# No. 50934

# United States of America
# and
# Japan

**Memorandum of Understanding between the National Aeronautics and Space Administration of the United States of America and the National Space Development Agency of Japan for Joint Development of the Tropical Rainfall Measuring Mission (with appendix). Washington, 20 October 1995**

**Entry into force:** *20 October 1995 by signature, in accordance with article XXII*

**Authentic text:** *English*

**Registration with the Secretariat of the United Nations:** *United States of America, 18 June 2013*

# États-Unis d'Amérique
# et
# Japon

**Mémorandum d'accord entre l'Administration nationale de l'aéronautique et de l'espace des États-Unis d'Amérique et l'Agence nationale de développement spatial du Japon pour le développement conjoint de la mission pour la mesure des précipitations tropicales (avec appendice). Washington, 20 octobre 1995**

**Entrée en vigueur :** *20 octobre 1995 par signature, conformément à l'article XXII*

**Texte authentique :** *anglais*

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[ ENGLISH TEXT – TEXTE ANGLAIS ]

# SPACE COOPERATION

## Tropical Rainfall Measuring Mission

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

Effected by Exchange of Notes at
Washington May 30, 1997

*and*

Memorandum of Understanding
Signed at Washington October 20, 1995
*with*
Agreement amending Memorandum of Understanding
Signed at Tokyo June 2, 1997

*and*

Agreement Extending the Agreement of May 30, 1997
Effected by Exchange of Notes at
Washington May 28, 2002
and
Agreement Extending the Agreement of May 30, 1997
Effected by Exchange of Notes at
Washington May 22, 2008

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## Preamble

The National Aeronautics and Space Administration of the United States of America (hereinafter referred to as "NASA) and the National Space Development Agency of Japan (hereinafter referred to as "NASDA"), together hereinafter referred to as "the Parties",

Recognizing that tropical rainfall is essential to the distribution of water throughout the Earth system, and over two-thirds of the worldwide precipitation occurs in the tropics, releasing the energy that helps to power the global atmospheric circulation, which shapes both weather and climate;

Recognizing that tropical rainfall also plays a key role in the sporadic "El Nino" climate anomalies that trigger floods and droughts around the world, and measuring tropical rainfall from the Earth's surface is difficult because of its high variability, and moreover, surface observations are not feasible over the vast ocean and jungle regions of the tropics;

Noting that advances in technology now make it possible to obtain these essential measurements from space;

Considering that in 1972, the first imaging microwave radiometer orbits on NASA's Nimbus-5 gave evidence that instantaneous rainfall rates could be measured from space, and in the early 1980's, the Communications Research Laboratory of Japan (hereinafter referred to as "CRL") developed an airborne microwave radar and radiometer system to investigate the interference of rain in satellite-to-ground communications;

Recalling that in 1986, the Tropical Rainfall Measuring Mission (TRMM) Science Steering Group, a team of experts in atmospheric, oceanic, and remote sensing sciences, began investigating the scientific justification and implementation process of a satellite mission to study systematically tropical rainfall, and in early 1987, NASA, NASDA, and CRL instituted a study of the feasibility of implementing TRMM as a joint space project;

Considering that the resulting three-year TRMM mission is a part of a systematic, integrated program designed to increase the extent and accuracy of rainfall and latent heat measurements and provide strides in weather and climate research;

Noting that the goals of TRMM are as follows:

(1) to advance the Earth System Science objective of understanding the global energy and water cycle by means of providing distributions of rainfall and inferred heat over the global tropics;

(2) to understand the mechanisms through which tropical rainfall and its variability influence global circulation and to improve our ability to model these processes in order to predict global circulation and rainfall variability at monthly and longer time scales; and

(3) to evaluate a space-based system for rainfall measurement; and

Noting that NASA and NASDA will share data from TRMM for research, operational and other uses under the terms of the International Earth Observing system (IEOS) Data Exchange Principles (DEP) contained in the Appendix to this MOU;

Considering the above mentioned circumstances, have agreed as follows:

## Article 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 NASDA will cooperate in the joint development, launch, operations and use of the Tropical Rainfall Measuring Mission (hereinafter referred to as "TRMM") for peaceful purposes.

## Article II - Mission Description and Participation

1. The primary objective of the TRMM Project is to measure the distribution and variability of tropical rainfall and latent heat releases on a monthly basis for three years to advance the scientific understanding of the global energy and water cycles.

2. Accordingly, an observatory (hereinafter referred to as the "TRMM Observatory"), consisting of a satellite to be provided by NASA, carrying four NASA-provided instruments and one NASDA-provided instrument, is planned for launch in 1997. The TRMM Observatory shall be launched using an H-II launch vehicle provided by NASDA for injection into a near-circular orbit at a nominal initial altitude of 380 kilometers with an inclination of 35 degrees. Launch shall be from the Yoshinobu Launch Complex of NASDA's Tanegashima Space Center located on the Tanegashima Island of Japan (hereinafter referred to as the "launch site").

3. After an initial checkout period and a reduction in altitude to 350 kilometers, the TRMM Observatory is planned to be operated for three years at a nominal altitude of 350 km. The TRMM Observatory shall be operated by NASA utilizing its Tracking and Data Relay Satellite System (TDRSS) for command, control, data acquisition, and routine tracking. Science data received at the NASA Goddard Space Flight Center (GSFC) shall be processed by the TRMM Science Data and Information System (TSDIS) and the Earth Observing System Data and Information System (EOSDIS). Science data will also be sent to the NASDA Earth Observation Center and processed by the TRMM Data Processing System and Earth Observation Information