.

NOAA has an important, new statutory mandate through the America COMPETES Act to "conduct, develop, support, promote, and coordinate formal and informal education at all levels to increase public awareness about ocean, coastal, Great Lakes and atmospheric science and stewardship."

One of the greatest difficulties that NOAA has in “getting the message out” is in the communication of uncertainties. This is a problem that cuts across the entire agency. Addressing this problem will involve understanding how individuals and communities perceive and respond to risk. It will also involve raising the level of scientific sophistication of its partners and customers. The expertise required here is less the rigorous science of earth and environment and more the craftsmanship of communication and education.

Transition of research to applications

Application of the best available science and technology is essential to meeting NOAA’s mission. This demands an operations enterprise that is able to quickly recognize and apply significant new research products and methods. Further, it requires a research and development enterprise focused on the ultimate application of emerging science and technology to user needs. Lastly, applying the best available science and technology requires that a formalized management structure guides the transfer of research to operational applications so that such transfers are effective and efficient in meeting mission responsibilities.

During the FY 2011-15 Planning process it is essential that the transition of research to applications is planned and prioritized at both the Program and Goal levels. This effort should also include the planning for external-to-internal transitions, such as NASA-NOAA and university-NOAA transition efforts.

Elements of a Business Case

In the course of planning for the FY 2011-15 period, NOAA's planners at the Program- and the Goal-levels will propose alternative investment strategies that would serve the agency's mission to meet our Nation's economic, social, and environmental needs. The diversity of NOAA services to the public – from hurricane forecasts to climate research to coastal management, to name a few – means that NOAA creates value for the Nation in a multitude of ways, and that there is no one best way for the agency to invest the next dollar.

The best investment strategies, however, will be able to communicate a successful and compelling business case that explains why the agency ought to invest in one alternative (rather than others) and that details how that alternative would be implemented. Business cases, as part of the strategic planning process, do not have to conform to presupposed fiscal constraints, but their development should be informed by the broader fiscal context of the agency, and of the federal government as a whole, particularly as there will be increasing pressure on discretionary spending in the coming years.

The following are the key components of such a business case. Alternative investment strategies should make the case that:

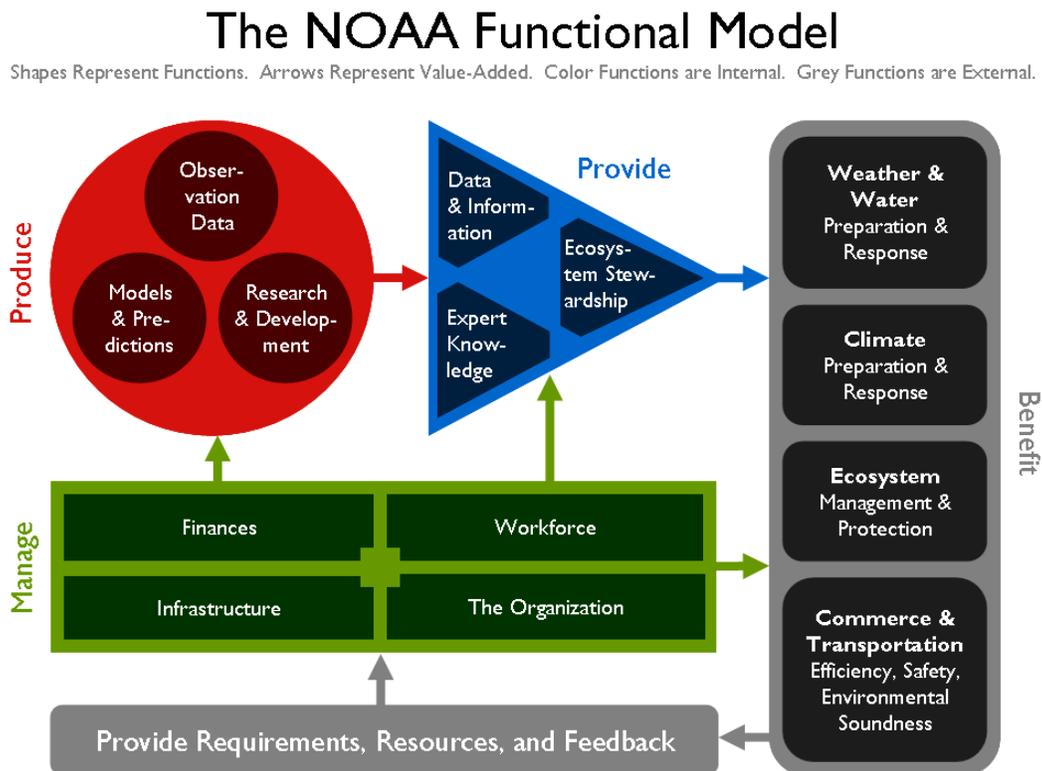
- ***Partner and customer demand is high for a new or improved product or service.*** What type of product or service is needed? Who needs it? How will they apply it? How have customers and partners been engaged to determine this?
- ***NOAA has clear responsibility, authority, and distinction to meet the demand.*** Who is telling the agency that it must, could, or should perform these duties?
- ***NOAA and its partners have a solid foundation of capabilities upon which to build a solution.*** How ready is NOAA to execute a possible solution? What elements of a solution are already in place, both within the agency and externally?
- ***A clear solution details how to fill the gap between existing and proposed capabilities.*** What capabilities are currently missing? What capabilities must be added? If the solution were executed, how would all the pieces fit together? What scientific or technical improvements to operational performance would result?
- ***Social, economic, and environmental impacts of the NOAA solution would be high.*** How would the product and service outputs of this solution directly benefit partners and customers? How would they improve public health and safety, reduce economic costs, have socio-cultural benefits, or increase environmental sustainability? What would be the consequences if NOAA failed to act?
- ***Technical, organizational, and fiscal risks of the NOAA solution would be manageable.*** What might be the potential challenges to implementing the plan as envisaged – on schedule and within budget? How might they be overcome? Are we accepting an appropriate level of risk?

NOAA's Enduring Functions

In preparing for the FY 2011-15 NOAA Program, it is helpful for the agency's planners to think in terms of the enduring, ideal-typical functions that are conducted within the agency, how they relate to each other, and how they create value for the Nation. NOAA's enduring functions are the things that the agency does – and will continue to do – irrespective of Line or Goal delineation. Analysis of functions allows us to consider how the outputs of those functions are utilized by NOAA partners and customers, as well as other functions within the agency.

The NOAA Functional Model (see figure below) depicts NOAA's unique functional types in relation to each other. The Model provides a conceptual account of what NOAA does, as derived from statutory mission drivers. It provides a perspective of the work of the agency that transcends disciplinary boundaries, organizational boundaries, people, places, and scale of activity. The model provides a common analytical framework and lexicon for both the NOAA workforce and policy-oriented stakeholders. Each function is a link within a value-chain; it adds value to inputs to create better outputs. At the most general level, NOAA manages its resources to produce its core content and to provide final products and services. Partners and customers then apply NOAA's final products and services, as well as NOAA's directed resources, to their particular needs.

It is important to acknowledge that NOAA is not the sole player in the arenas within which it functions. Rather, NOAA has many partners, the abilities of which it integrates with its own for a common purpose. To accomplish its mission, NOAA must rely upon others who have authority and responsibility beyond its own. The ability to leverage, convince, and evaluate others' actions is central to NOAA's success.



Conclusion

As stated in the introduction, the AGM provides planning guidance to the agency by identifying a limited number of high-level, high-impact, high-visibility, NOAA-wide priorities that require significant and sustained financial or managerial resources and effort. These priorities are a natural extension of NOAA's strategic Goals as shaped by recent trends and events in the agency's external environment. The Planning phase will be completed by Strategy Papers that present business cases for each of these seven priority areas, as well as by Strategic Portfolio Analyses, conducted by Goal Teams, that provide a scenario-based account of the comprehensive set of activities toward each strategic Goal. The elements of a successful business case and the account of NOAA's enduring functions serve as further guidance to the agency in developing these and other planning documents for the FY 2011-15 period.

For more information on this or other NOAA planning documents, or on any aspect of NOAA strategic planning, please email strategic.planning@noaa.gov.