JAXA's examples of International Mechanisms for Cooperation in the Peaceful Exploration and Use of Outer Space

Japan Aerospace Exploration Agency (JAXA)

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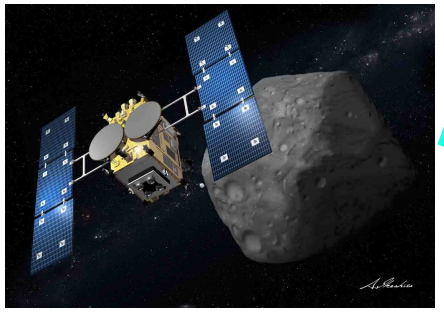
1. “Hayabusa2” Project

Mission Outline

Launch
Dec, 2014

Earth Swing-by
Dec. 2015

Asteroid (1999JU3)
Arrival
June. 2018



•asteroid remote sensing
•small rovers and lander release
•multiple samplings

impactor
release

crater
forming

sampling from
artificial crater

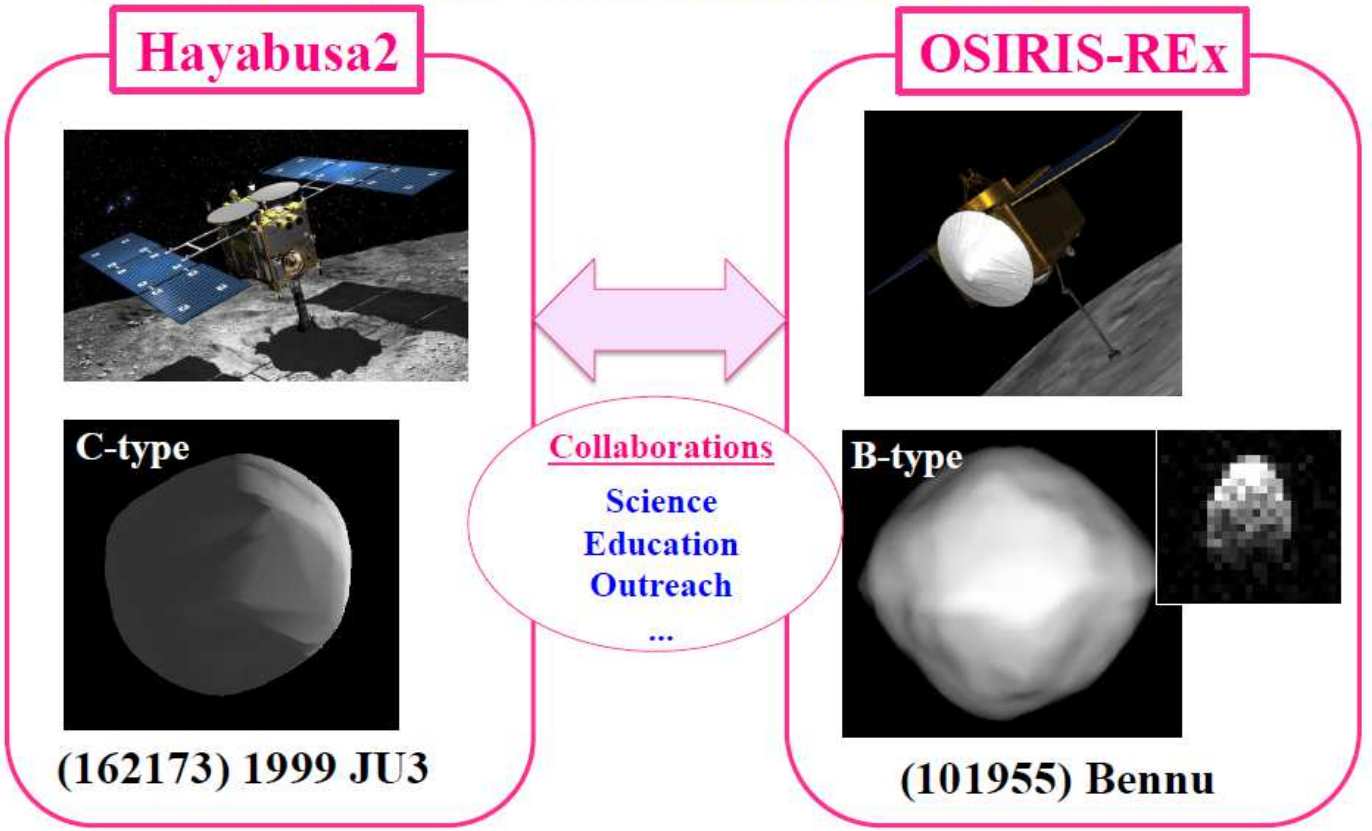
Departure
Dec. 2019

Earth Return
Dec. 2020

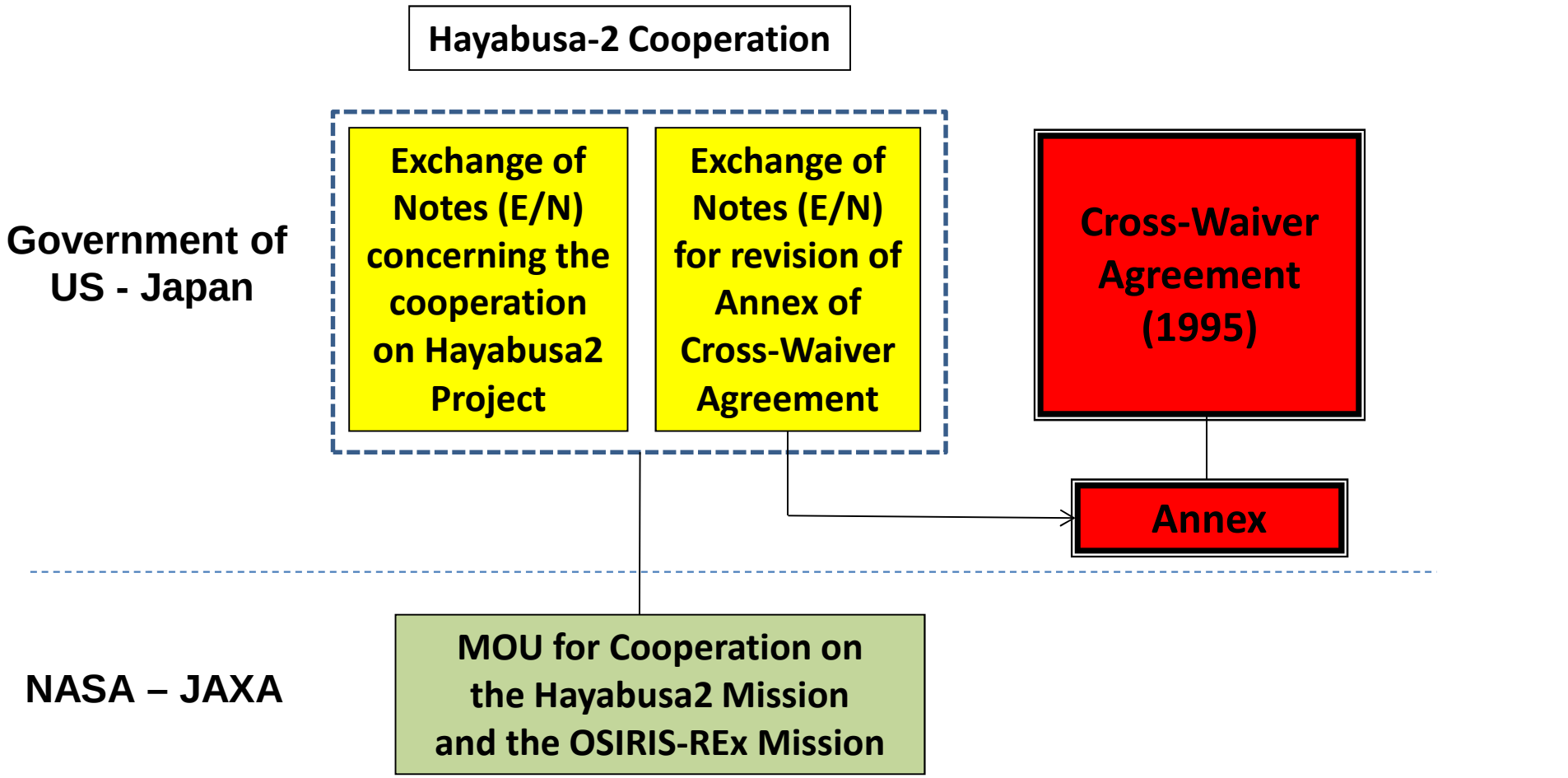
JAXA-NASA Cooperation

- NASA provides support for Hayabusa2 including the **NASA Deep Space Network** which enables advanced and reliable mission operations.
- **Asteroid sample exchange and joint participation** during key mission phases **with NASA' s asteroid explorer OSIRIS-REx**, JAXA and NASA will mutually maximize their missions' results.

Collaboration with OSIRIS-REx Team



Japan-US Cooperative Framework



Characteristics

- In the case of long-term projects with huge costs and unpredictable R&D risks, there may be some risks of cancelation of project, owing to domestic political change, budgetary problems, technical difficulties, and so on.

- In such cases, consultation mechanisms through diplomatic channel under Government level Arrangement (E/N, etc) may effectively work with a view to finding a mutually acceptable solution.

2. Sentinel Asia

Community

Space Community

APRSAF*

- Data Provision
- Promotion of Utilization
- Capacity Building

Disaster Management Community

ADRC**
Member Countries

- Utilization (User)

Sentinel Asia

Joint Project Team (JPT)

Join Project Team consists of total 96 organizations including 81 organizations of 25 countries/region and 15 international organizations as of January 2015.

JAXA is the secretariat of JPT.

International Community

**UN / ESCAP UN / OOSA
ASEAN AIT etc.**

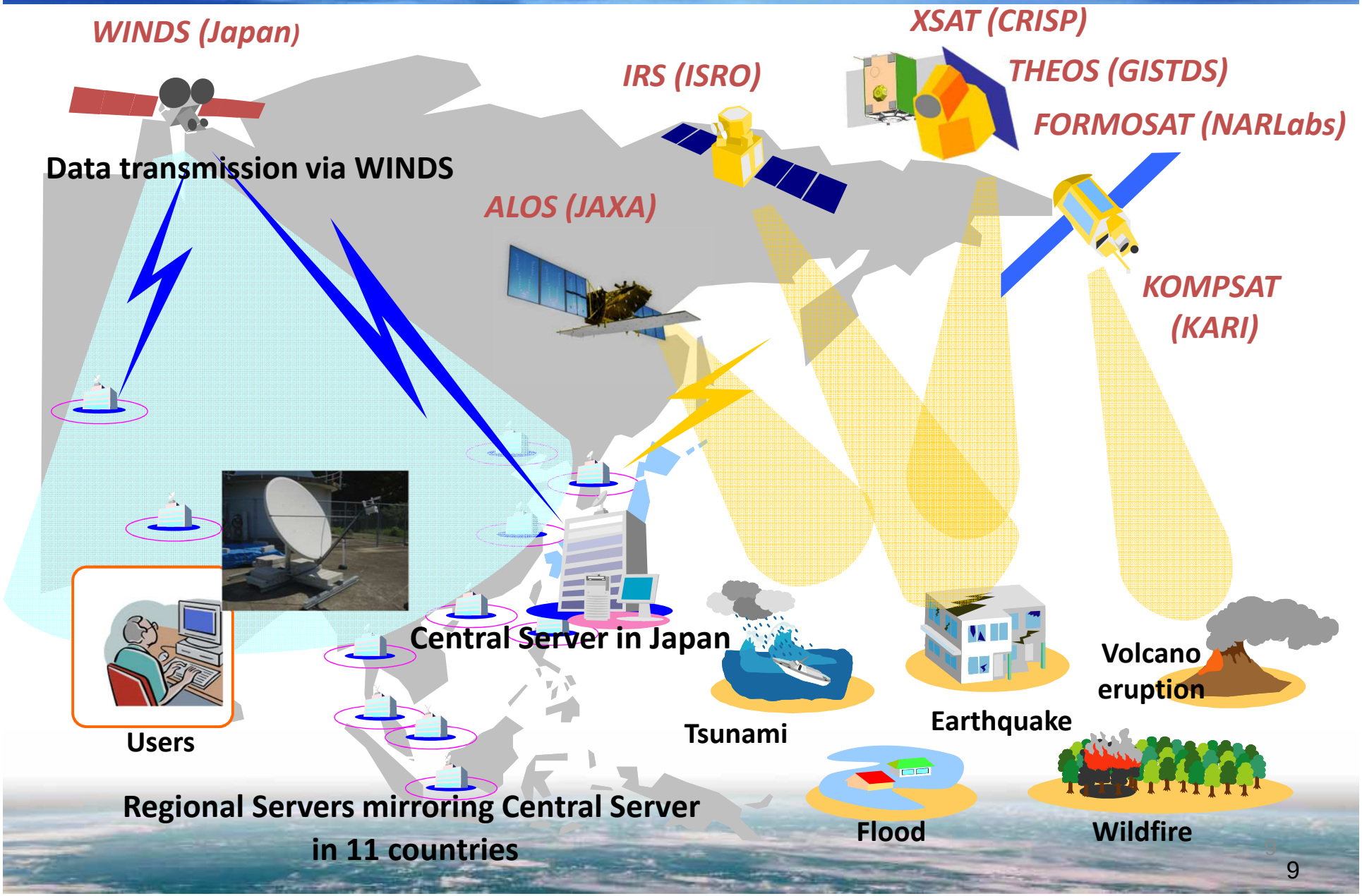
- International Cooperation

* Asian-Pacific Regional Space Agency Forum

** Asian Disaster Reduction Center

JPT meeting Yangon, Myanmar in November 2014

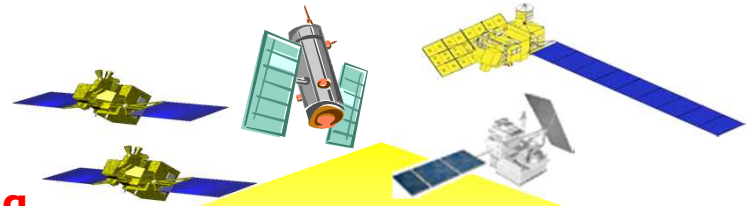
Emergency Observation using WINDS (STEP 2)



Concept of Step 3 (2013 onwards)

Positioning satellites

Earth observation satellites



Communication satellites

Information delivering to personal terminals

Monitoring

Information/data transmission

Pre-disaster

Mitigation:

Community education

Preparedness:

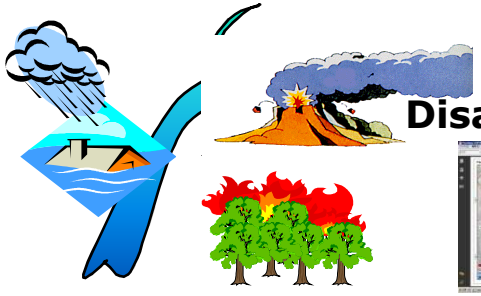
Hazard map

Early warning system

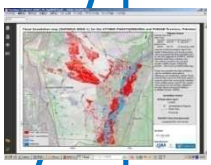
Just after disaster

Response:

Emergency observation



Disaster information



Post-disaster

Recovery:

Monitoring

Information sharing
(Web-GIS)

Human network
Capacity Building, Outreach

Capacity Building and Human Network

A good human network is the foundation of the project

The 9th Sentinel Asia System Operation Training by JAXA, hosted by BPPT in October 2012

The 8th Sentinel Asia System Operation Training by JAXA, hosted by AIT in February 2012

Document Structure

Terms of Reference on the Joint Project Team for Sentinel Asia Step3 (Step3 TOR)

https://sentinel.tksc.jaxa.jp/

Sentinel Asia Step3 Implementation Plan (Step3 IP)

Procedure of Emergency Observation
- Procedure of Emergency Observation Request (EOR Procedure)
- Procedure of Data Provider Node (DPN Procedure)
- Procedure of Data Analysis Node (DAN Procedure)

Sentinel Asia (SA) to Charter Interface Control Document (RSCSA-IC0014)

Cooperative Initiative

Characteristics

- Flexible and voluntary-basis framework attracted many developing countries to join the project and they can gain much benefits driven by satellite utilization.

  (In the case of Sentinel Asia, Joint Project Team consists of total 96 organizations.)

- Simple document structure can effectively adapt to the latest technical advancement (STEP1 -> STEP2 -> STEP3).

3. Cooperation on the high-quality protein crystal growth experiment on board the Japanese Experiment Module “KIBO”

Kibo-ABC

Asian Beneficial Collaboration through "Kibo" Utilization

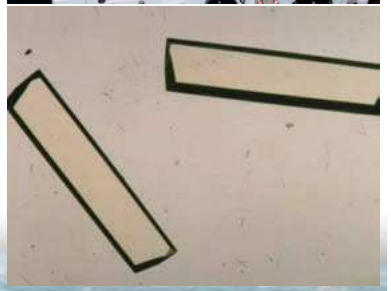
- **Established in 2012, in relation to the activity of APRSAF.**
- **Objectives to share benefits of ISS/Kibo;**
  - **Gateway to the Kibo Utilization**
    Increase the awareness of ISS/Kibo's benefits, and expand collaboration with nations in Asia and the Pacific.
  - **Capacity Building**
    Provide micro gravity opportunities for students and young researchers which could lead to develop real space experiments/activities onboard Kibo.

High-quality protein crystallization in KIBO

The high-quality protein crystal growth experiment on board “KIBO” was carried out as bilateral cooperation between JAXA and the Government of Malaysia.

1. Overview

- Malaysian researchers participated in six experiments from 2009 to 2012.
- Main purpose was to train Malaysian researchers for space experiments.
- Solved 16 proteins 3D structure, which potentially result to new enzyme development.
- Graduated 2 Ph.D., and 4 MS through this project.



2. Main responsibilities

(1)JAXA

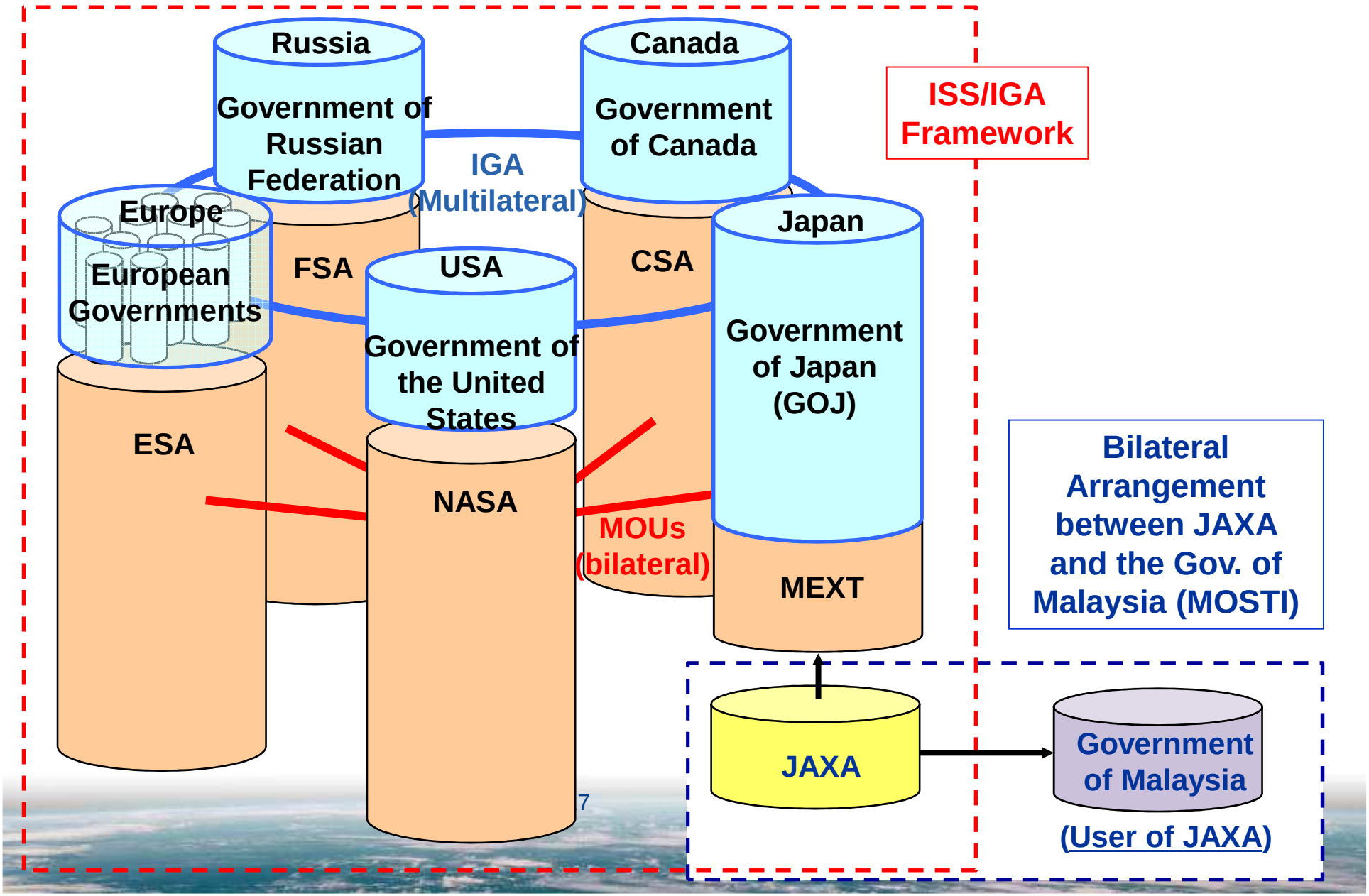
➢provide ANGKASA with environmental conditions for protein crystal growth experiment’s utilization onboard “KIBO”

➢ conduct the experiment

(2) Malaysia

➢provide JAXA with Samples of the Malaysian side.

JAXA-Malaysia Cooperative Framework

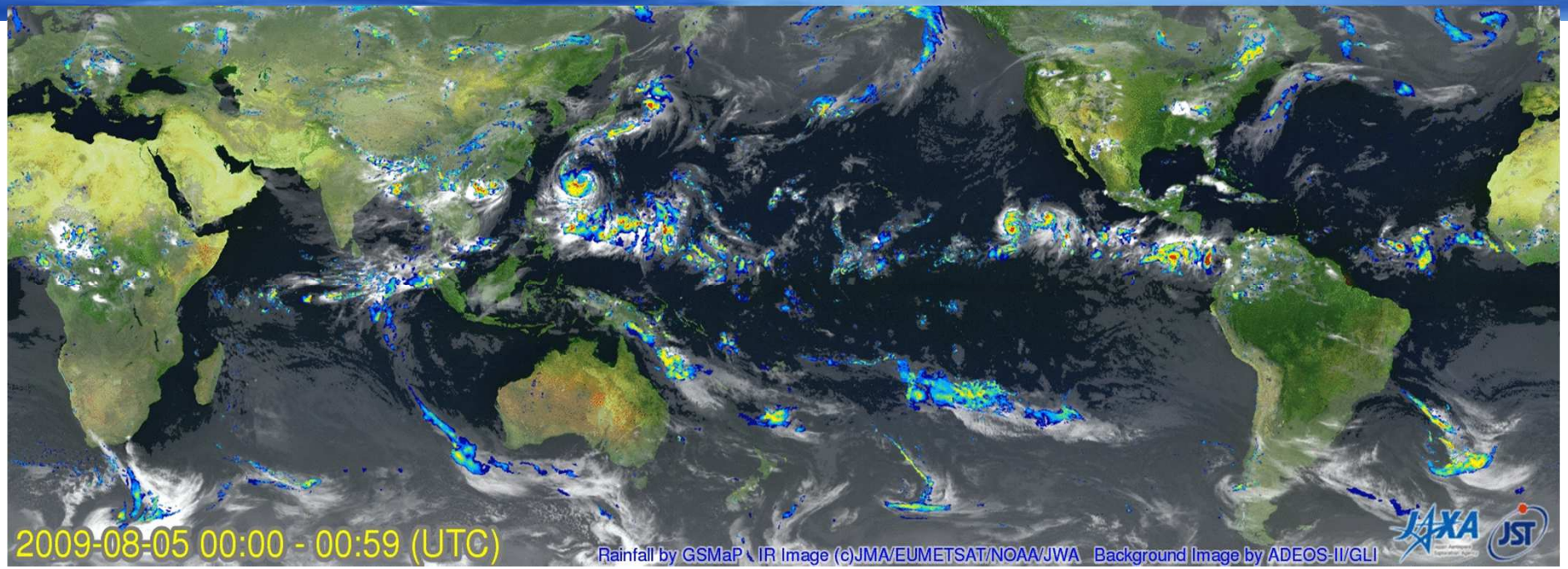


Characteristics

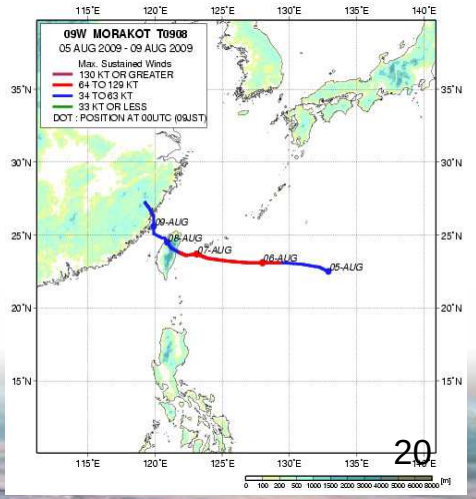
- As in the case of Sentinel Asia, this cooperation was originally driven by APRSAF (Kibo-ABC).
- At the same time, this cooperation is executed in line with the intergovernmental agreement (ISS IGA).
- In the bilateral arrangement between JAXA and the Government of Malaysia, the Government of Malaysia is regarded as a user of JAXA, and shall be subject to ISS IGA (the experiment and its results shall be used exclusively for peaceful purposes, etc).
- In this arrangement, necessary conditions for user side, such as intellectual property rights (attributed to the Malaysian side), are also defined.

4. Cooperative project between JAXA and the Asian Development Bank (ADB)

Global Rainfall Map in Near Real Time



Typhoon MORAKOT (09W): Aug. 5 – 10, 2009 (Big impact in Chinese Taipei)



- Global rainfall map merging GPM GMI, TRMM, AMSR2 and other satellite information
- Available 4-hour after observation, hourly update
- 0.1-degree latitude/longitude grid

http://sharaku.eorc.jaxa.jp/GSMaP/

Joint Project on Flood Risk Management

Participating countries: Bangladesh, the Philippines, and Viet Nam

JAXA contributes to flood forecasting using space technology

Global Satellite Mapping of Precipitation (GSMaP)

Precipitation Radar
Microwave Radiometer

Calibration

Rain Gauges

Flood Forecasting System

SMS distribution system

Input to the flood forecasting model of GSMaP Precipitation data calibrated by rain gauges on the ground

Flood Warning

- **Improvement of the flood warning lead time from 3 days to 5 days.**
  →Mitigation of loss of assets and damages
- **Direct distribution of information to the people by using cellular phones**

Implementation Framework (JAXA/ADB)

Counterpart Agency

Philippines
Bangladesh
Viet Nam

- Coordinate with related organizations and communities for pilot projects
- Assign TA project director to supervise and coordinate TA activities
- Participate in workshops, trainings, dialogues
- Apply TA outputs and evaluate the usefulness

Executing Agency: ADB

- Coordinate the whole TA
- Engage and supervise consultants

Engagement and supervision

Partnership Agreement

Implementing Agency: JAXA

- Study and verify the **calibration method of GSMaP**
- **Technical assistance** for applying sat-data to the existing system
- **Direction** to the consultants, coordination with stakeholders

Support

Consultants (international, national)

- General design, GSMaP calibration
- IF **system development**
- **Applying calibrated GSMaP to the existing system**
- **Developing WebGIS and SMS distribution system**

Advice

Advisory Committee: Univ. Tokyo etc.

- Advise to design and develop the systems applying remote sensing, GIS and ICT

Characteristics

- JAXA has the technical expertise of satellite data application and the calibration method of GSMaP, but does not have the expertise of design and development of flood forecasting system, nor applying calibrated data to the system, which are to be undertaken by consultants.
- ADB supervises consultants and provides funding to them.
- User entities in each countries apply flood warning system and distribute information to the people.
- These different roles and expertise are taken into consideration in the Implementation Framework.

Summary

- OST Article 1 facilitates and encourages international cooperation, while a type of “the exploration and use of outer space” “scientific investigation” and their international cooperation mechanisms have been greatly changing and expanding for 50 years.

- We hope to facilitate exchange of information of “best practices” of each countries in each contexts, having in mind to consider what is the best mechanisms for future generation space exploration, sustainable development goals, and so on.

Thank you very much for your attention.