

116TH CONGRESS
1ST SESSION

S. 881

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

IN THE SENATE OF THE UNITED STATES

MARCH 26, 2019

Mr. PETERS (for himself and Mr. GARDNER) introduced the following bill; which was read twice and referred to the Committee 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**

“Sec.

“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 ground-based and space-based critical in-
7 frastructure, modern technological systems, and hu-
8 mans working in space.

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

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

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

1 “(5) Space weather observation and forecasting
2 are essential for the success of space exploration.

3 “(6) In October 2015, the National Science and
4 Technology Council published a National Space
5 Weather Strategy and a National Space Weather
6 Action Plan seeking to integrate national space
7 weather efforts and add new capabilities to meet in-
8 creasing demand for space weather information.

9 “(b) FEDERAL AGENCY ROLES.—

10 “(1) FINDINGS.—Congress makes the following
11 findings:

12 “(A) The National Oceanic and Atmos-
13 pheric Administration—

14 “(i) provides operational space weath-
15 er forecasting and monitoring for civil ap-
16 plications;

17 “(ii) maintains ground and space-
18 based assets to provide observations need-
19 ed for forecasting, prediction, and warn-
20 ings;

21 “(iii) provides research to support op-
22 eration responsibilities; and

23 “(iv) develops requirements for space
24 weather forecasting technologies and
25 science.

1 “(B) The Department of Defense provides
2 operational space weather forecasting, moni-
3 toring, and research for the department’s
4 unique missions and applications.

5 “(C) The National Aeronautics and Space
6 Administration provides increased under-
7 standing of the fundamental physics of the
8 Sun-Earth system through space-based observa-
9 tions and modeling, develops new space-based
10 technologies and missions, and monitors space
11 weather for NASA’s space missions.

12 “(D) The National Science Foundation
13 provides increased understanding of the Sun-
14 Earth system through ground-based measure-
15 ments, technologies, and modeling.

16 “(E) The Department of the Interior col-
17 lects, distributes, and archives operational
18 ground-based magnetometer data in the United
19 States and its territories, works with the inter-
20 national community to improve global geo-
21 physical monitoring, and develops crustal con-
22 ductivity models to assess and mitigate risk
23 from space weather induced electric ground cur-
24 rents.

1 “(F) The Federal Aviation Administration
2 provides operational requirements for space
3 weather services in support of aviation and for
4 coordination of these requirements with the
5 International Civil Aviation Organization, inte-
6 grates space weather data and products into the
7 Next Generation Air Transportation System.

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

11 “(A) coordinate the development and im-
12 plementation of Federal Government activities
13 to improve the ability of the United States to
14 prepare, avoid, mitigate, respond to, and re-
15 cover from potentially devastating impacts of
16 space weather events; and

17 “(B) coordinate the activities of the space
18 weather interagency working group established
19 under subsection (c).

20 “(c) SPACE WEATHER INTERAGENCY WORKING
21 GROUP.—The National Science and Technology Council
22 shall establish an interagency working group on space
23 weather (referred to in this section as the ‘interagency
24 working group’) to continue coordination of executive

1 branch efforts to understand, prepare, coordinate, and
2 plan for space weather.

3 “(d) MEMBERSHIP.—In order to understand and re-
4 spond to the adverse effects of space weather, the inter-
5 agency working group shall leverage capabilities across
6 participating Federal agencies, including—

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

9 “(2) the National Aeronautics and Space Ad-
10 ministration;

11 “(3) the National Science Foundation;

12 “(4) the Department of Defense;

13 “(5) the Department of the Interior;

14 “(6) the Department of Homeland Security;

15 “(7) the Department of Energy;

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

18 “(9) the Department of State.

19 “(e) INTERAGENCY AGREEMENTS.—

20 “(1) SENSE OF CONGRESS.—It is the sense of
21 Congress that the interagency collaboration between
22 the National Aeronautics and Space Administration
23 and the National Oceanic and Atmospheric Adminis-
24 tration on terrestrial weather observations pro-
25 vides—

1 “(A) an effective mechanism for improving
2 weather and climate data collection while avoid-
3 ing unnecessary duplication of capabilities
4 across Federal agencies; and

5 “(B) an agency collaboration model that
6 could benefit space weather observations.

7 “(2) INTERAGENCY AGREEMENTS.—The Ad-
8 ministrator of the National Aeronautics and Space
9 Administration and the Administrator of the Na-
10 tional Oceanic and Atmospheric Administration shall
11 enter into one or more interagency agreements pro-
12 viding for cooperation and collaboration in the devel-
13 opment of space weather spacecraft, instruments,
14 and technologies in accordance with this chapter.

15 “(f) SPACE WEATHER ADVISORY GROUP.—

16 “(1) ESTABLISHMENT.—The interagency work-
17 ing group shall establish a space weather advisory
18 group (in this chapter referred to as the ‘advisory
19 group’) to facilitate communication and knowledge
20 transfer among Federal Government agencies, the
21 academic community, the commercial sector, and
22 space weather end users.

23 “(2) COMPOSITION.—The advisory group shall
24 be composed of not more than 15 members ap-

1 pointed by the interagency working group, of
2 whom—

3 “(A) 5 members shall be representatives of
4 the academic community;

5 “(B) 5 members shall be representatives of
6 the commercial sector; and

7 “(C) 5 members shall be nongovernmental
8 representatives of the space weather end user
9 community.

10 “(3) CHAIR.—Not later than 30 days after the
11 date on which the last member of the advisory group
12 is appointed under paragraph (2), the interagency
13 working group shall appoint 1 member as the Chair
14 of the advisory group.

15 “(4) TERMS.—The length of the term of each
16 member of the advisory group shall be 3 years be-
17 ginning on the date on which the member is ap-
18 pointed.

19 “(5) TERM LIMITS.—

20 “(A) IN GENERAL.—A member of the advi-
21 sory group may not serve on the advisory group
22 for more than 2 consecutive terms.

23 “(B) CHAIR.—A member of the advisory
24 group may not serve as the Chair of the advi-

1 sory group for more than 2 terms, regardless of
2 whether the terms are consecutive.

3 “(6) DUTIES.—The duties of the advisory
4 group shall be as follows:

5 “(A) To facilitate advances in the space
6 weather enterprise of the United States.

7 “(B) To improve the ability of the United
8 States to prepare for, avoid, mitigate, respond
9 to, and recover from space weather events.

10 “(C) To enable the coordination of re-
11 search to operations and operations to research,
12 as described in section 60703(d).

13 “(D) To advise the interagency working
14 group with respect to the development and im-
15 plementation of the integrated strategy devel-
16 oped under section 60702(b) and subsequent
17 updates and reevaluations.

18 **“§ 60702. Observations and forecasting**

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

22 “(b) INTEGRATED STRATEGY.—

23 “(1) IN GENERAL.—The Director of the Office
24 of Science and Technology Policy, in coordination
25 with the Administrator of the National Oceanic and

1 Atmospheric Administration, the Administrator of
2 the National Aeronautics and Space Administration,
3 the Director of the National Science Foundation,
4 and the Secretary of Defense, and in consultation
5 with the academic community, the commercial sec-
6 tor, and the advisory group shall develop an inte-
7 grated strategy for solar, solar wind, and geospace
8 observations beyond the lifetime of current assets
9 that considers the provision of solar, solar wind, and
10 geospace measurements and other space weather
11 measurements—

12 “(A) essential to space weather fore-
13 casting; and

14 “(B) important for scientific purposes.

15 “(2) CONSIDERATIONS.—In developing the
16 strategy under paragraph (1), the Director of the
17 Office of Science and Technology Policy shall—

18 “(A) consider small satellite options,
19 hosted payloads, commercial options, inter-
20 national options, and prize authority; and

21 “(B) leverage and build on work conducted
22 before the date of the enactment of this chapter
23 by the National Science and Technology Coun-
24 cil with respect to space weather.

1 “(c) CRITICAL OBSERVATIONS.—In order to sustain
2 current space-based observational capabilities, the Admin-
3 istrator of the National Aeronautics and Space Adminis-
4 tration shall—

5 “(1) in cooperation with the European Space
6 Agency and other international and interagency
7 partners, maintain operations of the Solar and
8 Heliospheric Observatory/Large Angle and Spec-
9 trometric Coronagraph (referred to in this section as
10 ‘SOHO/LASCO’) for as long as the satellite con-
11 tinues to deliver quality observations; and

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

13 “(d) ADDITIONAL CAPABILITY FOR SOLAR IMAG-
14 ING.—

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

19 “(2) OPTIONS.—The Administrator of the Na-
20 tional Oceanic and Atmospheric Administration, in
21 coordination with the Secretary of Defense and the
22 Administrator of the National Aeronautics and
23 Space Administration, shall develop options to build
24 and deploy one or more instruments for near real-
25 time coronal mass ejection imagery.

1 “(3) CONSIDERATIONS.—In developing options
2 under paragraph (2), the Administrator of the Na-
3 tional Oceanic and Atmospheric Administration shall
4 consider commercial solutions, prize authority, aca-
5 demic and international partnerships, microsatellites,
6 ground-based instruments, and opportunities to de-
7 ploy the instrument or instruments as a secondary
8 payload on an upcoming planned launch.

9 “(4) COSTS.—In implementing paragraph (1),
10 the Administrator of the National Oceanic and At-
11 mospheric Administration shall prioritize a cost-ef-
12 fective solution.

13 “(5) OPERATIONAL PLANNING.—The Adminis-
14 trator of the National Oceanic and Atmospheric Ad-
15 ministration shall develop an operational contingency
16 plan to provide continuous space weather forecasting
17 in the event of a SOHO/LASCO failure.

18 “(6) BRIEFING.—Not later than 120 days after
19 the date of enactment of the Space Weather Re-
20 search and Forecasting Act, the Administrator of
21 the National Oceanic and Atmospheric Administra-
22 tion shall provide a briefing to the Committee on
23 Commerce, Science, and Transportation of the Sen-
24 ate and the Committee on Science, Space, and Tech-
25 nology of the House of Representatives on the op-

1 tions for building and deploying the instrument or
2 instruments described in paragraph (2) and the
3 operational contingency plan developed under para-
4 graph (5).

5 “(e) FOLLOW-ON SPACE-BASED OBSERVATIONS.—
6 The Administrator of the National Oceanic and Atmos-
7 pheric Administration, in coordination with the Secretary
8 of Defense, shall develop requirements and a plan for fol-
9 low-on space-based observations for operational purposes,
10 in accordance with the integrated strategy developed
11 under subsection (b).

12 “(f) REPORT.—Not later than 180 days after the
13 date of enactment of the Space Weather Research and
14 Forecasting Act, the Director of the Office of Science and
15 Technology Policy shall submit to the Committee on Com-
16 merce, Science, and Transportation of the Senate and the
17 Committee on Science, Space, and Technology of the
18 House of Representatives a report on the integrated strat-
19 egy under subsection (b), including the plans for follow-
20 on space-based observations under subsection (e).

21 “(g) GROUND-BASED OBSERVATIONS.—The Na-
22 tional Science Foundation, the United States Geological
23 Survey, the Air Force, and where practicable in support
24 of the Air Force, the Navy shall each—

1 “(1) maintain and improve, as necessary and
2 advisable, ground-based observations of the Sun to
3 help meet the priorities identified in section
4 60703(a); and

5 “(2) provide space weather data by means of its
6 set of ground-based facilities, including radars,
7 lidars, magnetometers, radio receivers, aurora and
8 airglow imagers, spectrometers, interferometers, and
9 solar observatories.

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

12 “(1) make available to the public key data
13 streams from the platforms described in subsection
14 (g) for research and to support space weather model
15 development;

16 “(2) develop experimental models for scientific
17 purposes; and

18 “(3) support the transition of the experimental
19 models to operations where appropriate.

20 **“§ 60703. Research and technology**

21 “(a) USER NEEDS.—

22 “(1) IN GENERAL.—The Administrator of the
23 National Oceanic and Atmospheric Administration,
24 the Secretary of the Air Force, and where prac-
25 ticable in support of the Air Force, the Secretary of

1 the Navy, in conjunction with the heads of other rel-
2 evant Federal agencies, shall conduct a comprehen-
3 sive survey to identify and prioritize the needs of
4 space weather forecast users, including space weath-
5 er data and space weather forecast data needed to
6 improve services and inform research priorities and
7 technology needs.

8 “(2) CONTENTS.—In conducting the com-
9 prehensive survey under paragraph (1), the Adminis-
10 trator of the National Oceanic and Atmospheric Ad-
11 ministration, the Secretary of the Air Force, and
12 where practicable in support of the Air Force, the
13 Secretary of the Navy, at a minimum, shall—

14 “(A) consider the goals for forecast lead
15 time, accuracy, coverage, timeliness, data rate,
16 and data quality for space weather observa-
17 tions;

18 “(B) identify opportunities to address the
19 needs identified under paragraph (1) through
20 collaborations with academia, the private sector,
21 and the international community;

22 “(C) identify opportunities for new tech-
23 nologies and instrumentation to address the
24 needs identified under paragraph (1); and

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

3 “(3) PUBLICATION.—Not later than 1 year
4 after the date of the enactment of the Space Weath-
5 er Research and Forecasting Act, and every 3 years
6 thereafter, the Administrator of the National Oce-
7 anic and Atmospheric Administration, the Secretary
8 of the Air Force, and where practicable in support
9 of the Air Force, the Secretary of the Navy, shall—

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

12 “(B) notify the Committee on Commerce,
13 Science, and Transportation of the Senate and
14 the Committee on Science, Space, and Tech-
15 nology of the House of Representatives of the
16 publication under subparagraph (A).

17 “(b) RESEARCH ACTIVITIES.—

18 “(1) BASIC RESEARCH.—The Director of the
19 National Science Foundation, the Administrator of
20 the National Aeronautics and Space Administration,
21 and the Secretary of Defense shall continue to carry
22 out basic research activities on heliophysics, geo-
23 space science, and space weather and support com-
24 petitive, merit-based, peer-reviewed proposals for re-
25 search, modeling, and monitoring of space weather

1 and its impacts, including science goals outlined in
2 Solar and Space Physics Decadal surveys conducted
3 by the National Academy of Sciences.

4 “(2) MULTIDISCIPLINARY RESEARCH.—

5 “(A) FINDINGS.—Congress finds that the
6 multidisciplinary nature of solar and space
7 physics creates funding challenges that require
8 coordination across scientific disciplines and
9 Federal agencies.

10 “(B) MULTIDISCIPLINARY RESEARCH.—

11 The Director of the National Science Founda-
12 tion, the Administrator of the National Oceanic
13 and Atmospheric Administration, and the Ad-
14 ministrator of the National Aeronautics and
15 Space Administration shall pursue multidisci-
16 plinary research in subjects that further our
17 understanding of solar physics, space physics,
18 and space weather.

19 “(C) SENSE OF CONGRESS.—It is the

20 sense of Congress that the Administrator of the
21 National Aeronautics and Space Administration
22 and the Director of the National Science Foun-
23 dation should support competitively awarded
24 Heliophysics Science Centers.

1 “(c) SCIENCE MISSIONS.—The Administrator of the
 2 National Aeronautics and Space Administration shall seek
 3 to implement missions that meet the science objectives
 4 identified in Solar and Space Physics Decadal surveys con-
 5 ducted by the National Academy of Sciences.

6 “(d) RESEARCH TO OPERATIONS; OPERATIONS TO
 7 RESEARCH.—

8 “(1) IN GENERAL.—The Administrator of the
 9 National Aeronautics and Space Administration, the
 10 Director of the National Science Foundation, the
 11 Administrator of the National Oceanic and Atmos-
 12 pheric Administration, the Secretary of the Air
 13 Force, and where practicable in support of the Air
 14 Force, the Secretary of the Navy, shall—

15 “(A) develop a formal mechanism to tran-
 16 sition National Aeronautics and Space Adminis-
 17 tration, National Science Foundation, United
 18 States Geological Survey, Air Force, and Navy
 19 research findings, models, and capabilities, as
 20 appropriate, to National Oceanic and Atmos-
 21 pheric Administration and Department of De-
 22 fense space weather operational forecasting cen-
 23 ters; and

1 “(B) enhance coordination between re-
2 search modeling centers and forecasting cen-
3 ters.

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

13 “(e) TECHNOLOGY DEVELOPMENT.—

14 “(1) FINDINGS.—Congress finds that observa-
15 tions and measurements closer to the Sun or at the
16 Sun-Earth Lagrangian L5 point with advanced in-
17 strumentation would provide for more advanced
18 warning of space weather disturbances (as defined in
19 section 3(a) of the Space Weather Research and
20 Forecasting Act).

21 “(2) TECHNOLOGY AND INSTRUMENTATION DE-
22 VELOPMENT.—The Administrator of the National
23 Aeronautics and Space Administration and the Di-
24 rector of the National Science Foundation shall sup-
25 port the development of technologies and instrumen-

1 tation to improve space weather forecasting lead-
 2 time and accuracy to meet the needs identified by
 3 the Administrator of the National Oceanic and At-
 4 mospheric Administration.

5 **“§ 60704. Space weather data**

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

9 “(1) make space weather related data obtained
 10 for scientific research purposes available to space
 11 weather forecasters and operations centers; and

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

14 “(b) RESEARCH.—The Administrator of the National
 15 Oceanic and Atmospheric Administration shall make space
 16 weather related data obtained from operational forecasting
 17 available for scientific research.”.

18 (b) TECHNICAL AND CONFORMING AMENDMENTS.—

19 (1) REPEAL OF SECTION 809.—Section 809 of
 20 the National Aeronautics and Space Administration
 21 Authorization Act of 2010 (42 U.S.C. 18388) and
 22 the item relating to that section in the table of con-
 23 tents under section 1(b) of that Act (124 Stat.
 24 2806) are repealed.

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

“607. Space weather60701”.

5 **SEC. 3. SPACE WEATHER BENCHMARKS.**

6 (a) DEFINITION OF SPACE WEATHER DISTURB-
 7 ANCE.—In this section, the term “space weather disturb-
 8 ance” includes geo-electric fields, ionizing radiation, iono-
 9 spheric disturbances, solar radio bursts, and upper atmos-
 10 phere expansion.

11 (b) BENCHMARKS.—

12 (1) REVIEW.—The Administrator of the Na-
 13 tional Aeronautics and Space Administration shall
 14 offer to enter into a contract with the National
 15 Academy of Sciences to review the report of the Na-
 16 tional Science and Technology Council entitled
 17 “Space Weather Phase 1 Benchmarks” and dated
 18 June 2018.

19 (2) UPDATES.—The space weather interagency
 20 working group established under section 60701(c) of
 21 title 51, United States Code, shall periodically review
 22 and update the benchmarks described in the report
 23 referred to in paragraph (1), as necessary, based
 24 on—

1 (A) the results of the review that para-
2 graph;

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

6 (C) the evolving needs of entities impacted
7 by space weather disturbances.

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

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

14 (b) SPACE WEATHER HAZARDS.—For purposes of
15 this section, the Administrator of the National Oceanic
16 and Atmospheric Administration, in consultation with the
17 heads of other relevant Federal agencies, shall provide in-
18 formation about space weather hazards to the Secretary
19 of Homeland Security.

20 (c) CRITICAL INFRASTRUCTURE.—The Secretary of
21 Homeland Security, in consultation with sector-specific
22 agencies, the Administrator of the National Oceanic and
23 Atmospheric Administration, and the heads of other rel-
24 evant agencies, shall—

1 (1) include, in meeting national critical infra-
2 structure reporting requirements, an assessment of
3 the vulnerability of critical infrastructure to space
4 weather events, as described by the space weather
5 benchmarks referred to in section 3(b); and

6 (2) support critical infrastructure providers in
7 managing the risks and impacts associated with
8 space weather.

9 (d) PROHIBITION ON NEW REGULATORY AUTHOR-
10 ITY.—Nothing in subsection (c) may be construed to grant
11 the Secretary of Homeland Security any authority to pro-
12 mulgate regulations that was not in effect on the day be-
13 fore the date of enactment of this Act.

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

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

19 (1) assess the vulnerability of the national secu-
20 rity community to space weather events, as described
21 by the space weather benchmarks referred to in sec-
22 tion 3(b); and

23 (2) develop national security mechanisms to
24 protect national security assets from space weather
25 threats.

1 (b) COOPERATION.—The Secretary of Defense, in
 2 consultation with the heads of other relevant Federal
 3 agencies, shall provide information about space weather
 4 hazards to the National Security Council, Director of Na-
 5 tional Intelligence, and heads of Defense Agencies for pur-
 6 poses of this section.

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

8 (a) IN GENERAL.—The Administrator of the Federal
 9 Aviation Administration, in consultation with the heads of
 10 other relevant Federal agencies, shall—

11 (1) assess the safety implications and vulner-
 12 ability of the national airspace system by space
 13 weather events, as described by the space weather
 14 benchmarks referred to in section 3(b);

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

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

24 (b) SPACE WEATHER COMMUNICATION.—The Ad-
 25 ministrator of the Federal Aviation Administration, in

1 consultation with the heads of other relevant Federal
2 agencies, shall develop methods to increase the interaction
3 between the aviation community and the space weather re-
4 search and service provider community.

○