

115TH CONGRESS
1ST SESSION

S. 141

To improve understanding and forecasting of space weather events, and for
other purposes.

IN THE SENATE OF THE UNITED STATES

JANUARY 12, 2017

Mr. PETERS (for himself, Mr. GARDNER, Mr. BOOKER, and Mr. WICKER) in-
troduced the following bill; which was read twice and referred to the Com-
mittee on Commerce, Science, and Transportation

A BILL

To improve understanding and forecasting of space weather
events, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

3 **SECTION 1. SHORT TITLE.**

4 This Act may be cited as the “Space Weather Re-
5 search and Forecasting Act”.

6 **SEC. 2. SPACE WEATHER.**

7 (a) IN GENERAL.—Subtitle VI of title 51, United
8 States Code, is amended by adding after chapter 605 the
9 following:

1 **“CHAPTER 607—SPACE WEATHER**

“60701. Space weather.

“60702. Observations and forecasting.

“60703. Research and technology.

“60704. Space weather data.

2 **“§ 60701. Space weather**

3 “(a) FINDINGS.—Congress makes the following find-
4 ings:

5 “(1) Space weather events pose a significant
6 threat to humans working in the space environment
7 and to modern technological systems.

8 “(2) The effects of severe space weather events
9 on the electric power grid, satellites and satellite
10 communications and information, airline operations,
11 astronauts living and working in space, and space-
12 based position, navigation, and timing systems could
13 have significant societal, economic, national security,
14 and health impacts.

15 “(3) Earth and space observations provide cru-
16 cial data necessary to predict and warn about space
17 weather events.

18 “(4) Clear roles and accountability of Federal
19 departments and agencies are critical for an efficient
20 and effective response to threats posed by space
21 weather.

22 “(5) In October 2015, the National Science and
23 Technology Council published a National Space

1 Weather Strategy and a National Space Weather
2 Action Plan seeking to integrate national space
3 weather efforts and add new capabilities to meet in-
4 creasing demand for space weather information.

5 “(b) FEDERAL AGENCY ROLES.—

6 “(1) FINDINGS.—Congress finds that—

7 “(A) the National Oceanic and Atmos-
8 pheric Administration provides operational
9 space weather forecasting and monitoring for
10 civil applications, maintains ground and space-
11 based assets to provide observations needed for
12 forecasting, prediction, and warnings, and de-
13 velops requirements for space weather fore-
14 casting technologies and science;

15 “(B) the Department of Defense provides
16 operational space weather forecasting, moni-
17 toring, and research for the department’s
18 unique missions and applications;

19 “(C) the National Aeronautics and Space
20 Administration provides increased under-
21 standing of the fundamental physics of the
22 Sun-Earth system through space-based observa-
23 tions and modeling, develops new space-based
24 technologies and missions, and monitors space
25 weather for NASA’s space missions;

1 “(D) the National Science Foundation pro-
2 vides increased understanding of the Sun-Earth
3 system through ground-based measurements,
4 technologies, and modeling;

5 “(E) the Department of the Interior col-
6 lects, distributes, and archives operational
7 ground-based magnetometer data in the United
8 States and its territories, and works with the
9 international community to improve global geo-
10 physical monitoring and develops crustal con-
11 ductivity models to assess and mitigate risk
12 from space weather induced electric ground cur-
13 rents; and

14 “(F) the Federal Aviation Administration
15 provides operational requirements for space
16 weather services in support of aviation and for
17 coordination of these requirements with the
18 International Civil Aviation Organization, inte-
19 grates space weather data and products into the
20 Next Generation Air Transportation System,
21 and conducts real-time monitoring of the
22 charged particle radiation environment to pro-
23 tect the health and safety of crew and pas-
24 sengers during space weather events.

1 “(2) OFFICE OF SCIENCE AND TECHNOLOGY
2 POLICY.—The Director of the Office of Science and
3 Technology Policy shall—

4 “(A) coordinate the development and im-
5 plementation of Federal Government activities
6 to improve the Nation’s ability to prepare,
7 avoid, mitigate, respond to, and recover from
8 potentially devastating impacts of space weath-
9 er events; and

10 “(B) coordinate the activities of the Na-
11 tional Space Weather Program members.

12 “(c) SPACE WEATHER INTERAGENCY WORKING
13 GROUP.—In order to continue coordination of executive
14 branch efforts to understand, prepare, coordinate, and
15 plan for space weather, the National Science and Tech-
16 nology Council shall establish an interagency working
17 group on space weather that includes representatives of
18 the Federal agencies participating in the National Space
19 Weather Program, and of other Federal agencies, as ap-
20 propriate.

21 “(d) NATIONAL SPACE WEATHER PROGRAM.—In
22 order to understand and respond to the adverse effects
23 of space weather, the National Space Weather Program
24 shall leverage capabilities across participating Federal
25 agencies, including—

1 “(1) the National Oceanic and Atmospheric Ad-
 2 ministration;

3 “(2) the National Aeronautics and Space Ad-
 4 ministration;

5 “(3) the National Science Foundation;

6 “(4) the Department of Defense;

7 “(5) the Department of the Interior;

8 “(6) the Department of Homeland Security;

9 “(7) the Department of Energy;

10 “(8) the Department of Transportation, includ-
 11 ing the Federal Aviation Administration; and

12 “(9) the Department of State.

13 “(e) INTERAGENCY AGREEMENTS.—

14 “(1) SENSE OF CONGRESS.—It is the sense of
 15 Congress that the interagency collaboration between
 16 the National Aeronautics and Space Administration
 17 and the National Oceanic and Atmospheric Adminis-
 18 tration on terrestrial weather observations pro-
 19 vides—

20 “(A) an effective mechanism for improving
 21 weather and climate data collection while avoid-
 22 ing unnecessary duplication of capabilities
 23 across Federal agencies; and

24 “(B) an agency collaboration model that
 25 could benefit space weather observations.

1 “(2) INTERAGENCY AGREEMENTS.—The Ad-
 2 ministrators of the National Aeronautics and Space
 3 Administration and the Administrator of the Na-
 4 tional Oceanic and Atmospheric Administration shall
 5 enter into one or more interagency agreements pro-
 6 viding for cooperation and collaboration in the devel-
 7 opment of space weather spacecraft, instruments,
 8 and technologies in accordance with this chapter.

9 **“§ 60702. Observations and forecasting**

10 “(a) POLICY.—It is the policy of the United States
 11 to establish and sustain a baseline capability for space
 12 weather observations.

13 “(b) INTEGRATED STRATEGY.—

14 “(1) IN GENERAL.—The Director of the Office
 15 of Science and Technology Policy, in coordination
 16 with the Administrator of the National Oceanic and
 17 Atmospheric Administration, the Administrator of
 18 the National Aeronautics and Space Administration,
 19 the Director of the National Science Foundation,
 20 and the Secretary of Defense, and in consultation
 21 with the academic and commercial communities,
 22 shall develop an integrated strategy for solar and
 23 solar wind observations beyond the lifetime of cur-
 24 rent assets, that considers—

1 “(A) the provision of solar wind measure-
 2 ments and other measurements essential to
 3 space weather forecasting; and

4 “(B) the provision of solar and space
 5 weather measurements important for scientific
 6 purposes.

7 “(2) CONSIDERATIONS.—In developing the
 8 strategy under paragraph (1), the Director of the
 9 Office of Science and Technology Policy shall con-
 10 sider small satellite options, hosted payloads, com-
 11 mercial options, international options, and prize au-
 12 thority.

13 “(c) CRITICAL OBSERVATIONS.—In order to sustain
 14 current space-based observational capabilities, the Admin-
 15 istrator of the National Aeronautics and Space Adminis-
 16 tration shall—

17 “(1) in cooperation with the European Space
 18 Agency, maintain operations of the Solar and
 19 Heliospheric Observatory/Large Angle and Spec-
 20 trometric Coronagraph (referred to in this section as
 21 ‘SOHO/LASCO’) for as long as the satellite con-
 22 tinues to deliver quality observations; and

23 “(2) prioritize the reception of LASCO data.

24 “(d) ADDITIONAL CAPABILITY FOR SOLAR IMAG-
 25 ING.—

1 “(1) IN GENERAL.—The Administrator of the
2 National Oceanic and Atmospheric Administration
3 shall secure reliable secondary capability for near
4 real-time coronal mass ejection imagery.

5 “(2) OPTIONS.—The Administrator of the Na-
6 tional Oceanic and Atmospheric Administration, in
7 coordination with the Secretary of Defense and the
8 Administrator of the National Aeronautics and
9 Space Administration, shall develop options to build
10 and deploy one or more instruments for near real-
11 time coronal mass ejection imagery.

12 “(3) CONSIDERATIONS.—In developing options
13 under paragraph (2), the Administrator of the Na-
14 tional Oceanic and Atmospheric Administration shall
15 consider commercial solutions, prize authority, aca-
16 demic and international partnerships, microsatellites,
17 ground-based instruments, and opportunities to de-
18 ploy the instrument or instruments as a secondary
19 payload on an upcoming planned launch.

20 “(4) COSTS.—In implementing paragraph (1),
21 the Administrator of the National Oceanic and At-
22 mospheric Administration shall prioritize a cost-ef-
23 fective solution.

24 “(5) OPERATIONAL PLANNING.—The Adminis-
25 trator of the National Oceanic and Atmospheric Ad-

1 ministration shall develop an operational contingency
2 plan to provide continuous space weather forecasting
3 in the event of a SOHO/LASCO failure.

4 “(6) BRIEFING.—Not later than 120 days after
5 the date of enactment of the Space Weather Re-
6 search and Forecasting Act, the Administrator of
7 the National Oceanic and Atmospheric Administra-
8 tion shall provide a briefing to the Committee on
9 Commerce, Science, and Transportation of the Sen-
10 ate and the Committee on Science, Space, and Tech-
11 nology of the House of Representatives on the op-
12 tions for building and deploying the instrument or
13 instruments described in paragraph (2) and the
14 operational contingency plan developed under para-
15 graph (5).

16 “(e) FOLLOW-ON SPACE-BASED OBSERVATIONS.—
17 The Administrator of the National Oceanic and Atmos-
18 pheric Administration, in coordination with the Secretary
19 of Defense, shall develop requirements and a plan for fol-
20 low-on space-based observations for operational purposes,
21 in accordance with the integrated strategy developed
22 under subsection (b).

23 “(f) REPORT.—Not later than 180 days after the
24 date of enactment of the Space Weather Research and
25 Forecasting Act, the Director of the Office of Science and

1 Technology Policy shall submit to the Committee on Com-
2 merce, Science, and Transportation of the Senate and the
3 Committee on Science, Space, and Technology of the
4 House of Representatives a report on the integrated strat-
5 egy under subsection (b), including the plans for follow-
6 on space-based observations under subsection (e).

7 “(g) GROUND-BASED OBSERVATIONS.—The Na-
8 tional Science Foundation, the Air Force, and where prac-
9 ticable in support of the Air Force, the Navy shall each—

10 “(1) maintain and improve, as necessary and
11 advisable, ground-based observations of the Sun in
12 order to help meet the priorities identified in section
13 60703(a); and

14 “(2) provide space weather data by means of its
15 set of ground-based facilities, including radars,
16 lidars, magnetometers, radio receivers, aurora and
17 airglow imagers, spectrometers, interferometers, and
18 solar observatories.

19 “(h) GROUND-BASED OBSERVATIONS DATA.—The
20 National Science Foundation shall—

21 “(1) provide key data streams from the plat-
22 forms described in subsection (g) for research and to
23 support space weather model development;

24 “(2) develop experimental models for scientific
25 purposes; and

1 “(3) support the transition of the experimental
2 models to operations where appropriate.

3 **“§ 60703. Research and technology**

4 “(a) USER NEEDS.—

5 “(1) IN GENERAL.—The Administrator of the
6 National Oceanic and Atmospheric Administration,
7 the Secretary of the Air Force, and where prac-
8 ticable in support of the Air Force, the Secretary of
9 the Navy, in conjunction with the heads of other rel-
10 evant Federal agencies, shall conduct a comprehen-
11 sive survey to identify and prioritize the needs of
12 space weather forecast users, including space weath-
13 er data and space weather forecast data needed to
14 improve services and inform research priorities and
15 technology needs.

16 “(2) CONTENTS.—In conducting the com-
17 prehensive survey under paragraph (1), the Adminis-
18 trator of the National Oceanic and Atmospheric Ad-
19 ministration, the Secretary of the Air Force, and
20 where practicable in support of the Air Force, the
21 Secretary of the Navy, at a minimum, shall—

22 “(A) consider the goals for forecast lead
23 time, accuracy, coverage, timeliness, data rate,
24 and data quality for space weather observa-
25 tions;

1 “(B) identify opportunities to address the
2 needs identified under paragraph (1) through
3 collaborations with academia, the private sector,
4 and the international community;

5 “(C) identify opportunities for new tech-
6 nologies and instrumentation to address the
7 needs identified under paragraph (1); and

8 “(D) publish a report on the findings
9 under subparagraphs (A) through (C).

10 “(3) PUBLICATION.—Not later than 1 year
11 after the date of enactment of the Space Weather
12 Research and Forecasting Act, the Administrator of
13 the National Oceanic and Atmospheric Administra-
14 tion, the Secretary of the Air Force, and where prac-
15 ticable in support of the Air Force, the Secretary of
16 the Navy, shall—

17 “(A) make the results of the comprehen-
18 sive survey publicly available; and

19 “(B) notify the Committee on Commerce,
20 Science, and Transportation of the Senate and
21 the Committee on Science, Space, and Tech-
22 nology of the House of Representatives of the
23 publication under subparagraph (A).

24 “(b) RESEARCH ACTIVITIES.—

1 “(1) BASIC RESEARCH.—As part of the Na-
2 tional Space Weather Program, the Director of the
3 National Science Foundation, Administrator of the
4 National Aeronautics and Space Administration, and
5 Secretary of Defense shall continue to carry out
6 basic research activities on heliophysics, geospace
7 science, and space weather and support competitive,
8 merit-based, peer-reviewed proposals for research,
9 modeling, and monitoring of space weather and its
10 impacts, including science goals outlined in Solar
11 and Space Physics Decadal surveys conducted by the
12 National Academy of Sciences.

13 “(2) MULTIDISCIPLINARY RESEARCH.—

14 “(A) FINDINGS.—Congress finds that the
15 multidisciplinary nature of solar and space
16 physics creates funding challenges that require
17 coordination across scientific disciplines and
18 Federal agencies.

19 “(B) MULTIDISCIPLINARY RESEARCH.—As
20 part of the National Space Weather Program,
21 the Director of the National Science Founda-
22 tion, the Administrator of the National Oceanic
23 and Atmospheric Administration, and the Ad-
24 ministrator of the National Aeronautics and
25 Space Administration shall pursue multidisci-

1 plinary research in subjects that further our
 2 understanding of solar physics, space physics,
 3 and space weather.

4 “(C) SENSE OF CONGRESS.—It is the
 5 sense of Congress that the Administrator of the
 6 National Aeronautics and Space Administration
 7 and Director of the National Science Founda-
 8 tion should support competitively awarded
 9 Heliophysics Science Centers.

10 “(c) SCIENCE MISSIONS.—The Administrator of the
 11 National Aeronautics and Space Administration shall seek
 12 to implement missions that meet the science objectives
 13 identified in Solar and Space Physics Decadal surveys con-
 14 ducted by the National Academy of Sciences.

15 “(d) RESEARCH TO OPERATIONS.—

16 “(1) IN GENERAL.—The Administrator of the
 17 National Aeronautics and Space Administration, the
 18 Director of the National Science Foundation, the
 19 Administrator of the National Oceanic and Atmos-
 20 pheric Administration, the Secretary of the Air
 21 Force, and where practicable in support of the Air
 22 Force, the Secretary of the Navy, shall—

23 “(A) develop a formal mechanism to tran-
 24 sition National Aeronautics and Space Adminis-
 25 tration, National Science Foundation, Air

1 Force, and Navy research findings, models, and
 2 capabilities, as appropriate, to National Oceanic
 3 and Atmospheric Administration and Depart-
 4 ment of Defense space weather operational fore-
 5 casting centers; and

6 “(B) enhance coordination between re-
 7 search modeling centers and forecasting cen-
 8 ters.

9 “(2) OPERATIONAL NEEDS.—The Adminis-
 10 trator of the National Oceanic and Atmospheric Ad-
 11 ministration and the Secretary of Defense, in coordi-
 12 nation with the Administrator of the National Aero-
 13 nautics and Space Administration and the Director
 14 of the National Science Foundation, shall develop a
 15 formal mechanism to communicate the operational
 16 needs of space weather forecasters to the research
 17 community.

18 “(e) TECHNOLOGY DEVELOPMENT.—

19 “(1) FINDINGS.—Congress finds that observa-
 20 tions and measurements closer to the Sun and ad-
 21 vanced instrumentation would provide for more ad-
 22 vanced warning of space weather disturbances (as
 23 defined in section 3 of the Space Weather Research
 24 and Forecasting Act).

1 “(2) TECHNOLOGY AND INSTRUMENTATION DE-
 2 VELOPMENT.—The Administrator of the National
 3 Aeronautics and Space Administration and the Di-
 4 rector of the National Science Foundation shall sup-
 5 port the development of technologies and instrumen-
 6 tation to improve space weather forecasting lead-
 7 time and accuracy to meet the needs identified by
 8 the Administrator of the National Oceanic and At-
 9 mospheric Administration.

10 **“§ 60704. Space weather data**

11 “(a) IN GENERAL.—The Administrator of the Na-
 12 tional Aeronautics and Space Administration and the Di-
 13 rector of the National Science Foundation shall—

14 “(1) make space weather related data obtained
 15 for scientific research purposes available to space
 16 weather forecasters and operations centers; and

17 “(2) support model development and model ap-
 18 plications to space weather forecasting.

19 “(b) RESEARCH.—The Administrator of the National
 20 Oceanic and Atmospheric Administration shall make space
 21 weather related data obtained from operational forecasting
 22 available for scientific research.”.

23 (b) TECHNICAL AND CONFORMING AMENDMENTS.—

24 (1) REPEAL OF SECTION 809.—Section 809 of
 25 the National Aeronautics and Space Administration

1 Authorization Act of 2010 (42 U.S.C. 18388) and
 2 the item relating to that section in the table of con-
 3 tents under section 1(b) of that Act (124 Stat.
 4 2806) are repealed.

5 (2) TABLE OF CHAPTERS.—The table of chap-
 6 ters of title 51, United States Code, is amended by
 7 adding after the item relating to chapter 605 the fol-
 8 lowing:

“607. Space weather 60701”.

9 **SEC. 3. SPACE WEATHER METRICS.**

10 (a) DEFINITIONS.—In this section:

11 (1) SPACE WEATHER DISTURBANCE.—The term
 12 “space weather disturbance” includes geo-electric
 13 fields, ionizing radiation, ionospheric disturbances,
 14 solar radio bursts, and upper atmospheric expansion.

15 (2) SPACE WEATHER BENCHMARK.—The term
 16 “space weather benchmark” means the physical
 17 characteristics and conditions describing the nature,
 18 frequency, and intensity of space weather disturb-
 19 ances.

20 (b) BENCHMARKS.—

21 (1) PRELIMINARY.—Not later than 90 days
 22 after the date of enactment of this Act, the Space
 23 Weather Interagency Working Group, established
 24 under section 60701 of title 51, United States Code,

1 in consultation with academic and commercial ex-
2 perts, shall—

3 (A) assess existing data, the historical
4 record, models, and peer-reviewed studies on
5 space weather; and

6 (B) develop preliminary benchmarks, based
7 on current scientific understanding and the his-
8 torical record, for measuring solar disturbances.

9 (2) FINAL.—Not later than 18 months after
10 the date the preliminary benchmarks are developed
11 under paragraph (1), the Space Weather Inter-
12 agency Working Group shall publish final bench-
13 marks.

14 (3) REVIEW.—The Administrator of the Na-
15 tional Aeronautics and Space Administration shall
16 contract with the National Academy of Sciences to
17 review the benchmarks established under paragraph
18 (2).

19 (4) REVISIONS.—The Space Weather Inter-
20 agency Working Group shall update and revise the
21 final benchmarks under paragraph (2), as necessary,
22 based on—

23 (A) the results of the review under para-
24 graph (3);

1 (B) any significant new data or advances
 2 in scientific understanding that become avail-
 3 able; or

4 (C) the evolving needs of entities impacted
 5 by solar disturbances.

6 **SEC. 4. PROTECTION OF CRITICAL INFRASTRUCTURE.**

7 (a) IN GENERAL.—The Administrator of the Na-
 8 tional Oceanic and Atmospheric Administration, in con-
 9 sultation with the heads of other relevant Federal agen-
 10 cies, shall provide information about space weather haz-
 11 ards to the Secretary of Homeland Security for purposes
 12 of this section.

13 (b) CRITICAL INFRASTRUCTURE.—The Secretary of
 14 Homeland Security, in consultation with sector-specific
 15 agencies, the Administrator of the National Oceanic and
 16 Atmospheric Administration, and the heads of other rel-
 17 evant agencies, shall—

18 (1) include, in meeting national critical infra-
 19 structure reporting requirements, an assessment of
 20 the vulnerability of critical infrastructure to space
 21 weather events, as described by the space weather
 22 benchmarks under section 3; and

23 (2) support critical infrastructure providers in
 24 managing the risks and impacts associated with
 25 space weather.

1 (c) PROHIBITION ON NEW REGULATORY AUTHOR-
 2 ITY.—Nothing in subsection (b) may be construed to grant
 3 the Secretary of Homeland Security any authority to pro-
 4 mulgate regulations that was not in effect on the day be-
 5 fore the date of enactment of this Act.

6 (d) DEFINITION OF SECTOR-SPECIFIC AGENCY.—In
 7 this section, the term “sector-specific agency” has the
 8 meaning given the term in Presidential Policy Directive—
 9 21 of February 12, 2013 (Critical Infrastructure Security
 10 and Resilience), or any successor.

11 **SEC. 5. PROTECTION OF NATIONAL SECURITY ASSETS.**

12 (a) IN GENERAL.—The National Security Council, in
 13 consultation with the Office of the Director of National
 14 Intelligence, the Secretary of Defense, and the heads of
 15 other relevant Federal agencies, shall—

16 (1) assess the vulnerability of the national secu-
 17 rity community to space weather events, as described
 18 by the space weather benchmarks under section 3;
 19 and

20 (2) develop national security mechanisms to
 21 protection national security assets from space weath-
 22 er threats.

23 (b) COOPERATION.—The Secretary of Defense, in
 24 consultation with the heads of other relevant Federal
 25 agencies, shall provide information about space weather

1 hazards to the National Security Council, Director of Na-
2 tional Intelligence, and heads of Defense Agencies for pur-
3 poses of this section.

4 **SEC. 6. ENSURING THE SAFETY OF CIVIL AVIATION.**

5 (a) IN GENERAL.—The Administrator of the Federal
6 Aviation Administration, in consultation with the heads of
7 other relevant Federal agencies, shall—

8 (1) assess the safety implications and vulner-
9 ability of the national airspace system by space
10 weather events, as described by the space weather
11 benchmarks under section 3;

12 (2) assess methods to mitigate the safety impli-
13 cations and effects of space weather on aviation
14 communication systems, aircraft navigation systems,
15 satellite and ground-based navigation systems, and
16 potential health effects of radiation exposure; and

17 (3) assess options for incorporating space
18 weather into operational training for pilots, cabin
19 crew, dispatchers, air traffic controllers, meteorolo-
20 gists, and engineers.

21 (b) SPACE WEATHER COMMUNICATION.—The Ad-
22 ministrator of the Federal Aviation Administration, in
23 consultation with the heads of other relevant Federal
24 agencies, shall develop methods to increase the interaction

- 1 between the aviation community and the space weather re-
- 2 search and service provider community.

