

**SPACE COOPERATION**

**Global Precipitation Measurement  
Mission**

**Agreement Between the  
UNITED STATES OF AMERICA  
and JAPAN**

Effected by Exchange of Notes at  
Washington December 19, 2008

*with*

**Memorandum of Understanding**



NOTE BY THE DEPARTMENT OF STATE

Pursuant to Public Law 89—497, approved July 8, 1966  
(80 Stat. 271; 1 U.S.C. 113)—

“ . . .the Treaties and Other International Acts Series issued under the authority of the Secretary of State shall be competent evidence . . . of the treaties, international agreements other than treaties, and proclamations by the President of such treaties and international agreements other than treaties, as the case may be, therein contained, in all the courts of law and equity and of maritime jurisdiction, and in all the tribunals and public offices of the United States, and of the several States, without any further proof or authentication thereof.”

## JAPAN

### Space Cooperation: Global Precipitation Measurement Mission

*Agreement effected by exchange of notes at  
Washington December 19, 2008;  
Entered into force December 19, 2008.  
**With memorandum of understanding.***

***NOTE: This publication adds memorandum of understanding to TIAS 08-1219.***

**MEMORANDUM OF UNDERSTANDING**  
**BETWEEN**  
**THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION**  
**OF THE UNITED STATES OF AMERICA**  
**AND**  
**THE JAPAN AEROSPACE EXPLORATION AGENCY**  
**FOR**  
**COOPERATION ON THE**  
**GLOBAL PRECIPITATION MEASUREMENT PROGRAM**

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## **Preamble**

The National Aeronautics and Space Administration of the United States of America (NASA) and the Japan Aerospace Exploration Agency (JAXA) (hereinafter jointly referred to as the "Parties") having expressed their mutual interest in a Global Precipitation Measurement (GPM) mission (hereinafter referred to as the "Program");

Desiring to pursue cooperation in the observation of precipitation and the water cycle from space for peaceful purposes; and

Recalling the Agreement Between the Government of the United States of America and the Government of Japan Concerning Cross-Waiver of Liability for Cooperation in the Exploration and Use of Space for Peaceful Purposes of April 24, 1995 (the "Cross-Waiver Agreement"), the Exchange of Notes of the same date between the Government of the United States of America and the Government of Japan concerning subrogated claims and the Agreed Minutes concerning the Cross-Waiver Agreement of December 8, 2000;

Recalling the agreement between the Government of the United States of America and the Government of Japan concerning the cooperation between NASA and JAXA on the Formulation Activity of the GPM Program, effected by exchange of notes at Washington on June 10, 2005, and section 1 of the Memorandum of Understanding Between NASA and JAXA for Cooperation on the Formulation Activity of the GPM Program, signed June 21 and 27, 2005;

Recalling that JAXA shall provide one H-IIA (2 metric ton class) vehicle (H-IIA 202) as prescribed in V (JAXA Responsibilities) of the Arrangement Between NASA and the Japan Aerospace Exploration Agency (JAXA) Regarding NASA's Provision of Shuttle Launch Services for JEM in Exchange for JAXA's Provision of Goods and Services, signed January 23 and 25, 2008 and the Implementing Arrangement (IA) between NASA and the Ministry of Education, Culture, Sports, Science, and Technology of Japan (MEXT) Regarding NASA's Provision of Shuttle Launch Services for JEM in Exchange for MEXT's Provision of Goods and Services, signed January 22 and 23, 2008;

Pursuant to paragraph 1 of the agreement between the Government of the United States of America and the Government of Japan concerning the cooperation between NASA and JAXA on the Development and Operations Activity of the Global Precipitation Measurement mission, effected by exchange of notes at Washington December 19, 2008 (hereinafter referred to as the "Exchange of Notes");

Have agreed as follows:

## I – Purpose

The purpose of this Memorandum of Understanding (hereinafter referred to as the “MOU”) is to establish the terms and conditions under which NASA and JAXA will cooperate in the joint development, launch, operations and use of the Program for peaceful purposes. The Program consists of NASA and JAXA assets operating in partnership with other earth-observing satellites and instruments to produce global precipitation science data.

## II – Definitions

1. The **GPM mission** comprises all space and ground segment components provided by GPM Partners including the core observatory provided by NASA and JAXA, Low-Inclination Observatory data provided by NASA, and GCOM-W1 data provided by JAXA.
2. A **GPM Partner** is a country or agency with a space segment (i.e., Core Observatory and constellation satellite) contribution to the international GPM effort and jointly recognized by NASA and JAXA.
3. **GPM data** consist of all standard data products as defined by the Joint Precipitation Measurement Missions (PMM) Science Team.
4. **All Instrument Level 1 data** is the level 1 data of the GPM Core Observatory, Low Inclination Observatory, GCOM-W1, and all other GPM Partners’ microwave sensors.

## III – Mission Description

1. The GPM mission is an international collaboration that includes NASA, JAXA and additional international partners. The objective is to advance precipitation measurements from space by deploying the space-borne Core Observatory as a reference standard to unify a constellation of microwave sensors to provide next generation global precipitation measurements for scientific research and societal applications. The GPM Core Observatory data will be combined on the ground with data from other constellation satellites participating as part of the Program.
2. The primary GPM scientific objectives are: (1) to establish new standards for precipitation measurement capabilities from space, (2) to advance understanding of the global water/energy cycle variability and freshwater availability, (3) to improve weather

forecasting skills through frequent and accurate measurements of instantaneous rain rates and rain-affected radiances, (4) to advance climate modeling and prediction capabilities through improved knowledge of precipitation microphysics, atmospheric latent heat release, and surface water fluxes, and (5) to advance prediction capabilities for flood, drought, freshwater resources and other hydrological applications through improved sampling and coverage of high-resolution precipitation estimates.

3. The GPM Core Observatory consists of a NASA-provided Core Spacecraft, the NASA-provided GPM Microwave Imager (GMI) instrument, and the JAXA-provided Dual-frequency Precipitation Radar (DPR) instrument consisting of the Ku-band radar (KuPR) and Ka-band radar (KaPR). The development of the DPR instrument is based on the joint research between JAXA and the National Institute of Information and Communications Technology (NICT) of Japan.

4. a. The Core Observatory is planned for launch in 2013 using an H-IIA launch vehicle for a direct injection into a circular orbit at a nominal initial altitude of 407 km with an inclination of 65 degrees. Launch shall be from the Yoshinobu Launch Complex of the Tanegashima Space Center (TNSC) located on the Tanegashima Island of Japan (hereinafter referred to as the “launch site”).

b. After the successful separation from the launch vehicle and completion of a checkout period, the GPM Core Observatory is planned to be operated for three years at a nominal altitude of 407 km. The GPM Core Observatory shall be operated by NASA utilizing its Tracking and Data Relay Satellite System (TDRSS) for command, control, and data acquisition. Science data received at the NASA Goddard Space Flight Center (GSFC) shall be processed by the NASA Precipitation Processing System (PPS) and JAXA GPM data system.

#### **IV – NASA Responsibilities**

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

1. **Development of Instruments**

Design, develop, produce, calibrate and space-qualify a GPM Microwave Imager (GMI) which, together with the JAXA-provided Dual-frequency Precipitation Radar (DPR), is primary to the GPM mission.

2. **Development of the GPM Core Spacecraft and integration of the Instruments**

a. Design, develop, produce, and space-qualify the GPM Core Spacecraft;

b. Integrate the GMI instrument and the DPR with the GPM Core Spacecraft to create the GPM Core Observatory;



- c. Provide JAXA with two duplicate spacecraft interface simulators designed to verify the DPR-to-spacecraft interfaces with regard to command and data handling functions, bus hardware, and the other spacecraft functions;
  - d. Provide JAXA with a GPM core spacecraft-to-DPR drill template and a set of test/flight kinematic mounts;
  - e. Obtain all necessary national and international radio frequency approvals for in-orbit operations and for ground stations within the territorial jurisdiction of the United States; and
  - f. Provide necessary arrangement and support for JAXA engineers supporting integration and testing of the DPR, including office space, computer linkage, and attending regular briefing meetings.
3. Shipping and Launch Site Activities
- a. Provide all shipping and handling of the GPM Core Observatory (including test and support equipment needed at the launch site) until the GPM Core Observatory is handed over to JAXA for H-IIA integration;
  - b. Perform all required post-shipping tests of the GPM Core Observatory at the launch site;
  - c. Perform the radio-frequency end-to-end test at the launch site for command and telemetry flow;
  - d. Support JAXA in its application for hydrazine fuel special loading license, as necessary;
  - e. Provide the hydrazine and its fueling and pressurization of the Propulsion Subsystem of the GPM Core Observatory;
  - f. Support the mutually-agreed-upon integration and test program between the GPM Core Observatory and the H-IIA launch vehicle;
  - g. Determine GPM Core Observatory readiness for launch;
  - h. Maintain a launch team at the launch site to perform all GPM Core Observatory-related launch activities; and
  - i. Pack and ship all materials to be returned from the launch site to GSFC.
4. Operation after the separation of the GPM Core Observatory from the Launch Vehicle and throughout the operational period

- a. Monitor and control the GPM Core Observatory after separation from the launch vehicle;
- b. Utilize and operate the TDRSS and GSFC institutional support facilities for communications, tracking, telemetry and command links to the GPM Core Observatory;
- c. Utilize and operate the Mission Operations Center (MOC) at GSFC to support the operation of the GPM Core Observatory and to assist with successful mission control;
- d. Perform an initial on-orbit check-out of the GPM Core Observatory with JAXA supporting the planning and data analysis for the DPR checkout, including initial DPR calibrations;
- e. Plan and conduct the operation of the GPM Core Observatory including the DPR with the support of JAXA for DPR planning and DPR engineering data analysis for the 3-year mission life or until termination of the mission;
- f. Plan and conduct calibration and validation to verify performance of NASA-provided instruments;
- g. In the MOC, monitor the health and safety parameters of the DPR and report to JAXA any anomalies found;
- h. Provide web-accessible monitoring system for all DPR housekeeping data, and other data in real-time, necessary to check the DPR status; and
- i. Operate the GPM Core Observatory after the 3 year mission life in the event of extended duration.

5. Data Systems

- a. Receive Core Observatory and Low Inclination Observatory instrument data plus housekeeping data at White Sands Complex (WSC) and transfer them to the GSFC MOC;
- b. Design, develop, and operate the NASA Precipitation Processing System (PPS) to capture, produce, distribute, and archive all GPM data in accordance with X (Data Distribution);
- c. Provide all DPR housekeeping data, DPR Level Zero Processing (LZP) data and other data in real-time, necessary to check the DPR status;

- d. Provide all DPR housekeeping data, DPR Level Zero Processing (LZP) data, and the other necessary data in near-real-time to perform data processing at the JAXA GPM data system;
- e. Provide the GMI instrument Level 1 data and the other necessary data used to obtain this Level 1 data from Level 0 data in near-real-time, and other higher level products to JAXA when available;
- f. Provide JAXA with NASA algorithm for GMI Levels 1 and 2 as used to generate standard products, which will not be distributed to a third party beyond NASA and JAXA;
- g. Provide JAXA with NASA's catalogue data; and
- h. Provide the conduit to the GSFC MOC via the PPS for JAXA to interface with the MOC for special operations, command loads, external calibration requests and configuration changes for the DPR.

#### 6. Low-Inclination Observatory Data

Make Low-Inclination Observatory level 1 data available for GPM mission in accordance with X (Data Distribution). The provision of the Low-Inclination Observatory data for the GPM mission starts at the time that initial on-orbit calibration and validation finishes, or 6 months earlier than the GPM Core Observatory launch, whichever is later, and ends when the Core Observatory data collection ends, or the Low-Inclination Observatory data collection ends, whichever is earlier.

#### 7. Safety

- a. Assist JAXA in its efforts to comply with U.S. safety regulations;
- b. Comply with JAXA's Launch Vehicle Payload Safety Standard and the technical standards for high pressure gas equipment for space use, with assistance from JAXA; and
- c. Comply with JAXA's Launch safety requirements and safety instructions, and comply with Japanese safety regulations, with assistance from JAXA.

#### 8. Other

- a. Develop and maintain documentation to be detailed in the GPM Project Implementation Plan (PIP), e.g.:
  - DPR-to-Core Spacecraft Interface Control Document (DPR ICD),
  - Safety Data Package (SDP)-Phase 0/1, 2, 3.

- b. Jointly develop NASA-JAXA Joint Requirements document and Core Observatory to H-IIA Launch Vehicle Interface Control Document (ICD);
- c. Hold meetings, videocons/telecons, and reviews periodically in the United States of America;
- d. Exchange personnel and information with JAXA, as needed, to address engineering, operations, and science issues;
- e. Comply with NASA requirements for Space Asset protection, Information Technology security, and Communications security with assistance from JAXA at the Tanegashima Space Center for launch operations;
- f. Ensure all equipment that requires electrical power be compatible to power services at the host's facilities, and;
- g. Lead the joint development and configuration control of the GPM PIP.

## **V – JAXA Responsibilities**

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

1. Development of DPR Instrument
  - a. Design, develop, produce, calibrate, and space-qualify the DPR for subsequent delivery to GSFC at the mutually agreed date for integration and tests at GSFC;
  - b. Provide all shipping and handling of the DPR from Japan to the integration site-at GSFC, including the lifting, handling, and test and support equipment required for integration and testing at GSFC;
  - c. Perform all post-shipping tests of the DPR at GSFC;
  - d. Support a mutually-agreed-upon integration and test program of the DPR with the GPM Core Observatory at GSFC and at the launch site;
  - e. Pack and ship the DPR ground support equipment (GSE) to be returned from GSFC to Japan; and
  - f. Provide DPR information required to generate the Safety Data Package (SDP).
2. Launch Vehicle, Launch Site Facilities and Launch Site Activities for the GPM Core Observatory

- a. Procure the H-IIA launch service with a 4S type fairing and 1194-M type Payload Adapter Fitting (PAF) for a dedicated launch of the GPM Core Observatory and provide the Launch Site Facilities and support for the GPM Core Observatory;
- b. Deliver a test PAF with a Marmon Clampband Assembly including test pyrotechnics and provide technicians to install and properly configure the Marmon Clampband Assembly and pyrotechnic set up, for NASA to perform structural tests of the GPM Core Spacecraft, and to perform fit and separation shock tests of the GPM Core Observatory at GSFC in the mutually agreed-upon timeframe;
- c. Deliver the flight PAF to GSFC to perform an interface fit test with the GPM Core Observatory and transport the flight PAF to the launch site for subsequent integration to the GPM Core Observatory;
- d. Integrate the GPM Core Observatory with the H-IIA launch vehicle with NASA support in all joint activity between the GPM Core Observatory and the Launch Vehicle, including the encapsulation process;
- e. Provide NASA with Self Contained Atmosphere Protection Equipment (SCAPE) suits with compatible Radio Frequency (RF) communication equipment for the hazardous hydrazine fuel loading/unloading operations;
- f. Provide necessary support to NASA for transportation of the GPM Core Observatory and associated GSE at the launch site;
- g. Provide real-time launch operation information to the designated NASA data pick-up point at the launch site;
- h. Support the GPM Core Observatory RF end-to-end test(s) which shall include obtaining all the necessary radio frequency approvals required by the Government of Japan;
- i. Apply for the GPM propulsion system special loading license with support from NASA;
- j. Support NASA in the hydrazine fueling and pressurization;
- k. Include a NASA representative as part of the Launch Team by providing a position in the Range Control Center (RCC) who will be part of the Go/No-Go launch decision process on launch day; and
- l. Launch the GPM Core Observatory to the mutually-agreed-upon insertion orbit and deploy the GPM Core Observatory from the launch vehicle.

3. Operation after the Separation of the GPM Core Observatory

- a. Support planning and data analysis for DPR initial on-orbit check;
- b. Integrate DPR operation requests and support NASA's planning and conducting of DPR operations including data analysis to verify proper DPR instrument operations; and
- c. Plan and conduct calibration and validation to verify performance of the DPR.

4. Data Systems

- a. Design, develop, and operate the JAXA GPM data system to capture, produce, distribute and archive all GPM data in accordance with X (Data Distribution);
- b. Provide the DPR instrument Level 1 data and the other necessary data used to obtain this Level 1 data from Level 0 data in near-real-time, and other higher level products to NASA when available;
- c. Provide NASA with JAXA algorithm for DPR Levels 1 and 2 as used to generate standard products, which will not be distributed to a third party beyond NASA and JAXA; and
- d. Provide NASA with JAXA's catalogue data.

5. GCOM-W1 data

Make GCOM-W1 level 1 data available for the GPM mission in accordance with X (Data Distribution). The provision of the GCOM-W1 Observatory data for the GPM mission starts at the time that initial on-orbit calibration and validation finishes, or 6 months earlier than the GPM core observatory launch, whichever is later, and ends when the core observatory data collection ends, or the GCOM-W1 Observatory data collection ends, whichever is earlier.

6. Safety

- a. Comply with NASA's safety requirements and safety instructions and comply with U.S. safety regulations, with assistance from NASA.
- b. Assist NASA in its efforts to comply with JAXA launch vehicle safety requirements.

7. Other
  - a. Develop and maintain documentation to be detailed in the GPM PIP, e.g.:
    - DPR Instrument Operation Documents (Instrument User's Guide),
    - GPM Mission Operation Interface Specification (MOIS) between NASA PPS/MOC and JAXA Earth Observation Resource Center (EORC).
  - b. Jointly develop NASA-JAXA Joint Requirements document and Core Observatory to H-IIA Launch Vehicle Interface Control Document (ICD);
  - c. Hold meetings, videocons/telecons, and reviews periodically in Japan;
  - d. Exchange personnel and information with NASA as needed, to address engineering, operations, and science issues;
  - e. Provide necessary support to NASA on arrangements related to radio-frequency interference issues;
  - f. Comply with NASA requirements for Space Asset protection, Information Technology security, and Communications security, with assistance from NASA at the Tanegashima Space Center for launch operations;
  - g. Ensure all equipment that requires electrical power be compatible to power services at the host's facilities; and
  - h. Provide support to NASA in developing the GPM PIP.

## **VI – Program and Project Management**

1. NASA shall establish a GPM Project Office headed by a Project Manager, who shall be responsible for the GPM core observatory design, fabrication, test, calibration, integration, delivery, on-orbit verification, operation, and GPM data processing. The NASA Program Executive shall be responsible for the U.S. GPM Program, including funding advocacy and interfaces with supporting NASA Programs.
2. JAXA shall establish a GPM/DPR Project Team headed by a Project Manager, who shall be responsible for the DPR instrument design, fabrication, test, calibration, integration, delivery and on-orbit verification, operation, and GPM data processing. The JAXA GPM/DPR Project Manager shall be responsible for the Japanese GPM Program, including funding advocacy and interfaces with supporting JAXA Programs and launch services procurement.
3. The NASA Project Manager shall prepare, in close coordination with the JAXA Project Manager, a GPM Project Implementation Plan (PIP), which shall then be subject to approval by the NASA and JAXA Project Managers. This GPM PIP addresses the

following areas of responsibility for each Party: project management, schedules, interface requirements, design analysis, integration and testing, data processing, launch operations, flight and mission operations, and GPM data processing. In case of conflict between the GPM PIP and the MOU, the MOU shall prevail. Changes to the GPM PIP require the approval of the respective Project Managers.

4. A GPM NASA-JAXA Joint Steering Group (JSG) shall be established by both Parties to provide overall program guidance, to review NASA-JAXA project implementation status, and to resolve issues beyond the managerial scope of the respective Project Managers. The GPM NASA-JAXA JSG shall include the NASA Science Mission Directorate Earth Science Division Director, the JAXA Space Applications Mission Directorate Program Management and Integration Department Director, the NASA GPM Program Executive, The JAXA GPM/DPR Project Manager, the NASA GPM Project Manager, the NASA and JAXA GPM Program and Project Scientists, and such other members as agreed. Decisions at the JSG shall be taken by consensus.

## **VII – Scientific Investigations**

1. In order to meet the science goals of the GPM program, NASA and JAXA shall establish a NASA-selected Precipitation Measurement Missions (PMM) Science Team, JAXA-selected PMM Science Team, and a Joint PMM Science Team (comprising 6-7 scientists from each PMM Science Team, selected by the respective Program Scientists). NASA and JAXA shall have the PMM Science Teams act as advisory bodies to the NASA and JAXA Program/Project Management for the definition and maintenance of science requirements for GPM, including the GPM algorithm development, GPM data systems, and GPM data products.

2. Both Parties ensure each other and acknowledge as follows: The U.S.-Japan Joint PMM Science Team is responsible for advising the NASA and JAXA Program/Project Management on defining the joint scientific requirements for the GPM mission. The U.S.-Japan Joint PMM Science Team shall recommend the science requirements for the JAXA and NASA data systems and for the joint algorithm and validation of the GPM data products.

Specifically, the U.S.-Japan Joint PMM Science Team has responsibility to:

- a. Recommend the overall scientific requirements for the GPM mission in terms of the GPM mission science, GPM Core Observatory performance and functions, GPM Core Observatory operation, instrument operation and calibration of the GPM Core Observatory, data processing, joint algorithm development and validation, and all levels of data products generated by the NASA and JAXA data systems;
- b. Recommend the procedures for data processing, updating of algorithms for GPM data, and the GPM Core Observatory operation plan;



- c. Approve the release of the GPM data to the U.S. and Japan PMM science team members, selected investigators, GPM partners, and the general GPM data users.
- d. Ensure that both the U.S. PMM Science Team and the Japan PMM Science Team have access through their respective data systems to ground-based measurements collected by each Party for purpose of evaluating GPM data products;
- e. Resolve science-related issues arising from both PMM Science Teams;
- f. Work to increase the level of cooperation in all research activities between the U.S. and Japan PMM Science Teams and with other international project groups related to GPM mission;
- g. Approve activities of GPM Data Working Group (GDaWG) related to data and data system issues; and
- h. Hold a U.S./Japan meeting at least annually to review the status of activities and goals enumerated in the preceding section 2a through 2h, and such other business as may be brought to the attention of the Joint PMM Science Team.

### **VIII – GPM Mission Governance**

1. NASA and JAXA shall establish a GPM mission coordinating group for GPM partners to assist in coordinating GPM global activities. This group will be composed of GPM partners approved by NASA and JAXA. The group will be jointly chaired by NASA and JAXA.
2. Membership in the GPM mission coordinating group shall consist of constellation satellite contributors.
3. NASA or JAXA shall make arrangements with other GPM partners in order to ensure the following:
  - a. GPM partners shall make available to NASA, JAXA and all other GPM partners as appropriate at least their instrument Level 1 data.
  - b. GPM partners shall provide necessary technical information to NASA, JAXA and all other GPM partners as appropriate to enable the use of this instrument Level 1 data.

4. All partnerships are established through MOUs with either NASA or JAXA. NASA and JAXA will establish all GPM partnerships, and NASA and JAXA will advise and concur on each Party's partner solicitations. These MOUs will include language describing mission governance and data distribution.

### **IX – Financial Arrangements**

The Parties shall each bear the costs of discharging their respective responsibilities, including travel and subsistence of personnel and transportation of all equipment and other items for which it is responsible. Further, it is understood that the ability of the Parties to carry out their obligations is subject to the availability of appropriated funds. Should either Party encounter budgetary problems which may affect the activities to be carried out under this MOU, the Party encountering the problems shall notify and consult with the other Party as soon as possible.

### **X – Data Distribution**

NASA and JAXA, as the leading partners in the GPM mission, agree and shall ensure that:

1. All instrument Level 1 data will be made available among GPM partners, consistent with each partner's data distribution policies.
2. All instrument Level 1 data will be made available as soon as the initial on-orbit calibration and validation finishes.
3. No additional latency outside of download, processing, and network access shall be added to the time at which GPM partners can use all instrument Level 1 data.
4. GPM data and all instrument Level 1 data will be available to users for research, operational, applications, and outreach purposes. For purposes other than hereinbefore provided, the specified data will be made available in accordance with terms and conditions to be established by the Party that conveys the data to an external entity.
5. The analyzed results from GPM data shall be made available to the general scientific community through publication in appropriate journals or presentations at scientific conferences as soon as possible and consistent with standard scientific practices. Such publications shall credit the NASA/JAXA GPM project and the approved GPM partners. In the event that reports or publications are copyrighted, all approved GPM partners shall be granted a royalty free right under the copyright to reproduce, use and distribute such copyrighted work for their purposes by the copyright holder.

## **XI – Coping with Anomaly in Development Phase and Schedule Impacts**

1. Should JAXA find or be informed by NASA of an anomaly of the DPR, after delivery of the DPR to NASA, JAXA shall repair, improve, or exchange the necessary parts for substitutes after consultation with NASA. If JAXA deems that such an anomaly may adversely affect the GPM development schedules, JAXA shall inform and consult with NASA without delay.
2. Should NASA find an anomaly of the GPM core observatory that impacts DPR development and operations, NASA shall inform and consult with JAXA without delay.
3. Should a delay in the development of the GPM launch vehicle services or other issue be deemed to affect adversely the GPM development schedules, JAXA shall inform and consult with NASA without delay.
4. Should a delay in the development of the GPM core observatory or other issue be deemed to affect the DPR development schedules and/or launch schedule, NASA shall inform and consult with JAXA without delay.
5. Should a delay in the development of the DPR be deemed to affect the GPM Core Observatory development schedule, JAXA shall inform and consult with NASA without delay.

## **XII – Coping with Launch Anomaly**

Should NASA or JAXA find a launch anomaly, that Party shall inform the other Party without delay and both Parties shall make every effort to resolve it.

## **XIII – Coping with Anomaly in Flight**

1. Should NASA or JAXA find a DPR in-flight anomaly of the DPR, that Party shall inform the other Party without delay and both Parties shall make every effort to resolve it.
2. Should NASA find a GPM Core Spacecraft or other instrument in-flight anomaly impacting DPR operations, NASA shall inform and consult with JAXA without delay and both Parties shall make every effort to resolve it.

## **XIV – Mishap Investigation**

In the case of a mishap or mission failure, the Parties agree to provide assistance to each other in the conduct of any investigation, bearing in mind, in particular, the provisions of XVII (Transfer of Goods and Technical Data). 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 Agreement, the Parties agree to establish a process for investigating each such mishap as part of their program/project implementation agreements.

#### **XV – Facilitation of Movement of Persons and Goods**

Each of the Parties shall facilitate the movement of persons and goods necessary to comply with this MOU into and out of its territory, subject to its laws and regulations.

#### **XVI – Ownership of Equipment**

Equipment provided by NASA pursuant to this MOU shall remain the property of NASA. Equipment provided by JAXA pursuant to this MOU shall remain the property of JAXA. Each Party agrees to return any of the other Party's equipment in its possession to the other Party at the conclusion of the project.

#### **XVII – Transfer of Goods and Technical Data**

The Parties are obligated to transfer only those technical data (including software) and goods necessary to fulfill their respective responsibilities under this MOU, in accordance with the following provisions, notwithstanding any other provisions of this MOU:

1. All activities under this MOU shall be carried out in accordance with the Parties' national laws and regulations, including their export control laws and regulations and those pertaining to the control of classified information.
2. The transfer of technical data for the purpose of discharging the Parties' responsibilities with regard to interface, integration, and safety shall normally be made without restriction, except as required by paragraph 1, above.
3. All transfers of goods and proprietary or export-controlled technical data are subject to the following provisions. In the event a Party or its related entity (defined for the purpose of XVII (Transfer of Goods and Technical Data) as contractors, subcontractors, grantees, or cooperating entities, or any lower tier contractor, subcontractor, grantee, or cooperating entities of a Party) finds it necessary to transfer goods or to transfer proprietary or export controlled technical data, for which protection is to be maintained, such goods shall be specifically identified and such proprietary or export-controlled technical data shall be marked. The identification for goods and the marking on proprietary or export-controlled technical data shall indicate that such goods and technical data shall be used by the receiving Party and its related entities only for the purposes of fulfilling the receiving Party's or related entities' responsibilities under this MOU, and that such goods and technical data shall not be disclosed or retransferred to any other entity without the prior written permission of the furnishing Party or its related entity. The receiving Party or

related entity shall abide by the terms of the notice and protect any such identified goods and marked proprietary technical data or marked export-controlled technical data from unauthorized use and disclosure. The Parties to this MOU shall cause their related entities to be bound by the provisions of XVII (Transfer of Goods and Technical Data) related to use, disclosure, and retransfer of identified goods and marked technical data through contractual mechanisms or equivalent measures.

4. All goods exchanged in the performance of this MOU shall be used by the receiving Party or related entity exclusively for the purposes of the MOU. Upon completion of the activities under the MOU, the receiving Party or related entity shall return or, at the request of the furnishing Party or its related entity, otherwise dispose of all goods and marked proprietary technical data or marked export-controlled technical data provided under this MOU, as directed by the furnishing Party or related entity.

### **XVIII – Intellectual Property Rights**

1. Nothing in this MOU shall be construed as granting, either expressly or by implication, to the other Party any rights to, or interest in, any inventions or works of a Party or its related entities made prior to the entry into force of, or outside the scope of, this MOU, including any patents (or similar forms of protection in any country) corresponding to such inventions or any copyrights corresponding to such works.

2. Any rights to, or interest in, any invention or work made in the performance of this MOU solely by one Party or any of its related entities, including any patents (or similar forms of protection in any country) corresponding to such invention or any copyright corresponding to such work, shall be owned by such Party or related entity.

3. It is not anticipated that there will be any joint inventions made in the performance of this MOU. Nevertheless, in the event that an invention is jointly made by NASA and/or its related entities or by JAXA and/or its related entities in the performance of this MOU, the Parties shall, in good faith, consult and agree within 90 calendar days as to:

- (a) the allocation of rights to, or interest in, such joint invention, including any patents (or similar forms of protection in any country) corresponding to such joint invention;
- (b) the responsibilities, costs, and actions to be taken to establish and maintain patents (or similar forms of protection in any country) for each such joint invention; and
- (c) the terms and conditions of any license or other rights to be exchanged between the Parties or granted by one Party to the other Party.

4. For any jointly authored work by the Parties, if the Parties decide to register the copyright in such work, they shall, in good faith, consult and agree as to the responsibilities, costs, and actions to be taken to register copyrights and maintain copyright protection (in any country).

5. Subject to the provisions of XVII (Transfer of Goods and Technical Data) and XX (Public Information), each Party shall have an irrevocable royalty free right to reproduce,

prepare derivative works, distribute, and present publicly, and authorize others to do so on its behalf, any copyrighted work based on or containing GPM data or final results produced as a result of the GPM Mission for its own purposes, regardless of whether the work was created solely by, or on behalf of, the other Party or jointly with the other Party.

### **XIX – Duty-Free Entry**

To the maximum extent permitted by relevant laws and regulations, each Party shall facilitate free customs clearance and waiver of all applicable customs duties and taxes for goods necessary for the implementation of this MOU. In the event that any customs duties or taxes of any kind are nonetheless levied on such equipment and related goods, such customs duties or taxes shall be borne by the Party of the country levying such customs duties or taxes.

### **XX – Public Information**

1. The Parties retain the right to release public information regarding their own activities under this MOU. The Parties shall coordinate with each other in advance concerning releasing to the public information that relates to the other Party's responsibilities or performance under this MOU.
2. The Parties shall make the final results obtained from the GPM Mission available to the general scientific community through publication in appropriate journals or by presentations at scientific conferences as soon as possible and in a manner consistent with good scientific practices. The Parties shall acknowledge in such publications and presentations that the results are obtained from the GPM Mission, which is a joint cooperative activity between the Parties.
3. The Parties acknowledge that the following data or information does not constitute public information and that such data or information shall not be included in any publication or presentation by a Party under XX (Public Information) without the other Party's prior written permission: (1) data furnished by the other Party in accordance with XVII (Transfer of Goods and Technical Data) of this MOU which is export-controlled, classified, or proprietary; or (2) information about an invention of the other Party before a patent application has been filed covering the same, or a decision not to file has been made.

### **XXI – Liability and Risk of Loss**

The Agreement Between the Government of the United States of America and the Government of Japan Concerning Cross-Waiver of Liability for Cooperation in the Exploration and Use of Space for Peaceful Purposes of April 24, 1995 (hereinafter referred to as "Cross-Waiver Agreement"), the Exchange of Notes of the same date between the

Governments of the United States of America and Japan concerning subrogated claims and the Agreed Minutes of December 8, 2000, concerning the Cross-Waiver Agreement shall apply to activities under this MOU.

#### **XXII – Registration**

NASA shall request that relevant U.S. authorities register the GPM spacecraft as a space object in accordance with the 1974 Convention on the Registration of Objects Launched into Outer Space (the Registration Convention). However, exercise of jurisdiction and control over named space objects shall be subject to the relevant provisions of this MOU. Registration pursuant to XXII (Registration) shall not affect the rights or obligations of the Parties under the 1972 Convention on International Liability for Damage Caused by Space Objects.

#### **XXIII – Settlement of Disputes**

The Parties agree to consult promptly with each other on all issues involving interpretation, implementation, or performance of this MOU. An issue concerning the interpretation, implementation, or performance of this MOU shall first be referred to the NASA GPM Program Executive and JAXA GPM/DPR Project Manager, then to the JSG, and then to the NASA Associate Administrator for Science Mission Directorate and the JAXA Executive Director in charge of the GPM Program for resolution. If they are unable to come to agreement on any issue, then the dispute shall be referred to the NASA Administrator and JAXA President or their designated representatives for joint resolution.

#### **XXIV – Amendment**

This MOU may be amended by the written agreement of the Parties.

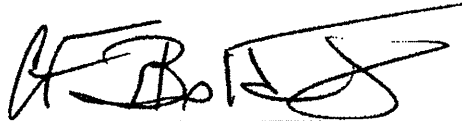
#### **XXV – Entry into Force, Duration and Termination**

1. This MOU shall enter into force upon its signature by the Parties, and shall remain in force, provided the Exchange of Notes remains in force, until one year after data collection from the GPM Core Observatory ceases or until five (5) years after Core Observatory science operations commence, or December 31, 2023, whichever comes first.
2. The duration of this MOU may be extended by written agreement of the Parties, provided the Exchange of Notes remains in force.
3. The obligations of the Parties set forth in the provisions in IX (Financial Arrangements), XVII (Transfer of Goods and Technical Data), XVIII (Intellectual Property Rights), and XXI (Liability and Risk of Loss) shall continue to apply after the expiration or termination of this MOU.

4. Notwithstanding termination of this MOU, the LZP data and standard products produced by each Party shall be archived by each Party for at least 10 years after the termination of this MOU, unless otherwise agreed to by the Parties.

5. Either Party may terminate this MOU at any time upon giving at least six (6) months written notice to the other Party of its intent to terminate. In the event of termination, the Parties shall endeavor to reach agreement on terms and conditions to minimize negative impacts of such termination on the other Party.

FOR THE NATIONAL  
AERONAUTICS AND SPACE  
ADMINISTRATION OF THE  
UNITED STATES OF AMERICA:



Charles F. Bolden, Jr.  
Administrator

June 30, 2009  
Date

FOR THE JAPAN  
AEROSPACE  
EXPLORATION AGENCY:



Keiji Tachikawa  
President

July 30, 2009  
Date