

# Weather Services for the Nation Becoming Second to None



*John Armstrong, Committee Chair  
November 14, 2012*

# Study Context



*Photo credit: Capital Weather Gang*

The Modernization and Associated Restructuring (MAR) of the National Weather Service was officially completed in 2000.

No comprehensive assessment of the execution and impact of the MAR has been conducted.

Congress asked the NAS to conduct an end-to-end assessment that addresses the past modernization as well as lessons learned to support future improvements to NWS capabilities.

# Charge to the Committee

The assessment should address:

- high-impact weather and new science and technologies that allow for even better **forecasts**;
- the integration of new technologies and better models into NWS **operations**;
- **workforce** composition and structure; and
- improving current **partnerships** with private industry, academia, and other governmental agencies.

The committee completed their work in two phases. Phase I was completed in October 2011. ***This report contains Phase II, which uses the lessons learned from the MAR to provide the NWS with advice for the future.***

# Committee Membership

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\*resigned during the course of the study

# Lessons from the MAR

The Committee's first report presented Lessons in:

1. Management and Planning
2. Modernization of Technology
3. Restructuring of Field Offices and Staff
4. Partnerships
5. Oversight and Advisory Groups

## **Overall Lesson - *The Need for Ongoing Modernization***

If a science-based agency like the National Weather Service, which provides critical services to the Nation, waits until it is close to becoming obsolete, it will require a complex and very expensive program to modernize.

# Today's Key Challenges

- **Keeping Pace** with accelerating scientific and technological advancement.
- **Meeting Expanding and Evolving User Needs** in an increasingly information-centric society.
- **Partnering with an Increasingly Capable Enterprise** that has grown considerably since the time of the MAR.

# The Evolving Context

- **Budget resources** are uncertain and will likely be constrained in 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.

Additional, important contextual issues:

- the rapid, transformative pace of **technological change**;
- the number and type of **observational data** will expand greatly;
- continued concentration of infrastructure investment and **population growth** in vulnerable areas;
- climate change implies the possibility of **changing weather patterns**;
- the **international dimensions** will continue to evolve.

# Responding to the Challenges

This report presents three main recommendations for *meeting the key challenges within the evolving context* facing the NWS

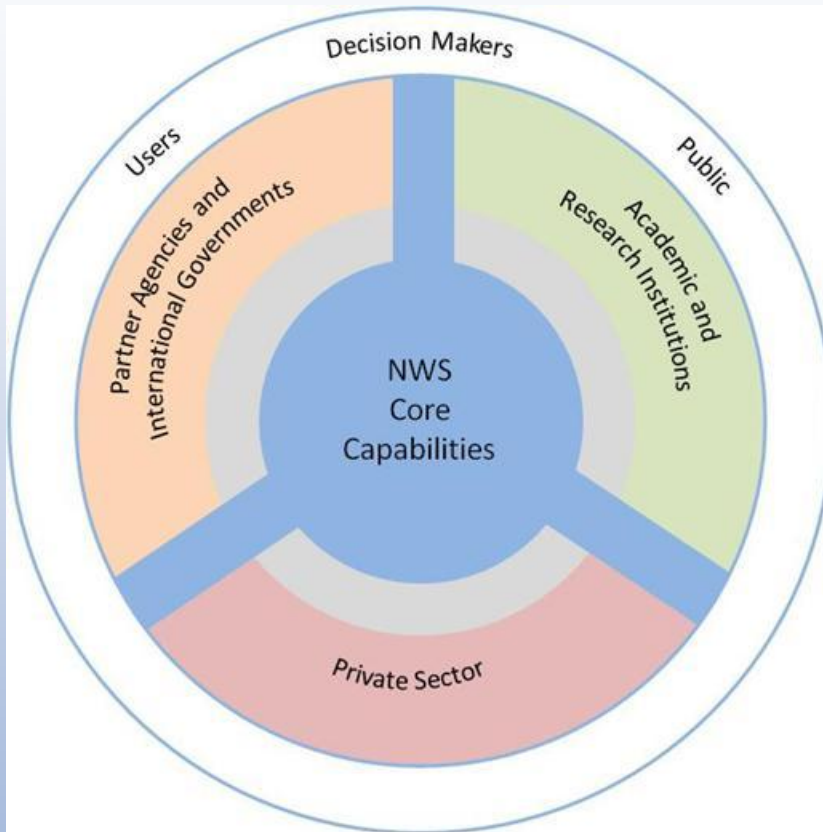


*Photo credit: NOAA*

1. **Prioritize Core Capabilities**
2. **Evaluate Function and Structure**
3. **Leverage the Entire Enterprise**



# Prioritize Core Capabilities



The public and the enterprise rely on NWS core capabilities

- **Foundational Datasets** include observations, advanced analyses either from modern data assimilation or other objective methods, and deterministic and probabilistic model-based predictions.
- **Essential Functions** activities and services that are mandated by the NWS mission such as product generation and dissemination
- **Operationally-Related Research** includes both research-to-operations (R2O) and operations-to-research (O2R)

# Prioritize Core Capabilities

## Recommendation I - *Prioritize Core Capabilities*

The NWS should:

1. **(Foundational Datasets)** Evaluate all aspects of its work that contribute to its foundational datasets, with the explicit goal of ensuring 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. **(Essential Functions)** 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. **(Operationally-Related Research)** Engage the entire enterprise to develop and implement a **national strategy** for a systematic approach to research to operations and operations to research.

# Prioritize Core Capabilities

## Rec I - *Prioritize Core Capabilities* Supporting Recommendations

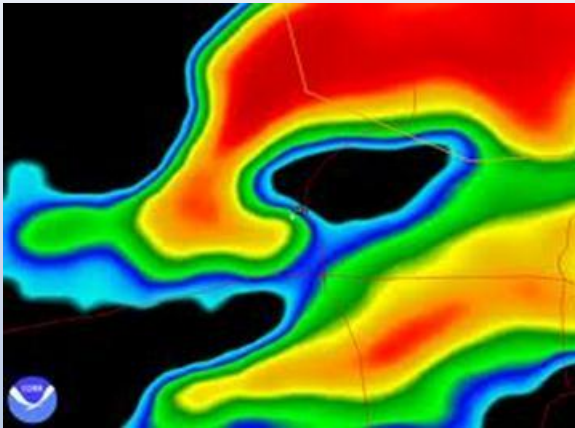


Photo credit: NOAA

- a) **Technology infusion.** Continue/improve programs for ongoing improvement
- b) **Numerical weather prediction (NWP).** Achieve higher quality and accuracy
- c) **Observational data metrics.** Use metrics to monitor value of observational datasets
- d) **Probabilistic forecasts.** Lead community effort to produce probabilistic products
- e) **Hydrologic prediction metrics.** Develop common, objective metrics with community
- f) **Incremental upgrades.** Core capability for development/testing of incremental advances

# Evaluate Function and Structure

*Congress has requested a **follow-on study of NWS operations**. The Committee agrees that this study is needed, and this recommendation and its sub-recommendations are intended to inform that study.*

## **Recommendation II - Evaluate Function and Structure**

In light of evolving technology, and because the work of the 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).

# Evaluate Function and Structure

## Rec II - *Evaluate Function and Structure* Supporting Recommendations

- a) **Post-event evaluations.** Broaden scope, possibly independent
- b) **Forecast offices.** Reconsider team structures within and between offices
- c) **Workforce evolution.** Develop performance metrics to aid staff skills evolution
- d) **Hydrologist staff.** Develop re-training capabilities to maintain currency



*Photo credit: NOAA*

# Leverage the Entire Enterprise

## Recommendation III - *Leverage the Entire Enterprise*

The NWS should **broaden collaboration 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.

# Leverage the Entire Enterprise

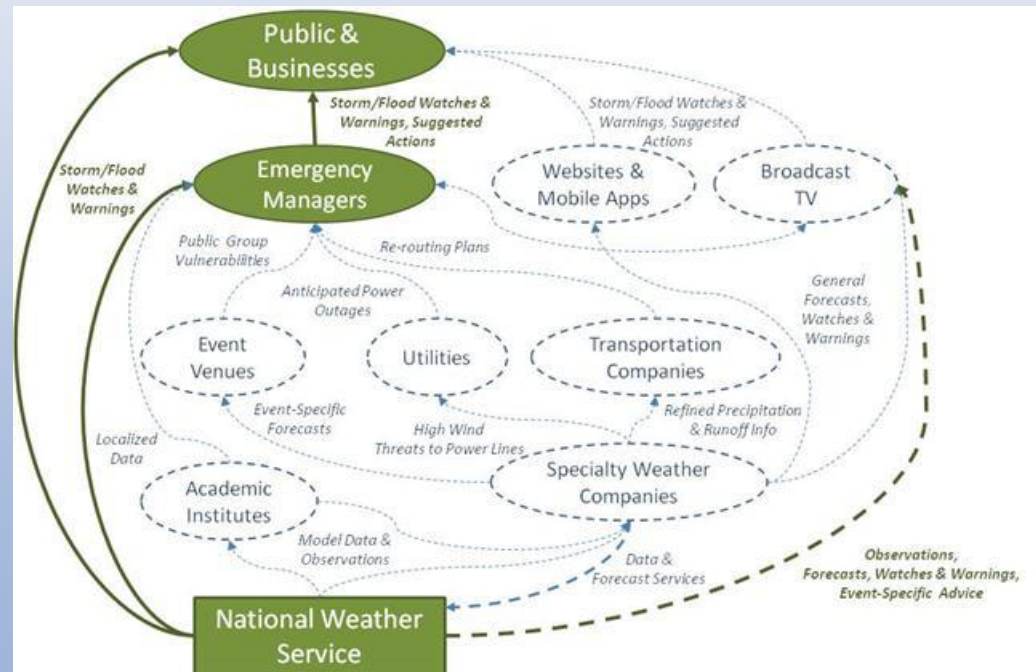
## Rec III - Leverage the Enterprise Supporting Recommendations

- a) **Secondary value-chain.** Improve understanding, and support with core capabilities
- b) **Major systems.** Strengthen systems engineering and procurement

The hypothetical **information value-chain** during a period of severe storm threat accompanied by flood potential.

This illustrates how various organizations may create and enhance information that eventually reaches the public.

**solid green** = primary value-chain  
**dashed blue** = secondary value-chain



# For more information

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Report is available online at [www.nap.edu](http://www.nap.edu).