

Building a Weather-Ready Nation



2019-2022
STRATEGIC PLAN



NOAA's
National Weather Service

TABLE of contents

Letter from the Director	3
Foreword	4
Mission, Vision and Principles	6
Goal 1: Reduce the impacts of weather, water, and climate events by transforming the way people receive, understand, and act on information.	8
Goal 2: Harness cutting-edge science, technology, and engineering to provide the best observations, forecasts, and warnings.	12
Goal 3: Evolve the NWS to excel in the face of change through investment in our people, partnerships, and organizational performance.	16
Appendices	20

Director's Message

Americans are increasingly dependent on timely, reliable, and accurate weather, water, and climate information for the protection of life and property and enhancement of the Nation's economy. The National Weather Service is working across the Department of Commerce to keep Americans safe by predicting extreme weather events earlier and with more accuracy.

The National Weather Service is committed to ensuring the safety of our citizens and protecting their livelihoods by providing the best observations, forecasts, and warnings, and linking those directly to life-saving decisions made in every community. We are continuously working to improve our forecast and warning capabilities, to better communicate the uncertainty inherent in extended forecasts, and to better connect forecasts and warnings to life and property-saving decisions.

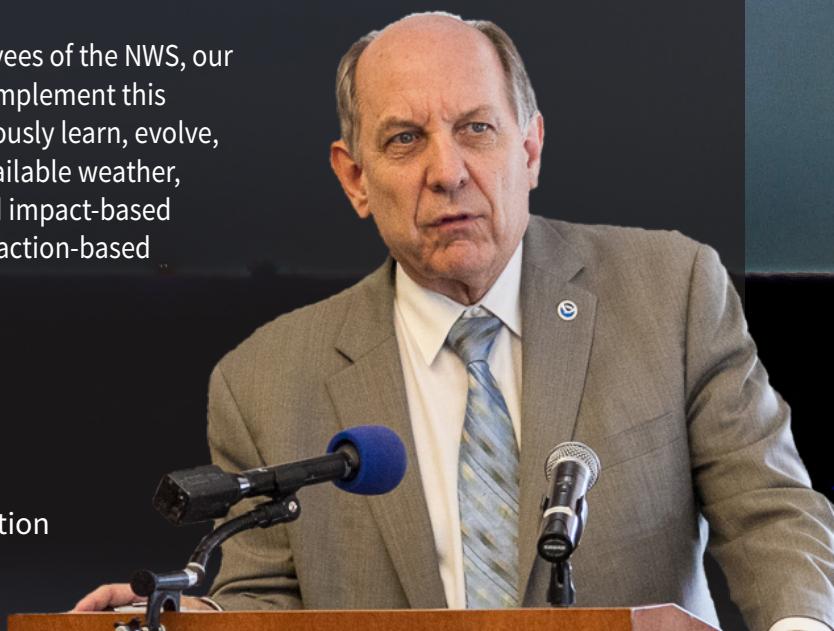
We do this by providing "impact-based decision support services," or IDSS, meeting the everyday decision needs of core partners at local, state, federal and tribal nation levels. As reflected in this new strategic plan, our efforts to evolve will require a focus on developing the skill sets and overall capacity to provide consistent and actionable forecasts, warnings, and preparedness information to decision-makers at all levels; operationalize advances in observations, science, and technology; and, align our operations, systems, and processes to provide consistent and reliable products and services.

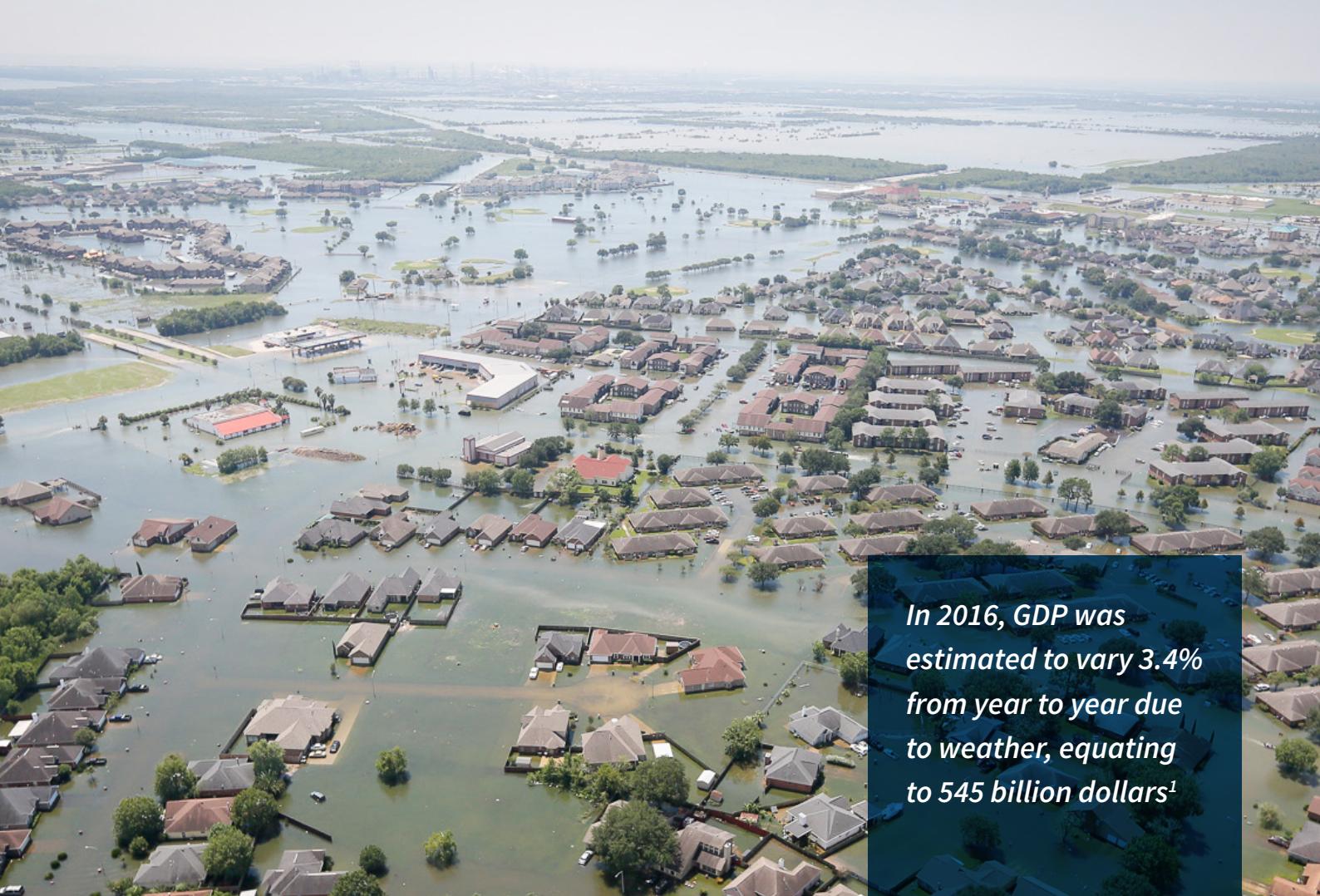
We will draw on the knowledge, skills, and abilities of the NWS employees who are among the most highly dedicated and motivated people in the Federal government, committed to realizing our mission of saving lives and property. In turn, we will support our workforce through more comprehensive training, streamlined hiring and development initiatives, and other activities that improve the employee experience at the NWS. However, we cannot do it alone. We will continue to strengthen our relationships with other NOAA line offices to provide integrated environmental information and services, develop and maintain key observations that drive our forecasts, and transition new science and technology into operations. We will also increasingly rely on our valued partnerships with the Weather, Water, and Climate Enterprise (Enterprise) to develop these capabilities and improve our ability to effectively reach the public with our forecasts and warnings. This entire Enterprise is also supporting the rapidly growing demand for weather, water, and climate information across multiple economic sectors, relying on NWS foundational data, models, and forecasts for their services. Only through these partnerships will we achieve our strategic vision for a Weather-Ready Nation, where society is ready, responsive and resilient to impending extreme weather and water events.

I look forward to working with the dedicated employees of the NWS, our core partners, and partners in the Enterprise as we implement this Strategic Plan. As we move forward, we will continuously learn, evolve, and improve our performance to deliver the best available weather, water and climate data, forecasts and warnings, and impact-based decision support services to ensure timely, reliable, action-based services that our nation has come to expect from the National Weather Service.



Dr. Louis W. Uccellini
Assistant Administrator for Weather Services,
National Oceanic and Atmospheric Administration
Director, National Weather Service





In 2016, GDP was estimated to vary 3.4% from year to year due to weather, equating to 545 billion dollars¹

foreword

A nationwide survey indicates that weather forecasts generate \$35 billion in economic benefits (2016) to U.S. households, about 6 times the cost spent on weather forecasting and research²

As extreme weather becomes more common and damaging due to a confluence of physical and socioeconomic factors³, the nation is turning to the National Weather Service to provide weather, water, and climate observations, forecasts and warnings to protect life and property and enhance the national economy. The NWS mission includes a wide range of service areas to address a multitude of atmospheric and hydrologic phenomena ranging from space weather to severe storms, tropical cyclones, winter storms, aviation and fire weather, inland and coastal flooding, droughts and other climate phenomena, marine/oceanic storm systems, and tsunamis, a domain extending from the “sun to the sea.”

Guided by the Weather-Ready Nation Strategic Plan developed in 2011, the NWS has worked to improve its forecast and warning capabilities and connect them to public safety decisions through impact-based decision support services. These advancements have enabled Americans to make better decisions in the face of extreme weather events to mitigate their impacts and enhance the resilience of our nation. However, much has changed in the last eight years, warranting an update to our strategic plan. Technology advancements are accelerating, leading to a more connected world with greater expectations for timely and actionable information. Technology is also driving advances in observations. Machine learning, big data analytics, the internet of things, and miniaturization are all contributing to a giant leap forward in how scientists observe the atmosphere. Furthermore, the Weather, Water, and Climate Enterprise continues to grow and is now engaged in all areas of the forecast value chain, from observations to decision support.

This plan is informed and influenced by:

The 2018-2022 Department of Commerce Strategic Plan, particularly Objective 3.3: Reduce Extreme Weather Impacts

The Weather Research and Forecasting Innovation Act of 2017 and 2019 reauthorization

Recommendations from external National Academy reports in 2011 and 2013

The NWS Operations and Workforce Analysis, conducted in 2015-2016

The President's Management Agenda, March 2018

As the NWS approaches its 150th anniversary, we see the need to more rapidly and holistically evolve the agency to realize the vision of a Weather-Ready Nation. This change will require a shift from individual performance to a more collaborative operational model, whereby the

collective wisdom and operations of our workforce are brought to bear on significant weather, water, and climate challenges. It will require the application of new science, tools, and technologies to process and communicate critical forecasts, warnings, and hazards. We will need to use nimble and effective approaches to keep workforce skills current and ensure that we can meet future customer needs.

*In 2016, **6.8 million homes** were at risk of hurricane storm surge damage, with reconstruction cost values of over 1.5 trillion dollars⁴*

The NWS contributes to NOAA's mission through expertise in weather, water, and climate prediction, but benefits from expertise and services from other NOAA offices in space-based and ocean observations, basic research and research-to-operations, ocean observations and ecological forecasts, and much more. Implementing this strategy will involve close collaboration with our NOAA colleagues, as our success depends on all of NOAA's capabilities. We will also leverage the full capacity of our broader set of partners across the entire Enterprise.

¹Lazo, J.K., Lawson, M., Larsen, P.H., and Waldman, D.M. (2011). *United States Economic Sensitivity to Weather Variability*. *Bulletin of the American Meteorological Society*, p.710. DOI:10.1175/2011BAMS2928.1.

²Lazo, J. K., Morss, R.E. and Demuth, J.L. (2009). *300 billion served: Sources, perceptions, uses, and values of weather forecasts*. *Bulletin of the American Meteorological Society* 90(6), 785-798.) and U.S. Department of Commerce, Economics and Statistics Administration. (2014). *Fostering Innovation, Creating Jobs, Driving Better Decisions: The Value of Government Data*.

³National Climate Assessment and NOAA NCEI Billion-Dollar Weather and Climate Disasters

⁴U.S. Department of Commerce/National Oceanic and Atmospheric Administration. (2018, June). *NOAA By The Numbers: Economic Statistics Relevant to NOAA's Mission*. Silver Spring, Maryland: United States.

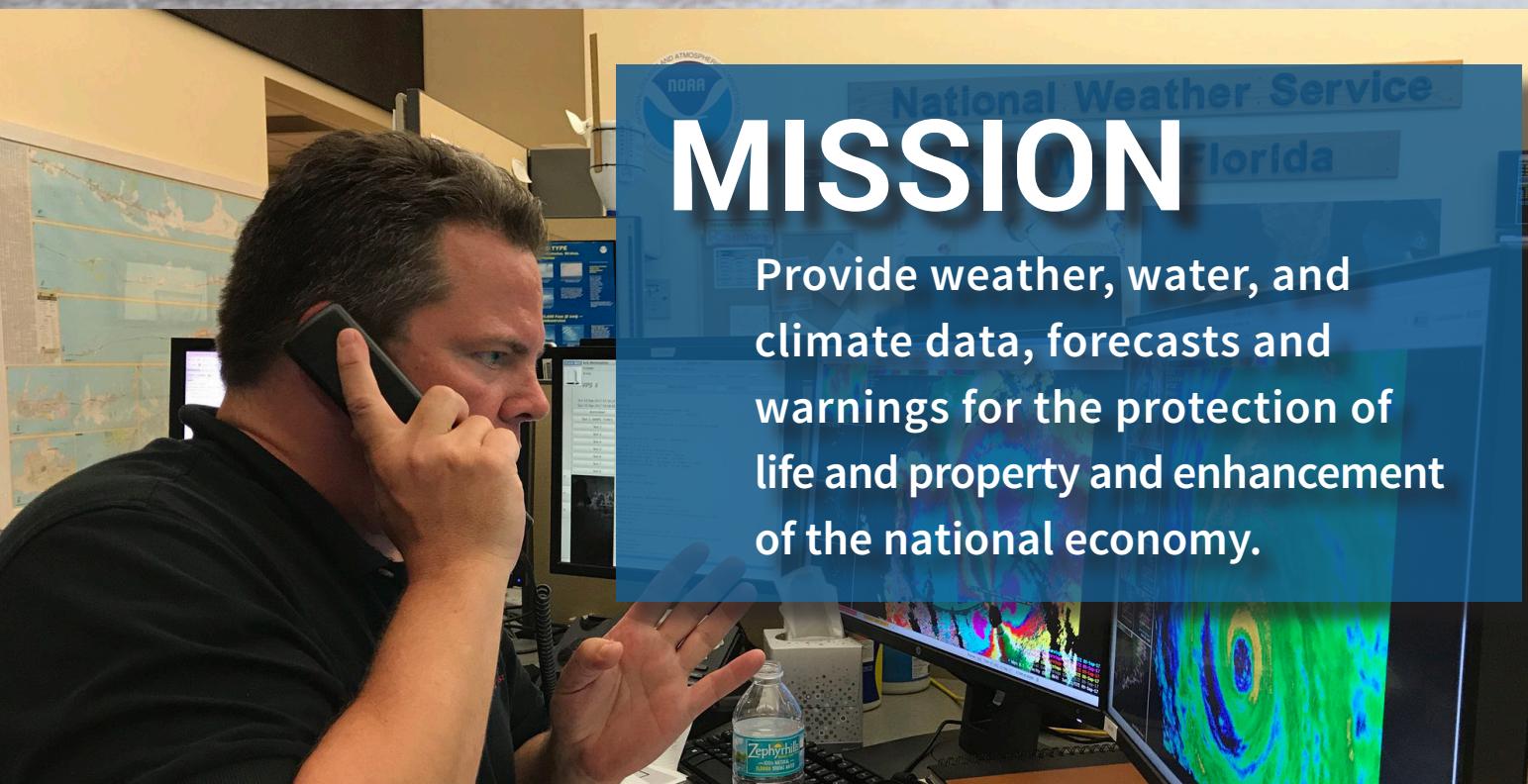
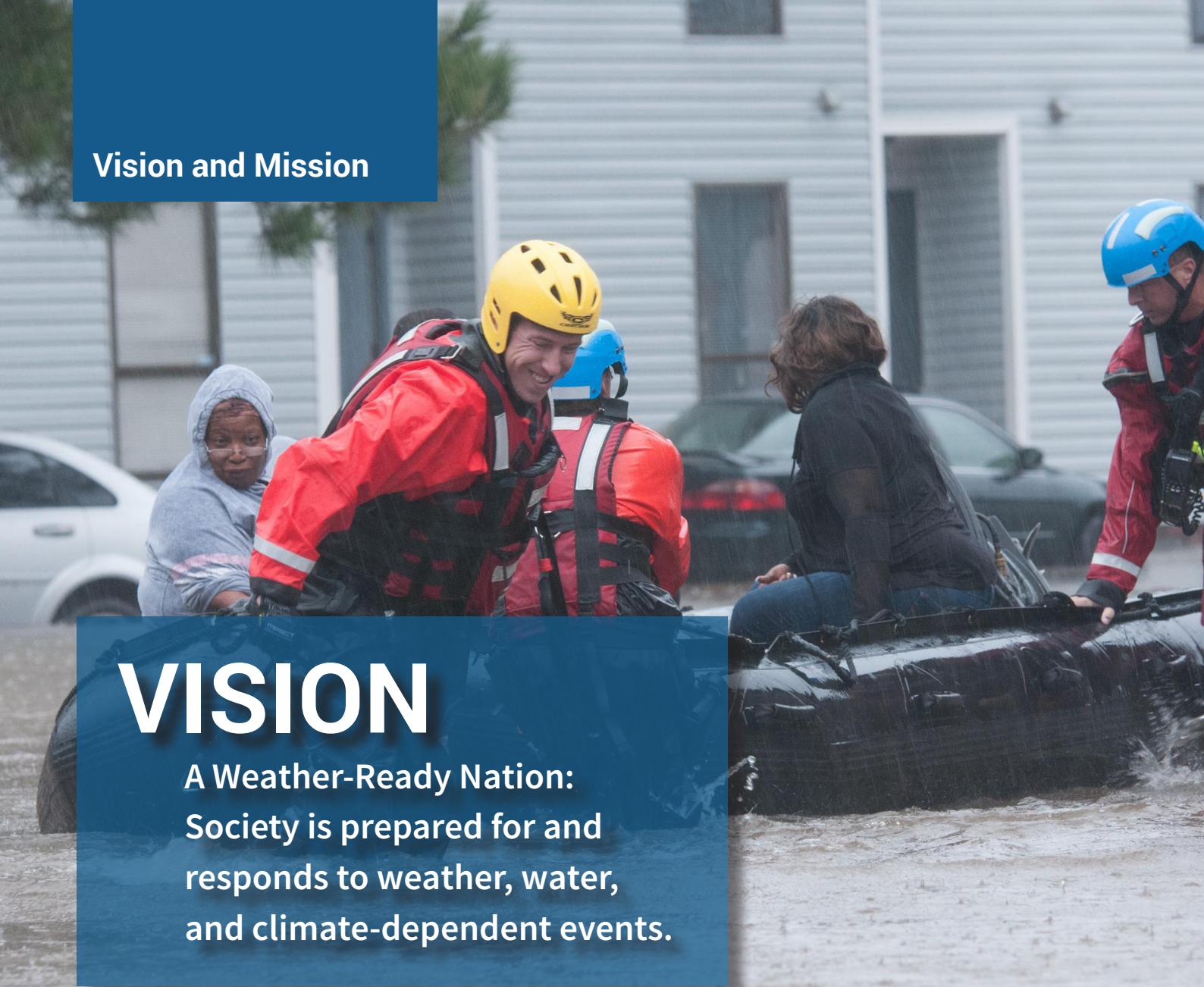
Vision and Mission

VISION

A Weather-Ready Nation:
Society is prepared for and
responds to weather, water,
and climate-dependent events.

MISSION

Provide weather, water, and
climate data, forecasts and
warnings for the protection of
life and property and enhancement
of the national economy.



2019-2022 Strategic Goals



GOAL 1

Reduce the impacts of weather, water, and climate events by transforming the way people receive, understand, and act on information.



GOAL 2

Harness cutting-edge science, technology, and engineering to provide the best observations, forecasts, and warnings.



GOAL 3

Evolve the NWS to excel in the face of change through investment in our people, partnerships, and organizational performance.



Core Principles

Our people drive our success; we are dedicated to our science-based service to the Nation.

We provide the best forecasts possible; connecting them to decisions that reduce impacts.

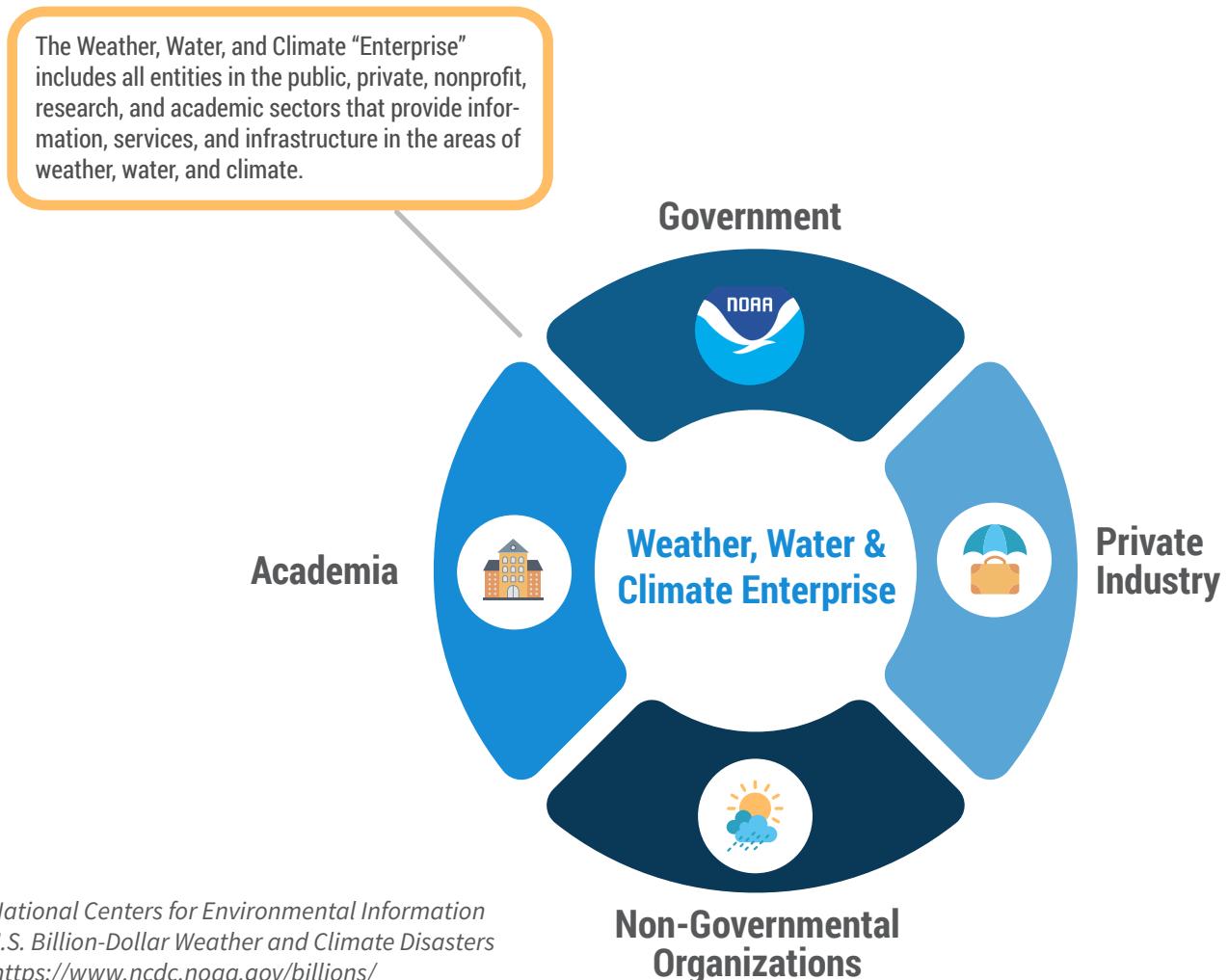
We cannot do it alone; teamwork and partnerships are essential for success.

We strive for excellence; continuously improving our science and engineering for mission performance.

GOAL 1

Reduce the impacts of weather, water, and climate events by transforming the way people receive, understand, and act on information.

Between 1980 and 2018, the United States sustained 241 weather and climate disasters in which overall damages/costs reached or exceeded \$1 billion⁵, with a significant toll on the lives of millions. To reduce the impact of extreme weather, water, and climate events, the National Weather Service will continue to transform the way that people receive and act on life and property saving information, with better forecasts, more accurate and timely warnings, and clearer communications, leading to better decisions, fewer lives lost, and a stronger economy. NWS will achieve this goal through impact-based decision support services (IDSS) that improve the Nation's ability to prepare for and respond to extreme events, while concurrently strengthening partnerships with governmental decision-makers and by engaging the broader Weather, Water, and Climate Enterprise (Enterprise).



⁵NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2019). <https://www.ncdc.noaa.gov/billions/>

Objectives

to achieve Goal 1

Transformative Impact-Based Decision Support Services (IDSS)

- 1.1.** Connect forecasts and warnings to decisions made by public safety, emergency management, water resource management, and national and economic security agencies and officials to ensure planned, coordinated, and effective preparedness and response, especially for extreme weather, water, and climate events.
- 1.2.** Emphasize expert interpretation, consultation, and communication of forecasts and their impacts where and when they are most needed.
- 1.3.** Increase understanding of society's⁶ needs and provide targeted outreach and education to ensure public awareness, understanding, preparedness, and responsiveness for extreme events.
- 1.4.** Leverage Enterprise capabilities through a collaborative approach that minimizes impacts and maximizes public safety and economic resilience.

Impact-Based Decision Support Services:

IDSS is the provision of relevant information and interpretive services that enable partners to prepare for and respond to extreme weather, water, and climate events for the protection of lives and livelihoods.



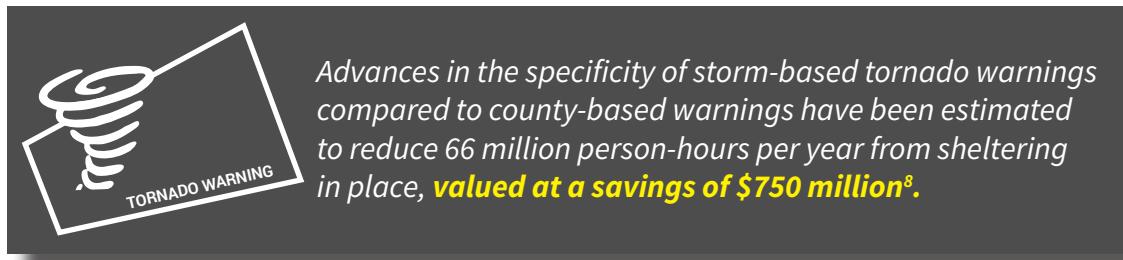
It was estimated that IDSS provided by NWS and others for New York City winter storms alone provide up to \$65 million in value to the aviation sector per year.⁷

⁶Society: People living together in organized communities of the United States with shared laws, traditions, and values, which includes emphasis on underserved or vulnerable populations.

⁷ABT Associates Inc. Social and Economic Effects of Severe Winter Storms: New York Case Study, 2017.

Better Information for Better Decisions

- 1.5.** Integrate social, behavioral, and economic sciences to simplify the communication of information and improve the understanding and utility of forecasts and warnings.
- 1.6.** Improve the quantification of confidence, specificity, and potential impacts within forecasts and warnings.



- 1.7.** Improve the accuracy of weather and climate forecasts by extending current day-2 performance to day-3 for extreme weather events; establishing 10-day forecasts as accurate as current 7-day weather forecasts; and providing seamless week 3-4 temperature and precipitation forecasts to link information at weather and sub-seasonal timescales.
- 1.8.** Deliver actionable water resources information from national to street-level and across all time scales; provide minutes-to-months river forecasts that quantify both atmospheric and hydrologic uncertainty; improve forecasts of total water in the coastal zone by linking terrestrial and coastal models in partnership with the National Ocean Service; and deliver forecasts of flood inundation linked with other geospatial information to inform life-saving decisions.
- 1.9.** Collaborate across NOAA to increase visibility and access to the full range of integrated environmental information, forecasts, products, and services.

NWS will be providing better information for better decisions across all service areas:

*Aviation
Climate
Fire Weather
Marine Weather
Public Weather
Severe Weather*

*Space Weather
Tropical Weather
Tsunamis
Water Resources
Winter Weather*

⁸Sutter, D. and Erickson, S. (2010). *The time cost of tornado warnings and the savings with storm-based warnings*. *Weather, Climate, and Society*, 2(2), 103-112. Retrieved February 24, 2017.

Timely and Consistent Messaging

1.10. Deliver one consistent NWS forecast from national to local scales with accurate and actionable messaging.

1.11. Apply a common operating picture across all NWS operational offices to support rapid and seamless in-person and/or virtual decision support.

1.12. Provide more frequent and timely access to forecast information through a continuously-updated and interoperable database.

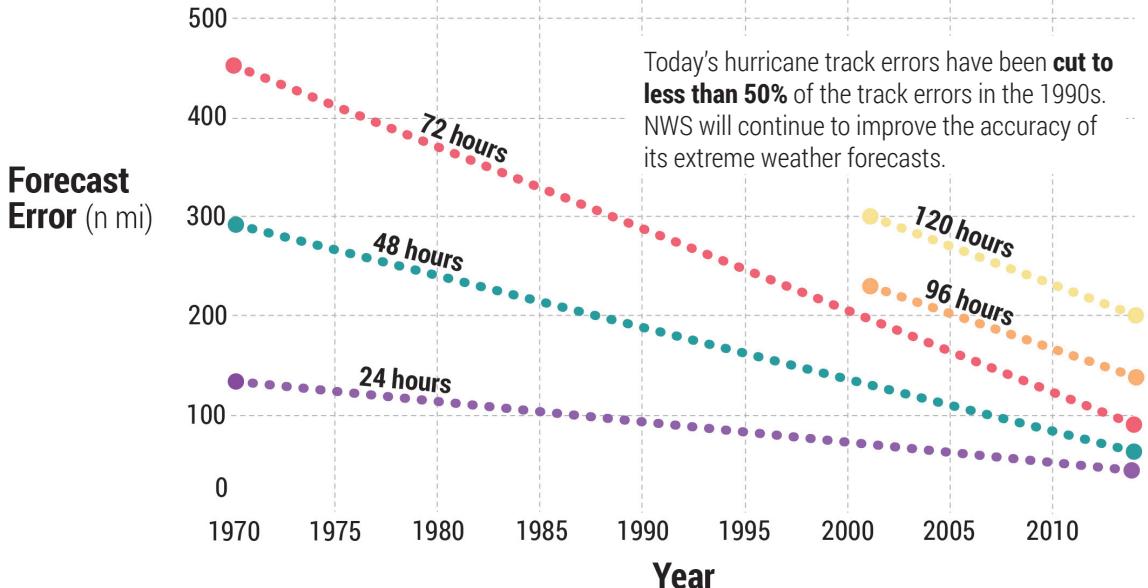
1.13. Leverage Enterprise capabilities to extend the reach and amplify NWS forecasts and warnings to improve individualized decision-making.

Improved forecasts will drive better response to high-impact weather, water and climate events, such as: hurricanes, floods, wildfires, tornadoes, drought, and extreme cold or heat.

A **Common Operating Picture** is an accessible repository of digital, extensible environmental data and forecasts to enable multi-level collaboration across the entire NWS.



Average NHC Atlantic Track Forecast Errors
Tropical Storms and Hurricanes



GOAL 2

Harness cutting-edge science, technology, and engineering to provide the best observations, forecasts, and warnings.

To remain on the cutting edge and lead the world in Earth system observations and weather prediction, the National Weather Service must sustain and improve its observing system infrastructure with new technologies while leveraging more observations through innovative public and private partnerships, looking for ways to do things more cost-effectively. Next generation weather and earth system models will be developed using a community-based approach, along with advances in high-performance computing. The National Weather Service will also improve its tools, systems, and policies for virtualization, analytics, data management, and dissemination, ensuring full utilization of state-of-the art science, data sources, and technologies. Collaboration with partners across NOAA, other federal agencies, and the Enterprise will be critical to enable effective research to operations and operations to research activities.



*The term “**Earth system**” refers to Earth’s interacting physical, chemical, and biological processes. The system consists of the land, oceans, atmosphere and poles.*

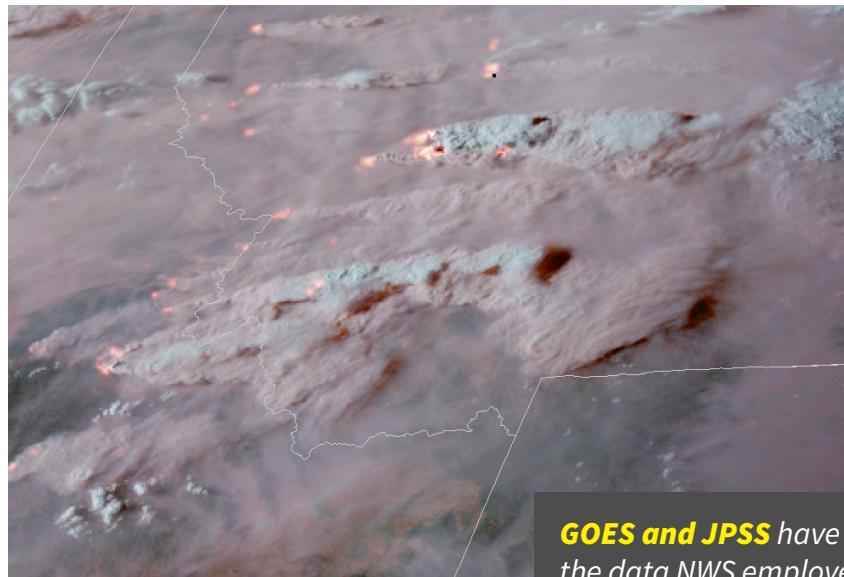
Objectives to achieve Goal 2

Advanced Models

- 2.1.** Build the world’s best unified, community-based, numerical earth system prediction capabilities through collaboration with Enterprise partners.
- 2.2.** Harness the power of ensemble modeling as the starting point for NWS forecast operations and to quantify certainty and promote consistency across all NWS service areas.
- 2.3.** Adopt the next generation of high-performance computing to advance forecasts of extreme and high-impact events.

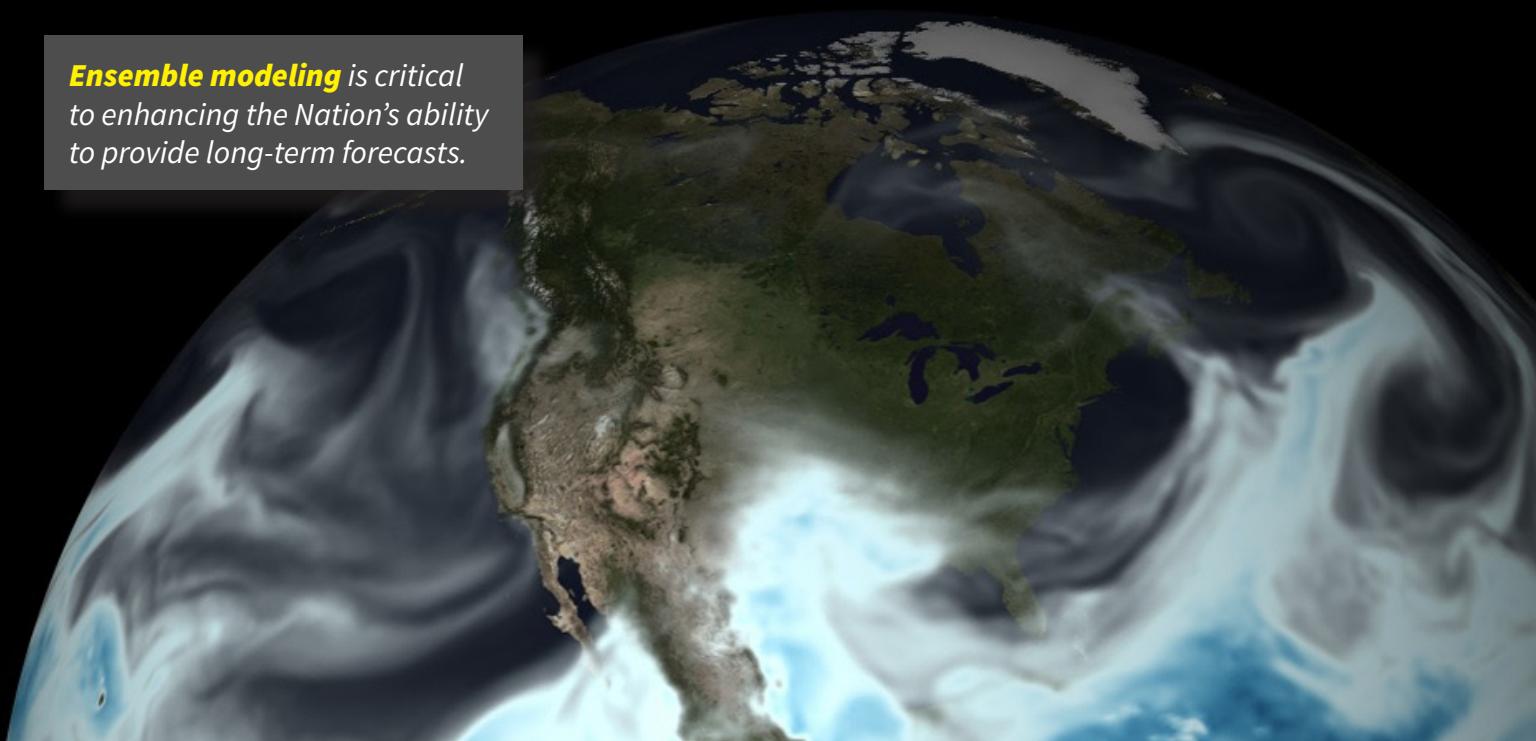
Integrated Observations

- 2.4. Ensure continuous operations with foundational observing assets, including radar and satellite systems, and adoption of emerging technologies to reduce costs and improve information.
- 2.5. Utilize the broad observational capabilities of the Enterprise to establish the best possible analysis of the atmosphere, land surface, oceans, and cryosphere to ensure situational awareness, enable enhanced data assimilation, and meet growing user demands.



GOES and JPSS have vastly expanded the data NWS employees can access and include in the forecast and warning process.

Ensemble modeling is critical to enhancing the Nation's ability to provide long-term forecasts.



Systems, Technologies, and Tools

2.6. Modernize the agency's systems, technologies, and tools to enable IDSS anytime, at any location.



Virtualization of NWS systems
will improve collaboration across NWS and with key decision makers.

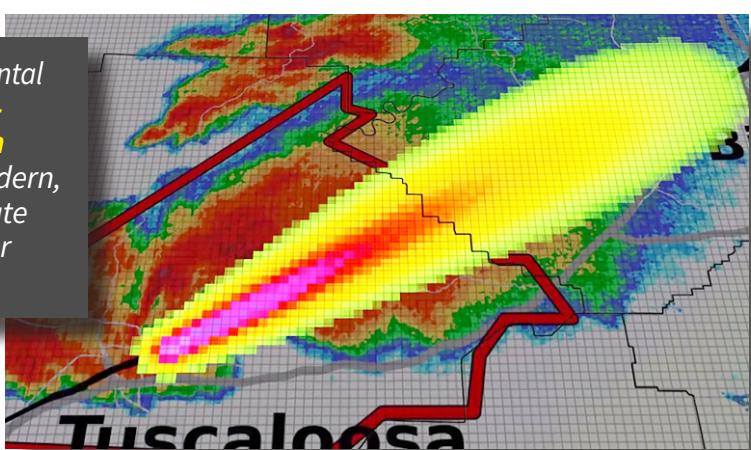
2.7. Incorporate predictive analytics, cognitive computing, artificial intelligence, and automation to combine forecast information with impact information and focus forecaster time and energy when and where it matters most.

2.8. Leverage Enterprise expertise to advance analytics, visualization, collaboration technologies, and social science.

As of 2017, the weather, water, and climate Enterprise was **valued at ~10 billion** and growing 10-15% annually⁹.

2.9. Improve Enterprise accessibility, reliability, and interoperability of weather, water, and climate data and information, including use of Geographic Information Systems (GIS), to support public safety, economic growth, and Enterprise innovations.

*Forecasting a Continuum of Environmental Threats (FACETs) is a proposed **next-generation severe weather watch and warning framework** that is modern, flexible, and designed to communicate clear and simple hazardous weather information to serve the public.*



⁹National Weather Service Enterprise Analysis Report Findings on changes in the private weather industry, June 8, 2017.

Research to Operations and Operations to Research (R2O/O2R)

2.10. Partner with the Office of Oceanic and Atmospheric Research (OAR)¹⁰, the U.S. weather research community, and other Enterprise partners to ensure continuous development and transition of the latest scientific and technological advances into operations.

2.11. Streamline processes for rapid prototyping and adoption of innovative science and technologies into operations to support evolving forecaster roles and improve R2O/O2R efficiency.



*NOAA, other Federal partners and the Enterprise are working together to bring **life-saving science** to every community.*

¹⁰OAR includes Cooperative Institutes, labs, and testbeds.

GOAL 3

Evolve the NWS to excel in the face of change through investment in our people, partnerships, and organizational performance.

Adapting to the ever-increasing pace of change will require the National Weather Service to effectively evolve towards a partner and customer-centric service delivery model. We must build an agile organization that can quickly respond to and align with changing mission needs, innovations, and technological advancements. We will support our workforce, including training and development in science-based service delivery, increased diversity to drive higher performance, and enhanced support to sustain a healthy organizational culture. This will require changes to NWS operations, business processes, information technologies, and facilities. Finally, we must strengthen partnerships with the Enterprise to leverage the full range of available tools, expanding our collective reach while improving our level of performance.



*Image:
Strategic Workforce Management Flowchart from the 2018 President's Management Agenda*

*The NWS Operations and Workforce Analysis found that most public safety decisions are local, reinforcing the **need for a local, place-based NWS presence** to meet the IDSS needs of the Nation.*



Objectives

to achieve Goal 3

Workforce for the Future

- 3.1.** Enhance the employee experience by increasing belonging, inclusion, and diversity in the workforce; promoting organizational health and culture initiatives to improve performance and employee satisfaction; cultivating continuous learning and professional development; and increasing the effectiveness of labor-management engagement.
- 3.2.** Implement a comprehensive workforce training and development plan to advance the expanding skill sets required for operational forecasting, including greater emphasis on decision support; ensure expertise in core mission support capabilities including engineering, technology, and administration; and strengthen efficiency and productivity with enhanced capabilities in project management, configuration management, and risk management.
- 3.3.** Sustain workforce capacity and skills that meet evolving mission needs, with outreach and strategies to improve the recruitment and retention of the best available talent, including those with STEM skill sets; implement hiring efficiencies and align hiring actions with workload needs; expand deployment-ready staff certified to support major events in collaboration with local and regional partners and across NOAA; and formalize knowledge transfer systems to sustain mission operations.
- 3.4.** Strengthen the skills of NWS leaders to be adaptive and lead change effectively.

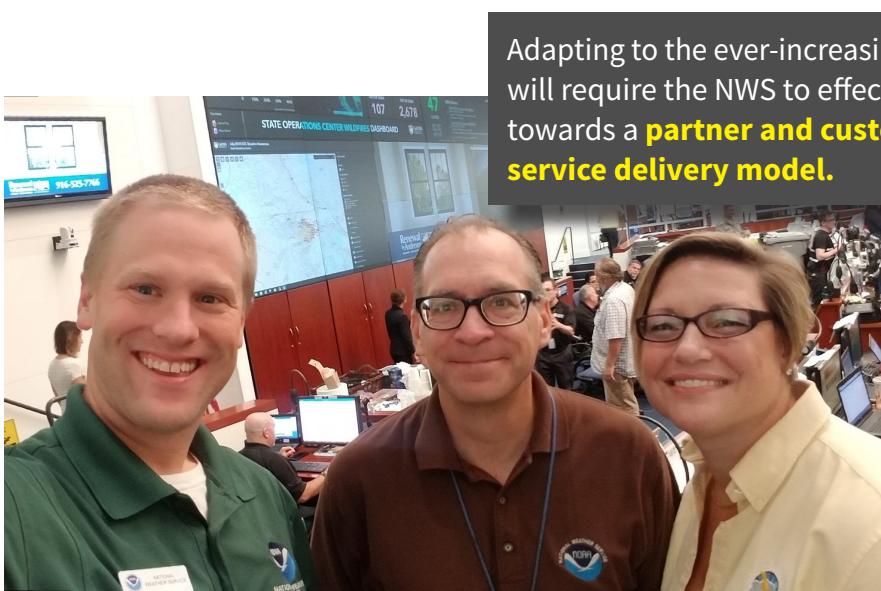


Roles and responsibilities: every job will change as the NWS evolves to connect timely observations, forecasts, and warnings to life-saving decisions at the local, state, tribal nation, and federal levels.



Organizational Alignment

- 3.5.** Implement the Collaborative Forecast Process to improve the quality, consistency and accuracy of forecasts, reduce duplication of effort, and drive greater integration across the NWS.
- 3.6.** Evolve the NWS operating model, organizational structures, roles, and staffing to align resources with shifting user demands and enhance the quality, quantity, and consistency of IDSS at every level.



Adapting to the ever-increasing pace of change will require the NWS to effectively evolve towards a **partner and customer-centric service delivery model**.

- 3.7.** Sunset low-priority products and services as NWS builds toward a unified and consistent set of forecast products and services.



The **Collaborative Forecast Process** provides the best, unified forecast by leveraging expertise across local, regional, and national levels in a collaborative manner with clear roles and responsibilities. The result: "one event, one forecast."

Essential Enterprise Partnerships

- 3.8.** Clarify and leverage the unique roles and capabilities of Enterprise partners to respond to the increasing demand for actionable weather, water, and climate information.
- 3.9.** Expand public-private partnerships that fast-track Enterprise innovations, strengthen relationships, eliminate barriers, and share best practices to focus continuous improvements.

Business Operations

3.10. Streamline governance processes to accelerate decision-making, enable organizational adaptability, effectively delegate authority, maximize investment value, and link strategy to execution.

3.11. Adopt agency and industry best practices to improve program performance, acquisition, and budget execution, and through implementation of internal controls and compliance with appropriations law.

3.12. Quantify the economic benefit of products and services to demonstrate value and inform future investments, using cost-benefit analyses for all major purchases.

3.13. Fully execute a comprehensive organizational performance strategy and expand performance metrics to include customer experience, satisfaction, and impact on partner decisions.

3.14. Transform cross-NOAA capabilities to engineer, advance, and integrate modern information technology systems, enable future operational scenarios and capabilities, improve effectiveness, transparency and customer service.

3.15. Integrate and simplify IT security for all mission requirements and reduce duplication of effort across systems.

3.16. Optimize efficiency and mission success through facility upgrades and co-location with other NOAA Line Offices, academia, research laboratories, emergency management, and water resource management facilities.

To understand and **respond to changing customer needs**, NWS must rigorously assess its interactions with public safety, emergency management, and water resource management officials.



Co-location of the WFO Houston/Galveston with the Galveston County Office of Emergency Management **helped facilitate critical IDSS** during Hurricane Harvey.

Appendix A

Key drivers for this strategic plan

The President's Management Agenda

In March 2018, the President released his Management Agenda. This agenda lays out a long-term vision for modernizing the Federal Government in key areas that will improve the ability of agencies to work on behalf of the American people to:

- Deliver mission outcomes,
- Provide excellent service, and
- Effectively steward taxpayer dollars.

The NWS Strategic Plan reflects these principles and articulates a vision that focuses on mission-driven results, customer experience, and stewardship of taxpayer dollars.

Department of Commerce Strategic Plan 2018-2022

The NWS Strategic Plan advances and expands upon Strategic Objective 3.3 of the Department of Commerce (DOC) Strategic Plan – “Reduce Extreme Weather Impacts.” This objective articulates four strategies that reflect the need to reduce the economic impact of severe weather and water events. The four strategies are:

- Evolve the National Weather Service to deliver better forecasts, earlier warnings, and clearer communication of high-impact weather and water events.
- Strengthen partnerships with America's weather industry and other members of the Weather, Water, and Climate Enterprise (Enterprise).
- Deploy the next generation of satellites, aircraft, ocean-going ships, and observation and data gathering systems.
- Develop and deploy next-generation environmental observation and modeling systems to make informed planning, resources management, and investment decisions.

As further outlined in the DOC plan, NWS is im-

proving its ability to provide expert, timely, and actionable weather information to emergency managers, water resource managers, and other government agencies at the federal, state, local, and tribal levels. NWS is also committed to working with the Enterprise to achieve these improvements faster and at a lower cost to taxpayers.

NOAA Priorities

In 2018, acting NOAA Administrator RDML Tim Gallaudet, Ph.D., USN Ret. outlined these priority objectives for NOAA:

- Fully implementing the Weather Research and Forecasting Innovation Act of 2017 by leading the world in Earth observation and prediction and minimizing the impact of extreme weather and water events in the United States
- Increasing the sustainable economic contributions of our fisheries and ocean resources

These priorities establish clear connections across NOAA to ensure that our programs are coordinated and integrated to meet NOAA's mission. The NWS Strategic Plan is aligned with these objectives.

The Weather Research and Forecasting Innovation Act of 2017

A key component of this new strategic plan is the connection to the Weather Research and Forecasting Innovation Act of 2017. The Act is one of the primary strategic guideposts for federal weather services in the coming decades. Language in the Act added requirements for the evolution of the NWS, with emphasis in four areas: U.S. Weather Research and Forecasting Improvement, Sub-seasonal and Seasonal Forecasting Innovation, Weather Satellite and Data Innovation, Federal Weather Coordination and Tsunami Warning, Education, and Research. Highlights include the:

- Comprehensive engagement and collaboration with the U.S. Weather-Water-Climate Enterprise including government agencies,

private industry, academia, the research community, and non-governmental organizations;

- Prioritization of research that improves weather data, modeling, computing, and forecasting;
- Infusion of social science into impact-based decision support services;
- Expansion of impact-based decision-support services across all local, state, tribal, and federal levels;
- Acceleration of the joint technology transfer initiative to ensure the continuous transition of science and technology advances into operations;
- Analysis of observation systems to promote multi-sectoral research efforts to reinvigorate the U.S. Weather Research Program and transition research to operations,
- Development of a new seasonal forecasting program within the NWS;
- Recommendations on satellites and observations;
- Establishment of mechanisms to facilitate interagency coordination.

Evolving the National Weather Service

In light of the trends, challenges, and legislative expectations outlined above, the NWS is evolving to meet the changing and increasing needs for weather, water, and climate forecasts and warnings for the protection of life and property and enhancement of the Nation's economy. This evolution is driven by the increasing vulnerability of the American population to extreme weather and water events and the increasing demand for accurate, consistent, and actionable NWS products and services for our core partners. To meet these needs and achieve a Weather-Ready Nation, the NWS has committed to organizational change defined by five objectives:

- Better serve partners by enhancing the quality and consistency of IDSS at all levels of the organization.
- Develop the flexible and nimble workforce the NWS needs to deliver science-based services – both through enhancing skills today and hiring for tomorrow.
- Improve effectiveness of forecasting in sup-

port of IDSS through a collaborative process that makes the best use of technology, reduces duplication, and ensures consistency of the forecast.

- Match workforce to workload across the organization to enable rapid response during high-impact events by building a more robust organizational structure with enhanced flexibility to better meet the needs of NWS partners.
- Support the innovation, science, technology, and culture required for NWS to continuously improve over time.

These organizational objectives are integrated throughout this strategic plan in recognition of their critical necessity to achieve a Weather-Ready Nation.

Executive Order on Maintaining American Leadership in Artificial Intelligence

The NWS Strategic Plan acknowledges the President's Executive Order on Artificial Intelligence (AI) as an important driver for the future growth of the United States economy, enhancement of our economic and national security, and improvement to our quality of life. Advances in AI, including research and development, will be important in driving technological breakthroughs, creating new capabilities that contribute to achieving the National Weather Service mission.

Charting a Course for Success: America's Strategy for STEM Education

The NWS Strategic Plan acknowledges this important report of the Committee on STEM Education of the National Science and Technology Council. The three goals of this plan:

- Build strong foundations for STEM literacy
- Increase diversity, equity, and inclusion in STEM
- Prepare the STEM workforce of the future

represent key contributors to the long term success of the NWS towards achieving our objectives in this plan for "Workforce for the Future."

Appendix B

NWS performance goals and metrics

Goal 1 Metrics

1. NWS' FY19 DOC Agency Priority Goal:

- Deliver an enhanced excessive rainfall outlook product that extends the lead time of high risk productions from two to three days.
- Improve decision support services by demonstrating a new flood inundation mapping capability for freshwater, serving at least 8% of the US population.

Note: *The NWS will continue to improve the skill of 2 inch rainfall forecasts made 3 days in advance and will continue to add domains to approach 100% US population coverage in the contiguous United States between FY19 and FY22.*

2. Initiate an experimental IDSS customer experience index that assesses engagement and relationships with core government to government partners based on foundational NWS products and services, qualities such as trust, reliability, consistency, understandability, accuracy, timeliness, and actionability.

3. Recognize new and renewed StormReady Communities and TsunamiReady Communities.

4. Evaluate and improve the reach of NWS forecasts, warnings, and preparedness information through social media.

5. Maintain a high American Customer Satisfaction Index score for the NWS.

6. Heidke Skill Score for Week 3-4 Temperature.

Goal 2 Metrics

7. Improve the useful forecast lead time for the Global Forecast System and the Global Ensemble Forecast System.

8. Develop a NOAA Global Ocean Observing systems index to measure the relative health of NOAA's ocean observational infrastructure and improve availability and accuracy in collaboration with other NOAA Line Offices.

9. Measure the timeliness of the delivery of products from the NWS Integrated Dissemination Program (IDP) (experimental - e.g. % of products delivered within X minutes of their planned delivery time, integrated over the year).

Goal 3 Metrics

10. Improve NWS Organizational Health Index (OHI) scores in key priority areas, including trust, innovation, role clarity, and recognition.

11. Vacancy rate (%) as measured by the number of funded positions (based on enacted appropriation) minus the number of NWS employees divided by the number of funded positions.

12. Number of employees that are certified deployment-ready in NWS operational offices.

13. Conduct one economic valuation study every other year across different NWS service areas to assess the economic impact of forecasts and decision support to the Nation.

Note: *NWS also tracks and reports on a number of operational metrics as part of the Government Performance and Results Act (GPRA) requirements, not included here. Metric language will be refined and baselines and targets will be developed.*

Appendix C

How this Strategic Plan was developed

In the fall of 2017, NWS began the process of developing an updated strategic plan for 2019-2022. Plan development was led by the NWS Executive Council and designed and coordinated by the Office of Organizational Excellence (OOE). Lynne Carbone & Associates, Inc. (LCA), an independent organization and management consulting firm, provided support to NWS Leadership and OOE through survey synthesis and analysis, meeting facilitation, and draft plan development. LCA also prepared a re-

port reflecting a consolidation and analysis of the employee feedback in response to survey questions posted on the National Weather Service Insider from May 7 through June 9, 2018 as input to the plan. In addition, two working teams – one comprised of NWS senior leaders and another comprised of NWS managers and a NWS Employees Organization (NWSEO) representative – analyzed the various inputs and developed the goals and objectives in the plan.

The following table summarizes the key steps in the NWS strategic plan development process.

TIMEFRAME	KEY PROCESS STEPS
Fall 2017	<ul style="list-style-type: none">• Analyzed and synthesized background and inputs from internal and external reports, plans, NWS presentations and assessments.• Engaged NWS leadership at NWS Fall Strategy Meeting.• Established executive and manager-level working teams.
Winter 2018	<ul style="list-style-type: none">• Incorporated strategies from 2018-2022 DOC Strategic Plan• Working teams developed draft high-level framework.• NWS Partners provided input at AMS Annual Meeting.• Executive team completed draft for senior leadership review.
Spring 2018	<ul style="list-style-type: none">• OOE visited all Regions, NCEP and HQ Offices providing an overview of the planning process and high-level draft strategic plan summary.
Summer 2018	<ul style="list-style-type: none">• Engaged workforce and solicited feedback on high-level strategic questions and core principles. Compiled results and adjusted draft plan to reflect major messages and common themes from employees.• Shared draft plan with other NOAA Line Offices and emergency management partners• Provided draft plan to NOAA Leadership and solicited feedback.• Incorporated all comments and feedback into final draft.• Shared draft plan and garnered feedback at NWS Partners Meeting.
Fall 2018-Winter 2019	<ul style="list-style-type: none">• Gained final clearance by NOAA Leadership and the Department of Commerce.

Appendix D

Image captions

Cover Image - Emergency Response Specialist, Stephanie Sipprell, discusses the details of a winter storm with Jonathan Kurtz and Kelly Allen at the Central Region ROC.

Image 1 (page 4) - Flooding in Port Arthur, Texas. Image: Daniel J. Martinez/U.S. Air National Guard.

Image 2 (page 6) - North Carolina first responders evacuate residents of a neighborhood that fell victim to the flooding caused by Hurricane Matthew in Fayetteville, North Carolina, U.S. on October 8, 2016. Image: Jonathan Shaw/U.S. Army National Guard.

Image 3 (page 6) - Chip Kasper, forecaster in the Weather Forecast Office (WFO) in WFO Key West, provides an update on Hurricane Irma over the phone.

Image 4 (page 7) - IMET, Lisa Reed Kriederman, provides weather support for a wildfire.

Image 5 (page 7) - AWIPS workstation displaying data at a WFO during severe weather operations.

Image 6 (page 7) - Logan Johnson interacts with a WRN Ambassador.

Image 7 (page 7) - Employees from across the National Weather Service participate in the Effective Hurricane Messaging class in April 2018.

Image 8 (page 9) - Angie Enyedi gives a press briefing on Hurricane Irma.

Image 9 (page 11) - Chart showing the improvement in hurricane forecasting over the last few decades in the Atlantic Basin.

Image 10 (page 11) - Brooke Bingaman provides a media weather briefing during Hurricane Lane.

Image 11 (page 13) - Image from the GOES East satellite depicting wildfires in Idaho and Montana.

Image 12 (page 13) - Visualization of precipitable water from the Global Forecast System (GFS).

Image 13 (page 14) - IMET, Alex Hoon provides a briefing on-site at a wildfire to Nicole Peterson and Alex DeSmet.

Image 14 (page 14) - FACETs product conveying grid-based probabilities of a severe weather event.

Image 15 (page 15) - Kate Abshire and Jennifer Vogt participating in NOAA's 2018 Multi-Radar Multi-Sensor (MRMS) Hydrometeorology Testbed.

Image 16 (page 16) - Forecaster, Shawn DeVinny, provides a briefing to incident command staff at the City of Minneapolis Emergency Operations Center during Super Bowl 52.

Image 17 (page 17) - Staff at the WFO in Seattle, WA.

Image 18 (page 18) - Matt Solum, Bill Rasch and Michelle Mead on-site at the California Office of Emergency Services in support of 2018 wildfires.

Image 19 (page 19) - Photo of the Galveston County Office of Emergency Management and the Houston-Galveston National Weather Service building.