U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON ENVIRONMENT

HEARING CHARTER

Restoring U.S. Leadership in Weather Forecasting
Part 2

Wednesday, June 26, 2013
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

PURPOSE

The Subcommittee on Environment will hold a second hearing entitled *Restoring U.S. Leadership in Weather Forecasting* on Wednesday, June 26, 2013 in Room 2318 of the Rayburn House Office Building. The purpose of the hearing is to examine ways to improve the National Oceanic and Atmospheric Administration (NOAA) weather forecasting, and to receive testimony on draft legislation to prioritize weather-related research. The first hearing was held May 23rd.

WITNESS LIST

Panel 1

- **The Honorable Kathryn Sullivan**, Acting Administrator, National Oceanic and Atmospheric Administration.

Panel 2

- **Dr. Kelvin Droegemeier**, Vice President for Research, Regents' Professor for Meteorology, Weathernews Chair Emeritus, University of Oklahoma.
- **Dr. William Gail**, Chief Technology Officer, Global Weather Corporation, President-Elect, American Meteorological Society.
- **Dr. Shuyi Chen**, Professor, Meteorology and Physical Oceanography, Rosentiel School of Marine and Atmospheric Sciences, University of Miami.

BACKGROUND

Recent extreme weather events in the United States have underscored the need for reliable, first-class weather forecasting. Within NOAA, the National Weather Service (NWS), the Office of Oceanic and Atmospheric Research (OAR), and the National Environmental Satellite, Data, and Information Service (NESDIS) play important roles in developing and

deploying U.S. weather forecasting capabilities.[1] NOAA is joined in this effort by an ever-evolving weather enterprise with the private sector. The National Academy of Sciences recently emphasized the importance of this partnership, noting that "[p]rivate sector and other organizations provide sensor data, weather forecasts, and end-user services to a broad set of customers."[2]

Weather impacts American lives, and extreme weather poses significant risks to important parts of the U.S. economy. NOAA has traced a rise in weather disasters costing the economy up to $1 billion in damage per weather event, and a recent analysis found that substantial parts of the economy are sensitive to weather variability, representing more than three percent of Gross Domestic Product and nearly $500 billion a year.[3]

In a 2012 report on the National Weather Service, the National Academy of Sciences stated that "[a]s an outgrowth of public and private sector investment in weather, climate, and hydrological research, new observational, data assimilation, prediction, and other technology advancements are exceeding the capacity of the NWS to optimally acquire, integrate, and communicate critical forecast and warning information based on these technological achievements."[4] Similarly, a *USA Today* editorial last October following Superstorm Sandy highlighted concerns about American weather forecasting abilities, concluding that "[t]he American model is the basis for many forecasts, and its reliability problems beyond the short term suggest something major is amiss…. The European model's embarrassing superiority on Sandy ought to accelerate efforts to identify and fix what's wrong."[5]

In response to the destruction of property and loss of life associated with Superstorm Sandy, Congress approved the *Disaster Relief Appropriations Act of 2013* which included $50 million in funding to NOAA's research office and $48 million to the Weather Serviceto improve forecasting equipment and supercomputer infrastructure.[6] This appropriation has been characterized as a "down payment" for "game-changing improvements" for U.S. weather prediction.[7]

Citing ongoing concerns about potential data gaps for NOAA's polar-orbiting and geostationary satellite programs, including a potential polar-orbiting gap of 17 to 53 months, the Government Accountability Office added NOAA's satellite programs to its High Risk List in 2013. This potential gap in weather satellite coverage and management problems with NOAA's

[1] For more information on these responsibilities, see: "To Observe and Protect: How NOAA Procures Data for Weather Forecasting," March 28, 2012, http://science.house.gov/hearing/subcommittee-energy-and-environment-hearing-how-noaa-procures-data-weather-forecasting.
[2] http://dels.nas.edu/resources/static-assets/materials-based-on-reports/reports-in-brief/Weather-Services-Report-Brief.pdf.
[3] http://journals.ametsoc.org/doi/pdf/10.1175/2011BAMS2928.1.
[4] http://www.nap.edu/catalog.php?record_id=13429.
[5] http://www.usatoday.com/story/opinion/2012/10/30/sandy-forecasting-ecmwf-gfs/1670035/.
[6] http://www.gpo.gov/fdsys/pkg/PLAW-113publ2/pdf/PLAW-113publ2.pdf
[7] Jason Samenow, "Game-changing improvements in the works for U.S. weather Prediction, The Washington Post, May 15, 2013, http://www.washingtonpost.com/blogs/capital-weather-gang/wp/2013/05/15/game-changing-improvements-in-the-works-for-u-s-weather-prediction/.

satellites has been the subject of several Science, Space, and Technology Committee hearings over many years.[8] The GAO emphasized the potential effects of a gap:

> According to NOAA program officials, a satellite data gap would result in less accurate and timely weather forecasts and warnings of extreme events, such as hurricanes, storm surges and floods. Such degradation in forecasts and warnings would place lives, property, and our nation's critical infrastructures in danger. Given the criticality of satellite data to weather forecasts, the likelihood of significant gaps and the potential impact of such gaps on the health and safety of the U.S. population and economy, GAO has concluded that the potential gap in weather satellite data is a high-risk area and added it to the High Risk List in 2013.[9]

In addition, independent reviews of NOAA's weather research portfolio have also recommended a stronger emphasis on moving research-to-operations within NOAA's weather portfolio. In 2010, the National Academy of Public Administration stated that OAR "provides particularly important institutional glue to support innovation across NOAA."[10] In April 2013, NOAA's Science Advisory Board stated that "unless… science is transitioned into operations… NOAA will fail in its mission. NOAA must make certain that the intended end use of the scientific information is understood from the start by its researchers working on scientific questions and, ensure that internal as well as external end-user needs are incorporated explicitly into the problem formulation."[11]

NOAA plays an important role in making procurement decisions about observing systems that provide data for weather prediction in the U.S. NOAA currently uses information from over 100 observational networks, including space-based remote sensing, atmospheric observations, surface observations, and ocean observations. One method to analyze the value of weather data from observing systems is called an Observing System Simulation Experiment (OSSE). OSSEs employ computer modeling used to investigate the potential impact of planned observing systems or to test current observational and data assimilation systems. NOAA has stated that OSSEs "could play a critical role in…identifying future observation systems and data assimilation systems for improvement."[12]

For these reasons, the Weather Forecasting Improvement Act of 2013 (H.R. 2413) introduced by Environment Subcommittee Vice Chairman Jim Bridenstine will prioritize the mission of NOAA to include the protection of lives and property, and make funds available to improve weather-related research, operations, and computing resources. The bill directs NOAA to undertake quantitative, cost-benefit assessments used in obtaining data for forecasts. It also directs NOAA

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[8] http://science.house.gov/hearing/subcommittee-investigations-and-oversight-hearing-continuing-oversight-nation%E2%80%99s-weather; http://science.house.gov/hearing/joint-hearing-investigations-and-oversight-energy-and-environment-subcommittees-polar; http://science.house.gov/hearing/subcommittee-investigations-and-oversight-hearing-polar-weather-satellites.

[9] http://www.gao.gov/highrisk/mitigating_gaps_in_weather_satellite_data.

[10] http://www.napawash.org/wp-content/uploads/2010/09/NAPA-Final-Report_NOAA-Climate-Service-Study_September-20101.pdf.

[11] http://www.sab.noaa.gov/Reports/2013/SAB%20R&D%20Portfolio%20Review%20Report%20to%20NOAA%20FINAL.pdf.

[12] http://laps.noaa.gov/met/osse.html.

to prepare a report outlining the options of commercial opportunities for obtaining space-based weather observations.

ADDITIONAL READING

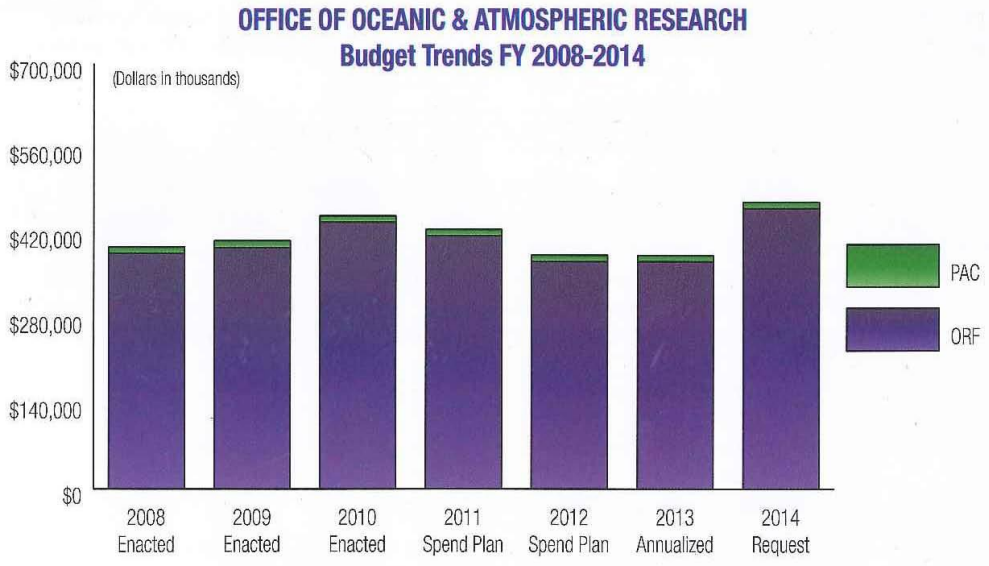
- National Academies of Science Report, *Weather Services for the Nation: Becoming Second to None*, *August 2012.*
- Dan Vergano, USA Today, *U.S. Forecast's Late Arrival Stirs Weather Tempest*, October 2012.
- NOAA Science Advisory Board Report, *In the Nation's Best Interest: Making the Most of NOAA's Science Enterprise*, April 2013.

Appendix 1: OFFICE OF OCEANIC & ATMOSPHERIC RESEARCH BUDGET[13]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION — FY 2014 BUDGET SUMMARY

OFFICE OF OCEANIC & ATMOSPHERIC RESEARCH

(DOLLARS IN THOUSANDS)	FY 2012 SPEND PLAN	FY 2013 ANNUALIZED CR	FY 2014 REQUEST	INCREASE (DECREASE)
OAR — ORF				
Climate Research	$181,044	$141,394	$188,840	$47,446
Weather and Air Chemistry Research	67,779	68,191	81,624	13,433
Ocean, Coastal, and Great Lakes Research	114,719	156,165	179,806	23,641
Information Technology, R&D & Science Education	8,946	9,000	11,786	2,786
Total, OAR - ORF	372,488	374,750	462,056	87,306
Total, OAR - PAC	10,296	10,350	10,379	29
GRAND TOTAL OAR (Direct Obligations)	**$382,784**	**$385,100**	**$472,435**	**$87,335**
Total FTE	**755**	**755**	**769**	**14**



ORF: Operations, Research, and Facilities

PAC: Procurement, Acquisition, & Construction

[13] http://www.corporateservices.noaa.gov/nbo/fy14_bluebook/FINALnoaaBlueBook_2014_Web_Full.pdf.

The Weather Improvement Act of 2013
Section-by-Section Analysis

Section 1. Title. Weather Forecasting Improvement Act of 2013.

Section 2. Public Safety Priority. Directs Under Secretary (NOAA Administrator) to make weather forecasting to protect lives and property NOAA's top planning and management priority in relevant line offices.

Section 3. Weather Research and Forecasting Innovation.

(a) Establishes/codifies NOAA weather research program, directing agency to place "priority emphasis on development more accurate and timely warnings and forecasts of high impact weather events that endanger life and property."
(b) (b)(1) and (b)(2) describe specific program elements to be pursued—advanced radar, aerial systems, computing/modeling, and OSSEs.
(b)(3) codifies longstanding joint OAR-NWS tech transfer program, moving its funding from NWS.
(c) Directs NOAA to support academic weather research through competitive grants and contracts.

Section 4. Tornado Warning Extension Program. Establishes a Tornado Warning Extension Program focused on developing and extending accurate tornado forecasts and warning beyond one hour in order to reduce loss of life, injury, and damage to the economy.

Section 5. Weather Research and Development Planning. Directs NOAA to develop a prioritized weather research plan to guide activities authorized under the Act and restore U.S. leadership in weather modeling, prediction, and forecasting. Specifies that the plan shall identify, through consultation with the National Science Foundation, research necessary to integrate social science knowledge into weather forecast and warning processes.

Section 6. Observing System Planning. Directs NOAA to maintain a list of observation data requirements and systematically evaluate the combination of systems necessary to meet such requirements, including as they related to potential data gaps. Directs NOAA to develop a range of options to address any identified gaps.

Section 7. Observing System Simulation Experiments. Directs NOAA to undertake Observing System Simulation Experiments (OSSEs) to quantitatively assess the relative value and benefits of observing capabilities and systems. Specifies under what conditions OSSEs should be performed.

Section 8. Computing Resources Prioritization Report. Directs NOAA to issue a plan for assuring that NOAA aggressively pursues the newest, fastest, and most cost effective high performance computing technologies in support of its weather prediction mission, and identifies opportunities to reallocate existing advanced computing resources from lower priority uses to improve operational weather prediction.

Section 9. Commercial Weather Data. Clarifies that restrictions in existing law prohibiting the sale of weather satellite systems to the private sector do not extend to the purchase of weather data through contracts with commercial providers or the placement of instruments on private payloads.

Section 10. Definitions.

Section 11. Authorization of Appropriations. Authorizes, out of funds made available to OAR's operations, research, and facilities appropriations account, $100 million for each of fiscal years 2014 through 2017 to carry out the weather research program established under section 3. Also authorizes $20 million annually to carry out the joint technology transfer initiative described in section 3(b)(3).