IMPLEMENTING ARRANGEMENT

BETWEEN

THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

OF THE

UNITED STATES OF AMERICA

AND

THE BRAZILIAN SPACE AGENCY (AEB)

OF THE

FEDERATIVE REPUBLIC OF BRAZIL

FOR COOPERATION ON THE SCINTILLATION PREDICTION OBSERVATIONS

RESEARCH TASK

TABLE OF CONTENTS

PREAMBLE

ARTICLE 1 – PURPOSE OF COOPERATION

ARTICLE 2 – RELATIONSHIP TO THE FRAMEWORK AGREEMENT

ARTICLE 3 – RESPONSIBILITIES

ARTICLE 4 – RIGHTS IN AND DISTRIBUTION OF SCIENTIFIC DATA

ARTICLE 5 – POINTS OF CONTACT

ARTICLE 6 – MANAGEMENT AND DOCUMENTATION

ARTICLE 7 – CROSS-WAIVER OF LIABILITY

ARTICLE 8 – REGISTRATION OF SPACE OBJECTS

ARTICLE 9 – RELEASE OF RESULTS AND PUBLIC INFORMATION

ARTICLE 10 – ACCESS TO FACILITIES

ARTICLE 11 – OWNERSHIP OF GOODS AND DATA

ARTICLE 12 – INVESTIGATIONS OF MISHAPS AND CLOSE CALLS

ARTICLE 13 – AMENDMENTS

ARTICLE 14 – ENTRY INTO FORCE, DURATION, AND TERMINATION

PREAMBLE

The National Aeronautics and Space Administration (NASA) of the United States of America and the Brazilian Space Agency (AEB) of the Federative Republic of Brazil, hereinafter referred to collectively as the "Implementing Agencies" and individually as "Party";

Recognizing a long and fruitful history of successful cooperation between the Implementing Agencies;

Considering their mutual interest in cooperating on the Scintillation Prediction Observations Research Task (SPORT);

Recalling the terms of the Framework Agreement between the Government of the United States of America and the Government of the Federative Republic of Brazil on Cooperation in the Peaceful Uses of Outer Space, which was signed on March 19, 2011 and entered into force on April 3, 2018 (hereinafter referred to as the "Framework Agreement");

Have agreed as follows:

ARTICLE 1
PURPOSE OF COOPERATION

The purpose of this Implementing Arrangement is to set forth the respective responsibilities of the Implementing Agencies and the terms and conditions under which they shall cooperate on the SPORT mission.

1.1 SPORT is a CubeSat partnership between NASA, AEB, the Brazilian National Institute for Space Research (INPE), and the Technical Aeronautics Institute (ITA) that will study the preconditions leading to equatorial plasma bubbles in the ionosphere. These bubbles are the primary source of radar reflections in the equatorial F-region ionosphere and cause strong scintillations on radio signals passing through them. SPORT will address two specific questions about these phenomena:

1. What is the state of the ionosphere that gives rise to the growth of plasma bubbles that extend into and above the F-peak at different longitudes?

2. How are plasma irregularities at satellite altitudes related to the radio scintillations observed passing through these regions?

1.2 SPORT will address these questions using both in situ and radio occultation sensors on a 6U CubeSat. The CubeSat will fly a full suite of 6 scientific instruments provided by U.S. institutions, and these will be augmented by Brazilian ground network resources. The SPORT CubeSat will fly in a mid-inclination orbit, and in conjunction with the ground network will probe the ionospheric state in a given longitude sector twice per day. These multiple daily measurements will allow SPORT to track the development of plasma bubbles and scintillations.

1.3 The anticipated launch date is the first half of 2020 and the expected lifetime of the SPORT CubeSat is greater than two years. Approximately one year is required to achieve the mission science goals.

ARTICLE 2
RELATIONSHIP TO THE FRAMEWORK AGREEMENT

This Implementing Arrangement, concluded pursuant to Article 4 (Implementing Arrangements) of the Framework Agreement, incorporates by reference and is subject to the terms and conditions of the Framework Agreement, except as otherwise provided in this Implementing Arrangement.

ARTICLE 3
RESPONSIBILITIES

3.1 NASA Responsibilities

NASA shall use reasonable efforts to carry out the following responsibilities:

(a) Provide the Ion Velocity Meter (IVM) instrument, ensure the instrument's compliance with expected requirements, and deliver the instrument to INPE for integration onto the spacecraft;
(b) Provide the GPS Occultation (CTECS) instrument, ensure the instrument's compliance with expected requirements, and deliver the instrument to INPE for integration onto the spacecraft;
(c) Provide the Electric Field Probe (EFP) instrument, ensure the instrument's compliance with expected requirements, and deliver the instrument to INPE for integration onto the spacecraft;
(d) Provide the Langmuir Probe (LP) instrument, ensure the instrument's compliance with expected requirements, and deliver the instrument to INPE for integration onto the spacecraft;
(e) Provide the Swept Impedance Probe (IP) instrument, ensure the instrument's compliance with expected requirements, and deliver the instrument to INPE for integration onto the spacecraft;
(f) Provide the Fluxgate Magnetometer (MAG) instrument, ensure the instrument's compliance with expected requirements, and deliver the instrument to INPE for integration onto the spacecraft;
(g) Provide instrument data reduction and calibration for IVM, CTECS, EFP, LP, IP, and MAG;
(h) Provide NASA support personnel on-site at INPE/ITA facilities to monitor and support integration and testing activities;
(i) Receive integrated and completed SPORT observatory and confirm compliance with technical specifications;
(j) Coordinate and provide launch and deployment of the SPORT observatory;

(k) Provide INPE and ITA with launch requirements and environments for use in INPE testing;
(l) Provide INPE and ITA with instrument commands;
(m) Provide INPE with processed instrument data;
(n) Provide mirrored data archive and backup data distribution at the Goddard Space Flight Center Space Physics Data Facility;
(o) Conduct system-engineering analysis of SPORT mission; and
(p) Facilitate on-site presence of ITA and INPE personnel to monitor and support transition and launch activities.

3.2 AEB Responsibilities

3.2.1 AEB shall supervise and jointly coordinate with ITA to ensure that ITA will use reasonable efforts to carry out the following responsibilities:

(a) Develop and provide the SPORT 6U CubeSat bus subsystems and components and deliver the CubeSat bus subsystems and components to INPE;
(b) Provide completed and integrated SPORT observatory to NASA for final requirements confirmation and launch coordination; and
(c) Facilitate on-site presence of NASA and related personnel and technical staff of each instrument to monitor and support integration, verification and testing activities.

3.2.2 AEB shall supervise and jointly coordinate with INPE to ensure that INPE shall use reasonable efforts to carry out the following responsibilities:

(a) Receive the SPORT 6U CubeSat bus subsystems and components and provide its integration and testing with ITA personnel with support from the INPE Laboratory of Integration and Testing (LIT) infrastructure and technical staff;
(b) Integrate onto the SPORT 6U CubeSat bus the IVM, CTECS, EFP, LP, IP, and MAG instruments with ITA technical staff and support from LIT infrastructure and technical staff;
(c) Perform environmental and functional tests of integrated SPORT observatory with support from ITA and NASA;
(d) Facilitate on-site presence of NASA and related personnel and technical staff of each instrument to monitor and support integration, verification and testing activities;
(e) With support of ITA technical staff, provide comprehensive science data downlink to ground-based Brazilian facilities;
(f) Conduct system-engineering analysis of ground segment facilities for SPORT operation;
(g) Provide mission operations command and monitoring from Brazilian facilities at Sao Jose dos Campos and Santa Maria through the Brazilian Satellite Control Center (CCS);
(h) Provide relevant ground network observations and associated data for SPORT data analysis architecture; and

(i) Receive, archive and distribute mission data at the Brazilian Monitoring and Study of Space Weather Program (EMBRACE) facilities and disseminate processed data to the scientific community.

3.3 Joint Responsibilities

The Implementing Agencies shall use reasonable efforts to carry out the following responsibilities:

(a) Organize and convene a SPORT Science Team (SST) including NASA, AEB, INPE and ITA representatives; and
(b) Arrange and participate in SPORT science data analyses through the SST.

ARTICLE 4
RIGHTS IN AND DISTRIBUTION OF SCIENTIFIC DATA

The Implementing Agencies, INPE and ITA shall have access to and use of all data generated under this Implementing Arrangement.

4.1 The scientific data generated under this Implementing Arrangement shall be made available for public access as soon as practicable and consistent with good scientific practice.

ARTICLE 5
POINTS OF CONTACT

5.1 The NASA point of contact is:

Dr. J. Daniel Moses
Program Scientist
Heliophysics Division, Science Mission Directorate
NASA Headquarters
300 E St SW
Washington, DC 20546
Phone: (202) 358-0558
E-mail: dan.moses@nasa.gov

5.2 The AEB point of contact is:

Dr. Rodrigo Leonardi
Coordinator
Coordination for Research, Development and Innovation
AEB Headquarters
SPO – Setor Policial, Área 5, Quadra 3, Bloco A
Brasília, DF, 70610 200
Phone: +55 (61) 3411-5206

E-mail: rodrigo.leonardi@aeb.gov.br

5.3 Any change in a Party's respective contact information shall be communicated in writing to the other Party.

ARTICLE 6
MANAGEMENT AND DOCUMENTATION

Each agency shall designate a Project Manager for the purposes of implementing the activities under this Implementing Agreement.

6.1 NASA and AEB Project Managers shall cooperate in the implementation of the Implementing Agencies' activities under this Implementing Arrangement.

6.2 Each of the Implementing Agencies shall manage, in accordance with its own rules and procedures, its activities under this Implementing Arrangement.

6.3 The AEB Project Manager shall supervise and jointly coordinate with INPE and ITA the implementation of their responsibilities in accordance with Article 3.2.

ARTICLE 7
CROSS-WAIVER OF LIABILITY

The Implementing Agencies note that there are multiple launch opportunities for the SPORT observatory through the CubeSat Launch Initiative. As of the date of signature of this Implementing Arrangement, the precise launch vehicle and/or deployment of the SPORT observatory has yet to be determined.

7.1 If the SPORT observatory is launched as a secondary payload on a vehicle not destined for the International Space Station, then the Cross-Waiver of Liability in Article 12 of the Framework Agreement shall be applicable to this Implementing Arrangement.

7.2 If the SPORT observatory is launched as a secondary payload on a vehicle destined for the International Space Station or deployed directly from the International Space Station, the Implementing Agencies will utilize a specific Cross-Waiver of Liability applicable to the International Space Station. In accordance with Articles 4.1 (Implementing Arrangements) and 12.1 (Cross-Waiver of Liability) of the Framework Agreement, the Implementing Agencies hereby agree that the following Cross-Waiver of Liability provision shall apply to this Implementing Arrangement:

7.2.1 The objective of this Article is to establish a cross-waiver of liability in the interest of encouraging participation in the exploration, exploitation, and use of outer space through the International Space Station (ISS). The Implementing Agencies intend that the cross-waiver of liability be broadly construed to achieve this objective.

7.2.2 For purposes of this Article:

(a) The term "Damage" means:

(i) Bodily injury to, or other impairment of health of, or death of, any person;
(ii) Damage to, loss of, or loss of use of any property;
(iii) Loss of revenue or profits; or
(iv) Other direct, indirect, or consequential damage.

(b) The term "Launch Vehicle" means an object, or any part thereof, intended for launch, launched from Earth, or returning to Earth which carries Payloads, persons, or both.

(c) The term "Payload" means all property to be flown or used on or in a Launch Vehicle.

(d) The term "Partner State" includes each Contracting Party for which the *Agreement Among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America concerning Cooperation on the Civil International Space Station* (IGA) has entered into force, pursuant to Article 25 (Entry Into Force) of the IGA or pursuant to any successor agreement. A Partner State includes its Cooperating Agency. It also includes any entity specified in the *Memorandum of Understanding Between the National Aeronautics and Space Administration of the United States of America and the Government of Japan Concerning Cooperation on the Civil International Space Station* ("NASA-Japan MOU") to assist the Government of Japan's Cooperating Agency in the implementation of the NASA-Japan MOU.

(e) The term "Protected Space Operations" means all Launch Vehicle or Transfer Vehicle activities, ISS activities, and Payload activities on Earth, in outer space, or in transit between Earth and outer space in implementation of this Implementing Arrangement, the IGA, MOUs concluded pursuant to the IGA, and implementing arrangements. It includes, but is not limited to:

(i) Research, design, development, test, manufacture, assembly, integration, operation, or use of Launch Vehicles or Transfer Vehicles, the ISS, Payloads, or instruments, as well as related support equipment and facilities and services; and
(ii) All activities related to ground support, test, training, simulation, or guidance and control equipment and related facilities or services.

"Protected Space Operations" also includes all activities related to evolution of the ISS, as provided for in Article 14 (Evolution) of the IGA.

"Protected Space Operations" excludes activities on Earth which are conducted on return from the ISS to develop further a Payload's product or process for use other than for ISS-related activities in implementation of the IGA.

(f) The term "Transfer Vehicle" means any vehicle that operates in space and transfers Payloads or persons or both between two different space objects, between two different

locations on the same space object, or between a space object and the surface of a celestial body. A Transfer Vehicle also includes a vehicle that departs from and returns to the same location on a space object.

7.2.3 Cross-waiver of liability:

(a) Each Party agrees to a cross-waiver of liability pursuant to which each Party waives all claims against any of the entities or persons listed in subparagraphs 7.2.3(a)(i) through 7.2.3(a)(iv) of this Article based on Damage arising out of Protected Space Operations. This cross-waiver shall apply only if the person, entity, or property causing the Damage is involved in Protected Space Operations and the person, entity, or property damaged is damaged by virtue of its involvement in Protected Space Operations. The cross-waiver shall apply to any claims for Damage, whatever the legal basis for such claims, against:

(i) The other Party;
(ii) A Partner State other than the United States of America;
(iii) A Related Entity of any entity identified in paragraph 7.2.3(a)(i) or 7.2.3(a)(ii) of this Article; or
(iv) The employees of any of the entities identified in paragraphs 7.2.3(a)(i) through 7.2.3(a)(iii) of this Article.

(b) In addition, each Party shall, by contract or otherwise, extend the cross-waiver of liability, as set forth in paragraph 7.2.3(a) of this Article, to its Related Entities by requiring them, by contract or otherwise, to:

(i) Waive all claims against the entities or persons identified in paragraph 7.2.3(a)(i) through 7.2.3(a)(iv) of this Article; and
(ii) Require that their Related Entities waive all claims against the entities or persons identified in paragraphs 7.2.3(a)(i) through 7.2.3(a)(iv) of this Article.

(c) For avoidance of doubt, this cross-waiver of liability includes a cross-waiver of claims arising from the *Convention on International Liability for Damage Caused by Space Objects*, which entered into force on September 1, 1972 (hereinafter the *"Liability Convention")*, where the person, entity, or property causing the Damage is involved in Protected Space Operations and the person, entity, or property damaged is damaged by virtue of its involvement in Protected Space Operations.

(d) Notwithstanding the other provisions of this Article, this cross-waiver of liability shall not be applicable to:

(i) Claims between a Party and its own Related Entity or between its own Related Entities;
(ii) Claims made by a natural person, his/her estate, survivors or subrogees (except when a subrogee is a Party to this Implementing Arrangement or is

otherwise bound by the terms of this cross-waiver) for bodily injury to, or other impairment of health of, or death of, such person;

(iii) Claims for Damage caused by willful misconduct;

(iv) Intellectual property claims;

(v) Claims for Damage resulting from a failure of a Party to extend the cross-waiver of liability to its Related Entities, pursuant to paragraph 7.2.3(b) of this Article; or

(vi) Claims by a Party arising out of or relating to the other Party's failure to perform its obligations under this Implementing Arrangement.

(e) Nothing in this Article shall be construed to create the basis for a claim or suit where none would otherwise exist.

(f) In the event of third-party claims which may arise out of, *inter alia,* the *Liability Convention*, the Implementing Agencies shall consult promptly on any potential liability, on any apportionment of such liability, and on the defense of such claim.

ARTICLE 8
REGISTRATION OF SPACE OBJECTS

Pursuant to Article 13 (Registration of Space Objects) of the Framework Agreement, AEB shall request that its Government register the SPORT observatory as a space object.

ARTICLE 9
RELEASE OF RESULTS AND PUBLIC INFORMATION

The Implementing Agencies shall make the results available to the general scientific community, as appropriate and agreed between the Implementing Agencies, in a timely manner.

ARTICLE 10
ACCESS TO FACILITIES

Access by the Implementing Agencies to each other's facilities or property, or to each other's Information Technology (IT) systems or applications, is contingent upon compliance with each other's respective security and safety policies and guidelines including, but not limited to: standards on badging, credentials, and facility and IT system application/access.

ARTICLE 11
OWNERSHIP OF GOODS AND DATA

Unless otherwise agreed in writing, each Implementing Agency shall retain ownership of all goods and data it provides to the other Implementing Agency under the terms of this Implementing Arrangement, without prejudice to any individual rights of ownership of the Implementing

Agencies' respective Related Entities. To the extent feasible, and recognizing that goods and data sent into space or integrated into the other Implementing Agency's goods and data cannot be returned, each Implementing Agency agrees to return the other Implementing Agency's goods and data in its possession at the conclusion of activities under this Implementing Arrangement.

ARTICLE 12
INVESTIGATIONS OF MISHAPS AND CLOSE CALLS

In the case of a close call, mishap or mission failure, the Implementing Agencies agree to provide assistance to each other in the conduct of any investigation, bearing in mind, in particular, the provisions of Article 11 (Transfer of Goods and Technical Data) of the Framework Agreement.

12.1 In the case of activities which might result in the death of or serious injury to persons, or substantial loss of or damage to property as a result of activities under this Implementing Arrangement, the Implementing Agencies agree to establish a process for investigating each such mishap.

ARTICLE 13
AMENDMENTS

This Implementing Arrangement may be amended at any time by written agreement of the Implementing Agencies.

ARTICLE 14
ENTRY INTO FORCE, DURATION, AND TERMINATION

14.1 This Implementing Arrangement shall enter into force upon the date of the final signature and shall remain in force through December 31, 2025. Either Party may terminate it by notifying the other Party in writing at least 60 days in advance.

14.2 In addition to the continuing obligations undertaken by the Implementing Agencies in Article 17.3 (Termination) of the Framework Agreement, the obligations of the Implementing Agencies set forth in Article 4 (Rights In and Distribution of Scientific Data) and Article 7 (Cross-Waiver of Liability) of this Implementing Arrangement shall continue to apply, notwithstanding termination or expiration of this Implementing Arrangement.

FOR THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION:

James W. Morhard
Deputy Administrator

Place: WASHINGTON DC

Date: March 18, 2019

FOR THE BRAZILIAN SPACE AGENCY:

Carlos Augusto Teixeira de Moura
President

Place: Washington, DC

Date: 18 - Março - 2019