

warnings and forecasts of high impact weather events that endanger life and property.

(3) Research and development, and transfer of knowledge, technologies, and applications to the National Weather Service and other appropriate agencies and entities, including the United States weather industry and academic partners, related to—

(A) advanced radar, radar networking technologies, and other ground-based technologies, including those emphasizing rapid, fine-scale sensing of the boundary layer and lower troposphere, and the use of innovative, dual-polarization, phased-array technologies;

(B) aerial weather observing systems;

(C) high performance computing and information technology and wireless communication networks;

(D) advanced numerical weather prediction systems and forecasting tools and techniques that improve the forecasting of timing, track, intensity, and severity of high impact weather, including through—

(i) the development of more effective mesoscale models;

(ii) more effective use of existing, and the development of new, regional and national cloud-resolving models;

(iii) enhanced global weather models;

and

(iv) integrated assessment models;

(E) quantitative assessment tools for measuring the impact and value of data and observing systems, including Observing System Simulation Experiments (as described in section 8517 of this title), Observing System Experiments, and Analyses of Alternatives;

(F) atmospheric chemistry and interactions essential to accurately characterizing atmospheric composition and predicting meteorological processes, including cloud microphysical, precipitation, and atmospheric electrification processes, to more effectively understand their role in severe weather; and

(G) additional sources of weather data and information, including commercial observing systems.

(4)<sup>1</sup> A technology transfer initiative, carried out jointly and in coordination with the Director of the National Weather Service, and in cooperation with the United States weather industry and academic partners, to ensure continuous development and transition of the latest scientific and technological advances into operations of the National Weather Service and to establish a process to sunset outdated and expensive operational methods and tools to enable cost-effective transfer of new methods and tools into operations.

(4)<sup>1</sup> Advancing weather modeling skill, reclaiming and maintaining international leadership in the area of numerical weather prediction, and improving the transition of research into operations by—

(A) leveraging the weather enterprise to provide expertise on removing barriers to improving numerical weather prediction;

(B) enabling scientists and engineers to effectively collaborate in areas important for improving operational global numerical weather prediction skill, including model development, data assimilation techniques, systems architecture integration, and computational efficiencies;

(C) strengthening the National Oceanic and Atmospheric Administration's ability to undertake research projects in pursuit of substantial advancements in weather forecast skill;

(D) utilizing and leverage existing resources across the National Oceanic and Atmospheric Administration enterprise; and

(E) creating a community global weather research modeling system that—

(i) is accessible by the public;

(ii) meets basic end-user requirements for running on public computers and networks located outside of secure National Oceanic and Atmospheric Administration information and technology systems; and

(iii) utilizes, whenever appropriate and cost-effective, innovative strategies and methods, including cloud-based computing capabilities, for hosting and management of part or all of the system described in this subsection.

#### (c) Extramural research

##### (1) In general

In carrying out the program under this section, the Assistant Administrator for Oceanic and Atmospheric Research shall collaborate with and support the non-Federal weather research community, which includes institutions of higher education, private entities, and nongovernmental organizations, by making funds available through competitive grants, contracts, and cooperative agreements.

##### (2) Sense of Congress

It is the sense of Congress that not less than 30 percent of the funds for weather research and development at the Office of Oceanic and Atmospheric Research should be made available for the purpose described in paragraph (1).

#### (d) Annual report

Each year, concurrent with the annual budget request submitted by the President to Congress under section 1105 of title 31 for the National Oceanic and Atmospheric Administration, the Under Secretary shall submit to Congress a description of current and planned activities under this section.

(Pub. L. 115-25, title I, §102, Apr. 18, 2017, 131 Stat. 92; Pub. L. 115-423, §4(a), Jan. 7, 2019, 132 Stat. 5456.)

#### AMENDMENTS

2019—Subsec. (b)(4). Pub. L. 115-423 added par. (4) relating to advancing weather modeling skill.

#### § 8513. Tornado warning improvement and extension program

##### (a) In general

The Under Secretary, in collaboration with the United States weather industry and academic partners, shall establish a tornado warning improvement and extension program.

<sup>1</sup> So in original. Two pars. (4) have been enacted.

**(b) Goal**

The goal of such program shall be to reduce the loss of life and economic losses from tornadoes through the development and extension of accurate, effective, and timely tornado forecasts, predictions, and warnings, including the prediction of tornadoes beyond 1 hour in advance.

**(c) Program plan**

Not later than 180 days after April 18, 2017, the Assistant Administrator for Oceanic and Atmospheric Research, in coordination with the Director of the National Weather Service, shall develop a program plan that details the specific research, development, and technology transfer activities, as well as corresponding resources and timelines, necessary to achieve the program goal.

**(d) Annual budget for plan submittal**

Following completion of the plan, the Under Secretary, acting through the Assistant Administrator for Oceanic and Atmospheric Research and in coordination with the Director of the National Weather Service, shall, not less frequently than once each year, submit to Congress a proposed budget corresponding with the activities identified in the plan.

(Pub. L. 115–25, title I, §103, Apr. 18, 2017, 131 Stat. 94.)

**§ 8514. Hurricane forecast improvement program****(a) In general**

The Under Secretary, in collaboration with the United States weather industry and such academic entities as the Administrator considers appropriate, shall maintain a project to improve hurricane forecasting.

**(b) Goal**

The goal of the project maintained under subsection (a) shall be to develop and extend accurate hurricane forecasts and warnings in order to reduce loss of life, injury, and damage to the economy, with a focus on—

- (1) improving the prediction of rapid intensification and track of hurricanes;
- (2) improving the forecast and communication of storm surges from hurricanes; and
- (3) incorporating risk communication research to create more effective watch and warning products.

**(c) Project plan**

Not later than 1 year after April 18, 2017, the Under Secretary, acting through the Assistant Administrator for Oceanic and Atmospheric Research and in consultation with the Director of the National Weather Service, shall develop a plan for the project maintained under subsection (a) that details the specific research, development, and technology transfer activities, as well as corresponding resources and timelines, necessary to achieve the goal set forth in subsection (b).

(Pub. L. 115–25, title I, §104, Apr. 18, 2017, 131 Stat. 94.)

**§ 8515. Weather research and development planning**

Not later than 1 year after April 18, 2017, and not less frequently than once each year there-

after, the Under Secretary, acting through the Assistant Administrator for Oceanic and Atmospheric Research and in coordination with the Director of the National Weather Service and the Assistant Administrator for Satellite and Information Services, shall issue a research and development and research to operations plan to restore and maintain United States leadership in numerical weather prediction and forecasting that—

(1) describes the forecasting skill and technology goals, objectives, and progress of the National Oceanic and Atmospheric Administration in carrying out the program conducted under section 8512 of this title;

(2) identifies and prioritizes specific research and development activities, and performance metrics, weighted to meet the operational weather mission of the National Weather Service to achieve a weather-ready Nation;

(3) describes how the program will collaborate with stakeholders, including the United States weather industry and academic partners; and

(4) identifies, through consultation with the National Science Foundation, the United States weather industry, and academic partners, research necessary to enhance the integration of social science knowledge into weather forecast and warning processes, including to improve the communication of threat information necessary to enable improved severe weather planning and decision-making on the part of individuals and communities.

(Pub. L. 115–25, title I, §105, Apr. 18, 2017, 131 Stat. 95.)

**§ 8516. Observing system planning**

The Under Secretary shall—

(1) develop and maintain a prioritized list of observation data requirements necessary to ensure weather forecasting capabilities to protect life and property to the maximum extent practicable;

(2) consistent with section 8517 of this title, utilize Observing System Simulation Experiments, Observing System Experiments, Analyses of Alternatives, and other appropriate assessment tools to ensure continuous systemic evaluations of the observing systems, data, and information needed to meet the requirements of paragraph (1), including options to maximize observational capabilities and their cost-effectiveness;

(3) identify current and potential future data gaps in observing capabilities related to the requirements listed under paragraph (1); and

(4) determine a range of options to address gaps identified under paragraph (3).

(Pub. L. 115–25, title I, §106, Apr. 18, 2017, 131 Stat. 95.)

**§ 8517. Observing System Simulation Experiments****(a) In general**

In support of the requirements of section 8516 of this title, the Assistant Administrator for Oceanic and Atmospheric Research shall under-