

Weather Services for the Nation: Becoming Second to None

Statement of
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Congressmen, colleagues: Thank you for inviting me to talk to you today. My name is Bill Gail. I am co-founder and Chief Technology Officer of Global Weather Corporation, a provider of precision weather forecasts to businesses within the energy, media, transportation, and consumer sectors. We are a successful startup in today's economy because quality weather information is increasingly needed by business to serve customers and improve operations. My academic training is in physics and electrical engineering and I have two decades of experience in the fields of meteorology satellites, weather services, and location-aware software.

I'm speaking to you today in my role as a member of the Committee that produced the report "Weather Services for the Nation: Becoming Second to None," issued by the National Research Council and the National Academy of Sciences. This report, released in August of 2012, was the second report of a two-part assessment of the National Weather Service's Modernization and Associated Restructuring. In the first report, the Committee concluded that the Modernization and Associated Restructuring was a success and worth the investment. One of the most striking results of the Modernization has been the improvement in the probability of detecting and issuing warnings for severe weather events. For example, the probability of detection for flash floods

increased from about 40 percent to about 90 percent over the course of the Modernization. The second report presents advice for the National Weather Service (NWS) on how best to plan, deploy, and oversee future improvements based on lessons from the past.

TODAY'S KEY CHALLENGES

The Modernization of the 1990's produced major improvements to our nation's weather observing systems and to the NWS structure. It was primarily the response to an internal failure to properly modernize over several decades. The Committee felt that the NWS successfully internalized most lessons from the Modernization, and has since continued to modernize. Yet today the challenges they face are no less important than those of the Modernization era. Rather than internal failures, today's challenges are largely external, reflecting the ever-evolving user needs and technology context of our society. These challenges include:

- *Keeping Pace.* The pace of scientific and technological advancement in the atmospheric and hydrological sciences continues to accelerate. As an outgrowth of public and private-sector investment, technology advancements are exceeding the capacity of the NWS to optimally utilize these technological achievements. Furthermore, enormous amounts of data generated by new surface networks, radars, satellites, and numerical models need to be rapidly distilled into actionable information to create and communicate effective public forecasts and warnings. The skills required to comprehend, manage, and optimize this decision-making process go beyond traditional meteorological and hydrological curricula. Hence, the NWS workforce skill set will need to evolve appropriately.

- *Meeting Expanding and Evolving User Needs.* Increasingly, the United States is an information-centric society. Meteorological and hydrological information in particular is central to societal security and welfare. Unlike some other industries, weather is largely an information-based enterprise. The public expects continuous improvement in public safety and property protection related to severe weather.
- *Partnering with an Increasingly Capable Enterprise¹.* At the time of the Modernization, delivery of weather information was largely synonymous with the NWS, the broadcasting sector, and the private-sector suppliers of weather data and services that supported the broadcasting sector. Outside of this, the weather, water, and climate enterprise had limited capacity. Today, the enterprise has grown considerably, and now the NWS has many important partners. All of these entities rely on core NWS infrastructure and capabilities to provide customized services. Together this combination of the NWS and third parties serves the nation better than the NWS could on its own.

These challenges are made more difficult by the external context, two areas of which are of particular importance:

- *Budget resources* are uncertain and will likely be constrained for the next decade.
- *Operational performance standards* against which NWS is measured, including those set by international weather service counterparts and private-sector entities, are increasingly high.

¹ The “enterprise” includes all entities in the public, private, non-profit, research, and academic sectors that provide information, services, and infrastructure in the areas of weather, water, and climate. For the purposes of this report, “enterprise” is often used as shorthand to refer to those enterprise elements outside NOAA that it can draw on in its mission. The non-NOAA portion of the enterprise is now of equal or greater economic size compared to the NOAA portion.

Additional important contextual issues include: the transformative pace of technological change; expansion of the number and type of observational data; continued concentration of infrastructure investment and population growth in vulnerable areas; the possibility of changing weather patterns arising from climate change; and ongoing evolution of international dimensions.

RESPONDING TO THE CHALLENGES

Meeting today's key challenges will require NWS to evolve its role and how it operates. The goal is for it to become more agile and effective. This report presents three main recommendations for accomplishing this: Prioritize Core Capabilities, Evaluate Function and Structure, and Leverage the Entire Enterprise.

Prioritize Core Capabilities

The NWS needs to prioritize those core capabilities that only the NWS can provide so as to deliver the products and services upon which the public and the entire weather, water, and climate enterprise depend. These core capabilities include creating foundational datasets, performing essential functions such as issuing forecasts, watches, and warnings, and conducting operationally-related research.

Recommendation: The National Weather Service (NWS) should:

- 1. Evaluate all aspects of its work that contribute to its foundational datasets, with the explicit goal of ensuring that those foundational datasets are of the highest quality and that improvements are driven by user needs and scientific advances. As part of**

this initial and ongoing evaluation effort, clear quality and performance metrics should be established. Such metrics would address the technical components of NWS operations, as well as the efficiency and effectiveness of the flow of weather information to end users.

- 2. Ensure that a similarly high priority is given to: (a) product generation and dissemination; (b) the brokering and provision of data services, and (c) development and enhancement of analysis tools for maintaining a common operating picture (COP).**
- 3. Engage the entire enterprise to develop and implement a national strategy for a systematic approach to research-to-operations and operations-to-research.**

In support of this recommendation, the NWS should:

- Continue effective technology infusion programs,
- Improve numerical weather prediction systems,
- Develop and advance observational data metrics,
- Lead a community effort to provide probabilistic forecasts,
- Develop hydrologic prediction metrics, and
- Maintain an ongoing capability for development and testing of its incremental technical upgrades.

Evaluate Function and Structure

The current structure of the NWS primarily reflects the functions of the weather, water, and climate enterprise in the 1990s. Technology, including improvements in communications and

computer forecast models, has changed much of the rationale for the present organizational structure of the NWS. In view of the directions outlined in NWS's *Weather-Ready Nation Roadmap* for expanding the role of forecasters and other NWS staff, it would be prudent to evaluate the NWS's organizational and functional structure.

Recommendation: In light of evolving technology, and because the work of the National Weather Service (NWS) has major science and technology components, the NWS should evaluate its function and structure, seeking areas for improvement. Any examination of potential changes in the function and organizational structure of the NWS requires significant technical input and expertise, and should include metrics to evaluate the process of structural evolution. Such an examination would include individual NWS field offices, regional and national headquarters and management, as well as the National Centers and the weather-related parts of the National Oceanic and Atmospheric Administration (NOAA) such as the National Environmental Satellite, Data, and Information Service (NESDIS) and the Office of Oceanic and Atmospheric Research (OAR).

In support of this recommendation, the NWS should:

- Broaden the scope of its post-event evaluations,
- Expand its vision of team structures and functions within and between forecast offices,
- Develop performance metrics-based approaches to assessing staff skill sets,
- Retrain service-hydrologist staff to instill an evolutionary culture.

Leverage the Entire Enterprise

The relationship between NWS and the rest of the enterprise has improved considerably since the Modernization, with praise deserved by all parties. The Committee views further improvement of NWS-enterprise interaction as a way to enhance the NWS's capability to accomplish its mission of serving the public. This is especially important when it is seeking to enhance its service at a time when the nation faces constrained resources. Leveraging the entire enterprise provides one means to further NWS's mission of serving the public.

Recommendation: The National Weather Service (NWS) should broaden collaboration and cooperation with other parts of the weather, water, and climate enterprise. The greatest national good is achieved when all parts of the enterprise function optimally to serve the public and businesses. This process starts with the quality of core NWS capabilities but is realized through the effectiveness of NWS-enterprise relationships. A well-formulated enterprise strategy will also return direct benefit from the enterprise to the NWS, especially in areas of shared research, technology development, observational data sources, and improved end-user access to NWS-generated information.

In support of this recommendation, the NWS should:

- Seek to better understand the functioning of the secondary value-chain (defined as enterprise partners that provide value-added services beyond dissemination of NWS weather and warnings), and
- Strengthen its systems engineering and procurement processes for major systems.

EXAMPLES FROM THE WEATHER ENTERPRISE

Better weather information can both save lives and be a growth engine for the economy. A recent study showed that variability in U.S. economic output due to weather-related supply and demand inefficiencies is more than 3 percent of GDP. In some states, it is over 10 percent. A significant portion of this can be recovered as economic growth through improved weather information. I would like to provide two examples from my own company's experience reflecting innovative approaches to business growth through better use of weather information. These illustrate the importance to our nation of both the NWS and the Committee's recommendations.

The Omaha World-Herald news group, owned by Berkshire Hathaway, has recently acquired nearly 100 small- and mid-sized newspapers. Their vision is that newspaper companies are not dying, but rather the best source of critical local information, which will be delivered by these companies increasingly over web and mobile. Accurate weather forecasts are often the most important information they provide to smaller communities. The move to web and mobile allows them to customize forecasts for each reader, creating new ways for businesses to become more efficient and individuals more productive. Commercial weather companies are helping them implement the vision, but NWS foundational information is essential to making it possible.

Xcel Energy is the off-taker utility for 10 percent of America's wind farm capacity. Starting in 2009, Xcel privately-funded R&D at the National Center for Atmospheric Research, focused on improving the accuracy of wind forecasts. The resulting forecast system has since been successfully transitioned to a commercial company. Its operational use saved \$7.9 million for Xcel ratepayers in 2011 alone, but it depends critically on data from NWS.

THE OUTCOME: A NATIONAL WEATHER SERVICE SECOND TO NONE

Meeting today's challenges will require changes at the NWS over as much as a decade.

Fortunately, the Modernization established a solid foundation as a starting point. The recommendations presented in our report will help the NWS address these challenges, making it more agile and effective. It will have the highest quality core capabilities among national weather services. It will have a more agile organizational structure and workforce that will allow it to directly or indirectly reach more end users, save more lives, and help more businesses. And it will have leveraged these capabilities through the broader enterprise. In a constrained resource environment, this approach makes possible benefits to the nation beyond what the NWS budget alone allows.