118TH CONGRESS
2D SESSION

H. R. 6093

IN THE SENATE OF THE UNITED STATES

MAY 1, 2024

Received; read twice and referred to the Committee on Commerce, Science, and Transportation

AN ACT

To improve the National Oceanic and Atmospheric Administration's weather research, support improvements in weather forecasting and prediction, expand commercial opportunities for the provision of weather data, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) SHORT TITLE.—This Act may be cited as the ''Weather Research and Forecasting Innovation Reauthorization Act of 2023'' or the ''Weather Act Reauthorization Act of 2023''.

(b) TABLE OF CONTENTS.—The table of contents for this Act is as follows:

SEC. 2. DEFINITIONS.

(a) IN GENERAL.—In this Act, the terms ''seasonal'', ''State'', ''subseasonal'', ''Under Secretary'', ''weather enterprise'', ''weather data'', and ''weather industry'' have the meanings given such terms in section 2 of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8501).

(b) WEATHER DATA DEFINED.—Section 2 of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8501) is amended—

(1) by redesignating paragraph (5) as paragraph (6); and

(2) by inserting after paragraph (4) the following new paragraph:

''(5) WEATHER DATA.—The term 'weather data' means information used to track and predict weather conditions and patterns, including forecasts, observations, and derivative products from such information.''.

TITLE I—REAUTHORIZATION OF THE WEATHER RESEARCH AND FORECASTING INNOVATION ACT OF 2017

SEC. 101. PUBLIC SAFETY PRIORITY.

Section 101 of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8511) is amended by adding at the end the following new sentence: ''The Under Secretary shall ensure the National Oceanic and Atmospheric Administration remains focused on providing accurate and timely weather forecasts that protect lives and property and enhance the national economy by disseminating to the public and core partners through nimble, flexible, and mobile methods critical weather information and impact-based decision support services.''.

SEC. 102. UNITED STATES WEATHER RESEARCH AND FORECASTING.

Section 110 of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8519) is amended to read as follows:

"SEC. 110. AUTHORIZATION OF APPROPRIATIONS.

"(a) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Office of Oceanic and Atmospheric Research to carry out this title the following:

"(1) $155,000,000 for fiscal year 2024, of which—

"(A) $90,000,000 is authorized for weather laboratories and cooperative institutes;

"(B) $30,000,000 is authorized for the United States Weather Research Program;

"(C) $20,000,000 is authorized for tornado, severe storm, and next generation radar research; and

"(D) $15,000,000 is authorized for the joint technology transfer initiative described in section 102(b)(4) of this title.

"(2) $156,550,000 for fiscal year 2025, of which—

"(A) $90,900,000 is authorized for weather laboratories and cooperative institutes;

"(B) $30,300,000 is authorized for the United States Weather Research Program;

"(C) $20,200,000 is authorized for tornado, severe storm, and next generation radar research; and

"(D) $15,150,000 is authorized for the joint technology transfer initiative described in section 102(b)(4) of this title.

"(3) $158,116,000 for fiscal year 2026, of which—

"(A) $91,809,000 is authorized for weather laboratories and cooperative institutes;

"(B) $30,603,000 is authorized for the United States Weather Research Program;

"(C) $20,402,000 is authorized for tornado, severe storm, and next generation radar research; and

"(D) $15,302,000 is authorized for the joint technology transfer initiative described in section 102(b)(4) of this title.

"(4) $159,697,000 for fiscal year 2027, of which—

"(A) $92,727,000 is authorized for weather laboratories and cooperative institutes;

"(B) $30,909,000 is authorized for the United States Weather Research Program;

"(C) $20,606,000 is authorized for tornado, severe storm, and next generation radar research; and

"(D) $15,455,000 is authorized for the joint technology transfer initiative described in section 102(b)(4) of this title.

"(5) $161,294,000 for fiscal year 2028, of which—

"(A) $93,654,000 is authorized for weather laboratories and cooperative institutes;

"(B) $31,218,000 is authorized for the United States Weather Research Program;

"(C) $20,812,000 is authorized for tornado, severe storm, and next generation radar research; and

"(D) $15,609,000 is authorized for the joint technology transfer initiative described in section 8512(b)(4) of this title.

"(b) LIMITATION.—No additional funds are authorized to carry out this title or the amendments made by this title.".

SEC. 103. VERIFICATION OF THE ORIGINS OF ROTATION IN TORNADOES EXPERIMENT (VORTEX).

(a) IN GENERAL.—Section 103 of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8513) is amended to read as follows:

"SEC. 103. VERIFICATION OF THE ORIGINS OF ROTATION IN TORNADOES EXPERIMENT (VORTEX).

''(a) IN GENERAL.—The Under Secretary, in collaboration with the United States weather industry and academic partners, shall maintain a program for rapidly improving tornado forecasts, predictions, and warnings, including forecaster training in radar interpretation and information integration from new sources.

''(b) GOAL.—The goal of the program under subsection (a) shall be to develop and extend accurate tornado forecasts, predictions, and warnings in order to reduce the loss of life or property related to tornadoes, with a focus on the following:

''(1) Improving the effectiveness and timeliness of tornado forecasts, predictions, and warnings.

''(2) Optimizing lead time and providing actionable information beyond one hour in advance.

''(3) Transitioning from warn-on-detection to warn-on-forecast.

''(c) INNOVATIVE OBSERVATIONS.—The Under Secretary shall ensure the program under subsection (a) peri-

odically examines, tests, and evaluates the value of incorporating innovative observations, such as novel sensor technologies, observation tools or networks, crewed or uncrewed systems, and hosted instruments on commercial aircrafts, vessels, and satellites, with respect to the improvement of tornado forecasts, predictions, and warnings.

''(d) ACTIVITIES.—The Under Secretary shall award grants for research, including relating to the following:

''(1) Implementing key goals and achieving program milestones to the maximum extent practicable as outlined by the National Oceanic and Atmospheric Administration's 2019 report, 'Tornado Warning Improvement and Extension Program Plan'.

''(2) In coordination with the National Science and Technology Council's Social and Behavioral Sciences Subcommittee, improving the social, behavioral, risk, communication, and economic sciences regarding vulnerabilities, risk communication, and delivery of information critical for reducing the loss of life or property related to tornadoes.

''(3) Improving the physical sciences, computer modeling, and tools related to tornado formation, the impacts of tornadoes on the built and natural envi-

ronment, and the interaction of tornadoes and hurricanes.

''(e) WARNINGS.—In carrying out subsection (a), the Under Secretary, in coordination with the program established under section 406, shall—

''(1) conduct and transition to operations the research necessary to develop and deploy probabilistic weather forecast guidance technology for tornadoes and related weather phenomena;

''(2) incorporate into tornado modeling and forecasting, as appropriate, social, behavioral, risk, communication, and economic sciences;

''(3) enhance workforce training on radar interpretation and use of tornado warning systems; and

''(4) expand computational resources to support higher-resolution modeling to advance the capability for warn-on-forecast.

''(f) TORNADO RATING SYSTEM.—The Under Secretary, in collaboration with local communities and emergency managers, shall—

''(1) evaluate the system used as of the date of the enactment of this section to rate the severity of tornadoes;

''(2) determine whether updates to such system are required to ensure such ratings accurately reflect the severity of tornados; and

''(3) if determined necessary, update such system.

''(g) ANNUAL BUDGET.—The Under Secretary shall, not less frequently than annually, submit to Congress a proposed budget corresponding with carrying out this section.''.

(b) CLERICAL AMENDMENT.—The table of contents in section 1(b) of the Weather Research and Forecasting Innovation Act of 2017 is amended by amending the item relating to section 103 to read as follows:

''Sec. 103. Verification of the Origins of Rotation in Tornadoes Experiment (VORTEX).''.

SEC. 104. HURRICANE FORECAST IMPROVEMENT PROGRAM.

Section 104 of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8514) is amended to read as follows:

''SEC. 104. HURRICANE FORECAST IMPROVEMENT PROGRAM.

''(a) IN GENERAL.—The Under Secretary, in collaboration with the United States weather industry and academic partners, shall maintain a program to improve hurricane forecasting, predictions, and warnings.

''(b) GOAL.—The goal of the program under subsection (a) shall be to develop and extend accurate hurricane forecasts, predictions, and warnings in order to reduce the loss of life or property related to hurricanes, with a focus on the following:

''(1) Improving the understanding and prediction of rapid intensity change and projected path of hurricanes, including probabilistic methods for hurricane hazard mapping.

''(2) Improving the forecast and impact-based communication of inland flooding, compound flooding, and storm surges from hurricanes, in coordination with the program established under section 205 of the Weather Act Reauthorization Act of 2023.

''(3) Incorporating social, behavioral, risk, communication, and economic sciences to clearly inform response to prevent the loss of life or property, such as evacuation or shelter in place.

''(4) Evaluating and incorporating, as appropriate, innovative observations, such as novel sensor technologies, observation tools or networks, crewed or uncrewed systems, and hosted instruments on commercial aircrafts, vessels, and satellites.

''(c) ACTIVITIES.—The Under Secretary shall award grants for research, including relating to the following:

''(1) Implementing key strategies and following priorities and objectives outlined by the National Oceanic and Atmospheric Administration's 2019 report 'Hurricane Forecast Improvement Program'.

''(2) In coordination with the National Science and Technology Council's Social and Behavioral Sciences Subcommittee and other relevant interagency committees, improving the social, behavioral, risk, communications, and economic sciences related to vulnerabilities, risk communication, and delivery of information critical for reducing the loss of life or property related to hurricanes.

''(3) Improving the physical sciences, operational modeling, and tools related to hurricane formation, the impacts of wind and water-based hurricane hazards on the built and natural environment, and the interaction of hurricanes and tornadoes.

''(d) WARNINGS.—In carrying out subsection (a), the Under Secretary, in coordination with the program established under section 406, shall—

''(1) conduct and transition to operations the research necessary to develop and deploy probabilistic weather forecast guidance technology relating to hurricanes and related weather phenomena;

''(2) incorporate into hurricane modeling and forecasting, as appropriate, social, behavioral, risk, communication, and economic sciences research; and

''(3) expand computational resources to support and improve higher-resolution operational modeling of hurricanes and related weather phenomena.

''(e) ANNUAL BUDGET.—The Under Secretary shall, not less frequently than annually, submit to Congress a proposed budget corresponding with carrying out this section.''.

SEC. 105. TSUNAMI WARNING AND EDUCATION ACT REAUTHORIZATION.

(a) TITLE HEADING.—The Tsunami Warning and Education Act (enacted as title VIII of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (Public Law 109–479)) is amended in the title heading, by inserting ''**RESEARCH,**'' after ''**WARNING,**''.

(b) PURPOSES.—Section 803 of the Tsunami Warning and Education Act (33 U.S.C. 3202) is amended—

(1) in paragraph (2), by inserting ''timeliness and'' before ''accuracy'';

(2) in paragraph (7), by striking ''and'' after the semicolon;

(3) in paragraph (8), by striking the period and inserting ''; and''; and

(4) by adding at the end the following new paragraph:

''(9) to ensure data and metadata are managed, archived, and made available for operations, research, education, and mitigation activities in accordance with section 305 of the Weather Research and Forecasting Innovation Act of 2017.''.

(c) TSUNAMI FORECASTING AND WARNING PROGRAM.—Section 804 of the Tsunami Warning and Education Act (33 U.S.C. 3203) is amended—

(1) in subsection (b)—

(A) in paragraph (4), by inserting '', using industry and scientific best practices,'' after ''operational condition'';

(B) in paragraph (5)—

(i) in subparagraph (C), by striking ''global seismic network'' and inserting ''Global Seismic Network'';

(ii) by redesignating subparagraphs (D), (E), (F), and (G), as subparagraphs (E), (F), (G), and (H), respectively; and

(iii) by inserting after subparagraph (C) the following new subparagraph:

''(D) the global navigation satellite system (GNSS) network;'';

(C) by amending paragraph (6) to read as follows:

''(6) ensure data quality and management systems, support data and metadata access and archiving, and support the requirements of the program pursuant to the Foundations for Evidence-Based Policymaking Act of 2018 (Public Law 115–435) and chapter 31 of title 44, United States Code;'';

(D) in paragraph (7)—

(i) by amending the matter preceding subparagraph (A) to read as follows: ''include a cooperative effort among the Administration, the United States Geological Survey (USGS), the National Aeronautics and Space Administration (NASA), and the National Science Foundation (NSF) under which the Director of USGS, the Director of the NSF, and the Administrator of NASA shall—'';

(ii) in subparagraph (A), by striking ''and'' at the end; and

(iii) by adding at the end the following new subparagraphs:

''(C) provide reliable and real-time support for the GNSS network data streams from NSF, NASA, and USGS maintained networks, and supplement instrumentation coverage for rapid earthquake assessment;

''(D) assess the data and information relating to warning systems of collaborating agencies for potential utilization in NOAA's warning system, taking into consideration advancement in research and technology;

''(E) incorporate, as practicable, tsunami notifications and warnings in the USGS Earthquake Early Warning System; and

''(F) incorporate, as practicable, preliminary analysis or data from the National Earthquake Information Center regarding the source and magnitude of an offshore earthquake within five minutes of detection;'';

(E) in paragraph (8)—

(i) by inserting '' and decision support aides'' after ''graphical warning products,''; and

(ii) by inserting ''-prone'' after ''tsunami'';

(F) in paragraph (9), by striking ''and'' after the semicolon;

(G) in paragraph (10), by striking the period and inserting ''; and''; and

(H) by adding at the end the following new paragraph:

''(11) update tsunami inundation maps, models, or other geographic products, in order to best support, as appropriate, relevant agencies with tsunami mitigation and recovery activities.'';

(2) in subsection (c)—

(A) by striking paragraph (1) and redesignating paragraphs (2) and (3) as paragraphs (1) and (2), respectively; and

(B) in paragraph (1), as so redesignated—

(i) by striking ''the Atlantic Ocean, including the Caribbean Sea and Gulf of Mexico, that are determined—'' and inserting ''the Pacific, Arctic, and Atlantic Oceans, including the Caribbean Sea and Gulf of Mexico, that are determined to pose significant risks of tsunami for States

and United States territories along the coastal areas of such regions; and''; and

(ii) by striking subparagraphs (A) and (B);

(3) by redesignating subsections (d), (e), (f), and (g) as subsections (e), (f), (g), and (h), respectively;

(4) by inserting after subsection (c) the following new subsection:

''(d) TSUNAMI WARNING ALERT LEVEL EVALUATION.—The Administrator, in collaboration with social scientists, emergency personnel, and high-risk communities, shall—

''(1) evaluate tsunami alert levels terminology, timing, and effectiveness;

''(2) determine if such alerts produce the desired response and understanding from possible tsunami-prone communities; and

''(3) if necessary, update the alert level system for increased effectiveness.'';

(5) in subsection (e), as so redesignated—

(A) in paragraph (1)—

(i) in the matter preceding subparagraph (A), by inserting ''responsible for Alaska, the continental United States, Ha-

waii, United States territories, and international entities the Administrator determines appropriate'' before the period;

(ii) in subparagraph (A), by striking ''which is primarily responsible for Alaska and the continental United States''; and

(iii) in subparagraph (B), by striking '', which is primarily responsible for Hawaii, the Caribbean, and other areas of the Pacific not covered by the National Center'';

(B) in paragraph (2)—

(i) in subparagraph (A), by inserting ''current,'' after ''sea level,'';

(ii) in subparagraph (B), by striking ''and volcanic eruptions'' and inserting ''volcanic eruptions, or other sources'';

(iii) in subparagraph (C), by striking ''buoy data and tidal'' and inserting ''and coastal'';

(iv) in subparagraph (E), by striking ''Integrated Ocean Observing System of the Administration'' and inserting ''United States and global ocean and coastal observing system'';

(v) in subparagraph (H), by inserting ''monitoring needs,'' after ''response,''; and

(vi) by amending subparagraph (I) to read as follows:

''(I) Providing a Tsunami Warning Coordinator to coordinate with partners and stakeholders products and services of the centers supported or maintained under paragraph (1).'';

(C) by amending paragraph (3) to read as follows:

''(3) FAIL-SAFE WARNING CAPABILITY.—The Administrator shall support and maintain fail-safe warning capability for the tsunami warning centers supported or maintained under paragraph (1), and such centers shall conduct at least one service back up drill biannually.'';

(D) in paragraph (4)—

(i) by amending the matter preceding subparagraph (A) to read as follows: ''The Administrator shall coordinate with the weather forecast offices of the National Weather Service, the centers supported or maintained under paragraph (1), and such national and regional program offices of the Administration as the Administrator or

the coordinating committee, as established in section 805(b), consider appropriate to ensure that regional and local weather forecast offices—'';

(ii) in subparagraph (B), by striking ''and'' after the semicolon;

(iii) in subparagraph (C), by striking the period and inserting ''; and''; and

(iv) by adding at the end the following new subparagraph:

''(D) conduct education and outreach efforts to help prepare coastal communities for tsunami hazards.'';

(E) in paragraph (5)—

(i) in the section heading, by striking ''UNIFORM'' and inserting ''STANDARDIZED'';

(ii) in subparagraph (A), by striking ''uniform'' and inserting ''standardized'';

(iii) in subparagraph (C)(ii), by striking ''uniform'' and inserting ''standardized'';

(iv) in subparagraph (D), by striking ''and'' after the semicolon;

(v) in subparagraph (E), by striking the period and inserting ''; and''; and

(vi) by adding at the end the following new subparagraph:

''(F) align the analytic techniques and methodologies of the existing tsunami warning centers supported or maintained under paragraph (1) to ensure seamless continuity of operations and mitigate risk of operational failure by prioritizing investments that include—

''(i) replacing end of life equipment;

''(ii) ensuring product consistency;

''(iii) enabling consistent operational process for backup capabilities;

''(iv) mitigating existing operational security risks; and

''(v) meeting information security requirements specified in chapter 35 of title 44, United States Code.''; and

(F) by adding at the end the following new paragraph:

''(7) REPORTING.—Not later than 180 days after the date of the enactment of this paragraph and annually thereafter until such time as all relevant requirements have been satisfied, the Adminis-

trator shall provide to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate an update briefing on the progress of the following:

''(A) Standardizing products and procedures under paragraph (5), including tsunami assessments, forecast guidance, and related products.

''(B) Migrating the message generation systems of the centers supported or maintained under paragraph (1) to the Advanced Weather Information Processing Systems, or successor systems.

''(C) The structural reorganization effort, if necessary, to align such centers' organizational charts.

''(D) The expected timeline for the full completion of standardizing such centers' products and procedures.'';

(6) in subsection (f), as so redesignated—

(A) in paragraph (1)—

(i) in the matter preceding subparagraph (A), by inserting ''detect, measure, and'' after ''used to'';

(ii) in subparagraph (B), by striking ''and'' after the semicolon;

(iii) in subparagraph (C), by striking ''and the Advanced National Seismic System'' and inserting ''the Advanced National Seismic System, and the global navigation satellite system (GNSS); and''; and

(iv) by adding at the end the following new subparagraph:

''(D) ensure research is coordinated with tsunami warning operations;''; and

(B) in paragraph (3), by inserting ''according to industry best practices'' before the period; and

(7) in subsection (h)(2)(A), as so redesignated, by striking ''accuracy of the tsunami model used'' and inserting ''timeliness and accuracy of the forecast used to issue the warning''.

(d) NATIONAL TSUNAMI HAZARD MITIGATION PROGRAM.—Section 805(c) of the Tsunami Warning and Education Act (33 U.S.C. 3204(c)) is amended—

(1) in paragraph (5)—

(A) by redesignating subparagraphs (B), (C), (D), (E), (F), and (G) as subparagraphs (C), (D), (E), (F), (G), and (H), respectively;

(B) by inserting after subparagraph (A) the following new subparagraph:

''(B) Coastal digital elevation models (DEMs) to support the development of inundation maps.''; and

(C) by adding at the end the following new subparagraphs:

''(I) Evaluation of the variation of inundation impact resulting from tsunami-driven sediment transport.

''(J) Evaluation of tsunami debris impact on critical infrastructure (as such term is defined in section 1016(e) of Public Law 107–56 (42 U.S.C. 5195c(e))) and lifelines.

''(K) High-resolution and high-quality digital elevation models needed for at-risk coastlines, ports, and harbors, particularly for regions not covered by existing inundation maps.''; and

(2) in paragraph (7)(C), by inserting ''and behavioral'' after ''social'';

(e) TSUNAMI RESEARCH PROGRAM.—Section 806 of the Tsunami Warning and Education Act (33 U.S.C. 3205) is amended—

(1) in subsection (a)—

(A) by striking ''section 805(d)'' and inserting ''section 805(b)''; and

(B) by inserting ''and management'' after ''data collection'';

(2) in subsection (b)—

(A) in paragraph (1), by inserting ''deployment and'' after ''may include'';

(B) in paragraph (3), by striking ''social science research'' and inserting ''social and behavioral science research, including data collection,'';

(C) in paragraph (4), by striking ''and'' after the semicolon;

(D) by redesignating paragraph (5) as paragraph (7); and

(E) by inserting after paragraph (4) the following new paragraphs:

''(5) develop decision support tools;

''(6) leverage and prioritize research opportunities; and''; and

(3) by adding at the end the following new subsection:

''(c) RESEARCH AND DEVELOPMENT PLAN.—Not later than 12 months after the date of the enactment of this subsection and not less frequently than every 36

months thereafter, the Administrator, in consultation with the Interagency Council for Advancing Meteorological Services, shall develop a research and development and research to operations plan to improve tsunami detection and forecasting capabilities that—

''(1) identifies and prioritizes research and development priorities to satisfy section 804;

''(2) identifies key research needs for better detecting tsunamis that may occur in open ocean and along the coastlines of the United States and its territories, improve forecasting of tsunamis that are not seismically driven, and other opportunities determined appropriate;

''(3) develops plans for transitioning research to operations; and

''(4) identifies collaboration opportunities that may further and align tsunami research, development, warnings, and operations between the centers supported or maintained under section 804, the National Tsunami Hazard Mitigation Program, the National Oceanic and Atmospheric Administration Center for Tsunami Research, the National Science Foundation, the United States Geological Survey, the Federal Emergency Management Agency, insti-

tutions of higher education, private entities, stakeholders, and others determined appropriate.'';

(f) GLOBAL TSUNAMI WARNING AND MITIGATION NETWORK.—Section 807(d) of the Tsunami Warning and Education Act (33 U.S.C. 3206(d)) is amended by inserting ''and management'' after ''data sharing'';

(g) TSUNAMI SCIENCE AND TECHNOLOGY ADVISORY PANEL.—Section 808(b)(1) of the Tsunami Warning and Education Act (33 U.S.C. 3206a(b)(1)) is amended by inserting ''and behavioral'' after ''social'';

(h) AUTHORIZATION OF APPROPRIATIONS.—Section 809 of the Tsunami Warning and Education Act (33 U.S.C. 3207) is amended to read as follows:

''SEC. 809. AUTHORIZATION OF APPROPRIATIONS.

''There are authorized to be appropriated to the Administrator to carry out this title $30,000,000 for each of fiscal years 2024 through 2028, of which—

''(1) not less than 27 percent of the amount appropriated for each fiscal year shall be for activities conducted at the State level under the national tsunami hazard mitigation program under section 805; and

''(2) not less than 8 percent of the amount appropriated shall be for the tsunami research program under section 806.''.

SEC. 106. OBSERVING SYSTEM PLANNING.

Section 106 of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8516) is amended—

(1) in paragraph (3)—

(A) by inserting ''Federal'' before ''observing capabilities''; and

(B) by striking ''and'' after the semicolon;

(2) in paragraph (4)—

(A) by inserting '', including private sector partnerships or commercial acquisition,'' after ''options''; and

(B) by striking the period and inserting a semicolon; and

(3) by adding at the end the following new paragraphs:

''(5) compare costs and schedule, including cost-benefit analysis, of Federal and private sector supplemental options to fill the observation data requirements under paragraph (1) and gaps identified pursuant to paragraph (3); and

''(6) not later than one year after the date of the enactment of this paragraph, submit to Congress a report that provides an analysis of the technical, schedule, cost, and cost benefit analyses to place an operational polar-orbiting environmental satellite ca-

pability in the early morning orbit to support the weather enterprise and the Administration's mission.''.

SEC. 107. OBSERVING SYSTEM SIMULATION EXPERIMENTS.

Section 107 of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8517) is amended—

(1) in subsection (b)(3), by striking ''providing data'' and inserting ''comparison to current or experimental commercial system capabilities that provide data'';

(2) in subsection (c)(1), by striking '', including polar-orbiting and geostationary satellite systems,'';

(3) by striking subsection (d); and

(4) by redesignating subsection (e) as subsection (d).

SEC. 108. COMPUTING RESOURCES PRIORITIZATION.

Section 108 of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8518) is amended by striking subsection (a)(3)(C) and all that follows through subsection (b)(7) and inserting the following new subsections:

''(b) COMPUTING RESEARCH INITIATIVE.—

''(1) IN GENERAL.—The Under Secretary, in collaboration with the Secretary of Energy, shall

carry out an initiative, which may leverage Department of Energy high performance computers, cloud computing, or expertise, to run advanced coupled models in order to conduct proof of concept scenarios in comparison with current issued forecasts and models. The Under Secretary and Secretary of Energy shall carry out the initiative through a competitive, merit-reviewed process, and consider applications from Federal agencies, National Laboratories, institutions of higher education (as such term is defined in section 101 of the Higher Education Act of 1965 (20 U.S.C. 1001)), nonprofit institutions, and other appropriate entities (or a consortia thereof).

''(2) COMPONENTS.—In carrying out the initiative under paragraph (1), the Under Secretary shall prevent duplication and coordinate research efforts in artificial intelligence, high performance computing, cloud computing, quantum computing, modeling and simulation, machine learning, data assimilation, large scale data analytics, and predictive analysis across the National Oceanic and Atmospheric Administration, and may—

''(A) conduct research to compare National Weather Service forecast and model outputs to

predictions and model outputs developed through such initiative;

"(B) share relevant modeling system and applications innovations developed through such initiative, including Unified Forecast System-based applications, through community-based activities, in accordance with section 10601 of the James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 (15 U.S.C. 8512a);

"(C) leverage coordinating activities managed by the National Science and Technology Council, the Interagency Council for Advancing Meteorological Services, and other relevant interagency entities;

"(D) provide sufficient capacity for long-term archive and access of model output to support research and long-term study;

"(E) determine computing decisions based on an agile requirements framework; and

"(F) support the training, recruitment, and retention of the next generation weather, water, and climate computing workforce through incentives and pathways for career development and employment opportunities.

''(3) RESEARCH SECURITY.—The activities authorized under this section shall be applied in a manner consistent with subtitle D of title VI of the Research and Development, Competition, and Innovation Act (enacted as division B of Public Law 117–167; 42 U.S.C. 19231 et seq.).

''(4) TERMINATION.—The authority under this subsection shall terminate five years after the date of the enactment of this subsection.

''(c) ARTIFICIAL INTELLIGENCE INVESTMENTS.—The Under Secretary shall leverage artificial intelligence and machine learning technologies to facilitate, optimize, and further leverage advanced computing to accomplish critical missions of the National Oceanic and Atmospheric Administration by enhancing existing and forthcoming high-performance and cloud computing infrastructure or systems.

''(d) CENTERS OF EXCELLENCE.—The Under Secretary may expand, and where applicable establish, centers of excellence to aid the adoption of next-generation artificial intelligence and machine learning enabled advanced computing capabilities. Each such center may carry out activities that include the following:

''(1) Leveraging robust public-private partnership models to provide access to training, experience,

and long-term development of workforce and infrastructure.

''(2) Developing and optimizing tools, libraries, algorithms, data structures, and other supporting software necessary for specific applications on high performance computing systems.

''(3) Applying modern artificial intelligence, deep machine-learning, and advanced data analysis technologies to address current and future mission challenges.

''(4) To the maximum extent practicable, explore quantum computing and related application partnerships with public, private, and academic entities to improve the accuracy and resolution of weather predictions.

''(e) MULTI-YEAR CONTRACTS.—The Under Secretary may enter into multi-year contracts in accordance with section 3903 of title 41, United States Code, and shall ensure compliance with all clauses provided in such section to support operations, research, and development related to high performance and cloud computing infrastructure or systems with an unfunded contingent liability in the event of cancellation.

''(f) REPORT.—Not later than two years after the date of the enactment of this subsection, the Under Sec-

retary shall submit to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Commerce, Science, and Transportation and the Committee on Energy and Natural Resources of the Senate a report evaluating the following:

''(1) The effectiveness of the initiative required under subsection (b), including applied research discoveries and advanced modeling improvements achieved.

''(2) A best estimate of the overall value of high-resolution probabilistic forecast guidance for hazardous weather or water events (as such term is defined in section 406) using a next-generation weather forecast and warning framework.

''(3) The needs for cloud computing, quantum computing, or high-performance computing, visualization, and dissemination collaboration between the Department of Energy and the National Oceanic and Atmospheric Administration.

''(4) A timeline and guidance for implementation of the following:

''(A) High-resolution numerical weather prediction models.

''(B) Methods for meeting the cloud computing, quantum computing, or high-perform-

ance computing, visualization, and dissemination needs identified under paragraph (3).''.

SEC. 109. EARTH PREDICTION INNOVATION CENTER.

Paragraph (5) of section 102(b) of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8512(b)) is amended—

(1) in subparagraph (D), by striking ''and'' after the semicolon; and

(2) by striking subparagraph (E) and inserting the following new subparagraphs:

''(E) developing community weather research modeling systems that—

''(i) are accessible by the public in accordance with section 10601 of the James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 (15 U.S.C. 8512a) and available for archive and long-term study;

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

''(iii) utilize, 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 subparagraph;

''(iv) utilize modeling systems that allow for interoperability with new model components, modules, and next-generation software and coding languages;

''(v) allow for open testing and integration of promising operational model improvements from the broader community;

''(vi) access as close to a real-time basis as possible operational data and metadata, including commercially purchased data for use in Earth Prediction Innovation Center research and development testing grounds pursuant to redistribution restrictions, licensing agreements, and applicable existing laws and regulations; and

''(vii) provide supported and portable versions of the unified forecast system, including applications for hurricane, space weather, ocean, cryosphere, air quality, and coastal models, that can reproduce

current operational global and regional model prediction; and

''(F) establishing a National Oceanic and Atmospheric Administration Data Lake, to be maintained by the Administration, a commercial partner, or non-profit entity, that consolidates and maintains a publicly available and continuously updated collection of data and metadata used in numerical weather prediction for use in the Earth Prediction Innovation Center's model testing, pursuant to redistribution restrictions, licensing agreements, and applicable existing laws and regulations.''.

SEC. 110. SATELLITE ARCHITECTURE PLANNING.

Section 301 of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8531) is amended—

(1) in subsection (a), by striking paragraph (1) and redesignating paragraphs (2), (3), and (4) as paragraphs (1), (2), and (3), respectively;

(2) by amending subsection (b) to read as follows:

''(b) NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION SATELLITE SYSTEMS AND DATA.—

''(1) IN GENERAL.—The Under Secretary shall maintain a fleet of Administration space-based observation platforms that provide critical operations-focused data and information to support the National Oceanic and Atmospheric Administration's mission to monitor the global environment in order to protect lives and property from extreme weather and other natural phenomena.

''(2) COLLABORATION.—The Under Secretary shall implement recommendations from the NOAA Observing Systems Council to ensure an appropriate mix of government, academic, commercial sector, and international partnerships in the provision of data and information, including a broadened effort on data acquisition through the Commercial Data Program under section 302 when cost effective and beneficial to the Administration.

''(3) PRIORITY.—The Under Secretary shall ensure that Administration platforms maintained under paragraph (1) prioritize the development of products and services that are tailored to meet the National Oceanic and Atmospheric Administration's mission.

''(4) NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION.—The Under Secretary shall maintain

the National Centers for Environmental Information to provide a long-term archive and access to the Administration's national and global data and metadata.''; and

(3) in subsection (f)(1), by striking ''2023'' and inserting ''2030''.

SEC. 111. IMPROVING UNCREWED ACTIVITIES.

Subparagraph (G) of section 102(b)(3) of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8512(b)(3)) is amended by striking '', including commercial observing systems'' and inserting '', including stationary and mobile commercial observing systems, such as uncrewed aircraft and marine systems, to provide observations of the atmosphere and ocean, and other observations, in cooperation with the Office of Marine and Aviation Operations''.

SEC. 112. INTERAGENCY COUNCIL FOR ADVANCING METEOROLOGICAL SERVICES.

(a) IN GENERAL.—Section 402 of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8542) is amended—

(1) in subsection (a)—

(A) by striking ''Advancing Weather Services'' and inserting ''Advancing Meteorological

Services (in this section referred to as the 'Interagency Council')''; and

(B) by striking ''Committee'' each place it appears and inserting ''Council'';

(2) by amending subsections (b) and (c) to read as follows:

''(b) CO-CHAIRS.—The Director of the Office of Science and Technology Policy and the Under Secretary shall serve as co-chairs of the Interagency Council. The Under Secretary shall serve as the Federal Coordinator for Meteorology.

''(c) FURTHER COORDINATION.—The Director of the Office of Science and Technology Policy shall take such steps as are necessary to coordinate the activities of the Federal Government with stakeholders in the United States weather industry, academic partners, State governments, and emergency managers, including by implementing mechanisms to encourage and enable the participation of non-Federal employees in the functions of the Interagency Council.'';

(3) by adding at the end the following new subsections:

''(d) FUNCTIONS.—The Interagency Council shall be the formal mechanism by which all relevant Federal departments and agencies coordinate implementation of pol-

icy and practices to ensure United States global leadership in meteorological services. In doing so, the Interagency Council shall review programs and support relevant weather research and forecast innovation activities, as well as other related implementation activities, related to Federal meteorological services, including by carrying out the following:

''(1) Identifying and helping prioritize meteorological research and service delivery needs, including relating to observations, operational systems, communications, and infrastructure.

''(2) Providing recommendations to streamline or consolidate activities and develop greater efficiencies in cross-agency activities.

''(3) Leveraging Earth system science research outcomes of the National Oceanic and Atmospheric Administration, the National Aeronautics and Space Administration, and other relevant Federal departments and agencies, including research outcomes related to the relevant recommended key science and applications questions and priorities in the National Academies of Sciences, Engineering, and Medicine's 2018 report 'Thriving on Our Changing Planet: A Decadal Strategy for Earth Observation from

Space', to understand and predict high-impact weather phenomena.

''(4) Facilitating the expansion and strengthening of partnerships with private sector entities to advance meteorological research, communications, and computing in collaboration with the Earth system science, service, and stakeholder communities.

''(5) Sharing information regarding meteorological research improvement needs and science opportunities across relevant Federal departments and agencies.

''(6) Providing advice to all relevant Federal departments and agencies regarding potential collaborations and expected level of resources needed to maintain and operate the Interagency Council.

''(7) Enhancing communication and coordination and promoting sharing within relevant Federal departments and agencies and across the Interagency Council.

''(8) Developing, recruiting, and sustaining a professional and diverse workforce for meteorological research and services.

''(e) DATA INVENTORY.—The Interagency Council, in coordination and avoidance of duplication with the United States Group on Earth Observations, shall promote data

and metadata access and archive activities to increase accessibility, interoperability, and reusability by maintaining a data inventory of meteorological observations. Not less frequently than annually for a period of five years beginning on the date of the enactment of this subsection, the Interagency Council shall solicit updated information from private sector entities identifying current and near future sources of such data. Such data shall be made available to member departments and agencies under subsection (a).

''(f) COORDINATION OFFICE.—The Interagency Meteorological Coordination Office shall provide to the Interagency Council such administrative and logistical support as the Interagency Council may require, as determined by the co-chairs.

''(g) COST SHARE.—Member departments and agencies of the Interagency Council under subsection (a) may provide reimbursable financial support to the Interagency Meteorological Coordinating Office to enhance cost-sharing and collaboration related to weather research and forecast innovation activities.

''(h) REPORT.—Not later than one year after the date of the enactment of this subsection and annually thereafter, the Interagency Council shall publish a report which identifies among member agencies the following:

''(1) Federal programs that use meteorological observations, data sources, and capabilities.

''(2) Federal programs that acquire such data from private sector entities.

''(3) Advancements in meteorological data collection, assimilation, and forecasting that could improve Federal programmatic operational capabilities.

''(4) Barriers to acquiring meteorological observations, data sources, and capabilities that could be used to better meet Federal programmatic needs.''.

(b) REFERENCES.—Any reference to the Interagency Committee for Advancing Weather Services in any law, rule, regulation, paper, record, map, or other such document of the United States shall be deemed to be a reference to the Interagency Council for Advancing Meteorological Services.

SEC. 113. OCEAN OBSERVATIONS.

Subsection (b) of section 12304 of the Integrated Coastal and Ocean Observation System Act of 2009 (33 U.S.C. 3603) is amended by adding at the end the following new paragraph:

''(5) SHIPS OF OPPORTUNITY PILOT PROGRAM.—

''(A) IN GENERAL.—The Administrator, in coordination with the heads of relevant Federal

departments and agencies, shall, subject to relevant regulations and certifications, maintain pilot programs or projects to contract with research or commercial ship operators for data collection and assess the potential costs, benefits, and viability of a global network of ocean and atmospheric observing instruments operating on research or commercial ocean vessels, including in the Arctic, in order to supplement the Integrated Coastal, Great Lakes, and Ocean Observation System in improving understanding of coastal and ocean systems and their relationships to human activities.

''(B) STANDARDS AND SPECIFICATIONS.—The Administrator shall ensure that data acquired through the pilot program established pursuant to subparagraph (A) meets the most recent standards and specifications required for observation services and data as published pursuant to subsection (c) of section 302 of the Weather Research and Forecasting Innovation Act of 2017.

''(C) REPORT.—Not later than five years after the date of the enactment of this paragraph, the Administrator, in consultation with

the Secretary of Transportation, shall submit to Congress a report on the requirements for a global network of ocean and atmospheric instruments operating on research or commercial ocean vessels for measurement and data transmission.

''(D) SUNSET.—This paragraph shall terminate on the earlier of—

''(i) September 30, 2029; or

''(ii) one year after the date on which the report required under subparagraph (B) is submitted by the Administrator.''.

SEC. 114. CONSOLIDATION OF REPORTS.

(a) WEATHER RESEARCH AND FORECASTING INNOVATION ACT OF 2017.—

(1) IN GENERAL.—The Weather Research and Forecasting Innovation Act of 2017 is amended—

(A) in section 102 (15 U.S.C. 8512), by striking subsection (d);

(B) by amending section 105 (15 U.S.C. 8515) to read as follows:

''SEC. 105. WEATHER RESEARCH AND DEVELOPMENT PLANNING.

''Not later than two years after the date of the enactment of this section and not less frequently than semi-

annually thereafter, 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 maintain United States leadership in numerical weather prediction and forecasting that—

''(1) describes the forecasting skill and technology goals, objectives, expected budget, and progress of the National Oceanic and Atmospheric Administration in carrying out the program conducted under section 102;

''(2) identifies and prioritizes specific research and development activities, data collection and analysis, predictive modeling, demonstration of potential operational forecast application, education, training, and performance metrics, weighted to meet the operational weather and flood-event mission of the National Weather Service to achieve a weather-ready Nation;

''(3) describes how the program conducted under section 102 will collaborate with Federal agencies and departments, international partners, and stakeholders, including the United States weath-

er industry and academic partners, and the role of each in advancing weather forecasting and communication;

''(4) identifies, through consultation with the National Science Foundation, the United States weather industry, and academic partners, research necessary to advance the scientific understanding of weather processes and provide information to improve weather warning and forecast systems in the United States most effectively; and

''(5) describes how the National Oceanic and Atmospheric Administration is advancing community weather modeling.'';

(C) in section 403 (15 U.S.C. 8543)—

(i) in subsection (a), by inserting ''the'' after ''Director of''; and

(ii) by amending subsection (d) to read as follows:

''(d) ANNUAL BRIEFING.—Not less frequently than once each year, the Under Secretary shall brief the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science, Space, and Technology of the House of Representatives on participation in the program under subsection (a) and shall highlight

any innovations that come from the interaction described in subsection (b).''; and

(D) by striking sections 408 through 411 and section 414 and redesignating sections 412 and 413 as sections 408 and 409, respectively.

(2) CLERICAL AMENDMENTS.—The table of contents in section 1(b) of the Weather Research and Forecasting Innovation Act of 2017 is amended by striking the items relating to sections 408 through 414 and inserting the following new items:

''Sec. 408. Weather enterprise outreach.
''Sec. 409. Hurricane hunter aircraft.''.

(b) NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION AUTHORIZATION ACT OF 1992.—The National Oceanic and Atmospheric Administration Authorization Act of 1992 (Public Law 102–567) is amended—

(1) in section 106, by striking subsection (c) (15 U.S.C. 1537); and

(2) in section 108 (15 U.S.C. 8520)—

(A) by striking subsection (b); and

(B) by redesignating subsection (c) as subsection (b).

SEC. 115. NATIONAL LANDSLIDE PREPAREDNESS ACT REAUTHORIZATION.

The National Landslide Preparedness Act (43 U.S.C. 3101 et seq.) is amended—

(1) in section 3 (43 U.S.C. 3102)—

(A) in subsection (a)(3), by striking ''protect'' and inserting ''contribute to protecting'';

(B) in subsection (b)(1)(C)(ii), by striking ''implement'' and inserting ''disseminate'';

(C) in subsection (c)(2), by adding at the end the following:

''(J) The Administrator of the National Aeronautics and Space Administration.''; and

(D) in subsection (h), by striking ''2024'' and inserting ''2029''; and

(2) in section 5 (43 U.S.C. 3104)—

(A) in subsection (a)—

(i) in paragraph (1)(A), by inserting ''and derivative'' after ''3D elevation''; and

(ii) in paragraph (2)(B)(i), by inserting '', process, and integrate'' after ''acquire'';

(B) in subsection (b)(3)—

(i) by redesignating subparagraphs (D) and (E) as subparagraphs (E) and (F), respectively; and

(ii) by inserting after subparagraph (C) the following:

"(D) the 3D Hydrography Program Working Group;";

(C) in subsection (d)(3), by striking "publically" and inserting "publicly"; and

(D) in subsection (e), by striking "2024" and inserting "2029".

SEC. 116. AMENDMENTS TO HARMFUL ALGAL BLOOM AND HYPOXIA RESEARCH AND CONTROL ACT OF 1998.

(a) ASSESSMENTS.—Section 603 of the Harmful Algal Bloom and Hypoxia Research and Control Act of 1998 (33 U.S.C. 4001) is amended—

(1) in subsection (a)—

(A) by redesignating paragraphs (13) and (14) as paragraphs (14) and (15); and

(B) by inserting after paragraph (12) the following new paragraph:

"(13) the Department of Energy;";

(2) by striking subsections (b), (c), (d), (e), (h), and (i) and redesignating subsections (f) and (g) as subsections (b) and (c), respectively;

(3) in subsection (b), as so redesignated—

(A) in paragraph (1), by striking "coastal waters including the Great Lakes" and insert-

ing ''marine, estuarine, and freshwater systems''; and

(B) in paragraph (2)—

(i) by amending subparagraph (A) to read as follows:

''(A) examine the causes and ecological consequences of hypoxia on marine and aquatic species in their natural environments, and socio-cultural or economic costs of hypoxia, including impacts on food safety and security;'';

(ii) by redesignating subparagraphs (B) through (D) as subparagraphs (D) through (F), respectively;

(iii) by inserting after subparagraph (A) the following new subparagraphs:

''(B) examine the effect of other environmental stressors on hypoxia;

''(C) evaluate alternatives for reducing, mitigating, and controlling hypoxia and its environmental impacts;'';

(iv) in subparagraph (D), as so redesignated, by inserting '', social,'' after ''ecological''; and

(v) in subparagraph (E), as so redesignated, by striking ''hypoxia modeling and

monitoring data'' and inserting ''hypoxia modeling, forecasting, and monitoring and observation data''; and

(4) in subsection (c), as so redesignated, to read as follows:

''(c) ACTION STRATEGY AND SCIENTIFIC ASSESSMENT FOR MARINE AND FRESHWATER HARMFUL ALGAL BLOOMS.—

''(1) Not less often than once every 5 years, the Task Force shall complete and submit to Congress an action strategy, including a scientific assessment, of harmful algal blooms in the United States (in this Act referred to as the 'Action Strategy'). Each such Action Strategy, including scientific assessment, shall examine both marine and freshwater harmful algal blooms, including those in the Great Lakes and upper reaches of estuaries, those in freshwater lakes and rivers, and those that originate in freshwater lakes or rivers and migrate to coastal waters.

''(2) Each Action Strategy under this subsection shall—

''(A) examine the causes and ecological consequences, and the socio-cultural or economic costs, including impacts food safety and security, of harmful algal blooms;

''(B) examine the effect of other environmental stressors on harmful algal blooms;

''(C) examine potential methods to prevent, control, and mitigate harmful algal blooms and the potential ecological, social, cultural, and economic costs and benefits of such methods;

''(D) identify priorities for research needed to advance techniques and technologies to detect, predict, monitor, respond to, and minimize the occurrence, duration, and severity of harmful algal blooms, including recommendations to eliminate significant gaps in harmful algal bloom forecasting, monitoring, and observation data;

''(E) evaluate progress made by, and the needs of, Task Force activities and actions to prevent, control, and mitigate harmful algal blooms;

''(F) identify ways to improve coordination and prevent unnecessary duplication of effort among Federal departments and agencies with respect to research on harmful algal blooms;

''(G) include regional chapters relating to the requirements described in this paragraph in order to highlight geographically and eco-

logically diverse locations with significant ecological, social, cultural, and economic impacts from harmful algal blooms; and

''(H) define methodology used to determine ecological, social, cultural and economic impacts from harmful algal blooms and hypoxia.''.

(b) CONSULTATIONS.—Section 102 of the Harmful Algal Bloom and Hypoxia Amendments Act of 2004 (33 U.S.C. 4001a) is amended—

(1) by striking ''the coastal'';

(2) by inserting ''and'' after ''Indian tribes,'';

(3) by inserting ''and'' after ''local governments,''; and

(4) by striking ''with expertise in coastal zone science and management'' and inserting ''with relevant expertise''.

(c) NATIONAL HARMFUL ALGAL BLOOM AND HYPOXIA PROGRAM.—Section 603A of the Harmful Algal Bloom and Hypoxia Research and Control Act of 1998 (33 U.S.C. 4002) is amended—

(1) in subsection (a)—

(A) in paragraph (1)—

(i) by striking ''predicting,'' and inserting ''monitoring, observing, forecasting,''; and

(ii) by striking ''and'' after the semicolon;

(B) in paragraph (2)—

(i) by striking ''comprehensive research plan and action strategy under section 603B'' and inserting ''Action Strategy, including scientific assessment, under section 603(c)''; and

(ii) by striking the period and inserting ''; and''; and

(C) by adding at the end the following new paragraph:

''(3) the scientific assessment under section 603(b).'';

(2) in subsection (c)—

(A) in paragraph (3), by striking ''ocean and Great Lakes'' and inserting ''marine, estuarine, and freshwater systems''; and

(B) in paragraph (5), by inserting ''while recognizing each agency is acting under its own independent mission and authority'' before the semicolon;

(3) in subsection (d), by striking ''Except as provided in subsection (h), the'' and inserting ''The'';

(4) in subsection (e)—

(A) by amending paragraph (2) to read as follows:

''(2) examine, in collaboration with State and local entities and Indian Tribes, including island communities, low-population rural communities, Indigenous communities, subsistence communities, fisheries, and recreation industries that are most dependent on coastal and water resources that may be impacted by marine and freshwater harmful algal blooms and hypoxia, the causes, ecological consequences, cultural impacts, and social and economic costs of harmful algal blooms and hypoxia;'';

(B) by striking paragraph (3);

(C) by redesignating paragraphs (4), (5), and (6) as paragraphs (3), (4), and (5), respectively;

(D) in paragraph (3), as so redesignated—

(i) by striking ''to, regional'' and inserting ''to regional''; and

(ii) by striking ''agencies'' and inserting ''entities, and regional coastal observing systems (as such term is defined in section 12330(6) of the Integrated Coastal

and Ocean Observation System Act of 2009 (33 U.S.C. 3602(6)))'';

(E) in paragraph (5), as so redesignated, by inserting ''and communities'' after ''ecosystems'';

(F) by inserting after paragraph (5) the following new paragraph:

''(6) support sustained observations, including through peer-reviewed, merit-based, competitive grant funding, to provide State and local entities, Indian Tribes, and others access to real-time or near real-time observation data for decision-making to protect human and ecological health and local economies;'';

(G) in paragraph (8), by striking ''State and local'' and inserting ''State, local, and Tribal''; and

(H) in paragraph (9)(A), by striking ''tribal'' and inserting ''Tribal'';

(5) by amending subsections (f) and (g) to read as follows:

''(f) COOPERATIVE EFFORTS.—The Under Secretary shall work cooperatively with and avoid duplication of effort of other agencies on the Task Force, and with and of States, Indian tribes, and nongovernmental organiza-

tions concerned with marine and freshwater issues, and shall coordinate harmful algal bloom and hypoxia and related activities and research.

''(g) FRESHWATER AND ESTUARINE PROGRAM DUTIES.—

''(1) IN GENERAL.—The Administrator shall—

''(A) with respect to freshwater aspects of the Program, in coordination with the Task Force, carry out the duties under subsection (e) through the activities required under section 603C; and

''(B) with respect to estuarine aspects of the Program, coordinate with the Under Secretary to carry out activities required under this section.

''(2) NONDUPLICATION.—The Administrator shall ensure that activities carried out under this subsection focus on new approaches to addressing freshwater harmful algal blooms and are not duplicative of existing research and development programs authorized under this Act or any other law.''; and

(6) by amending subsection (h) to read as follows:

''(h) ANTI-DEFICIENCY ACT APPLIED TO HARMFUL ALGAL BLOOM SERVICES.—Any services by an officer or employee under this title relating to the immediate development and dissemination of the Harmful Algal Bloom Operational Forecast System of the National Centers for Coastal Ocean Science and the National Oceanic and Atmospheric Administration shall be considered, for purposes of section 1342 of title 31, United States Code, services for emergencies involving the safety of human life or the protection of property. Such consideration shall only apply to areas with active harmful algal blooms during any lapse in appropriations beginning on or after the date of the enactment of this subsection.''.

(d) NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION ACTIVITIES.—

(1) IN GENERAL.—Section 603B of the Harmful Algal Bloom and Hypoxia Research and Control Act of 1998 (33 U.S.C. 4003) is amended to read as follows:

''SEC. 603B. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION ACTIVITIES.

''(a) IN GENERAL.—The Under Secretary shall—

''(1) carry out marine, coastal, and Great Lakes harmful algal bloom and hypoxia events response activities;

''(2) develop and enhance operational harmful algal bloom observing and forecasting programs, including operational observations and forecasting, monitoring, modeling, data management, and information dissemination;

''(3) maintain and enhance peer-reviewed, merit-based, competitive grant funding relating to harmful algal blooms and hypoxia to—

''(A) maintain and enhance baseline monitoring programs established by the Program;

''(B) support the projects maintained and established by the Program;

''(C) address the research and management needs and priorities identified in the Action Strategy under section 603(c);

''(D) accelerate the utilization of effective methods of intervention and mitigation to reduce the frequency, severity, and impacts of harmful algal bloom and hypoxia events;

''(E) identify opportunities to improve monitoring of harmful algal bloom and hypoxia, with a particular focus on coastal waters that may affect fisheries, public health, or subsistence harvest;

''(F) examine the effects of other environmental stressors on harmful algal blooms and hypoxia;

''(G) assess the effects of multiple environmental stressors on living marine resources and coastal ecosystems; and

''(H) evaluate adaptation and mitigation strategies to address the impacts of harmful algal blooms and hypoxia;

''(4) enhance communication and coordination among Federal agencies carrying out marine and freshwater harmful algal bloom and hypoxia activities and research;

''(5) to the greatest extent practicable, leverage existing resources and expertise available from local research universities and institutions; and

''(6) use cost effective methods in carrying out this section.

''(b) INTEGRATED COASTAL AND OCEAN OBSERVATION SYSTEM.—The collection of monitoring and observing data under this section shall comply with all data standards and protocols developed pursuant to the Integrated Coastal and Ocean Observation System Act of 2009 (33 U.S.C. 3601 et seq.). Such data shall be made available through the system established under that Act.''.

(2) CLERICAL AMENDMENT.—The table of contents in section 2 of the Coast Guard Authorization Act of 1998 (Public Law 105–383) is amended by amending the item relating to section 603B to read as follows:

''Sec. 603B. National Oceanic and Atmospheric Administration activities.''.

(e) ENVIRONMENTAL PROTECTION AGENCY ACTIVITIES.—

(1) IN GENERAL.—The Harmful Algal Bloom and Hypoxia Research and Control Act of 1998 (33 U.S.C. 4001 et seq.) is amended by inserting after section 603B of that Act (33 U.S.C. 4003), as amended by subsection (d), the following new section:

''SEC. 603C. ENVIRONMENTAL PROTECTION AGENCY ACTIVITIES.

''The Administrator shall—

''(1) carry out research on the ecology and human health impacts of freshwater harmful algal blooms;

''(2) develop and maintain forecasting and monitoring of, and event response to, freshwater harmful algal blooms in lakes, reservoirs, rivers, and estuaries (including tributaries thereof);

''(3) enhance communication and coordination among Federal agencies carrying out freshwater

harmful algal bloom and hypoxia activities and research;

''(4) to the greatest extent practicable, leverage existing resources and expertise available from local research universities and institutions; and

''(5) use cost effective methods in carrying out this section.''.

(2) CLERICAL AMENDMENT.—The table of contents in section 2 of the Coast Guard Authorization Act of 1998 (Public Law 105–383) is amended by inserting after the item relating to section 603B, as amended by subsection (e), the following new item:

''Sec. 603C. Environmental Protection Agency activities.''.

(f) NATIONAL HARMFUL ALGAL BLOOM AND HYPOXIA OBSERVING NETWORK.—

(1) IN GENERAL.—Section 606 of the Harmful Algal Bloom and Hypoxia Research and Control Act of 1998 (33 U.S.C. 4005) is amended to read as follows:

''SEC. 606. NATIONAL HARMFUL ALGAL BLOOM OBSERVING NETWORK.

''(a) IN GENERAL.—The Under Secretary, acting through the National Centers for Coastal Ocean Science (referred to in this section as 'NCCOS') and the Integrated Ocean Observing System (referred to in this section as 'IOOS') of the National Oceanic and Atmospheric Ad-

ministration, shall integrate Federal, State, regional, and local observing capabilities to establish a national network of harmful algal bloom observing systems for the monitoring, detection, and forecasting of harmful algal blooms by leveraging the capacity of IOOS regional associations, including through the incorporation of emerging technologies and new data integration methods, such as artificial intelligence.

''(b) COORDINATION.— In carrying out subsection (a), the IOOS Program Office shall—

''(1) coordinate with NCCOS regarding observations, data integration, and information dissemination; and

''(2) establish a Harmful Algal Bloom Data Assembly Center to integrate, disseminate, and provide a central architecture to support ecological forecasting.''.

(2) CLERICAL AMENDMENT.—The table of contents in section 2 of the Coast Guard Authorization Act of 1998 (Public Law 105–383) is amended by amending the item relating to section 606 to read as follows:

''Sec. 606. National harmful algal bloom observing network.''.

(g) DEFINITIONS.—Section 609 of the Harmful Algal Bloom and Hypoxia Research and Control Act of 1998 (33 U.S.C. 4008) is amended—

(1) in paragraph (1), by striking ''means the comprehensive research plan and action strategy established under section 603B'' and inserting ''means the action strategy, including scientific assessment, for marine and freshwater harmful algal blooms established under section 603(c)'';

(2) in paragraph (3), to read as follows:

''(3) APPROPRIATE FEDERAL OFFICIAL.—The term 'appropriate Federal official' means—

''(A) in the case of marine systems or Great Lakes hypoxia or harmful algal bloom event, including those in estuarine areas, the Under Secretary; and

''(B) in the case of a freshwater hypoxia or harmful algal bloom event, the Administrator, in consultation with the Under Secretary.'';

(3) by striking paragraph (9);

(4) by redesignating paragraphs (4), (5), (6), (7), and (8) as paragraphs (6), (7), (8), (10), and (11);

(5) by inserting after paragraph (3) the following new paragraphs:

''(4) HARMFUL ALGAL BLOOM; HARMFUL ALGAL BLOOM AND HYPOXIA EVENT.—

"(A) HARMFUL ALGAL BLOOM.—The term 'harmful algal bloom' means marine or freshwater algae or macroalgae, including Sargassum, that proliferate to high concentrations, resulting in nuisance conditions or harmful impacts on marine and freshwater ecosystems, communities, or human health through the production of toxic compounds or other biological, chemical, or physical impacts of the algae outbreak.

"(B) HARMFUL ALGAL BLOOM AND HYPOXIA EVENT.—The term 'harmful algal bloom and hypoxia event' means the occurrence of a harmful algal bloom or hypoxia as a result of a natural, anthropogenic, or undetermined cause.

"(5) HARMFUL ALGAL BLOOM OR HYPOXIA EVENT OF SIGNIFICANCE.—The term 'harmful algal bloom or hypoxia event of significance' means a harmful algal bloom or hypoxia event that has had or will likely have significant detrimental environmental, economic, social, subsistence use, or public health impacts.";

(6) in paragraph (6), as so redesignated—

(A) by striking ''aquatic'' and inserting ''marine or freshwater''; and

(B) by striking ''resident'' and inserting ''marine or freshwater''; and

(7) by inserting after paragraph (8), as so redesignated, the following new paragraph:

''(9) SUBSISTENCE USE.—The term 'subsistence use' means the customary and traditional use of fish, wildlife, or other freshwater, coastal, or marine resources by any individual or community to meet personal or family needs, including essential economic, nutritional, or cultural applications.''.

(h) AUTHORIZATION OF APPROPRIATIONS.—Section 610 of the Harmful Algal Bloom and Hypoxia Research and Control Act of 1998 (33 U.S.C. 4009) is amended—

(1) in subsection (a), to read as follows:

''(a) IN GENERAL.—There is authorized to be appropriated to the Under Secretary to carry out this title $27,500,000 for each of fiscal years 2024 through 2028.''; and

(2) by adding at the end the following new subsection:

''(c) TRANSFER AUTHORITY.—The Under Secretary is authorized to make a direct non-expenditure transfer of funds authorized to be appropriated pursuant to sub-

section (a) to the head of any Federal department or agency, with the concurrence of such head, to carry out, as appropriate, relevant provisions of this title.''.

(i) NATIONAL LEVEL INCUBATOR PROGRAM; HARMFUL ALGAL BLOOM OR HYPOXIA EVENT OF SIGNIFICANCE.—

(1) IN GENERAL.—The Harmful Algal Bloom and Hypoxia Research and Control Act of 1998 (33 U.S.C. 4001 et seq.) is amended by adding at the end the following new section:

''SEC. 611. NATIONAL LEVEL INCUBATOR PROGRAM.

''(a) IN GENERAL.—The Under Secretary, in collaboration with research universities and institutions, shall establish a national level incubator program to increase the number of available control strategies and technologies relating to harmful algal blooms. Such incubator shall establish a framework for preliminary assessments of novel harmful algal bloom prevention, mitigation, and control technologies in order to determine the potential for effectiveness and scalability.

''(b) OPERATION.—The incubator established under subsection (a) shall provide merit-based funding for harmful algal bloom control strategies and technologies that eliminate or reduce through biological, chemical, or phys-

ical means the levels of harmful algae and associated toxins.

''(c) DATABASE.—The incubator established under subsection (a) shall include a database to catalog the licensing and permitting requirements, economic costs, feasibility, effectiveness, and scalability of both novel and established prevention, control, and mitigation measures.

''(d) PRIORITIZATION.—In carrying out the incubator established under subsection (a), the Under Secretary shall prioritize proposed activities that would, to the maximum extent practicable—

''(1) protect key habitats for fish and wildlife;

''(2) maintain biodiversity;

''(3) protect public health;

''(4) protect coastal resources of national, historical, and cultural significance; or

''(5) seek to partially or fully benefit communities of color, low-income communities, Indian Tribes or Indigenous communities, and rural communities.''.

(2) CLERICAL AMENDMENT.—The table of contents in section 2 of the Coast Guard Authorization Act of 1998 (Public Law 105–383) is amended by inserting after the item relating to section 610 the following new item:

''Sec. 611. National level incubator program.''.

(j) HARMFUL ALGAL BLOOM OR HYPOXIA EVENT OF SIGNIFICANCE.—Section 9(g) of the National Integrated Drought Information System Reauthorization Act of 2018 (33 U.S.C. 4010(g)) is amended—

(1) in paragraph (1)—

(A) in subparagraph (B), by adding at the end the following new sentence: ''The appropriate Federal official may waive the non-Federal share requirements of this subsection if such official determines no reasonable means are available through which the recipient of the Federal share can meet the non-Federal share requirement.''; and

(B) by adding at the end the following new subparagraph:

''(D) CONTRACT, GRANT, AND COOPERATIVE AGREEMENT AUTHORITY.—The Under Secretary of Commerce for Oceans and Atmosphere may enter into agreements and grants with States, Indian Tribes, local governments, or other entities to pay for or reimburse costs incurred for the purposes of supporting the determination of and assessing the environmental, economic, social, subsistence use, and public

health effects of a harmful algal bloom or hypoxia event of significance.'';

(2) in paragraph (2)(A), by inserting '', leadership official of an affected Indian Tribe, the executive official of the District of Columbia, or a territory or possession of the United States, including Puerto Rico, the Virgin Islands, Guam, the Commonwealth of the Northern Mariana Islands, the Trust Territories of the Pacific Islands, and American Samoa, if affected'' after ''State''; and

(3) by adding at the end the following new paragraph:

''(4) FUNDING AUTHORITY.—To carry out this subsection, notwithstanding any other provision of law, there is authorized to be appropriated from the amounts made available to the Under Secretary of Commerce for Oceans and Atmosphere $2,000,000, to remain available until expended.''.

(k) PROTECT FAMILIES FROM TOXIC ALGAL BLOOMS.—Section 128 of the Water Resources Development Act of 2020 (33 U.S.C. 610 note) is amended—

(1) by redesignating subsection (e) as subsection (f); and

(2) by inserting after subsection (d) the following new subsection:

''(e) HARMFUL ALGAL BLOOM TECHNOLOGIES.—In carrying out the demonstration program under subsection (a), the Secretary may enter into agreements with water and irrigation districts located in the focus areas described in subsections (c) and (d) for the use or sale of any new technologies developed under the program to expedite the removal of harmful algal blooms in such areas.''.

TITLE II—ENHANCING FEDERAL WEATHER FORECASTING AND INNOVATION

SEC. 201. WEATHER INNOVATION FOR THE NEXT GENERATION.

(a) IN GENERAL.—Not later than 180 days after the date of the enactment of this Act, the Under Secretary shall establish a Research, Development, Test, and Evaluation Program (in this section referred to as the ''Program'') to ensure the continued performance of weather radar capabilities, including systems currently being developed, with interferences in the line of sight of such radar.

(b) REQUIREMENTS.—In carrying out the Program, the Under Secretary, in consultation with the Interagency Council for Advancing Meteorological Services, shall—

(1) partner with the private sector, academia, Federal, State, and local government entities, and

any other entity the Under Secretary considers appropriate;

(2) identify, evaluate, and test existing or near-commercial technologies and solutions that improve radar coverage and performance, including by mitigating the potential impact of interferences on weather radar;

(3) to the maximum extent practicable, research additional solutions that could mitigate the effects of interferences on weather radar, such as—

(A) signal processing algorithms;

(B) short-term forecasting algorithms to replace contaminated data;

(C) the use of dual polarization characteristics in mitigating the effects of wind turbines on weather radar; and

(D) gap filling radars to provide supplemental or replacement observations in impacted areas; and

(4) develop, support, or partner with developers to provide commercially viable technical mitigation solutions for interferences to weather radar capabilities that are compatible with the operational requirements of the weather radar systems.

(c) PRIORITY.—In carrying out subsection (b), the Under Secretary shall prioritize consideration of the following technology-based mitigation solutions:

(1) Phased array weather radar systems.

(2) Supplementing or replacing contaminated data with commercial radar data.

(3) The utilization of data from private sector associated meteorological towers or similar capabilities.

(4) The display on local forecasting equipment of wind farm boundaries and consolidated wind farm areas.

(5) The installation and provision of access to rain gauges.

(6) Any other technology-based mitigation solution the Under Secretary determines could improve radar coverage by overcoming interferences, beam blockage, or ghost echoes.

(d) REPORT; RECOMMENDATION.—

(1) IN GENERAL.—Not later than two years after the date of the enactment of this section and annually thereafter until the Program terminates pursuant to subsection (e), the Under Secretary shall submit to Congress a report on the implementation of the Program, including an evaluation of

each technology-based mitigation solution identified for priority consideration pursuant to subsection (c), and a recommendation regarding additional identification and testing of new technologies based on such consideration.

(2) FINAL RECOMMENDATION.—Not later than five years after the date of the enactment of this section, the Under Secretary shall provide to Congress a recommendation on whether additional research, testing, and development through the Program established under subsection (a) is needed, and a determination of whether a cessation of field research, testing, development and evaluation is appropriate.

(e) TERMINATION.—The authority of the Under Secretary to carry out the Program shall terminate on the earlier of—

(1) September 30, 2029; or

(2) one year after the date on which the final recommendation required under subsection (d)(2) is submitted by the Under Secretary.

(f) DEFINITIONS.—In this section:

(1) BEAM BLOCKAGE.—The term ''beam blockage'' means a signal that is partially or fully blocked due to an interference.

(2) GHOST ECHO.—The term ''ghost echo'' means radar signal reflectivity or velocity return errors in radar data due to the proximity of an interference.

(3) INTERFERENCE.—The term ''interference'' includes the following:

(A) a wind turbine that could limit the effectiveness of a weather radar system;

(B) any building that disrupts or limits the effectiveness of a weather radar system; or

(C) any other natural or human built structure that affects a weather radar system.

SEC. 202. NEXT GENERATION RADAR.

(a) IN GENERAL.—The Under Secretary shall develop a plan to replace the Next Generation Weather Radar of the National Weather Service (''NEXRAD'') system in existence as of the date of the enactment of this section.

(b) PROCUREMENT DEADLINE.—The Under Secretary shall take such actions as may be necessary to ensure the replacement described in subsection (a) is completed by not later than September 30, 2040.

(c) ELEMENTS.—The plan developed pursuant to subsection (a) shall include the following:

(1) Estimates of quantifiable improvements in radar performance and service delivery, including coverage and accuracy, to be made from replacement of the NEXRAD system referred to in such subsection.

(2) Development of a digital phased array radar test article designed to test and determine the specifications and requirements for such replacement.

(3) Establishment of a weather surveillance radar testbed for the following:

(A) Evaluation of commercial radars with the potential to replace or supplement the NEXRAD system.

(B) Providing technical assistance for commercial replacement or supplemental radars, including data void filling radars in regions where geographical topography prevents full utilization of conventional systems.

(4) Consultation and input solicited from meteorologists, emergency managers, and public safety officials regarding the specifications and requirements for the replacement of the NEXRAD system referred in such subsection.

(5) Prioritized locations for initial deployment of the replacement system described in subsection (a) that will replace the NEXRAD system.

(6) Expected locations of such replacement system described in subsection (a), including sites located more than 75 miles away from an existing NEXRAD station and additional appropriate locations.

(d) RADAR-AS-A-SERVICE.—

(1) IN GENERAL.—In order to supplement data voids in radar coverage in existence as of the date of the enactment of this section and ensure the continued performance of weather radar capabilities, the Under Secretary may utilize and contract with third party entities to fill such low-level and wide-area radar data voids using diverse weather radars and data assimilation technologies to better detect significant precipitation and severe weather over a greater area across the population.

(2) CONSIDERATIONS.—In carrying out the activities under paragraph (1), the Under Secretary may consider—

(A) utilizing and contracting with third-party entities that have participated in the testbed established in accordance with sub-

section (c)(3), the National Mesonet Program, or Cooperative Research and Development Agreements; and

(B) weather camera systems and services, including systems and services in consultation with the Federal Aviation Administration, as viable technologies to supplement weather forecasting and prediction needs.

(e) UPDATES TO CONGRESS.—The Under Secretary shall provide to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate periodic updates on the implementation of this section.

SEC. 203. DATA VOIDS IN HIGHLY VULNERABLE AREAS OF THE UNITED STATES.

(a) IN GENERAL.—The Under Secretary, in coordination with the Director of the National Weather Service and the Administrator of the Federal Emergency Management Agency, in consultation with the United States weather industry, academic partners, and in accordance with activities implemented through existing regional atmospheric, coastal, ocean, and Great Lakes observing systems, shall carry out activities to ensure equitable and comprehensive weather observation coverage and emer-

gency information sharing in the United States, including relating to the following:

(1) Reviewing areas in the continental United States and the territories that are considered under-observed, underserved, or highly vulnerable for weather phenomenon, including urban and offshore regions, and identifying associated challenges to providing such coverage.

(2) Increasing weather observations and developing new weather observational capabilities, such as urban heat island mapping campaigns, with respect to under-observed, underserved, or highly vulnerable regions.

(3) Establishing or supporting testbeds to develop and integrate new weather, water, and climate observation or emergency information sharing tools, such as next generational or supplemental radars for weather observations, in under-observed, underserved, or highly vulnerable regions.

(4) To the maximum extent practicable, advancing weather and water forecasting and climate modeling capabilities for under-observed, underserved, or highly vulnerable regions.

(5) Undertaking workforce development efforts for emergency management officials and meteorolo-

gists in under-observed, underserved, or highly vulnerable areas, including urban regions, of the United States.

(6) Using data void filling observations to better resolve extreme rainfall in complex topography.

(7) Contributing to a national integrated heat health information systems.

(b) PILOT PROGRAM.—In carrying out this section, the Under Secretary, acting through the Director of the National Weather Service and the Administrator of the Federal Emergency Management Agency, shall establish an interagency partnership to support pilot projects that accelerate coordination and use of localized weather, water, and climate data and impact-based communications in infrastructure and emergency management decisions by Federal, State, and local officials.

(c) PRIORITY.—At least one pilot project under subsection (b) shall address key science challenges to using mesonet data in local decision making and development of new tools and training for owners and operators of critical infrastructure (as such term is defined in section 1016(e) of Public Law 107–56 (42 U.S.C. 5195c(e))), such as dams, energy generation and distribution facilities, nuclear power plants, and transportation networks.

SEC. 204. ATMOSPHERIC RIVERS FORECAST IMPROVEMENT PROGRAM.

(a) IN GENERAL.—The Under Secretary, in collaboration with the United States weather industry and academic partners, shall establish an atmospheric river forecast improvement program (in this section referred to as the ''program'').

(b) GOAL.—The goal of the program shall be to reduce through the development and extension of accurate, effective, and actionable forecasts and warnings the loss of life or property from atmospheric rivers, including by—

(1) establishing quantitative atmospheric river forecast skill metrics that include quantifying the benefits of dynamical modeling, data assimilation, and machine learning improvements in the probabilistic forecasts of landfall location, extreme wind and precipitation, and cascading impacts;

(2) developing an atmospheric river forecast system within the unified forecast system, and advancing next-generation coupled modeling systems, with the capability of providing seasonal to short-range atmospheric river forecasts that include forecast of snow accumulation and other hydrologic components;

(3) advancing scientific understanding of the roles of atmospheric rivers in subseasonal to sea-

sonal precipitation and probabilistic predictions at subseasonal and seasonal scales;

(4) developing tools and improved forecast products to predict periods of active or inactive atmospheric river landfalls and inland penetration over the western United States with a focus on addressing stakeholder and public needs related to perceiving, comprehending, and responding to atmospheric river forecast improvements; and

(5) enhancing research transition to operations through the Administration's testbeds, including the evaluation of physical and social science, technology, and other research to develop products and services for implementation and use by relevant stakeholders.

(c) INNOVATIVE OBSERVATIONS AND MODELING.—The Under Secretary shall ensure the program periodically examines, tests, and evaluates the value of incorporating innovative observations, such as novel sensor technologies, observation networks, soil moisture monitoring systems, reservoir storage data, observations from crewed or uncrewed systems, and hosted instruments on commercial aircrafts, vessels, and satellites, and data assimilation tools, with respect to the improvement of atmospheric river forecasts, predictions, and warnings.

(d) PROGRAM PLAN.—Not later than 180 days after the date of the enactment of this Act, the Under Secretary shall develop a plan that details the specific research, development, data acquisition, and technology transfer activities, as well as corresponding resources, limitations, and timelines, necessary to achieve the goal of the program under subsection (b).

(e) ANNUAL BUDGET FOR PLAN SUBMITTAL.—After the development of the plan pursuant to subsection (d), the Under Secretary shall, not less frequently than annually, submit to Congress a proposed budget corresponding with the activities identified in such plan.

SEC. 205. COASTAL FLOODING AND STORM SURGE FORECAST IMPROVEMENT PROGRAM.

(a) IN GENERAL.—The Under Secretary, in collaboration with the Integrated Ocean Observing System, the United States weather industry, and academic partners, shall establish a coastal flooding and storm surge forecast improvement program (in this section referred to as the ''program'').

(b) GOAL.—The goal of the program shall be to reduce through the development and extension of accurate, effective, actionable, and probable forecasts and warnings the loss of life or property from coastal flooding, including high tide flooding, and storm surge events.

(c) PRIORITY.—In implementing the program, the Under Secretary shall prioritize activities that carry out the following:

(1) Improving understanding and capacity for real-time operational prediction of the ocean's role in coastal flooding, including high tide flooding, and storm surge events.

(2) Improving the capacity to mitigate or prevent the impacts of coastal flooding, including high tide flooding, and storm surge events, including by improving the understanding and capacity of coastal communities to perceive, comprehend, and respond to forecast information.

(3) Incorporating data from in situ distributed sensors into models.

(4) Developing probabilistic coastal flooding, including high tide flooding, and storm surge estimates to complement worst-case scenario estimates, including for use in long-term planning and risk management by States, Tribal governments, localities, and emergency managers in coordination with the Federal Emergency Management Agency, as appropriate.

(5) Establishing skill metrics for coastal inundation forecasting that quantify the benefits of dy-

namical modeling, data assimilation, and machine learning improvements in the probabilistic forecast of coastal flooding, including high tide flooding, and storm surge risk and impacts.

(6) Improving operational regional storm surge and wave prediction models to enhance probabilistic guidance and messaging.

(d) INNOVATIVE OBSERVATIONS AND MODELING.—The Under Secretary shall ensure the program periodically examines, tests, and evaluates the value of incorporating enhanced model physics, hybrid dynamical or machine learning based prediction systems, and innovative observations, such as novel sensor technologies, observation networks, crewed or uncrewed systems, and hosted instruments on commercial aircrafts, vessels, and satellites, with respect to the improvement of coastal flooding, including high tide flooding, and storm surge forecasts, predictions, and warnings.

(e) PROGRAM PLAN.—Not later than 180 days after the date of the enactment of this Act, the Under Secretary shall develop a plan that details the specific research, development, data acquisition, and technology transfer activities, as well as corresponding resources and timelines, necessary to achieve the goal of the program under subsection (b).

(f) ANNUAL BUDGET FOR PLAN SUBMITTAL.—After the development of the plan pursuant to subsection (e), the Under Secretary shall, not less frequently than annually, submit to Congress a proposed budget corresponding with the activities identified in such plan.

SEC. 206. AVIATION WEATHER AND DATA INNOVATION.

(a) PROGRAM.—The Under Secretary shall maintain an airborne observation program (in this section referred to as the ''program'') for the acquisition of atmospheric sensor data and the deployment of critical atmospheric sensors, including in partnership with the weather enterprise.

(b) ACTIVITIES.—The program shall include activities that carry out the following:

(1) Procurement of weather data available from commercial aircraft, as determined by the Under Secretary.

(2) Acquisition of additional vertical profile observations that provide spatial and temporal density, as determined by the Under Secretary.

(3) Analysis of procured data when incorporated into the National Oceanic and Atmospheric Administration's unified forecast system in order to provide improved forecast information for aircraft.

(c) BUDGET.—The Under Secretary shall, not less frequently than annually, submit to Congress a proposed budget corresponding with the activities described in subsection (b), including and analysis of activities that can be complemented by National Oceanic and Atmospheric Administration aircraft.

(d) AUTHORIZATION OF APPROPRIATIONS.—From amounts made available to the Commercial Data Program under section 302 of the Weather Research and Forecasting Innovation Act of 2017, there is authorized to be appropriated up to $10,000,000 for each of fiscal years 2024 through 2028 to carry out the program.

(e) AVIATION WEATHER AND TURBULENCE FORECASTING.—The Director of the National Weather Service shall include turbulence events, icing conditions, or other phenomena in the forecasting capabilities of the National Weather Service's Aviation Weather Center, and deliver operational forecasts with consistent, timely, and accurate weather and turbulence information for the airspace system and the protection of lives and property.

(f) COORDINATION.—In carrying out subsection (e), the Director of the National Weather Service shall give consideration to recommendations from the Administrator of the Federal Aviation Administration in furtherance of

section 44720 of title 49, United States Code, and improve weather and turbulence forecasting capabilities by—

(1) designating or establishing within the Federal Government an interagency working group to determine weather and environmental data or observation requirements, needs, and potential solutions related to aviation weather and turbulence modeling or forecasting;

(2) identifying current and future potential data gaps related to turbulence events or phenomena that can—

(A) identify or inform route specific flight planning; and

(B) be supplemented or filled by commercial aviation tools;

(3) transitioning research initiatives and pilot programs, including a pilot program of instrumentation for observing greenhouse gases and other atmospheric factors deployed on commercial aircraft and supporting the evaluation of a sustained observing network using such platforms, into operations that improve the forecasting missions of the Aviation Weather Center;

(4) developing and deploying improved probabilistic aviation weather forecast guidance technology; and

(5) updating interagency agreements as appropriate, including to address reimbursable agreements.

(g) NEXT GENERATION AVIATION RESEARCH.—Paragraph (3) of section 102(b) of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8512(b)), is amended—

(1) by redesignating subparagraphs (F) and (G) as subparagraphs (G) and (H), respectively; and

(2) by inserting after subparagraph (E) the following new subparagraph:

''(F) aviation weather phenomena, including atmospheric composition and turbulence, to improve scientific understanding and forecast capabilities for the airspace system;''.

(h) AVIATION INFORMATION DISSEMINATION.—The Under Secretary shall ensure the Aviation Weather Center is able, to the maximum extent possible, to disseminate in a timely manner full resolution aviation weather data, forecasts, and information to meet the needs of aviation users.

SEC. 207. NESDIS JOINT VENTURE PARTNERSHIP TRANSITION PROGRAM.

(a) IN GENERAL.—The Assistant Administrator of the National Environmental Satellite, Data, and Information Service, in consultation with the Administrator of the National Aeronautics and Space Administration, shall administer broad agency announcements and other transactional authority or contracting mechanisms, on an annual or more frequent basis, to support a joint venture partnership program that allows the Service to prioritize engagement with the private sector, academia, and other Federal departments and agencies.

(b) TRANSITION PROGRAM.—To support the development of next-generation technologies, missions, data systems, spacecraft, and instrument design, the Assistant Administrator of the National Environmental Satellite, Data, and Information Service, in consultation with the Administrator of the National Aeronautics and Space Administration, shall maintain a program to transition selected awards from research and study phases into demonstration. In selecting awardees for demonstrations, the Assistant Administrator shall consider technologies, missions, data systems, spacecraft, and instrument design that—

(1) improve upon the National Oceanic and Atmospheric Administration's satellite architecture;

(2) have a direct impact on implementing the recommendations of the Administration's 2018 Satellite Observing System Architecture Study, ''Building a Plan for NOAA's 21st Century Satellite Observing System''; and

(3) meet current or future mission requirements.

(c) OPERATIONAL PLANNING.—In carrying out the transition program under subsection (b), the Assistant Administrator of the National Environmental Satellite, Data, and Information Service shall monitor demonstration phase progress and plan for promising results that meet mission requirements to be transitioned into National Oceanic and Atmospheric Administration's operational satellite architecture.

(d) ANNUAL PLAN.—The Assistant Administrator of the National Environmental Satellite, Data, and Information Service shall submit to the Committee on Science, Space, and Technology, and the Committee on Commerce, Science, and Transportation an annual plan that outlines the progress made in the joint venture partnership program under subsection (a), the transition program for demonstrations under section (b), and transition to operational architecture planning under subsection (c).

(e) AUTHORIZATION OF APPROPRIATIONS.—From amounts authorized to be appropriated to the National Environmental Satellite, Data, and Information Service, there is authorized to be appropriated $20,000,000 for fiscal years 2024 through 2028 to carry out to this section.

SEC. 208. ADVANCED WEATHER INTERACTIVE PROCESSING SYSTEM.

(a) IN GENERAL.—The Under Secretary, acting through the Director of the National Weather Service, shall develop a strategy to transition operations of the Advanced Weather Interactive Processing System to an operational cloud-based environment in order to enable a more nimble, flexible, and mobile workforce.

(b) SERVICES.—The Under Secretary shall ensure that the Advanced Weather Interactive Processing System in an operational cloud-based environment referred to in subsection (a) provides impact-based decision support services to emergency managers at the Federal, State, local, and Tribal levels, and continues to provide the following services:

(1) Integrating and displaying forecast data, including meteorological, hydrological, climate, ocean, satellite, and radar data, for National Weather Service field offices and national centers.

(2) Acquiring and processing observational data from sensors and local sources.

(3) Providing an interactive communications system, including the satellite broadcast network, to connect relevant National Weather Service employees and sites.

(4) Initiating the dissemination of weather, water, marine, ecological, climate, aviation, and space warnings and forecasts in a rapid and highly reliable manner.

(c) ELEMENTS.—The transition strategy developed pursuant to subsection (a) may include the following:

(1) Establishment or support of testbeds, pilot projects, and functional testing activities to facilitate remote evaluation and automated testing.

(2) Coordinated training efforts needed for Federal and non-Federal users and operators of the Advanced Weather Interactive Processing System in an operational cloud-based environment referred to in subsection (a).

(3) Evaluation of bandwidth requirements to achieve a quality user experience.

(4) Installation of circuits to reduce lapses in network operations and support backup functions.

(5) Establishment of a cloud-based, remotely accessible repository for data referred to in subsection (b)(2).

(6) Development and deployment of virtualized systems to replace physical hardware at operational sites.

(7) Evaluation of commercial cloud providers, including hybrid approaches, to meet mission needs.

(8) Development, testing, demonstration, evaluation, and operationalization of forecast and warning products, consistent with the mission and scientific expertise of the Administration.

(d) TRANSITION DEADLINE.—The Under Secretary shall take such actions as may be necessary to ensure the transition strategy described in subsection (a) is completed by not later than September 30, 2030.

(e) UPDATES TO CONGRESS.—The Under Secretary shall submit to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate periodic updates on the implementation of this section.

(f) CONTINUED INNOVATION.—Nothing in this section may be construed as prohibiting the development of new forecast capabilities, sub-systems, or implementing

modeling advancements on the operational computing systems of the Administration.

SEC. 209. REANALYSIS AND REFORECASTING.

The Under Secretary may support reanalysis and reforecasting activities within the National Oceanic and Atmospheric Administration, including through the hazardous weather testbed of the Administration, for improving weather forecasts, extreme weather predictions, and weather and climate datasets.

SEC. 210. NATIONAL WEATHER SERVICE WORKFORCE.

(a) HIRING.—The Director of the National Weather Service shall annually submit to the Under Secretary and Congress an assessment of the milestones, timelines, and service level expectations required for the expeditious hiring and timely on-boarding of employees of the National Weather Service. Each such assessment may include the following:

(1) Recommendations to outsource hiring to any entity other than the National Weather Service in order to meet such milestones, timelines, and service level expectations.

(2) Determinations of the number of staff and designated positions required at each forecasting office to provide services to protect lives and property in the geographic region of responsibility.

(b) HEALTH AND MORALE ASSESSMENT.—The Director of the National Weather Service shall contract or continue to partner with an entity other than the National Weather Service to conduct an assessment of medical impacts, including stress and long-term health impacts, on National Weather Service employees related to required rotating shift work. Such assessment may include options for mitigating such impacts on employees and recommendations for improving benefits related to required rotating shift work.

(c) DESIGNATION OF SERVICE HYDROLOGIST.—

(1) IN GENERAL.—The Director of the National Weather Service may designate at least one service hydrologist at each Weather Forecast Office of the National Weather Service.

(2) LIMITATION.—Nothing in this section may be construed to authorize or require a change in the authorized number of full time equivalent employees of the National Weather Service or otherwise result in the employment of any additional employees.

(3) PERFORMANCE BY OTHER EMPLOYEES.—Notwithstanding paragraphs (4) and (5), the Director of the National Weather Service may assign the performance of the responsibilities described in this subsection to such other staff of the National

Weather Service as the Director considers appropriate

(4) RESPONSIBILITIES.—In order to increase impact-based decision support services, each service coordination hydrologist designated under paragraph (1) shall, with respect to hydrology, carry out the following:

(A) Be responsible for providing service to the geographic area of responsibility covered by the Weather Forecast Office at which the service coordination hydrologist is employed to help ensure that users of products and services of the National Weather Service can respond effectively to improve outcomes from flood events.

(B) Liaise with users of products and services of the National Oceanic and Atmospheric Administration, such as emergency managers, the public, academia, media outlets, users in the hydropower, transportation, recreation, and agricultural communities, and forestry, land, fisheries, and water management interests, to evaluate the adequacy and usefulness of the products and services referred to in subparagraph (A), including extended range streamflow forecasts, water supply forecasts, drought out-

looks, flood inundation mapping, coastal inundation, and flood warnings.

(C) Collaborate with the National Water Center, River Forecast Centers, other Weather Forecast Offices, the National Integrate Drought Information System, Administration offices, and Federal, State, local, and Tribal government agencies, as the Director considers appropriate, in developing, proposing, and implementing plans to develop, modify, or tailor such products and services to improve the usefulness of such products and services.

(D) Engage in interagency partnerships with Federal, State, local, and Tribal government agencies to explore the use of forecast-informed reservoir operations to reduce flood risk and inform decisions related to water resources management.

(E) Ensure the maintenance and accuracy of flooding and water resource management partner call lists, appropriate office hydrologic service policy or procedures, and other hydrologic information or dissemination methodologies or strategies.

(F) Work closely with Federal, State, local, and Tribal emergency and floodplain management agencies, and other agencies relating to disaster management, to ensure a planned, coordinated, and effective preparedness and response effort.

(5) ADDITIONAL RESPONSIBILITIES.—A service coordination hydrologist designated under this subsection may, with respect to hydrology—

(A) work with a State agency to develop plans for promoting more effective use of products and services of the National Weather Service throughout the State concerned;

(B) identify priority community preparedness objectives;

(C) develop plans to carry out the responsibilities described in paragraph (4); and

(D) conduct flooding event preparedness planning and citizen education efforts with and through various State, local, and Tribal government agencies and other disaster management-related organizations.

TITLE III—COMMERCIAL WEATHER AND ENVIRONMENTAL OBSERVATIONS

SEC. 301. COMMERCIAL DATA PROGRAM.

The Weather Research and Forecasting Innovation Act of 2017 is amended by striking section 302 (15 U.S.C. 8532) and inserting the following new section:

"SEC. 302. COMMERCIAL DATA PROGRAM.

''(a) PROGRAM ESTABLISHMENT.—The Under Secretary, in coordination with the heads of appropriate offices of the National Oceanic and Atmospheric Administration, shall maintain a Commercial Data Program to coordinate and execute acquisition of weather and environmental data and services from private sector entities for operational use.

''(b) PROGRAM ELEMENTS.—The Under Secretary shall acquire satellite, ground-based, airborne, or marine-based in situ, remote sensing, or crowd-sourced data and services for operational use relating to weather and environmental forecasting and modeling. The Under Secretary shall ensure the Commercial Data Program coordinates, collaborates, and ensures access to data across the Administration, including among the following:

''(1) The National Mesonet Program.

''(2) The Aircraft Based Observation Program.

''(3) The U.S. Integrated Ocean Observation Program, including existing regional associations.

''(4) The National Integrated Drought Information System, including the National Coordinated Soil Moisture Monitoring Network.

''(5) The Global Ocean Monitoring and Observing Program.

''(6) The National Data Buoy Center.

''(7) The Uncrewed Systems Operation Center.

''(8) The Ocean Exploration Program.

''(9) Any other program or office the Under Secretary determines appropriate.

''(c) STANDARDS AND SPECIFICATIONS.—Not later than 180 days after the date of the enactment of this section and on a continuous basis thereafter, the Under Secretary shall publish data, metadata, and service standards and specifications required for acquired observation services and data for use, licensing, and attribution to ensure quality, impact, and compatibility of such services and data with National Oceanic and Atmospheric Administration modeling capabilities, meteorological situational awareness, and forecasting.

''(d) PRIORITIZATION.—In acquiring commercial data and services, the Under Secretary shall prioritize obtaining surface-based, airborne-based, space-based, and

coastal- and ocean-based data, metadata, and services for operational use that participate in the Commercial Data Pilot Program or other programs of the National Oceanic and Atmospheric Administration that acquire commercial data or observations.

''(e) NOAA OBSERVING SYSTEMS AND FLEET COUNCILS.—

''(1) IN GENERAL.—The Under Secretary shall maintain the National Oceanic and Atmospheric Administration Observing Systems Council and the NOAA Fleet Council (in this subsection referred to as the 'Councils') to provide strategic recommendations and guidance regarding the prioritization, design, development, acquisition, upgrading, lifecycle, performance monitoring, and retiring of major observing systems portfolio components, including related to the acquisition of commercial weather and environmental data and services.

''(2) LINE OFFICE COORDINATION.—The Councils shall ensure coordination and adherence to uniform policies by providing guidance to all line offices of the National Oceanic and Atmospheric Administration engaged in observing systems portfolio design, technology, development, execution, and operation.

''(3) COMMITTEE.—The Under Secretary shall maintain a Committee within the Councils to develop and approve procedural directives, guides, or handbooks relevant to management of data and information, including commercial data, and coordinate data governance and management practices across the National Oceanic and Atmospheric Administration to promote consistent processes.

''(f) AUTHORIZATION OF APPROPRIATIONS.—

''(1) IN GENERAL.—There are authorized to be appropriated $100,000,000 for each of fiscal years 2024 through 2028 to carry out this section.

''(2) SENSE OF CONGRESS.—It is the sense of Congress that the Under Secretary should seek to enter into contracts or other appropriate agreements that enable the expenditure, to the maximum extent practicable, of amounts authorized to be appropriated or otherwise made available in a fiscal year to carry out this section.

''(g) DATA AND HOSTED PAYLOADS.—Notwithstanding any other provision of law, the Secretary of Commerce may enter into agreements relating to the following:

''(1) The purchase of weather and environmental data and services through contracts with commercial data and service providers.

''(2) The placement of weather instruments on co-hosted Federal, international, or private space, airborne, maritime, or ground platforms.

''(h) OMBUDSMAN.—The Under Secretary shall establish or designate at least one Ombudsman position within the Commercial Data Program to implement the recommendations of the Observing System Council under subsection (e) related to commercial weather and environmental data and services acquisitions. Such an Ombudsman shall act as the liaison between commercial data and service providers and the National Oceanic and Atmospheric Administration with respect to receiving recommendations and resolving issues related to engagement, testing, contracting, or other areas related to the Administration's efforts to acquire commercial weather and environmental data and services.

''(i) REPORT.—Not later than two years after the date of the enactment of this section, the Under Secretary shall submit to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate a report evaluating the activities and needed authorities related to data governance and management practices, including acquisition, collection, documentation, quality control, validation, reprocessing, storage, retrieval,

dissemination, and long-term preservation activities across all National Oceanic and Atmospheric Administration line, staff, and corporate offices.''.

SEC. 302. COMMERCIAL DATA PILOT PROGRAM.

The Weather Research and Forecasting Innovation Act of 2017 is amended by striking section 303 (15 U.S.C. 8533) and inserting the following new section:

''SEC. 303. COMMERCIAL DATA PILOT PROGRAM.

''(a) PROGRAM ESTABLISHMENT.—Within the Commercial Data Program under section 302, there shall be a Commercial Data Pilot Program to engage with external partners and providers to test and develop shared standards and methodologies for quality, use, licensing, and attribution of observation services and data, and to ensure quality, impact, and compatibility of such services and data with National Oceanic and Atmospheric Administration modeling capabilities, meteorological situational awareness, and forecasting. The Program is authorized to test and evaluate all sources and types of observation services, imagery, products, and data from private sector entities, including new and innovative surface-based, airborne-based, space-based, and coastal- and ocean-based data, metadata, and model components.

''(b) CRITERIA.—The Under Secretary shall ensure that data acquired through the Commercial Data Pilot

Program described in subsection (a) meets the most recent standards and specifications required for observation services and data as published pursuant to section 302(c).

''(c) PILOT CONTRACTS.—The Under Secretary shall, through an open competition, regularly enter into pilot contracts with private sector entities capable of providing observation services and data referred to in subsection (a) that meet the standards and specifications published pursuant to section 302(c) for so providing such services and data in a manner that allows the Under Secretary to calibrate and evaluate such services and data for use in National Oceanic and Atmospheric Administration activities.

''(d) ASSESSMENT OF VIABILITY.—The Under Secretary shall annually assess and submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science, Space, and Technology of the House of Representatives a summary of the pilot contracts entered into pursuant to subsection (c), the extent to which such contracts meet the standards and specifications published pursuant to section 302(c), and any additional information determined necessary related to the following:

''(1) The viability of assimilating observation services and data from private sector entities into

National Oceanic and Atmospheric Administration forecasts and models.

''(2) The expected value added or improvements from such services and data so assimilated into National Oceanic and Atmospheric Administration forecasts and models.

''(3) The accuracy, quality, timeliness, validity, reliability, usability, information technology security, and cost-effectiveness of obtaining observation services and data from private sector entities.

''(4) Steps to integrate within one year such services and data into operational use by the National Oceanic and Atmospheric Administration or any associated challenges in doing so.

''(e) OBTAINING FUTURE DATA.—If an assessment under subsection (d) demonstrates the ability of commercial services and data to meet the standards and specifications published pursuant to section 302(c), the Under Secretary shall—

''(1) when cost-effective and feasible, obtain observation services and data from private sector entities through the Commercial Data Program under section 302;

''(2) as early as possible in the acquisition process for any future National Oceanic and Atmos-

pheric Administration satellite system, determine whether there is a suitable, cost-effective, commercial capability available or that will be available to meet applicable instrument, spacecraft, or system requirements before completion of the critical design phase of such planned satellite system;

''(3) if a suitable, cost-effective, commercial capability is or will be available as described in paragraph (2), determine whether and how such capability is in the national interest if developed as a solely governmental system; and

''(4) submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science, Space, and Technology of the House of Representatives a report detailing any determinations made under paragraphs (2) and (3).

''(f) AUTHORIZATION OF APPROPRIATIONS.—From amounts authorized to be appropriated pursuant to section 302 to carry out such section, not less than 15 percent of such amounts each fiscal year are authorized to be appropriated to carry out this section.''.

SEC. 303. CONTRACTING AUTHORITY AND AVOIDANCE OF DUPLICATION.

Title III of the Weather Research and Forecasting Innovation Act of 2017 is amended by adding at the end the following new section:

"SEC. 304. CONTRACTING AUTHORITY AND AVOIDANCE OF DUPLICATION.

''(a) IN GENERAL.—Consistent with other Federal agencies that contract and partner with private sector entities, the Under Secretary is authorized to use contracting mechanisms and enter into agreements that utilize multiyear contract options. In carrying out sections 302 and 303, the Under Secretary shall, to the greatest extent possible—

''(1) enter into year-long or multiyear contract options using contracting mechanisms that foster resiliency of datatypes purchased;

''(2) partner and contract with multiple observation service and data providers simultaneously to reduce risks of data gaps and improve mission robustness; and

''(3) utilize authorities, such as additional forms of transaction agreements under section 301, that allow for innovative partnerships with private sector entities.

''(b) SAVINGS CLAUSE.—Nothing in this title may be construed as infringing on the acquisition authority or strategy of Federal entities authorized under title 10, United States Code.

''(c) UNNECESSARY DUPLICATION.—In meeting the requirements under this title, the Under Secretary shall avoid unnecessary duplication between the National Oceanic and Atmospheric Administration, the National Aeronautics and Space Administration, other Federal departments and agencies, and private sector entities, including relating to corresponding expenditures of funds and employment of personnel by—

''(1) coordinating existing activities with other civilian Federal departments and agencies which provide, contract, or partner with private sector entities to acquire, weather and environmental observations and data; and

''(2) coordinating and soliciting weather and environmental observations and data requirements and needs from other civilian Federal departments and agencies to be acquired by the Commercial Data Program under section 302.

''(d) FAIR COMPENSATION FOR INTERAGENCY NEEDS.—The Under Secretary, to the maximum extent practicable, shall ensure that Federal departments and

agencies utilizing services and data under sections 302 and 303 fairly compensate the National Oceanic and Atmospheric Administration, or the non-Federal entities providing such services or data, as appropriate, for use.''.

SEC. 304. DATA ASSIMILATION, MANAGEMENT, AND SHARING PRACTICES.

Title III of the Weather Research and Forecasting Innovation Act of 2017, as amended by section 303 of this Act, is further amended by adding at the end the following new section:

''SEC. 305. DATA ASSIMILATION, MANAGEMENT, AND SHARING PRACTICES.

''(a) DATA STANDARDS.—The Under Secretary, in collaboration with the weather enterprise, shall seek to establish consistent and open data and metadata standards to support open science, including simple cloud-optimized data formats and application programming interfaces that support findability, accessibility, usability, and preservability.

''(b) DATA INFRASTRUCTURE.—

''(1) IN GENERAL.—The Under Secretary, in consultation with the Chief Information Officer and appropriate program heads, shall consolidate and arrange data infrastructure needs to ensure efficient and effective data transfer between National Oceanic

and Atmospheric Administration offices by considering the use of commercial cloud technologies, or similar hybrid structures, to host and transmit data and metadata.

''(2) FEDERAL PARTNERSHIPS.—In carrying out paragraph (1), the Under Secretary may partner with the heads of other Federal departments and agencies, including the National Aeronautics and Space Administration, the Department of Energy, the United States Space Force, the United States Coast Guard, the United States Navy, the Federal Aviation Administration, the United States Forest Service, the Environmental Protection Agency, the National Science Foundation, and the United States Geological Survey, to collocate data with joint utility and support a transition to cloud architectures, including commercial cloud networks.

''(3) LONG TERM DATA ARCHIVE.—The Under Secretary shall ensure the long-term management, maintenance, and stewardship of archival data and metadata acquired through the Commercial Data Program under section 302 is conducted within the National Centers for Environmental Information.

''(c) DATA SHARING WITH THE WEATHER ENTERPRISE.—To the greatest extent practicable, the Under

Secretary shall make accessible to members of the weather enterprise that are United States persons data not subject to redistribution contract permissions and purchased through the Commercial Data Program under section 302 or shared through international government partners. If purchased data must be assimilated into numerical weather prediction models or automated forecast guidance to satisfy redistribution contract permissions, the Under Secretary shall make accessible without delay to members of the weather enterprise that are United States persons the numerical weather prediction model or automated forecast guidance output, as the case may be.

''(d) DATA ASSIMILATION.—

''(1) IN GENERAL.—The Under Secretary, in coordination with the Commercial Data Program under section 302, the National Centers for Environmental Information, and any other offices within the Administration, shall establish a program to test, advance, and implement data assimilation methods, which may include artificial intelligence, machine learning, data pre- and post-processing, efficient input and output, and next-generation algorithms.

''(2) DATA ASSIMILATION UNIVERSITY CONSORTIUM.—Through the program established pursuant

to paragraph (1), the Under Secretary shall establish a consortium consisting of institutions of higher education (as such term is defined in section 101 of the Higher Education Act of 1965 (20 U.S.C. 1001)) to address critical research challenges for data assimilation and foster a growing data assimilation workforce. The consortium shall seek to—

''(A) solve critical research issues for data assimilation through innovative research;

''(B) increase significantly the number of students, including graduate level and Ph.D. candidates, in data assimilation;

''(C) utilize modern software and frameworks, such as the Joint Effort for Data Assimilation Integration, to conduct data assimilation research and development and facilitate research to operations efforts;

''(D) identify and prioritize critical research areas in data assimilation and facilitate operations to research efforts;

''(E) establish and enable an effective collaboration infrastructure between National Oceanic and Atmospheric Administration facilities, such as labs, centers, or joint agency institutes, and the research community, including a mech-

anism for external partners to host Administration employees; and

''(F) establish mechanisms to enable all members of the consortium to archive and access data required to support the work under this subsection.

''(3) COORDINATION.—In carrying out this subsection, the Under Secretary shall ensure the National Oceanic and Atmospheric Administration and its associated activities focus on research to operations and operations to research, including by coordinating and collaborating with the Joint Center for Satellite Data Assimilation.

''(4) DATA ASSIMILATION, MANAGEMENT, AND SHARING PRACTICES SECURITY.—The activities authorized under this subsection shall be applied in a manner consistent with subtitle D of title VI of the Research and Development, Competition, and Innovation Act (enacted as division B of Public Law 117–167; 42 U.S.C. 19231 et seq.).

''(e) STUDY ON DATA MANAGEMENT.—

''(1) IN GENERAL.—Not later than 90 days after the data of the enactment of this section, the Under Secretary shall seek to enter into an agreement with a non-Federal entity to conduct a study

on matters concerning data practices and management needs at the National Oceanic and Atmospheric Administration. In conducting the study, the outside entity shall—

"(A) assess the costs and benefits of current data management needs for observational and operational mission requirements;

"(B) develop recommendations regarding how to make more robust and cost-effective the data portfolio of the Administration;

"(C) identify data infrastructure technologies and needs that are essential to the performance of modeling systems of the Administration;

"(D) assess the sharing needs and practices of the Administration for both internal and external sharing dissemination; and

"(E) develop recommendations for methods of data infrastructure sharing, including data purchased from the commercial sector.

"(2) AUTHORIZATION OF APPROPRIATIONS.—From amounts authorized to be appropriated to the Commercial Data Program under section 302, there are authorized to be appropriated to carry out the

study under paragraph (1) $1,000,000, to remain available until expended.''.

SEC. 305. CLERICAL AMENDMENT.

The table of contents in section 1(b) of the Weather Research and Forecasting Innovation Act of 2017 is amended by striking the items relating to sections 302 and 303 and inserting the following new items:

TITLE IV—COMMUNICATING WEATHER TO THE PUBLIC

SEC. 401. DEFINITIONS.

In this title:

(1) HAZARDOUS WEATHER OR WATER EVENTS.—The term ''hazardous weather or water events'' has the meaning given such term in section 406 of the Weather Research and Forecasting Innovation Act of 2017 (Public Law 115–25; 131 Stat. 109), as amended by section 402 of this Act.

(2) INSTITUTION OF HIGHER EDUCATION.—The term ''institution of higher education'' has the meaning given such term in section 101 of the Higher Education Act of 1965 (20 U.S.C. 1001).

(3) NOAA WEATHER RADIO.—The term ''NOAA Weather Radio'' means the National Oce-

anic and Atmospheric Administration Weather Radio All Hazards network.

(4) PUBLIC CLOUD.—The term ''public cloud'' means an information technology model in which service providers make computing services, including compute and storage and develop-and-deploy environments and applications, available on-demand to organizations and individuals over the public internet or other means that allows for the widest dissemination of information.

(5) WATCH; WARNING.—The terms ''watch'' and ''warning'' have the meanings given such terms in section 406 of the Weather Research and Forecasting Innovation Act of 2017 (Public Law 115–25; 131 Stat. 109), as amended by section 402 of this Act.

SEC. 402. HAZARDOUS WEATHER OR WATER EVENT RISK COMMUNICATION.

(a) IN GENERAL.—Section 406 of the Weather Research and Forecasting Innovation Act of 2017 (Public Law 115–25; 131 Stat. 109) is amended to read as follows:

''SEC. 406. HAZARDOUS WEATHER OR WATER EVENT RISK COMMUNICATION.

''(a) DEFINITIONS.—In this section:

''(1) HAZARDOUS WEATHER OR WATER EVENTS.—The term 'hazardous weather or water events' means weather or water events that have a high risk of loss of life or property, including the following:

''(A) Severe storms, such as hurricanes and short-fused, small-scale hazardous weather or hydrologic events produced by thunderstorms, including large hail, damaging winds, tornadoes, and flash floods.

''(B) Winter storms, such as freezing or frozen precipitation (including freezing rain, sleet, and snow), or combined effects of freezing or frozen precipitation and strong winds.

''(C) Other weather hazards, such as extreme heat or cold, wildfire, drought, dense fog, high winds, and river, coastal, or lakeshore flooding.

''(2) INSTITUTION OF HIGHER EDUCATION.—The term 'institution of higher education' has the meaning given such term in section 101 of the Higher Education Act of 1965 (20 U.S.C. 1001).

''(3) WATCH; WARNING.—

''(A) IN GENERAL.—The terms 'watch' and 'warning', with respect to a hazardous weather

or water event, mean products issued by the National Oceanic and Atmospheric Administration, intended for consumption by the general public, to alert the general public to the potential for or presence of such event and to inform action to prevent loss of life or property.

''(B) EXCEPTION.—The terms 'watch' and 'warning' do not include technical or specialized meteorological or hydrological forecasts, outlooks, or model guidance products.

''(b) SYSTEM COMMUNICATIONS.—The Under Secretary shall maintain and improve the system of the National Oceanic and Atmospheric Administration by which the risks of hazardous weather or water events are communicated to the general public, with the goal of informing response to prevent loss of life or property.

''(c) HAZARD RISK COMMUNICATION IMPROVEMENT AND SIMPLIFICATION.—

''(1) IN GENERAL.—To carry out subsection (b), the Under Secretary shall maintain a social, behavioral, risk, communication, and economic sciences program (in this section referred to as the 'Program'), for the purpose of simplifying and improving the communication of hazardous weather or water events.

''(2) TERMINOLOGY.—The Program, in coordination with social, behavioral, risk, communication, and economic science community and user feedback, shall identify, eliminate, or modify unnecessary, redundant, or confusing terms for communications regarding hazardous weather or water events and add new terminology, as appropriate.

''(3) COMMUNICATIONS IMPROVEMENT.—The Program shall improve the form, content, and methods of communications regarding hazardous weather or water events and associated risks to more clearly inform response to prevent the loss of life or property.

''(4) EVALUATIONS.—The Program, in coordination with the performance and evaluation branches of the National Weather Service and Oceanic and Atmospheric Research, shall develop metrics for such branches to track and evaluate the degree to which communications regarding hazardous weather or water events inform response.

''(5) SUPPORT PLAN.—The Program shall develop a plan for the purpose of carrying out paragraph (3). Such plan shall be periodically updated and informed by internal and extramural research and the results of the evaluation of communications

regarding hazardous weather or water events and associated risks under paragraph (4).

"(6) METHODS.—In carrying out this section, the Program shall develop and implement recommendations that—

"(A) are based on the best and most recent understanding from social, behavioral, economic, risk, and communications science research;

"(B) are validated by social, behavioral, risk, and communications science, taking into account the importance of methods that support reproduction and replication of scientific studies, use of rigorous statistical analyses, and, as applicable, data analysis supported by artificial intelligence and machine learning technologies;

"(C) account for the needs of various demographics, vulnerable populations, and geographic regions;

"(D) account for the differences between various types of hazardous weather or water events;

"(E) respond to the needs of Federal, State, and local government partners and media partners; and

"(F) account for necessary changes in the infrastructure, technology, and protocols for developing and disseminating watches and warnings.

"(7) COORDINATION.—In carrying out this section, the Program shall coordinate with the following:

"(A) Federal partners, including National Laboratories, cooperative institutes, and regional integrated sciences and assessments programs.

"(B) State and local government partners.

"(C) Tribal governments.

"(D) Institutions of higher education or a consortia thereof.

"(E) Media partners.

"(8) TIMELINESS AND CONSISTENCY.—The Program shall develop best practices and guidance for ensuring timely and consistent communications across public facing platforms that disseminate information related to hazardous weather or water events.".

(b) TABLE OF CONTENTS.—Section 1(b) of the Weather Research and Forecasting Innovation Act of

2017 is amended by amending the item relating to section 406 to read as follows:

"Sec. 406. Hazardous Weather or Water Event Risk Communication.".

SEC. 403. HAZARD COMMUNICATION RESEARCH AND ENGAGEMENT.

Section 406 of the Weather Research and Forecasting Innovation Act of 2017 (Public Law 115–25; 131 Stat. 109), as amended by section 402 of this Act, is further amended by adding at the end the following new subsections:

"(d) HAZARD COMMUNICATION RESEARCH AND ENGAGEMENT.—

"(1) IN GENERAL.—The Under Secretary shall maintain, as appropriate, a program to—

"(A) modernize the development and communication of risk-based, statistically reliable, probabilistic hazard information, with the goal of informing appropriate responses to hazardous weather or water events; and

"(B) improve the fundamental social, behavioral, economic, risk, and communication science relating to communications, including by means of collecting voluntary data, regarding hazardous weather or water events.

"(2) COORDINATION.—In carrying out the program under paragraph (1), the Under Secretary

shall coordinate and communicate with States, Tribal governments, localities, and emergency managers regarding research priorities and results.

''(3) PILOT PROGRAM FOR TORNADO HAZARD COMMUNICATION REQUIRED.—To further research into communications regarding hazardous weather or water events, the Under Secretary, in coordination with the VORTEX program under section 103 and in collaboration with one or more eligible institutions (or a consortia thereof), shall establish a pilot program for tornado hazard communication to test the effectiveness of implementing research into operations with respect to tornadoes.

''(4) PILOT STUDY FOR HURRICANE HAZARD COMMUNICATION.—

''(A) IN GENERAL.—To further research into communications regarding hazardous weather or water events, the Under Secretary, in coordination with the hurricane forecast improvement program under section 104, shall seek to enter into an agreement with an appropriate entity, as determined by the Under Secretary, to conduct a pilot study using a mixed methods approach, such as surveys, focus groups, and interviews, to gather information

from hurricane prone population areas regarding the levels of preparedness of such areas for hurricanes or in response to the National Oceanic and Atmospheric Administration's early forecasts and warnings. Such study shall evaluate the following:

''(i) Possession of disaster supplies.

''(ii) Evacuation decisions.

''(iii) Levels of trust of tropical cyclone information and hurricane path prediction from various sources.

''(iv) Access to tropical cyclone and hurricane warnings in such study participant's first language.

''(v) Determination regarding such study participant's reasoning that may hinder the ability of such a participant to evacuate or willingness to evacuate.

''(B) ADDITIONAL CRITERIA.—The pilot study described in subparagraph (A) shall define its methodology and be made publicly available on a website of the National Oceanic and Atmospheric Administration.

"(5) ELIGIBLE INSTITUTION DEFINED.—In this subsection, the term 'eligible institution' means any of the following:

"(A) An institution of higher education, nonprofit organization, or other institution located in a jurisdiction eligible to participate in the program under section 113 of the National Science Foundation Authorization Act of 1988 (42 U.S.C. 1862g).

"(B) An institution of higher education, nonprofit organization, or other institution located in proximity to a Weather Forecast Office of the National Weather Service.

"(e) HURRICANE SOCIAL, BEHAVIORAL, AND ECONOMIC SCIENCES.—As part of the program carried out under subsection (d), the Under Secretary shall carry out research and development activities to improve how the public receives, interprets, responds to, and values hurricane forecasts and warnings. In conducting such activities, the Under Secretary shall—

"(1) conduct a comprehensive review of what is known about how the public receives, interprets, responds to, and makes decisions regarding hurricane forecasts and warnings, including—

"(A) how the connections between weather observations, downstream models, and processes affect the decision tools or products derived from such hurricane forecasts and warnings;

"(B) how such hurricane forecasts and warnings generated by decision tools and products are used by emergency managers, governments, and other users to benefit the public and stakeholder groups;

"(C) how past experiences with hurricanes impacts decision making;

"(D) how the source of such hurricane forecasts and warnings affects interpretation;

"(E) how tropical cyclone warnings and watches are received and interpreted;

"(F) how understanding of and response to such hurricane forecasts and warnings vary across demographic groups, including the elderly, people with disabilities, and other vulnerable populations;

"(G) language barriers; and

"(H) how understanding and response to such hurricane forecasts and warnings varies across geographic areas, including rural, urban, and suburban areas;

''(2) identify communication data gaps based on the review conducted pursuant to paragraph (1);

''(3) carry out research, including data collection and baseline assessments, in coordination with the hurricane forecast improvement program under section 104 to evaluate and quantify the economic value of extending lead times of tropical cyclone and hurricane warnings and watches, including identifying the most effected or vulnerable populations and potential impacts to those populations;

''(4) as part of post-storm surveys and assessments conducted under section 406 of the Weather Act Reauthorization Act of 2023, conduct retrospective or ex ante assessments of previous hurricane forecasts and warnings with improvements to better understand the key components, including expected actions or behavior changes, of the value of the forecasts and warnings provided;

''(5) conduct cost benefit analysis of forecasts and warnings improvement alternatives developed through the hurricane forecast improvement program under section 104; and

''(6) conduct risk assessments for pre-, during, and post-storm periods in regions and communities

with significant elderly populations, including retirement communities.''.

SEC. 404. NATIONAL WEATHER SERVICE COMMUNICATIONS IMPROVEMENT.

(a) IMPROVEMENT OF NWS INSTANT MESSAGING SERVICE.—The Director of the National Weather Service shall improve the instant messaging service used by personnel of the National Weather Service by implementing, not later than October 1, 2027, a commercial off-the-shelf communications solution that replaces the instant messaging service commonly referred to as ''NWSChat''.

(b) REQUIREMENTS.—The communications solution implemented under this section shall—

(1) be hosted on the public cloud; and

(2) satisfy requirements set forth by the Director to ensure such solution—

(A) best accommodates future growth;

(B) performs successfully with increased numbers of users;

(C) is easy to use for the majority of users; and

(D) is similar to systems already in commercial use.

(c) FUNDING.—From amounts made available for Operations, Research, and Facilities, the Director of the

National Weather Service shall allocate up to $3,000,000 for each of fiscal years 2024 through 2027 to carry out this section.

SEC. 405. NOAA WEATHER RADIO MODERNIZATION.

(a) IN GENERAL.—The Under Secretary shall, to the maximum extent practicable, expand coverage of the NOAA Weather Radio and ensure its reliability. In carrying out this subsection, the Under Secretary shall—

(1) maintain support for existing systems serving areas not covered by or having poor quality cellular service;

(2) ensure consistent maintenance and operations monitoring, with timely repairs to broadcast transmitter site equipment and antennas;

(3) enhance the ability to amplify Non-Weather Emergency Messages via NOAA Weather Radio as necessary; and

(4) acquire additional transmitters as required to expand coverage to rural and underserved communities, units of the National Park System, and National Recreation Areas.

(b) MODERNIZATION INITIATIVE.—To the maximum extent practicable, the Under Secretary shall enhance NOAA Weather Radio to ensure its capabilities and cov-

erage remain valuable to the public. In carrying out this section, the Under Secretary shall—

(1) upgrade telecommunications infrastructure of NOAA Weather Radio to accelerate the transition of broadcasts to internet protocol-based communications over non-copper media;

(2) accelerate software upgrades to the Advanced Weather Interactive Processing System, or the relevant system successors, to implement partial county notifications and alerts;

(3) consult with relevant stakeholders, including the private sector, to enhance accessibility and usability of NOAA Weather Radio data and feeds;

(4) develop options, including satellite backup capability and commercial provider partnerships, for NOAA Weather Radio continuity in the event of Weather Forecast Office outages;

(5) research and develop alternative options, including microwave capabilities, to transmit NOAA Weather Radio signals to transmitters that are remote or do not have internet protocol capability; and

(6) transition critical applications to the Integrated Dissemination Program, or the relevant program successors.

(c) PRIORITY.—In carrying out subsection (b), the Under Secretary shall prioritize practices, capabilities, and technologies recommended in accordance with the assessment under subsection (d) to maximize accessibility, particularly in remote and underserved areas of the United States.

(d) ASSESSMENT FOR MANAGEMENT AND DISTRIBUTION.—Not later than one year after the date of the enactment of this Act, the Under Secretary shall complete an assessment of access to NOAA Weather Radio. In conducting such assessment, the Under Secretary shall take into consideration and provide recommendations regarding the following:

(1) The need for continuous, adequate, and operational real-time broadcasts of the NOAA Weather Radio in both urban and rural areas.

(2) Solicited inputs from relevant stakeholders on the compatibility of NOAA Weather Radio data for third party platforms that provide online services, such as websites and mobile device applications, or deliver NOAA Weather Radio access.

(3) Existing or new management systems that promote consistent, efficient, and compatible access to NOAA Weather Radio.

(4) The ability of NOAA to aggregate real time broadcast feeds at one or more central locations.

(5) Effective interagency coordination.

(6) The potential effects of an electromagnetic pulse or geomagnetic disturbance on NOAA Weather Radio.

(7) Any other function the Under Secretary determines necessary.

SEC. 406. POST-STORM SURVEYS AND ASSESSMENTS.

(a) IN GENERAL.—The Under Secretary shall continue to perform one or more post-storm surveys and assessments following every hazardous weather or water event determined by the Under Secretary to be of sufficient societal importance to warrant a post-event survey and assessment.

(b) COORDINATION.—The Under Secretary shall coordinate with Federal, State, local and Tribal governments, private entities, and relevant institutions of higher education (or a consortia thereof) when conducting post-storm surveys and assessments under this section to optimize data collection, sharing, integration, archiving, and access, as appropriate for research needs.

(c) DATA AVAILABILITY.—The Under Secretary shall make the appropriate data obtained from each post-storm survey and assessment conducted under this section avail-

able to the public as soon as practicable after conducting each such survey and assessment.

(d) IMPROVEMENT.—In carrying out this section, the Under Secretary shall—

(1) examine the role of uncrewed aerial and marine systems in data collection during post-storm surveys and assessments conducted under this section;

(2) identify gaps in and update tactics and procedures to enhance the efficiency and reliability of data obtained from post-storm surveys and assessments;

(3) to the maximum extent practicable, increase the number of post-storm community impact studies, particularly among under-observed, underserved, or highly vulnerable populations, including—

(A) surveying-individual responses;

(B) conducting review of the accuracy of prior risk evaluations;

(C) evaluating the efficacy of prior mitigation activity; and

(D) gathering survivability statistics; and

(4) as appropriate, integrate community-based, social, behavioral, risk, communication, and economic sciences elements into existing post-storm sur-

veys and assessments, including relating to efficacy of forecast and warning information, barriers to action, and messaging challenges.

(e) SUPPORT FOR EMPLOYEES.—The Under Secretary shall provide training, resources, and access to professional counseling to support the emotional and mental health and well-being of employees conducting post-storm surveys and assessments under this section.

(f) EXEMPTION.—Subchapter I of chapter 35 of title 44, United States Code, shall not apply to the collection of information during the conduct of a survey or assessment authorized under subsection (a).

SEC. 407. GOVERNMENT ACCOUNTABILITY OFFICE REPORT ON ALERT DISSEMINATION FOR HAZARDOUS WEATHER OR WATER EVENTS.

(a) IN GENERAL.—Not later than 540 days after the date of the enactment of this Act, the Comptroller General of the United States shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science, Space, and Technology of the House of Representatives a report that examines the information technology infrastructure of the National Weather Service of the National Oceanic and Atmospheric Administration, specifically regarding the system for timely public

notification via alerts and updates regarding hazardous weather or water events.

(b) ELEMENTS.—The report required by subsection (a) shall include the following:

(1) An analysis of the information technology infrastructure of the National Weather Service, including software and hardware capabilities and limitations, including an examination of server and data storage methods, broadband, data management, and data sharing.

(2) An identification of secondary and tertiary fail-safes for the timely distribution to the public of notifications via alerts and updates regarding hazardous weather or water events.

(3) A process analysis to determine the source and extent to which public notifications via alerts and updates regarding hazardous weather or water events have been delayed and an identification of possible improvements or corrective measures to address latency in the notification process.

(4) An assessment of whether collaboration with other Federal offices, States, or private entities could reduce delays in notifications to the public.

(5) A description of actions being undertaken to better identify critical steps in public notification via

alerts and updates for hazardous weather or water events that may be vulnerable to disruption or failure in the event of communication, technologic, or computational failure.

(6) The geographical differences in availability and effectiveness of rural systems, including an estimated number of rural areas affected by unreliable or unavailable accurate systems and barriers to obtain or upgrade such systems.

SEC. 408. DATA COLLECTION MANAGEMENT AND PROTECTION.

(a) DATA COLLECTION.—The Under Secretary may collect social, behavioral, and economic data, including Federal communication and related public response to hazardous weather or water events. Where appropriate, the Under Secretary shall encourage use of secondary data, purchase data, or partner with the private sector.

(b) DATA MANAGEMENT.—The Under Secretary shall establish a central repository system for the National Oceanic and Atmospheric Administration for social, behavioral, and economic data related to the communication of and related public response to hazardous weather or water events, including data developed or received pursuant to this title.

(c) PROTECTION OF DATA.—The Under Secretary shall ensure that all data collected and managed by the Administration is done within with all legal, regulatory, and contractual obligations and in accordance with chapter 31 of title 44, United States Code, and the Federal Evidence-Based Policymaking Act of 2018 (Public Law 115–435).

(d) DIGITAL WATERMARKING.—The Under Secretary shall develop methods to reduce the likelihood of unauthorized tampering with online public notifications of hazardous weather or water events, such as developing digital watermarks.

(e) POLICIES AND PROCEDURES.—The Under Secretary shall establish policies and procedures for the collection, archiving, and stewardship of data on community response, including the response of effected or vulnerable populations, to hazardous weather or water events.

TITLE V—IMPROVING WEATHER INFORMATION FOR AGRICULTURE AND WATER MANAGEMENT

SEC. 501. WEATHER AND CLIMATE INFORMATION IN AGRICULTURE AND WATER MANAGEMENT.

Section 1762 of the Food Security Act of 1985 (15 U.S.C. 8521) is amended—

(1) by amending subsection (h) to read as follows:

''(h) SUBSEASONAL TO SEASONAL FORECASTING PILOT PROJECTS.—

''(1) ESTABLISHMENT.—The Under Secretary shall establish not fewer than two pilot projects, in accordance with paragraph (2), within the U.S. Weather Research Program of the Oceanic and Atmospheric Research office of the National Oceanic and Atmospheric Administration to support improved subseasonal to seasonal precipitation forecasts for the following:

''(A) Water management in the western United States.

''(B) Agriculture in the central United States.

''(2) OBJECTIVES.—In carrying out this subsection, the Under Secretary shall ensure the following:

''(A) A pilot project under subparagraph (A) of paragraph (1) addresses key science challenges to improving forecasts and developing related products for water management in the western United States, including the following:

''(i) Improving operational model resolution, both horizontal and vertical, to resolve issues associated with mountainous terrain, such as intensity of precipitation and relative fraction of rain versus snow precipitation.

''(ii) Improving fidelity in the operational modeling of the atmospheric boundary layer in mountainous regions.

''(iii) Resolving challenges in predicting winter atmospheric circulation and storm tracks, including periods of blocked versus unblocked flow over the eastern North Pacific Ocean and western United States.

''(iv) Utilizing outcomes from the Atmospheric Rivers Forecast Improvement Program as authorized in section 204 of the Weather Act Reauthorization Act of 2023 to produce operational tools and services.

''(v) Improving the quality and temporal and spatial resolution of observations and accurate operational modeling of air-sea interactions, and the influence of

oceans on subseasonal and seasonal forecasting.

''(B) A pilot project under subparagraph (B) of paragraph (1) addresses key science challenges to improving forecasts and developing related products for agriculture in the central United States, including the following:

''(i) Improving the quality and temporal and spatial resolution of observations and accurate operational modeling of the land surface and hydrologic cycle, including soil moisture and flash drought processes.

''(ii) Improving fidelity in the operational modeling of warm season precipitation processes.

''(iii) Understanding and predicting large-scale upper-level dynamical flow anomalies that occur in spring and summer.

''(3) ACTIVITIES.—A pilot project under this subsection shall include activities that carry out the following:

''(A) Best implement recommendations of the National Weather Service's 2020 Report,

entitled 'Subseasonal and Seasonal Forecasting Innovation: Plans for the Twenty-First Century'.

''(B) Achieve measurable objectives for operational forecast improvement.

''(C) Engage with, and leverage the resources of, institutions of higher education (as such term is defined in section 101 of the Higher Education Act of 1965 (20 U.S.C. 1001)), or a consortia thereof, and entities within the National Oceanic and Atmospheric Administration in existence as of the date of the enactment of this subsection, including Regional Climate Centers and the National Centers for Environmental Information.

''(D) Are carried out in coordination with the Assistant Administrator for the Office of Oceanic and Atmospheric Research and the Director of the National Weather Service.

''(4) SUNSET.—The authority under this subsection shall terminate on the date that is five years after the date of the enactment of this subsection.''; and

(2) by amending subsection (j) to read as follows:

''(j) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated $45,000,000 for each of fiscal years 2024 through 2028 to carry out the activities under this section.''.

SEC. 502. NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM.

(a) IN GENERAL.—Section 3 of the National Integrated Drought Information System Act of 2006 (15 U.S.C. 313d) is amended—

(1) in subsection (b)—

(A) in paragraph (1)—

(i) in subparagraph (A), by striking ''and'' after the semicolon;

(ii) in subparagraph (B), by inserting ''and'' after the semicolon; and

(iii) by adding at the end the following new subparagraph:

''(C) incorporates flash drought research and tools to enhance timely response;'';

(B) in paragraph (5), by striking ''and'' after the semicolon;

(C) in paragraph (6)—

(i) by inserting ''(including ecological drought)'' after ''drought'' each place it appears; and

(ii) by striking the period and inserting a semicolon; and

(D) by adding at the end the following new paragraphs:

''(7) advance and deploy next generation technologies related to drought and related publicly available data, such as monitoring, preparedness, and forecasting capabilities utilizing artificial intelligence, machine learning, and cloud technologies; and

''(8) utilize observational networks, including the National Weather Service cooperative observer program and State or regional hydrological monitoring projects, and refine drought indicators across a variety of spatial and temporal scales for decision-support products by optimizing data and resources from across the Federal Government, including snowpack, soil moisture, groundwater, and rapid intensification data.'';

(2) in subsection (c)—

(A) in paragraph (2), by striking ''and'' after the semicolon;

(B) in paragraph (3), by striking the period and inserting ''; and''; and

(C) by adding at the end the following new paragraph:

''(4) in partnership with the National Mesonet Program, establish memoranda of understanding to provide coordinated, high-quality, nationwide drought information for the public good, including integrated soil moisture information in accordance with the 2021 report, 'A Strategy for the National Coordinated Soil Moisture Monitoring Network'.''; and

(3) by amending subsection (f) to read as follows:

''(f) MODELING UPDATE.—The Under Secretary, in partnership with National Integrated Drought Information System and the Climate Prediction Center of the National Weather Service, shall undertake an effort to transition existing drought products to probabilistic forecasts and incorporate new and improved dynamical and statistical forecast modeling tools.''.

(b) AUTHORIZATION OF APPROPRIATIONS.—Section 4 of the National Integrated Drought Information System Act of 2006 (15 U.S.C. 313d note) is amended to read as follows:

"SEC. 4. AUTHORIZATION OF APPROPRIATIONS.

"From amounts made available to Operations, Research, and Facilities of the National Oceanic and Atmospheric Administration, there are authorized to be appropriated to carry out this section the following:

"(1) $15,000,000 for fiscal year 2024.

"(2) $15,500,000 for fiscal year 2025.

"(3) $16,000,000 for fiscal year 2026.

"(4) $16,500,000 for fiscal year 2027.

"(5) $17,000,000 for fiscal year 2028.".

SEC. 503. NATIONAL MESONET PROGRAM.

(a) PROGRAM.—The Under Secretary shall maintain the National Mesonet Program (in this section referred to as the "Program"). The Program shall—

(1) obtain observations in all geographic environments to improve understanding of and forecast capabilities for atmospheric and water events, with a prioritization on leveraging available commercial, academic, and other non-Federal environmental data to enhance coordination across the private, public, and academic sectors of the United States weather enterprise; and

(2) establish memoranda of understanding with networks outside of the scope of the Program.

(b) PROGRAM ELEMENTS.—The Program shall carry out the following activities:

(1) Improve environmental observations used by the National Oceanic and Atmospheric Administration and the National Weather Service to support baseline forecasts, including nowcasts, and warnings that protect the Nation's citizens, businesses, military, and government agencies, and enable such individuals and entities to operate in safe, efficient, and orderly manners.

(2) When demonstrably cost effective and meeting or exceeding agency data quality standards, leverage existing networks of environmental monitoring stations, including supplemental radar systems, to increase the quantity and density of environmental observations and data available to the Administration.

(3) Establish means to integrate greater density and type of environmental observations into the Program on an annual basis, including by encouraging local and regional networks of environmental monitoring stations, in situ sensor networks and satellite constellations to participate in the Program.

(4) Yield increased quantities of boundary-layer data to improve numerical weather prediction performance, including regarding subseasonal to seasonal timescales.

(5) Provide the critical technical and administrative infrastructure needed to facilitate rapid integration and sustained use of new and emerging networks of environmental monitoring stations anticipated in coming years from non-Federal sources.

(6) Expand and enhance environmental observational networks in the roadway environment to provide real-time road weather and surface conditions for surface transportation and related economic sectors.

(7) Identify available terrestrial or marine environmental data, or quantifiable gaps in such data, to improve the understanding of air-sea interactions.

(8) Support the National Weather Service in reaching its target of a 30-minute warning time for severe weather through better predictive model algorithms driven by increasingly effective observations.

(9) Coordinate with existing Administration data used for forecasts, including data from the National Environmental Satellite, Data, and Information Service, the Integrated Ocean Observing System, the Global Ocean Monitoring and Observing Program, the National Data Buoy Center, and the National Ocean Service.

(10) Identify and communicate to the Office of Oceanic and Atmospheric Research and other partners priorities of research and development needed to advance observations in the Program.

(11) Support the National Coordinated Soil Moisture Monitoring Network in acquiring soil moisture and related data to support the development of decision-support products and other information services.

(c) FINANCIAL AND TECHNICAL ASSISTANCE.—

(1) IN GENERAL.—In furtherance of the Program, the Under Secretary may, to the extent amounts are made available, award up to 15 percent of the Program's annual appropriations for financial assistance to State, Tribal, private, and academic entities seeking to build, expand, or upgrade equipment and capacity of mesonet systems. Financial assistance under this subsection may be made in coordination with and in addition to awards from other Federal agencies.

(2) AGREEMENTS.—Before receiving financial assistance under paragraph (1), the State, Tribal, private, or academic entity seeking financial assistance under this subsection shall enter into an agreement with the Under Secretary to provide data to

the Program, subject to verification by the Program of the relative operational value and evaluation of the cost of such data, for use in weather prediction, severe weather warnings, and emergency response.

(3) ASSISTANCE AND OTHER SUPPORT.—The Under Secretary may provide technical assistance, project implementation support, and guidance to State, Tribal, private, and academic entities seeking financial assistance under this subsection. The Under Secretary may provide technical and financial assistance for maintenance of monitoring stations in underrepresented or remote areas of the country where it is financially unfeasible for one entity to operate such stations without such assistance.

(4) TERMS.—In providing financial assistance under this subsection, the Under Secretary shall establish terms to ensure that each State, Tribal, private, or academic entity that receives financial assistance under this subsection receives a level of Federal support commensurate with the quality and other characteristics of the data to be provided.

(5) DETERMINATION.—A State, Tribal, private, or academic entity may receive financial assistance under this subsection only if the Under Secretary determines such entity shall provide sufficient non-

Federal financial support and full maintenance to maintain the quality of the mesonet system and associated data standards required by the Program for a period of not less than five years.

(6) PRIORITY.—The Under Secretary shall prioritize providing assistance under paragraph (1) to at least one entity in an underrepresented or remote area.

(d) ADVISORY COMMITTEE.—

(1) IN GENERAL.—The Under Secretary shall ensure the Program has an active advisory committee of subject matter experts to make recommendations to the National Oceanic and Atmospheric Administration on the identification, implementation, procurement, and tracking of data needed to supplement the Program, and recommend improvements, expansions, and acquisitions of available data. The Under Secretary may designate an existing Federal advisory committee, subcommittee, or working group, including, if appropriate, the Science Advisory Board of the National Oceanic and Atmospheric Administration, to carry out this subsection.

(2) ACADEMIC EXPERTISE.—The advisory committee under paragraph (1), in consultation with the Program, shall include expertise from one or more

institutions of higher education (as such term is defined in section 101 of the Higher Education Act of 1965 (20 U.S.C. 1001)) to assist the advisory committee to identify, evaluate, and recommend potential partnerships, regional or subregional consortia, and collaborative methods that would expand the number of participants and volume of data in the Program.

(e) REGULAR REPORTING.—The Under Secretary shall provide regular briefings, not less than twice annually, to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate on all Program activities. Such briefings shall include information relating to the following:

(1) Efforts to implement the activities described in subsection (b).

(2) Any financial or technical assistance provided pursuant to subsection (c).

(3) Efforts to address recommendations received from the advisory committee under subsection (d).

(4) The potential need and associated benefits of a coastal and ocean mesonet, or other emerging areas of weather data needs.

(5) Progress toward eliminating gaps in weather observation data by States and regions of the United States.

(6) Any other topic the Under Secretary determines relevant.

(f) AUTHORIZATION OF APPROPRIATIONS.—From amounts made available to the National Weather Service, the Under Secretary, to carry out this section, shall allocate up to the following amounts for each specified fiscal year:

(1) $50,000,000 for fiscal year 2024.

(2) $55,000,000 for fiscal year 2025.

(3) $61,000,000 for fiscal year 2026.

(4) $68,000,000 for fiscal year 2027.

(5) $70,000,000 for fiscal year 2028.

SEC. 504. NATIONAL COORDINATED SOIL MOISTURE MONITORING NETWORK.

(a) IN GENERAL.—The Under Secretary, in collaboration with the Secretary of Agriculture, the Director of the United States Geological Survey, the Administrator of the National Aeronautics and Space Administration, and the heads of other relevant Federal agencies and departments, shall support the development, deployment, and maintenance of soil moisture monitoring networks by managing the National Coordinated Soil Moisture Monitoring

Network (in this section referred to as the ''Network'') within the National Integrated Drought Information System.

(b) ACTIVITIES.—The Under Secretary shall ensure the Network includes activities that carry out the following:

(1) Establishing a visible, user-friendly website.

(2) Developing a set of criteria for high-quality data sources.

(3) Supporting research necessary to develop or improve soil moisture monitoring products at a national scale.

(4) Increasing the number of long-term, high-quality, in situ and remote sensing soil moisture monitoring stations across the United States.

(5) Sharing methodologies and validation protocols with the private sector.

(6) Engaging with the citizen science community.

(7) Developing, releasing, and promoting new, nationwide point-based and gridded soil moisture data products that meet the needs of diverse end-user groups.

(8) Supporting community building and outreach to the network of individuals engaged with soil

moisture information delivery, from data provision to end-user decision making.

SEC. 505. NATIONAL WATER CENTER.

Section 301 of the Coordinated Ocean Observations and Research Act of 2020 (42 U.S.C. 10371) is amended—

(1) in subsection (a)—

(A) in paragraph (1)(A)—

(i) in the matter preceding clause (i), by inserting ''as a component of the National Centers for Environmental Prediction'' after ''center'';

(ii) in clause (i), by striking ''and'' after the semicolon;

(iii) in clause (ii), by striking the period and inserting ''; and''; and

(iv) by adding at the end the following new clause:

''(iii) to provide service backup capabilities and additional mission support services for River Forecast Centers.''; and

(B) in paragraph (2), by adding at the end the following new subparagraph:

''(F) Serving as the primary Center for collaboration and coordination of the National

Oceanic and Atmospheric Administration's water research and operational activities with existing Federal centers and networks, including the Department of Agriculture, the Army Corps of Engineers, the Bureau of Reclamation, the United States Geological Survey, and the Federal Emergency Management Agency.'';

(2) by striking subsection (b) and redesignating subsections (c) through (e) as subsections (b) through (d) respectively; and

(3) by amending subsection (c), as so redesignated, to read as follows:

''(c) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated $46,000,000 for each of fiscal years 2024 through 2028 to carry out this section.''.

SEC. 506. SATELLITE TRANSFERS REPORT.

Not later than 180 days after the date of the enactment of this Act, the Secretary of Commerce shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science, Space, and Technology of the House of Representatives a report describing the Department of Commerce's authorities, policies, and Federal Government-wide policies related to transferring any portion of the weather satellite systems operated by the Department of Commerce to any other

Federal department or agency. The report shall also include the following:

(1) A description of the process for decommissioning a Department of Commerce operational weather satellite, any existing agreements related to transfers of weather satellites, whether decommissioned or not, and any reimbursable agreements related to the transfer of physical property or the operation of Department of Commerce weather satellites on behalf of any other Federal department or agency.

(2) A summary of any Department of Commerce plans for potential transfer of existing or future weather satellite systems to any other Federal department or agency.

SEC. 507. PRECIPITATION FORECAST IMPROVEMENT PROGRAM.

(a) IN GENERAL.—Title VI of the Weather Research and Forecasting Innovation Act of 2017 (15 U.S.C. 8501 et seq.) is amended—

(1) by redesignating section 603 as section 604; and

(2) by inserting after section 602 the following new section:

"SEC. 603. PRECIPITATION FORECAST IMPROVEMENT PROGRAM.

''(a) IN GENERAL.—The Under Secretary, in collaboration with the United States weather industry, other Federal agencies, and academic partners, shall maintain a program to improve precipitation forecasting across timescales.

''(b) GOAL.—The goal of the program under subsection (a) shall be to provide more accurate, reliable, and timely precipitation forecasts across timescales through the development and application of a fully coupled Earth system prediction model in order to reduce the loss of life or property related to precipitation extremes, with a focus on the following:

''(1) Improving the understanding and prediction of precipitation extremes from a variety of weather systems, including atmospheric rivers.

''(2) Evaluating and incorporating, as appropriate, innovative observations into operational monitoring and forecast systems to improve precipitation forecasts.

''(3) Improving earth system model predictions of precipitation extremes from atmospheric rivers, tropical cyclones, summer-time thunderstorms, winter storms, and other phenomena, in coordination with relevant programs.

''(4) Enhancing research transition to operations through testbeds, including the evaluation of physical and social science, technology, and other research to develop products and services for implementation and use by relevant stakeholders.

''(5) Incorporating social, behavioral, and economic sciences best practices into operations for more effective and actionable watch and warning products that help drive public safety and damage mitigation decisions in coordination with the programs established in accordance with this Act.

''(6) Ensuring data and metadata management processes are in place to support data access and archive for long term research and operations among multiple partners.

''(c) ACTIVITIES.—In carrying out the program under subsection (a), the Under Secretary shall support research-to-operations work, including relating to the following:

''(1) Implementing key strategies and following priorities and objectives outlined by the National Oceanic and Atmospheric Administration's 'Precipitation Prediction Grand Challenge Strategy'.

''(2) Improving the physical science, operational modeling and tools, and technology related to better forecasting precipitation extremes across timescales.

''(3) Improving the social, behavioral, risk, communications, and economic sciences related to vulnerabilities, risk communication, and delivery of information critical for reducing the loss of life or property related to extreme precipitation.

''(4) Conducting the research necessary to develop and deploy probabilistic weather forecast guidance technology relating to precipitation extremes in operational practice.

''(5) Enhancing the operational capacity of the National Weather Service to deliver decision support for increasing precipitation extremes.

''(6) Expanding computational resources to improve precipitation modeling.

''(d) ANNUAL BUDGET.—The Under Secretary shall, not less frequently than annually, submit to Congress a proposed budget corresponding with carrying out this section.''.

(b) CLERICAL AMENDMENT.—The table of contents in section 1(b) of the Weather Research and Forecasting Innovation Act of 2017 is amended by striking the item

relating to section 603 and inserting the following new items:

"Sec. 603. Precipitation forecast improvement program.
"Sec. 604. Definitions.".

Passed the House of Representatives April 30, 2024.

Attest: KEVIN F. MCCUMBER,

Clerk.