

JAXA's Capacity Building Activities in Asia-Pacific Region

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ABSTRACT:

Japan Aerospace Exploration Agency (JAXA) started its capacity building activities for the Asia-Pacific region in 1995 in cooperation with Asian Institute of Technology (AIT), in Bangkok, Thailand. In addition, JAXA has been carrying out two different pilot projects with Thailand and Indonesia as a part of its capacity building activities. Main objectives of these projects are (1) to provide necessary technical know-how to RS & GIS users in the region as a contribution by the Government of Japan to capacity building recognized in WSSD*, EO Summit**, CEOS***, GEOSS**** and UNWCDR*****; (2) to use Japanese satellite data archived for more than last 25 years for sustainable development, planning and monitoring purposes in the region; (3) to develop in-house capacities of prospective users of the region by working on project-based training programs; and (4) to identify future space technology needs in the region for better service of forthcoming Japanese satellite programs. Through the pilot project with AIT, JAXA has so far succeeded in training 1,006 government employees of the region for last 11 years from 1995 to 2005.

It is expected that JAXA's capacity building activities will be more active with the data acquired with the Advanced Land Observing Satellite (ALOS) which was launched by JAXA's H-IIA launch vehicle on January 24, 2006. The ALOS aims at obtaining data useful for topography mapping, local environment observation and disaster monitoring. Furthermore, in February 2006, JAXA started the Joint Project Team Meeting (JPTM) for establishing a disaster management support system, called "Sentinel Asia", involving the regional space agencies, disaster management organizations and international entities. Capacity building activities in the region is considered as one of the focuses of JAXA's activities for next 10 years.

WSSD*: World Summit on Sustainable Development (known as the Johannesburg Summit held in South Africa in 2002)

EO Summit**: Earth Observation Summit (so far held in Washington D.C, Tokyo and Brussels, Belgium, since 2003)

CEOS***: Committee on Earth Observation Satellites

GEOSS****: Global Earth Observation System of Systems

UNWCDR*****: United Nations World Conference on Disaster Reduction (held in Kobe, Japan, in 2005)

1. WSSD Type-II Partnership Activities

At the WSSD held in September 2002 in South Africa, the following three activities were proposed by the Government of Japan and they were registered as the "WSSD Type-II Partnership Activities" of Japan: (1) Capacity Building Activities through AIT in Bangkok, Thailand; (2) Pilot Project with Thailand's GISTDA (Geo-Informatics and Space Technology Development Agency); and (3) Pilot Project with Indonesia's LAPAN (National Institute of Aeronautics and Space). "Asia-Pacific Earth Observation Pilot Project" is the registered title.

Since 1995, JAXA has been entrusting responsibility to AIT of providing technical training on Remote Sensing (RS), Geographical Information System (GIS) and Global Positioning System (GPS) in the Asia-Pacific region. As a result of the 11-year (1995~2005) training activities fully supported by JAXA and carried out by AIT, the number of trainees reached 1,006 from 27 countries.

The contents of the training programs at AIT have, of course, changed by the request in the age.

2. JAXA/AIT's 2005 Training Programs

To accomplish the above-mentioned 4 objectives of JAXA's

capacity building activities, JAXA/AIT conducted the training programs consist of the following 3 different types of activities during the JFY2005 (1 April 2005 – 31 March 2006):

1. Caravan Training Programs;
2. Mini-Projects; and
3. Workshops.

2.1 Caravan Training Programs

The purposes of the Caravan Training Programs are to promote basic technology, to transfer knowledge and to publicize JAXA activities by conducting those training programs in various countries of the region.

The Caravan Training Programs' distinctive characteristics is having a larger audience compared with inviting trainees AIT so that these are considered cost-effective. Topics are selected after considerable discussions with a respective RS/GIS organization in each country.

Characteristics of Caravan Training Programs are;

1. Duration: 5 days
2. Trainees: Technicians and middle level managers of respective agencies
3. Number of Countries Caravan Training Conducted: 2

4. Expected Number of Trainees: At least 25 participants in each country

For 2005, JAXA/AIT conducted the caravan training in the following 2 countries:

1. Sri Lanka
Dept. in charge within Government of Sri Lanka:
Survey Department
Title of Training: "Coastal Mapping using High Resolution Satellite Data"
Number of Participants: 28
2. Lao PDR
Ministry in charge within Government of Lao PDR:
Ministry of Science & Technology
Title of Training: "RS & GIS for Watershed Mgt."
Number of Participants: 38

2.2 Mini-Projects

Mini-projects are designed to contribute to JAXA's capacity building for the Asia-Pacific region through training programs and field work in a topic most relevant to each participating countries.

Mini-projects are also considered as an object-oriented training in RS, GIS and GPS. Participants are requested to carry out a project suitable to their needs. Consequently, necessary basic training and field work are carried out in order to achieve their respective goals.

Unlike conventional training programs focused on a particular topic, this new method can facilitate the participants to work in their own areas for a considerable amount of time and apply RS in their day to day work.

As unique characteristics of Mini-Projects, its duration is 9 weeks through the year as below:

1. First Term: 5-week classes and research work at AIT
2. Second Term: 1-week fieldwork at participant's own country
3. Third Term: 3-week Final-Report Making at AIT

For 2005 Mini-Projects, the number of trainees participated in the 2005 object-oriented mini-projects were 23 from 9 organizations.

8 out of 9 mini-projects were focusing on disaster management. Only exception which was unrelated to disaster management was Philippine Rice Research Institute (PhilRice)'s mini-project titled "Paddy Area Mapping and Yield Estimation."

The followings are the list of the 2005 Mini-Projects:

- (1) Bangladesh: Space Research and RS Organization (SPARRSO) "Flood Mitigation"
- (2) Cambodia: Department of Land Management "Land Use Planning Resource Management"
- (3) Cambodia: Dept. of Geography "Drought, Flood"
- (4) Nepal: Survey Department "Urban Planning for Earthquake Disaster Management"
- (5) Philippines: National Mapping and Resource Information Authority (NAMRIA) "Landslide, Flood"
- (6) Philippine: Rice Research Institute (PhilRice) "Paddy Area

Mapping and Yield Estimation."

- (7) Sri Lanka: Central Engineering Consultancy Bureau (CECB) "Landslide"
- (8) Vietnam: Space Technology Application Center (STAC), Institute of Physics "Mangrove Forest Management for Flood Mitigation"
- (9) Vietnam: Department of Dyke Management "Landslide"

2.3 2005 Workshops

JAXA conducted two workshops through AIT in 2005 as below:

1. One-Day Workshop titled as "Capacity Building in Asia - JAXA Collaboration" was held in Hanoi, Vietnam on 8 November 2005 in conjunction with Asian Conference on Remote Sensing (ACRS). Some selected mini-project participants made a presentation to appeal the fruit of their efforts.
2. Two-Day Workshop on Disaster Mitigation in collaboration with ASEAN SCOSA was conducted from 14 to 15 February 2006 in Vietnam. At this workshop, discussion was carried out on technical aspects of conducting the Mini Projects especially focusing on disaster management with selected countries. This workshop was also a coordinating meeting with Asian Disaster Reduction Center (ADRC), UNESCAP and ASEAN SCOSA (Sub-committee on Space Technology and Applications.)

3. Pilot Projects with GISTDA and LAPAN

JAXA, GISTDA of Thailand and LAPAN of Indonesia have been implementing a series of pilot projects aimed at improving the use of satellite data by government agencies in those countries.

This Asia-Pacific Earth Observation Pilot Project also aims at greatly contributing to promoting capacity building for wider use of satellite data in the region as a whole.

3.1 Japan's Contribution to Pilot Project with Thailand

JAXA launched the Advanced Earth Observing Satellite-II (ADEOS II) in 2002 and the Advanced Land Observing Satellite (ALOS) in January 2006.

Since those satellites can provide new opportunities of using satellites data, JAXA, AIT, GISTDA and LAPAN decided to continue the pilot project as the "WSSD Type-II Activities."

History of Pilot Project with Thailand is as follows;

- 1986-: Cooperation program in MOS-1 and JERS-1
Established data receiving, recording and processing system
- 1997-2002: JERS-1 Pilot Project
Researched satellite data utilization possibility in a few fields
Improved Thai users' skill
- 2001: Agreement for earth observation and satellite Application
- 2002: Transfer of the data receiving, recording and processing system

2003.12--ALOS Pilot Project
 Land management and city planning
 Practical use and various fields

Participating departments of Thailand are;

➤ **Department of Public Work and Town and Country Planning (DPT)**

- To extract DEM and DTM from ALOS data.
- To improve and update the building in city area by using the ALOS data.
- To compare and monitoring for the urban change and urban trend.
- To evaluate the damage area from disaster.
- To create 3D city model.

➤ **Land Development Department (LDD)**

- Land use/ land cover monitoring.
- Application of ALOS images and GIS technology for farm pond mapping.

➤ **Royal Irrigation Department (RID)**

- Irrigation Management in Provincial Irrigation Project.
- Application of Satellite Imagery for inundation area.

➤ **Department of National Park, Wildlife and Plant Conservation (DNP)**

- Forest resources assessment, forest cover monitoring and forest inventory on forest resources information and biodiversity of vegetation.
- Forest fire assessment.

➤ **Department of Fisheries (DOF)**

- Mapping and monitoring aquaculture areas and stationary coastal fishing gears.
- To distribute the information derived from ALOS the satellite data to relevant provincial fisheries offices.
- To assess the significance of using ALOS satellite data for other fisheries applications.

➤ **The Department of Disaster Prevention and Mitigation (DDPM)**

- Utilization of Satellite Data: to transform satellite data to be valuable and usable products such as Early Warning Messages, Hazard Map, Damage Assessment, Situation Evaluation of the disaster event and related issues.

3.2 Pilot Project with Indonesia <ADEOS-II>

The agreement was concluded between JAXA and LAPAN in September 2003 on the use of ADEOS-II Data, and it lasted until March 2006. The objectives of the Pilot Project with Indonesia were as below:

- Utilization verification of the ADEOS-II archive data or alternative data in the fishery field.
- Utilization verification of the ADEOS-II data through the marine and fishery projects, and the contribution to Indonesian
- Training of the remote sensing engineers in Indonesia.

The following researches and utilization verification were conducted at Udayana University using JAXA-provided data:

- Fishery sea area data making and presumption of fishery sea

area by GLI.

- Marine resources management such as oceanic basic production.
- Multi-dimensional mapping by sea color and temperature.
- Examination of GLI analysis data distribution procedure in developing countries.
- Watch of coast and seawater pollution by remote sensing, etc.

To present the final result of the above pilot project public, the event titled the "JAXA Pilot Project Symposium in Indonesia 2006 - ADEOS-II Data Utilization Report – was held at the Sanor Plaza Paradisa Hotel Bali on 23 February 2006 having 85 participants.

3.3 Pilot Project with Indonesia <ALOS>

In February 2006, an agreement was concluded through the adjustment among JAXA, LAPAN and the other participating organizations, and the pilot project was substantially begun with the training program carried out by JAXA and LAPAN from 6 to 10 March 2006. The contents of the training were such as the basic RS for ALOS data use, the three dimensional chart making with stereo images obtained by an optical sensor onboard ALOS, and the lecture on SAR use, etc. Consequently, 32 people (8 out of 32 were observers) attended, and the most participants evaluated that profitable technological training was obtained.

Objectives of the Pilot Project with Indonesia using the ALOS data are as below:

- (1) Utilization verification of the ALOS data in order to make the regular use of the data possible in fields of the environment, forestry, mapping, and disaster management at the administrative level in Indonesia.
- (2) Training for the data use is executed to make each participation organization to be able to use the ALOS data on their own in the future in order to satisfy the participants' technical support demand. Moreover, the utilization proof in each field is advanced by individually making the thematic map using ALOS real data. It is assumed to be the final purpose that these technologies to be established in Indonesia, and to improve the frequency level of the data use at the administrative level.

The following shows the ALOS Pilot Project structure with Indonesia:

- **Indonesian Soil Research Institute (ISORI), Center for Soil and Agro climate Research (CSAR), Ministry of Agriculture (MOA)**
 - Assessment of Land Degradation and Mass Movement Using ALOS Satellite Data
- **Geology Development and Research Centre (BPPT), Ministry of Energy and Mineral Natural Resources (DESDM)**
 - Modeling For Natural Resources Mapping
- **National Coordinating Agency for Surveying and Mapping (BAKOSURTANAL)**
 - Topographic Map Production using ALOS Data-Benchmark test in urban area of Jakarta, rural area of Bogor and forest area of Kalimantan/Papua
- **Center for Remote Sensing and Ocean Sciences**

(CReSOS)

- Development of Algorithms for Coastal Zone Management and Vessels Monitoring by Using ALOS Data
- **Regional Development Study Center (KIMPRASWIL), Bogor Agriculture University (IPB) GIS and Remote Sensing Center of Aceh Syiah Kuala University (UNSYIAH)**
 - Land Use, Land Cover and Terrain Changes in Nanggroe Aceh Darussalam, Indonesia
- **Center for Forestry Mapping, Ministry of Forestry (MOF)**
 - Application of ALOS Satellite Imagery For Indonesian Forest Resources Monitoring

4. Sentinel Asia (SA) Project

Based on UN statistics, the Asia and Oceania region has the largest proportion of natural disasters in the world. The Asia-Pacific Space Agency Forum (APRSAF) was established in 1993 for promotion of space technology and applications in the region. The 11th APRSAF, November 2004 in Canberra, Australia recommended starting a pilot project among APRSAF members for rapid response to disasters. The Asian Workshop on Satellite Technology Data Utilization for Disaster Monitoring, January 2005, in Kobe, Japan, held at the time of UN World Conference for Disaster Reduction (UNWCDR), and the Disaster Reduction through Effective Space Technology Utilization in Asian Region, May 2005, in Malaysia, further define the concept of the pilot project and recommended “the Sentinel Asia” project. The 12th APRSAF, October 2005, in Kitakyushu, Japan, agreed to initiate the Sentinel Asia project and to establish the Joint Project Team (JPT) to plan and implement the project. The 1st JPT meeting was held in February 2006, in Hanoi, Vietnam.

(1) Concept

The Sentinel Asia (SA) is to be an Internet-based, node-distributed, information distribution backbone, handling relevant information on multiple hazards, and where satellite imagery is sourced from all possible earth observing geostationary-, or low-earth orbiting satellites, including meteorological satellites providing data to the region. Countries in the Asia-Pacific region will also be able to use the network to “trigger” specialized satellite-data disasters in their countries. The implementation costs of the Sentinel Asia are expected to be very low, since much of the infrastructure is already in place in many countries of the region. This includes satellite reception facilities, satellite pre-processing computers and a public Internet backbone. Routine downloaded satellite data will then be pre-processed in near real-time to key information products which can be sent across the Internet. Capacity building is also seen as a critical element for developing this community network, and for making best use of the satellite-derived disaster information across all countries in the region.

(2) Approach

The Sentinel Asia will be developed in a stepwise approach:

- STEP 1 : establishment of SA (2006-2007) with initial focus on wildfires and floods
- STEP2: integration with satellite communication systems (2008-2009)
- STEP3: establishment of comprehensive disaster management support system

(3) Architecture

The SA system is physically to be composed of the following elements:

- **Nodes**
 - Data Provider Nodes would operate their own satellite reception facilities, and in some cases their own spacecraft, would pre-process the imagery in near real-time into agreed information products, to be made available through the network.
 - Local Service Node (User-Nodes) would automatically pull information products from the network in near real-time, and post it together with their own country’s GIS information on their nodes’ WebGIS server.
 - Research and Training Nodes would be working ‘offline’ from the basic network on development of new products, or adapting standard wildfire and flooding methods to new satellite sensors.
- **Information-Sharing Systems**

To help realize the information sharing among NODES, the following platforms can be utilized:

 - Digital Asia by Keio University, JAXA and AIT
 - ALOS Rapid Response System by ADRC and JAXA
 - Others

● **Observation Systems**

SA will initially use MODIS derived information on wildfires and ALOS derived disaster information, SA is designed to adapt to various satellites missions, especially those of countries in the region. It is envisioned that SA will be used to disseminate information derived from other satellites.

(4) JPT

The first meeting of the Joint Project Team (JPT) of the Sentinel Asia was initiated in Hanoi, February 2006. Participating agencies and their functions were identified in the meeting. Second JPT meeting will be held in June 2006 to elaborate the implementation plan and start implementation of the SA. JPT is open to any interested agency in the region which can contribute to the SA.

5. Conclusions

The Asia Pacific region is the one which has largest portion of people and natural disasters in the world. This is a region where most rapid development and capacity of space technology and applications are taking place. JAXA envisions that space technology can be effectively used in this region for the well-begin of the people and cooperation for responding to the regional requirements can be made. For that, space agencies and related user agencies need to cooperate. JAXA intends to contribute to capacity building in the region through the Asia Pacific Earth Observation Pilot Project in collaboration with GISTDA, LAPAN and AIT, and the Sentinel Asia project.