Space Activities of JAXA
Next-Generation Earth Observation Satellite System

December 5, 2005

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Director, Bangkok Office
Japan Aerospace Exploration Agency (JAXA)
Outline of JAXA

the center for space development and promoting space utilization

- An Incorporated Administrative Agency
  Established under the Law concerning Japan Aerospace Exploration Agency (Law No.161, 13th Dec. 2002)
- President: Mr. Keiji TACHIKAWA
- Personnel: approx.1,700 (+3000)
- Budget: approx.180B Yen (1.7B US$)
- Mission: Aerospace-related
  - academic research (including education)
  - fundamental research
  - applied research
  - practical research and development
- Location of main office: Tokyo, Japan
MISSION of JAXA

SP TRANSPORTATION

SATELLITES

SP UTILIZATION

EARTH OBSERVATION

R & D, Education
JAXA Vision

Space exploration and utilization for the next 20 years

- Develop launch vehicles and satellites with the highest reliability and world class capability, contributing to the realization of a secure and prosperous society.
- Promote “top science” in the field of space science while preparing for Japan’s own human space activities and the utilization of the Moon.
- Conduct flight demonstration of a prototype hypersonic vehicle with the cruising speed at Mach 5.
- With all of the above activities, contribute to turning the aerospace industry into a key industry.
Information Gathering and Warning System for Disaster and Crisis Management

- Positioning Satellites
- Very large mobile communication satellite
- Ultra high-speed communication satellite
- Earth observation satellites

Data collection

- Information delivering to personal terminals
- Information center
- Ground observation network

Residents in disaster areas

Disaster monitoring
**Integrated global environmental observing system**

**for environmental observations and predictions**

- **Satellite observation network**
  - LEO
  - GEO

- **Communication satellites**

- **Ground observation network**
  - Direct data distribution to operational users and data archive

- **Process study and modelling** on atmosphere, ocean, land, watercycles, and global warming by Earth observation data users

- **Predictions using models** for climate, hydrological cycle change, and carbon cycle

- **Assessment of impact from human activities**

- **Tools for policy making**
Earth System Models

Observations

Assimilation

Other Data Sources

Prediction and Analysis

Decision Support

Policy Decisions

Management Decisions

Ongoing feedback to optimize value, reduce gaps, and account for human activity

GEOSS

Global Earth Observation System of Systems

9 Social Benefit Areas

Disasters

Energy

Climate

Water

Weather

Ecosystems

Agriculture

Health

Biodiversity
JAXA Earth Observation Program for GEOSS

To develop and operate an Earth Observation System for GEOSS

A plan of advanced low Earth orbit satellites

<table>
<thead>
<tr>
<th>Category</th>
<th>Sensor Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea surface wind vector</td>
<td>AMSR F/O, Scatterometer (GCOM-W)</td>
</tr>
<tr>
<td>Sea surface temperature</td>
<td>AMSR F/O (GCOM-W)</td>
</tr>
<tr>
<td>Cloud structure</td>
<td>Cloud Profiling Radar (EarthCARE)</td>
</tr>
<tr>
<td>Aerosol</td>
<td>GLI F/O (GCOM-C)</td>
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<tr>
<td>CO₂ concentration</td>
<td>Greenhouse Gas Observation Sensor (GOSAT)</td>
</tr>
<tr>
<td>Precipitation</td>
<td>Dual-frequency Precipitation Radar (GPM)</td>
</tr>
<tr>
<td>Disaster monitoring</td>
<td>SAR (disaster monitoring), Optical Sensor (Geo-stationary)</td>
</tr>
</tbody>
</table>
Advanced Land Observing Satellite <ALOS>

Japanese Earth Resources Satellite-1 (JERS-1)

Advanced Earth Observing Satellite (ADEOS)

Enhanced land-observation technology

ALOS

• Disaster monitoring
• Cartography
• Regional observation
• Resources surveying

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Launch Date</td>
<td>Jan. 2006</td>
</tr>
<tr>
<td>Launch Vehicle</td>
<td>H-IIA</td>
</tr>
<tr>
<td>Spacecraft Mass</td>
<td>about 4,000kg</td>
</tr>
<tr>
<td>Generated Elec. Power</td>
<td>about 7kW</td>
</tr>
<tr>
<td></td>
<td>at EOL</td>
</tr>
<tr>
<td>Orbit</td>
<td>Sun Synchronous</td>
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<tr>
<td>Altitude</td>
<td>691.65km</td>
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<tr>
<td>Repeat Cycle</td>
<td>46 days</td>
</tr>
<tr>
<td>(Sub-Cycle)</td>
<td>(2 days)</td>
</tr>
</tbody>
</table>
PRISM

Characteristics

- Optical (panchromatic)
- Three optical systems in order to obtain terrain data
- Spatial resolution: 2.5m
- Sensor field of view: 35km/70km
- Cross track pointing capability: -1.5°~1.5°
  -> Basically, 1 time/46 days observation.

Mt. Fuji’s terrain elevation map derived by JERS-1/OPS stereo.
AVNIR-2

Characteristics

- Optical ~ infrared (4 band)
- Cross track pointing capability for disaster monitoring: $-44^\circ \sim 44^\circ$
- Spatial resolution: 10m
- Sensor field of view: 70km

Land-use classification map in Chiba Pref., Japan using Landsat/TM.
③ PALSAR

Characteristics

- Synthetic Aperture Radar (L band (1.27GHz))
- Cross track pointing capability: 10°~51°
- Spatial resolution: 10m
- Sensor field of view: 70km, 350km (Scan mode), etc...
- All-weather, day-and-night observation

Mt. Fuji’s terrain elevation map derived by JERS-1/SAR stereo.
Why ALOS is so unique?

◎ Two optical sensor (2.5m, 10m) and one Radar sensor

1) Providing terrain elevation map with 3~5m altitude accuracy
   - 2.5m resolution image.
   - Triplet stereoscopic images with nadir, forward, and backward.

2) Highly accurate position and attitude determination to provide "Mapping without any Ground Control points".
   - Exact satellite position information within 1 m accuracy.
   - Precise “pointing” information within 0.0002° accuracy.
   - Absolute time information for each pixel better than 0.37 ms.

3) Wide observation swath with 70km or wider.
   ⇔ Conventional high resolution satellites have narrower swath width

4) Large capacity mission data handling
Disaster monitoring by ALOS

When disaster strikes, prompt monitoring is the most important.

- The ALOS is capable of observation anywhere in the world;
  - **within 48 hours** after commanding and every 48 hours revisit.
  - **within 60 minutes** after data reception for “Quick Look” images.
  - **within 180 minutes** for “Geo and Radiometric Calibrated” images.
- **all-weather, cloud penetrating, day-and-night monitoring** using the ALOS’s PALSAR.
ALOS Data Distribution

- **ALOS data node concept**
  - Volume of ALOS data, downlinked to JAXA’s ground station, will be 500 Giga byte to 1 Tera byte per day.
  - It is desirable to promote ALOS data worldwide.
  - **ALOS data node** will play a key role as a data processing and distribution center in the region specified.

- ALOs data will be disseminated to users worldwide **at a low price** on a non-discriminative basis.
Current ALOS Status
The series of satellites, GCOM (Global Climate observation Mission), consist of 2 satellite series:

- The sea surface observation mission, so called **GCOM-W**, will have **AMSR F/O** and **SeaWinds**.
- The atmospheric and terrestrial observation mission, so called **GCOM-C**, will have **GLI F/O**.

- Each satellite series will have **3 satellites with 5 years** mission life to exceed 11 years which is a nominal period of solar cycle and is the longest period of climate change. The series totally covers 13 years overlapping 2 years.
TRMM (Tropical Rainfall Measuring Mission)

- TRMM and the world-first-space-borne Precipitation Radar (PR) enables to observe rainfall directly from the space.
- Launch date: November 1997
- Altitude: 350km (before 2001) and 450km (after 2001)
TRMM observes rain structure

Hurricane Nonnie 08/22/98

horizontal cross section at a height of 2.5km

3D Rain Structure

Fig.2  3-D Rain Structure
Core Satellite

- Dual-frequency Precipitation Radar (DPR)
- Microwave Radiometer
  - Highly sensitive precipitation measurement
  - Calibration of constellation MRW precipitation estimates

Constellation Satellites

- Microwave Radio-meters (MWR) installed on each country’s satellite
  - Frequent precipitation measurement

Expected Partners:
- NASA, NOAA (US), ESA (EU), JAXA, China, Korea, others

3-hourly global rainfall map

JAXA (Japan):
- DRP, H-IIA (TBD)

NASA (US):
- Spacecraft, MWR

Blue: Inclination ~65° (GPM core)
Green: Inclination ~35° (TRMM)

2 satellites
8 satellites
APRSAF is an annual meeting initiated jointly by MEXT/JAXA

**APRSAF-12** was held on October 11-13, 2005 in Kitakyushu, Japan

- Established in 1993
- Objective: to enhance the development of each country’s space program and to exchange views toward the future cooperation in space activities in the Asia-Pacific region

[Members]
26 countries
+ 8 International Organizations
Concept of Disaster Management system using Space Technology in Asian countries

Disaster!

Request Image/Data

ADRC
Accept Order from Member Count.

Notify

ALOS

WINDS

Distribute Image/Data

Notify

Partner Agencies to support Asian Countries

JAXA
Develop a plan of Action

Asian Countries
Disaster Management Organizations
A Disaster Risk Management System in Asia-Pacific Region (2010- )

Space Safety Net Asia
- Archive Data
- Observation Data

Earth Observation Satellites

Information Sharing Platform

Web GIS

Information Communication System
- High speed transmission

Disaster Management Agencies

Residents in disaster areas

Providing services directly to personal

Disaster Prevention
- Warning
- Refuge
- Rescue

Knowledge Sharing

Data

Data

Data

Data
JAXA’s Knowledge Sharing at AIT

JAXA and AIT are promoting the following three types of knowledge sharing activates.

- **(1) Caravan Training Programs**;
- **(2) Workshops**; and
- **(3) Mini-Projects**

Mini-pilot project for disaster management
- Training at AIT (2 weeks)
- Survey and research at AIT (3 weeks)
- OJT at home country (1 week)
- Training and OJT at AIT (3 weeks)

Participating countries
- Vietnam, Nepal, Philippines, Sri Lanka...
JAXA will conduct its activities for the benefit of the people of Japan and all humankind, by devoting its capabilities and resources.

Thank You !!