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SUMMARY

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The Weather Research and Forecasting Innovation Act of 2017: Congressional Direction to NOAA in P.L. 115-25

Congress provides direction on a broad range of the National Oceanic and Atmospheric Administration's (NOAA's) weather-related activities in Titles I through IV of P.L. 115-25, the Weather Research and Forecasting Innovation Act of 2017, signed into law on April 18, 2017. The legislation aims to improve NOAA's weather forecasts and warnings, both for the protection of lives and property and for the enhancement of the national economy. The act also covers topics such as future weather satellite data needs, gaps in Next Generation Weather Radar (NEXRAD) coverage, and improvements in the transfer of research and development (R&D) to National Weather Service (NWS) operations. Title V of P.L. 115-25 covers NOAA's tsunami program activities and is not addressed in this report.

P.L. 115-25 incorporates components of various bills introduced in the House and Senate and topics discussed in hearings between the 113th and 115th Congresses. For example, the issue of improving seasonal forecasts, reflected in Title II of P.L. 115-25, was introduced in S. 1331 in the 114th Congress.

Titles I through IV in P.L. 115-25 are summarized below:

- Title I addresses the transfer of R&D from NOAA's Office of Oceanic and Atmospheric Research (OAR) to operations at NWS. Title I also includes a sense of Congress that not less than 30% of the funding for weather R&D at NOAA should be made available to the nonfederal weather research community;
- Title II focuses on improving subseasonal and seasonal forecasts at NWS;
- Title III addresses the future of weather satellites and NOAA's use of commercially provided weather data; and
- Title IV provides congressional direction to NOAA on coordinating weather data and observations; improving the exchange of expertise among NOAA entities; enhancing communication of watches and warnings of hazardous weather events; and conducting outreach to the nonfederal and federal entities in the broader weather enterprise, among other topics.

P.L. 115-25 also includes requirements for various reports to Congress and other deliverables, many of which were due during the 115th Congress. Throughout P.L. 115-25, Congress requires reports on progress in meeting its authorizations over time frames from 30 days to several years; NOAA has published some of the required reports in the allotted timeframe and in public repositories.

Continuing questions for Congress include whether appropriated amounts have been sufficient to meet authorized activities and priorities expressed in the law and to what degree NOAA has implemented the activities and priorities provided in P.L. 115-25.

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Introduction

The Weather Research and Forecasting Innovation Act of 2017 (P.L. 115-25) addresses a broad range of National Oceanic and Atmospheric Administration (NOAA) activities in five titles: Titles I through IV primarily address weather-related programs, policies, and activities, and Title V amends the Tsunami Warning and Education Act (Title VIII of P.L. 109-479). This report discusses the weather-related activities included in Titles I through IV of P.L. 115-25.

In P.L. 115-25, Congress provides direction to NOAA regarding the agency's research and development (R&D) activities, with the broad goal of improving weather forecasting, warnings, and communication to recipients and users of weather information. Congress held hearings and introduced legislation in the 113th,114th, and 115th Congresses on topics that were incorporated into P.L. 115-25. Thus the law reflects many of the priorities and issues of interest to Members regarding improving forecasts, federal coordination, and communication in the weather enterprise; incorporating commercially available weather data into forecasts and warnings; and enhancing the research-to-operations pathway so that new scientific and technological advances can be incorporated more rapidly into forecasts and warnings, among other topics.

Title I of P.L. 115-25 emphasizes the transfer of R&D advances to operations at the National Weather Service (NWS), and includes a sense of Congress that not less than 30% of funding for weather R&D at NOAA's Office of Oceanic and Atmospheric Research (OAR) should be made available to the nonfederal weather research community, which includes academia, private-sector entities, and nongovernmental organizations.

Title II of P.L. 115-25 centers on improving NWS forecasts, specifically *subseasonal* and *seasonal* forecasts, defined in the law as forecasts of two weeks to three months and forecasts of three months to two years, respectively.

Title III focuses on weather satellites, including microsatellite constellations, and future needs of the weather satellite observing systems. Title III also includes direction on the acquisition of commercial weather data; it requires NOAA to evaluate whether commercial weather data from satellites could meet some or all of NOAA's future needs.

Title IV directs NOAA to coordinate weather data and observations; improve the exchange of expertise between R&D and operational activities; enhance communication of watches and warnings of hazardous weather events; improve outreach to the weather enterprise;[1] and study gaps in the national NEXRAD coverage,[2] among other topics.

This report discusses each title briefly by summarizing selected sections. Furthermore, the report identifies where NOAA was required to report to Congress on its progress in fulfilling the legislation's requirements and includes links to reports to Congress where available.

[1] The terms *weather enterprise* and *weather industry* are defined in P.L. 115-25 as including individuals and organizations from public, private, and academic sectors that contribute to the research, development, and production of weather forecast products and are primary consumers of the weather forecast products.

[2] NEXRAD is the **Nex**t-Generation **Rad**ar of the National Weather Service. The NEXRAD system comprises 160 sites in the United States and some overseas locations, consisting of high-resolution Doppler weather radar installations which detect precipitation and wind. See National Oceanic and Atmospheric Administration (NOAA), National Centers for Environmental Information, "Next Generation Weather Radar (NEXRAD)," at https://www.ncei.noaa.gov/products/radar/next-generation-weather-radar.

Title I: United States Weather Research and Forecasting Improvement

Title I of P.L. 115-25 (15 U.S.C. 8501 et seq.) focuses on authorizing R&D efforts at NOAA, mostly led by OAR, primarily to improve forecasts and warnings of potentially damaging weather events. Title I addresses a broad array of activities authorized in the legislation that range from conducting basic R&D on weather to enhancing observing systems to improve the data used for forecasts and warnings. Title I also requires NOAA to address the issue of how to improve the incorporation of research findings into NWS operations. The research-to-operations challenge also is addressed in other titles of P.L. 115-25.

Section 101 states that the priorities for the R&D efforts shall be the protection of life and property and the enhancement of the national economy.[3] Section 102 authorizes a broad portfolio of R&D activities to address the priorities in Section 101, such as improving the fundamental understanding of weather; enhancing the understanding of how the public receives, interprets, and responds to dangerous weather; and facilitating the transfer of knowledge, technologies, and applications to NWS, and requires an annual description of current and planned activities.[4]

Sections 103 and 104 focus on tornadoes and hurricanes, respectively. The goal of Section 103 is to reduce loss of life and economic damage from tornadoes by improving tornado forecasts, predictions, and warnings. The act requires NOAA to create a tornado warning improvement and extension program plan to achieve its goal and to submit to Congress a proposed budget for its tornado program plan activities each year.[5] The goal of Section 104 is to improve hurricane forecasting to reduce loss of life, injuries, and economic damage. The section requires NOAA to maintain a project to improve hurricane forecasting, and to develop a plan to implement the hurricane project.[6] The tornado plan and the hurricane plan were due within 180 days and one year of enactment, respectively (i.e., by October 2017 and April 2018).

Section 105 requires an R&D and research-to-operations plan within one year of enactment (i.e., by April 2018) to be updated annually, with the goal of restoring and maintaining U.S. leadership in numerical weather forecasting and prediction.[7] The section also requires NOAA to consult with the National Science Foundation, the U.S. weather industry, and academic partners to identify

[3] This is also the mission statement of the National Weather Service, "The National Weather Service (NWS) provides weather, water, and climate data, forecasts and warnings for the protection of life and property and enhancement of the national economy." See NOAA, NWS, "National Weather Service Mission Statement," at http://www.nws.noaa.gov/mission.php.

[4] For an example of an annual report, see NOAA, *Report to Congress: Weather Research and Forecasting Innovation: Annual Report of Current and planned Activities within the Office of Oceanic and Atmospheric Research*, 2020, at https://doi.org/10.25923/parx-ey64. The 2020 report is the most recent one listed in NOAA's Institutional Repository. In this instance, as well as in several other cases throughout this report, CRS reached out to NOAA to obtain more recent data which the agency was unable to provide by the publication date of this report.

[5] NOAA, *Report to Congress: Tornado Warning Improvement and Extension Program Plan*, 2019, at https://doi.org/10.25923/z1v4-z040. Section 103 also requires NOAA to submit an annual proposed budget for the plan to Congress, which CRS did not locate.

[6] NOAA, *Report to Congress: Hurricane Forecasting Improvement Program Plan*, 2019, at https://doi.org/10.25923/agg3-ky80.

[7] CRS did not locate the plan.

research necessary to enhance the integration of social science research into weather forecasts and warnings.[8]

Sections 106-109 deal with weather observation systems; observing system simulation experiments;[9] computer resources; and activities to help operationalize R&D so that it can used by NWS for forecasts and warnings. In addition, Section 108 requires an annual report on computing resources prioritization.[10]

Title I authorizes $111.52 million per year for FY2017 and FY2018 for OAR R&D and an additional $20 million per year for the technology transfer initiative authorized in Section 102.

Title II: Subseasonal and Seasonal Forecasting Innovation

Section 201 of Title II of P.L. 115-25 amends P.L. 99-198 (15 U.S.C. 8521) to add eight subsections (c through j) with the primary goal of improving temperature and precipitation forecasts in *subseasonal forecasts* (forecasts of two weeks to three months) and *seasonal forecasts* (forecasts of three months to two years). This section of Title II amends the part of the *U.S. Code* that declares it is in the public interest that the federal government be involved in providing weather and climate information useful for agriculture and silviculture. Improving forecasts during the time spans defined as subseasonal and seasonal aligns with improving the forecasts needed by agricultural and silvicultural interests. The subsections summarized below expand on functions and requirements for these forecasts more broadly.

Subsection 201(c) requires the Director of NWS to collect and use information to make subseasonal and seasonal forecasts; use existing models and research to improve those forecasts; determine how those forecasted conditions will affect severe weather and other weather-related natural hazards; and develop an internet clearinghouse to share the forecasts and accompanying information.[11]

Subsection 201(d) requires the NWS director to provide the forecasts and accompanying information to the public. Subsection 201(e) requires NOAA to designate research and monitoring required for the subseasonal and seasonal forecasts as a priority in one or more of the solicitations of the Cooperative Institutes of Oceanic and Atmospheric Research; to contribute to the interagency Earth System Prediction Capability; and to consult with the Secretary of Defense and the Secretary of Homeland Security to determine the highest priorities for their departments regarding subseasonal and seasonal forecasts.

Subsection 201(f) requires NOAA to foster communication, understanding, and use of the forecasts by the intended users. It gives NOAA discretion to provide assistance to states for

[8] For example, this type of research could lead to improvements in how citizens and communities receive, understand, and respond to forecasts and warnings so as to respond in ways to reduce injuries and fatalities.

[9] These experiments are described in P.L. 115-25 as quantitative assessments of the relative value and benefits of observing capabilities and systems. They would be conducted prior to acquisition of observing systems, such as weather satellites, with lifecycle costs greater than $500 million, and prior to the purchase of any new major commercially provided data with a lifecycle cost greater than $500 million. P.L. 115-25 establishes two priority experiments: (1) global navigation satellite system radio occultation and (2) geostationary hyperspectral sounder global constellation.

[10] NOAA, *Triennial Report on Computing Resources Prioritization*, 2021, at https://doi.org/10.25923/8e00-1186. The 2021 report is the most recent one listed in NOAA's Institutional Repository and other NOAA websites.

[11] CRS did not locate this internet clearinghouse.

individuals who would be designated "forecast communication coordinators," who would serve as liaisons among federal agencies and other entities of the weather enterprise, and who would receive and disseminate the subseasonal and seasonal forecasts. NOAA support would be limited to $100,000 per year per state and would require a 50% match (from the state, a university, a nongovernmental organization, a trade association, or the private sector).

Subsection 201(g) requires other federal agencies to cooperate with NOAA. Subsection 201(h) requires a report to Congress on implementation of the subseasonal and seasonal forecasts, due within 18 months of enactment (October 2018).[12] Subsection 201(i) defines terms used in Section 201. Subsection 201(j) authorizes appropriations of $26.5 million per year to carry out these activities in FY2017 and FY2018.

Title III: Weather Satellite and Data Innovation

Title III of P.L. 115-25 (15 U.S.C. 8531 et seq.) addresses two main issues: (1) weather satellites and (2) commercial weather data. The topics are interrelated. Title III provides direction for NOAA regarding current and future weather satellite data needs and authorizes NOAA to consider how commercially provided weather satellite data could enhance and improve observations, leading to better forecasts and warnings in the future.

Section 301 of Title III of P.L. 115-25 addresses microsatellite constellations, integration of data from the ocean observing system, and a study and report on future satellite data needs. Subsection 301(a) requires NOAA to complete and operationalize the microsatellite project called the Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC-1 and COSMIC-2).[13] Under the law, NOAA is to deploy microsatellites in polar and equatorial orbits, integrate the satellite data into operational and research weather forecast models, and make the data free and available to everyone.[14] The COSMIC satellite system makes use of a technique called radio occultation, using radio signals from global positioning system (GPS) satellites, which allows high-precision measurements of the global atmosphere. The subsection also requires an annual report on the status of the project until the project's completion and operationalization.[15]

Subsection 301(a) also requires the NWS director to integrate data collected by the Integrated Ocean Observing System into regional weather forecasts and to support the development of real-time data-sharing products and forecast products. It requires NOAA to identify where monitoring and observing systems have degraded and may have reduced the quality of weather forecasts. Subsection 301(a) requires NOAA to follow report recommendations, authorized under Subsection 301(b), on specifications for weather satellite systems.

Subsection 301(b) requires NOAA to enter into an agreement with the National Academy of Sciences (NAS) to conduct a study on future weather satellite needs. The resulting report is due within two years of entering into the agreement for the study. If an agreement cannot be achieved

[12] NOAA, *Report to Congress: Subseasonal and Seasonal Forecasting Innovation: Plans for the Twenty-First Century*, 2020, at https://doi.org/10.25923/mesd-8b58.

[13] University Consortium for Atmospheric Research, *UCAR Community Programs*, COSMIC Program Office, at http://www.cosmic.ucar.edu/.

[14] NOAA launched COSMIC-1 in 2006 and retired it in 2020 and launched COSMIC-2 in 2021 (NOAA NESDIS, " After 14 years, COSMIC/FORMOSAT-3 Ends Service," at https://www.nesdis.noaa.gov/news/after-14-years-cosmicformosat-3-ends-service; and NOAA NESDIS, "COSMIC-2 Launch," at https://www.nesdis.noaa.gov/current-satellite-missions/currently-flying/cosmic-2/cosmic-2-launch).

[15] CRS did not locate an annual report.

with NAS, Subsection 301(b) would allow NOAA to enter into an agreement with another nonfederal government entity with expertise and objectivity comparable to NAS. The legislation authorized $1 million total for the study and report during FY2018 and FY2019.[16]

Subsection 302(a) authorizes NOAA to purchase weather data from commercial sources and to place NOAA weather satellites on government or private-sector payloads for launch into orbit. Subsection 302(b) directs NOAA, within 180 days of enactment (October 2017), to submit to Congress a strategic plan for procuring commercial weather data.[17]

Congress has expressed interest in expanding NOAA's use of commercially available weather data for at least the previous two Congresses. Outstanding issues include whether and how commercially available data meet the requirements and specifications for use in NOAA's forecasts and warnings. Subsection 302(c) authorizes NOAA to address some of these issues. The subsection requires NOAA to publish data and metadata standards and specifications for space-based commercial weather data within 30 days of enactment (i.e., due by May 2017).[18] It also requires NOAA to publish standards and specifications for geostationary hyperspectral sounder data as soon as possible.

Subsection 302(c) also requires NOAA to conduct at least one pilot program by contracting with one or more private-sector data providers that can meet the standards and specifications that NOAA would develop and publish. Within three years of the pilot project contract agreement, Subsection 302(c) requires NOAA to submit a report to Congress on the pilot program's progress toward meeting the criteria developed and published earlier.[19] The law authorized appropriations of $6 million annually for FY2017 through FY2020.

Subsection 302(d) requires NOAA to obtain commercial weather data from the private sector, depending on whether the pilot program is deemed successful. The subsection also requires NOAA to determine whether a government meteorological space system is required, if NOAA finds that commercial data sources can meet any or all of the observational requirements of such a system. This provision implies that if commercial vendors can provide data that meet all the requirements developed by NOAA, then NOAA would determine whether a federal government weather satellite system is in the national interest. The legislation requires NOAA to report to Congress on its determination.[20]

Subsection 302(e) requires that NOAA continue to meet its existing international meteorological agreements, including practices set forth in World Meteorological Organization Resolution 40.[21] Section 303 requires NOAA to avoid unnecessary duplication between private and public sources of data.

Title IV: Federal Weather Coordination

Title IV of P.L. 115-25 (15 U.S.C. 8541 et seq., 131 Stat. 109; 131 Stat. 112-113) contains 14 sections that deal with a wide range of NOAA activities, most of which address federal

[16] CRS did not locate this study.

[17] CRS did not locate this plan.

[18] CRS did not locate this report.

[19] NOAA, *Report to Congress: Commercial Weather Data Pilot Program*, 2018, at https://doi.org/10.25923/r3n0-f173.

[20] CRS did not locate this report.

[21] See World Meteorological Organization (WMO), "WMO Policy and Practice for the Exchange of Meteorological and Related Data and Products Including Guidelines on Relationships in Commercial Meteorological Activities," Resolution 40, at https://community.wmo.int/en/resolution-40.

coordination, communication, and issues related to data sharing and exchanges of personnel to foster better interactions between research scientists and practitioners. Some of the authorized activities focus on improving NWS outreach to user communities, and other sections address specific issues that Congress previously has identified as possible weaknesses in the weather enterprise, namely possible gaps in ground-based radar coverage by NEXRAD systems.

Section 401 instructs NOAA to maintain its Environmental Services Working Group to provide advice for prioritizing weather research and for existing and emerging technologies, to identify opportunities to improve communications between all entities within the weather enterprise, and to advise on other issues. Section 401 requires the working group to be composed of at least 15 members, experts in all fields relevant to weather,[22] and requires the working group to submit an annual report on NOAA's progress in implementing working group recommendations.[23]

Section 402 requires the director of the White House Office of Science and Technology Policy to establish an Interagency Committee for Advancing Weather Services. The committee is charged with coordinating weather research and innovation activities across the federal government. The Federal Coordinator for Meteorology serves as co-chair of the committee.

Section 403 allows the directors of OAR and NWS to detail up to 10 personnel from one office to the other in an exchange program to allow OAR scientists and NWS operational staff to interact. The section also requires an annual report to Congress on participation in the program and resulting innovations.[24] Section 404 allows the NWS director to host postdoctoral fellows and academic researchers—for up to one year—at any of the NOAA National Centers for Environmental Prediction,[25] to permit forecasters and academic researchers to interact directly, and to foster innovation at NWS.

Section 405 requires the NWS director to designate at least one warning coordination meteorologist at each weather forecast office to increase impact-based decision support services.[26] The law requires that each warning coordination meteorologist (1) provide service to the geographic area covered by the weather forecast office; (2) work with all users of NWS products and services to evaluate their utility; (3) collaborate with state, local, and tribal agencies to improve products and services for those entities; (4) maintain severe weather call lists, severe weather policy and procedures, and severe weather dissemination methodologies and strategies; and (5) work with state, local, and tribal emergency managers to ensure better preparedness and response. The NWS director may assign other responsibilities in addition to the five required above. The NWS director also may place a warning coordination meteorologist with a state or local emergency manager.

Section 406 (131 Stat. 109) requires NOAA to assess its system for issuing hazardous weather and water event watches and warnings within two years of enactment (i.e., by April 2019) and to

[22] These fields would include, for example, atmospheric chemistry, atmospheric physics, meteorology, hydrology, social science, risk communications, electrical engineering, and computer sciences.

[23] NOAA Science Advisory Board, *2023 Environmental Information Services Working Group (EISWG) Report to Congress*, July 26, 2023, at https://sab.noaa.gov/wp-content/uploads/SAB_Report_Jul2023_EISWG_RtC.pdf.

[24] NOAA, *Report to Congress: Office of Oceanic and Atmospheric Research and National Weather Service Exchange Program, 2017, at* https://repository.library.noaa.gov/view/noaa/20599. The 2017 report is the most recent one listed in NOAA's Institutional Repository and other NOAA websites.

[25] The nine National Centers for Environmental Prediction are the Aviation Weather Center, Climate Prediction Center, Environmental Modeling Center, Central Operations, National Hurricane Center, Ocean Prediction Center, Storm Prediction Center, Space Weather Prediction Center, and Weather Prediction Center. See NWS, "National Centers for Environmental Protection," at http://www.ncep.noaa.gov/.

[26] NWS regional organization is at http://www.weather.gov/organization/regional. Currently, there are 122 weather forecast offices.

submit the resulting report to Congress.[27] The assessment's focus is to include how best to communicate risks that would improve mitigation, enhance broad and rapid communication to the public, preserve benefits of the existing system, and maintain the system's utility for government and commercial users. The law requires NOAA to consult with a wide variety of individuals and entities within the weather enterprise and to make use of NAS, if practicable. The law also required NOAA to make recommendations to Congress to improve the system, based on the results of the study.

Section 407 authorizes the NWS director to establish the NOAA Weather Ready All Hazards Award Program, which would provide annual awards to individuals or organizations that use or provide NOAA Weather Radio receivers or transmitters to save lives and protect property. Individuals and organizations that employ tools other than NOAA Weather Radios for early warnings also may qualify for the award.

Section 408 (131 Stat. 112) requires NOAA to submit a report to Congress within 60 days of enactment (i.e., by June 2017) that analyzes the impact of the U.S. Air Force withdrawal from the U.S. Weather Research and Forecasting Model.[28]

Section 409 (131 Stat. 112) requires NOAA to continue its contract with an external organization to conduct a baseline analysis of NWS operations and workforce.[29]

Section 410 requires NOAA to submit a report to Congress within 180 days of enactment (October 2017) on the use of contractors at NWS for the FY2017 fiscal year. The section also requires that NOAA include eight different types of information in the report and make that information publicly available each year within 180 days after the end of the fiscal year.[30] Section 410 also directs NOAA to publish updated information from the report after each subsequent fiscal year on a "publicly accessible internet website."[31]

Section 411 (131 Stat. 113) requires the NWS director to review the existing research, products, and services with the potential to improve modeling and forecasting in the urban environment and to submit a report to Congress on the findings.[32]

Section 412 authorizes NOAA to establish outreach mechanisms to the weather enterprise to assess the agency's forecasts and forecast products and to determine the highest forecast needs of the weather-enterprise community.

Section 413 requires NOAA to acquire backup capabilities for its WP-3D Orion and G-IV hurricane hunter aircraft.[33]

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[27] NOAA, *Report to Congress: Improving National Oceanic and Atmospheric Administration Communication of Hazardous Weather and Water Events*, 2020, at https://doi.org/10.25923/x490-xp67.

[28] The U.S. Weather Research and Forecasting Model is a weather prediction system designed for both research and operations. The Weather Research & Forecasting Model, at https://www.mmm.ucar.edu/models/wrf. CRS did not locate this report.

[29] NOAA National Weather Service, *Operations and Workforce Analysis Catalog*, September 2017, at https://doi.org/10.25923/zabw-4h92.

[30] NOAA, *Report to Congress: The National Oceanic and Atmospheric Administration's Report on Contract Positions at the National Weather Service*, 2020, at https://doi.org/10.25923/8p4p-vn52.

[31] CRS did not locate this website.

[32] CRS did not locate this report.

[33] Hurricane hunters are specially equipped aircraft that collect data during a hurricane to help forecasters make accurate hurricane predictions and better understand storm processes. NOAA, *Office of Marine & Aviation Operations*, NOAA Hurricane Hunters, at http://www.omao.noaa.gov/learn/aircraft-operations/about/hurricane-hunters.

Section 414 (131 Stat. 113) requires the Secretary of Commerce to complete a study within 180 days of enactment (i.e., by October 2017) on gaps in coverage of NEXRAD. The section requires the Secretary to identify areas that have limited or no NEXRAD coverage for which no or insufficient warnings were given for hazardous weather events or for which degraded forecasts resulted in deaths, injuries, or substantial property damage.[34] It also requires the Secretary to submit a report on the study's findings to Congress and to submit within 90 days of the study's completion (i.e., by January 2018) the Secretary's recommendations for improving hazardous weather detection and forecasting in the areas identified as having limited or no NEXRAD coverage.[35]

Concluding Observations

Congress provides broad and far-ranging direction regarding weather-related activities for NOAA and NWS in the first four titles of P.L. 115-25. Some might argue that this law may represent the most widely varied set of provisions addressing weather issues at NOAA in a single bill since NOAA was first organized. Throughout P.L. 115-25, Congress requires reports on progress in meeting its authorizations over time frames from 30 days to several years; NOAA has published some of the required reports in the allotted timeframe and in public repositories.[36] The reports allow Congress to track NOAA's progress in implementing the specific requirements outlined in the law.

Some of the issues Congress might consider include whether the level of enacted appropriations for activities authorized in P.L. 115-25 is commensurate with the scale and scope of those activities. Over the long term, Congress may choose to assess whether the law's research-to-operations focus and NOAA's increased use of commercial data sources is resulting in improved forecasts and warnings.

The test of whether congressional direction in P.L. 115-25 is effective ultimately will be gauged by how improvements in forecasts and warnings reduce the amount of damage and numbers of injuries and fatalities from dangerous weather.

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[34] NOAA, *Study: Gaps in NEXRAD Radar Coverage*, 2019, at https://repository.library.noaa.gov/view/noaa/25911.

[35] NOAA, *Report to Congress: Gaps in NEXRAD Radar Coverage*, 2020, at https://doi.org/10.25923/kmy7-7q82.

[36] See the footnotes for each provision for links to publicly available documents. In some cases, the reports or other materials were not available online. CRS reached out to NOAA to obtain the reports but NOAA did not provide the documents by the publication of this report.

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