Earth Observation Long Term Senario in Japan

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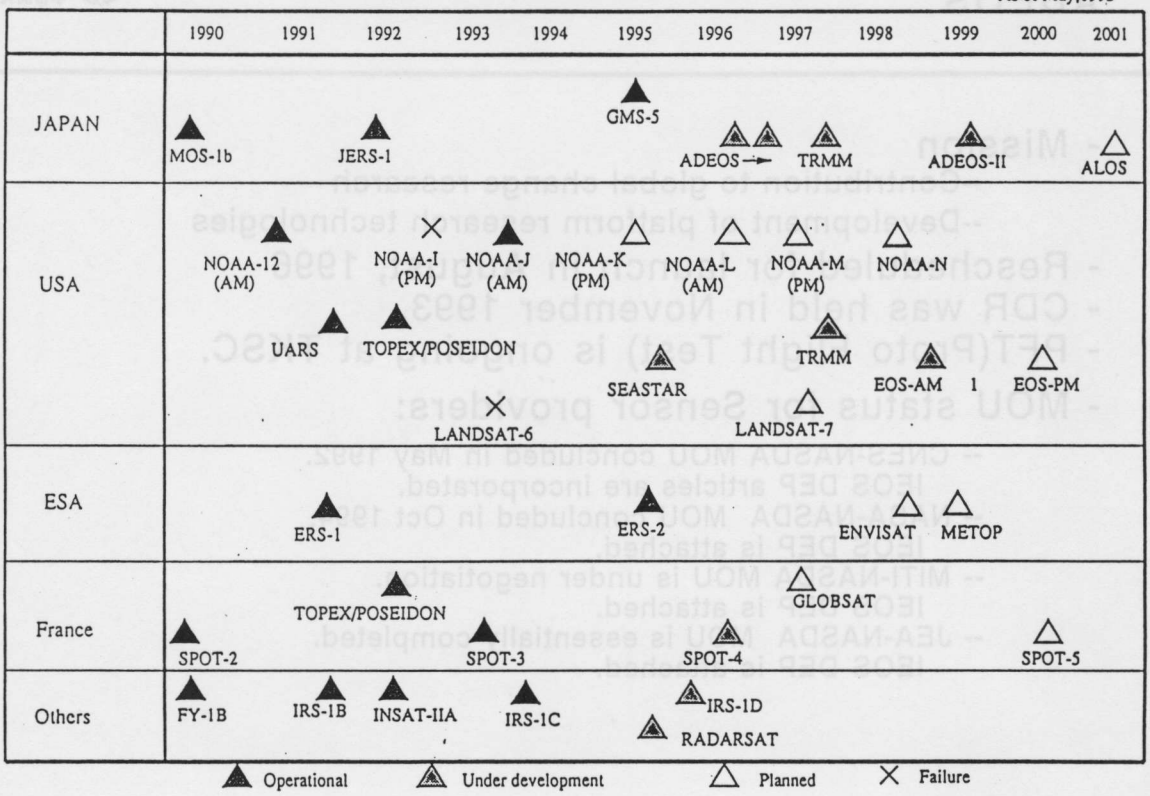
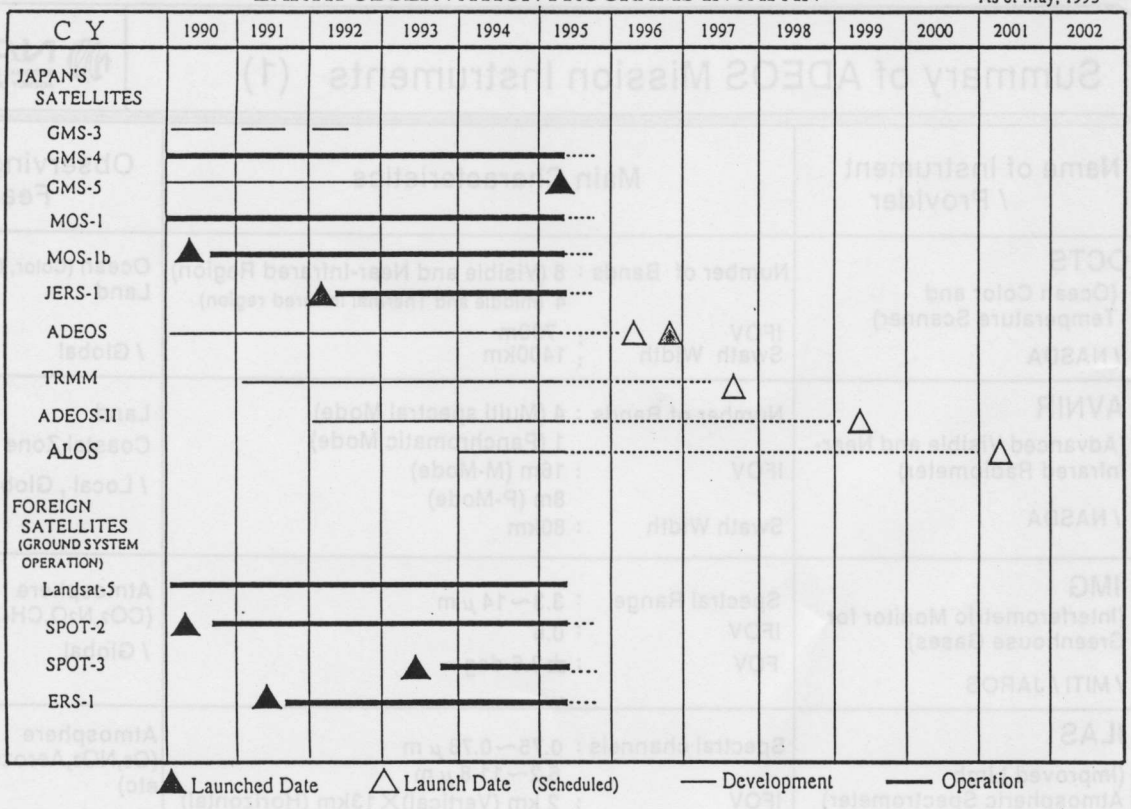
World Earth Observation Satellite Programs

As of May,1995



EARTH OBSERVATION PROGRAMS IN JAPAN

As of May, 1995



- Mission
  - --Contribution to global change research
  - --Development of platform research technologies
- Rescheduled for launch in August, 1996
- CDR was held in November 1993.
- PFT(Proto Flight Test) is ongoing at TKSC.
- MOU status for Sensor providers:
  - -- CNES-NASDA MOU concluded in May 1992.
    IEOS DEP articles are incorporated.
  - -- NASA-NASDA MOU concluded in Oct 1994.
    IEOS DEP is attached.
  - -- MITI-NASDA MOU is under negotiation.
    IEOS DEP is attached.
  - -- JEA-NASDA MOU is essentially completed.
    IEOS DEP is attached.

Summary of ADEOS Mission Instruments (1)

NASDA NATIONAL SPACE DEVELOPMENT AGENCY OF JAPAN

Name of Instrument / Provider	Main Characteristics	Observing Feature
OCTS (Ocean Color and Temperature Scanner) / NASDA	Number of Bands : 8 (Visible and Near-Infrared Region) 4 (middle and Thermal Infrared region) IFOV : 700m Swath Width : 1400km	Ocean (Color, Temperature) Land / Global
AVNIR (Advanced Visible and Near-Infrared Radiometer) / NASDA	Number of Bands : 4 (Multi spectral Mode) 1 (Panchromatic Mode) IFOV : 16m (M-Mode) 8m (P-Mode) Swath Width : 80km	Land Coastal Zone / Local , Global
IMG (Interferometric Monitor for Greenhouse Gases) / MITI / JAROS	Spectral Range : 3.3～14 μ m IFOV : 0.6° FOV : ±3.6 deg	Atmosphere (CO_2,N_2O,CH_4,CFCs,etc) / Global
ILAS (Improved Limb Atmospheric Spectrometer) / EA	Spectral channels : 0.75～0.78 μ m 6.2～11.8 μ m IFOV : 2 km (Vertical)×13km (Horizontal)	Atmosphere (O_3,NO_2,Aerozols,CFC11, etc) / Local (North and South Pole Region)

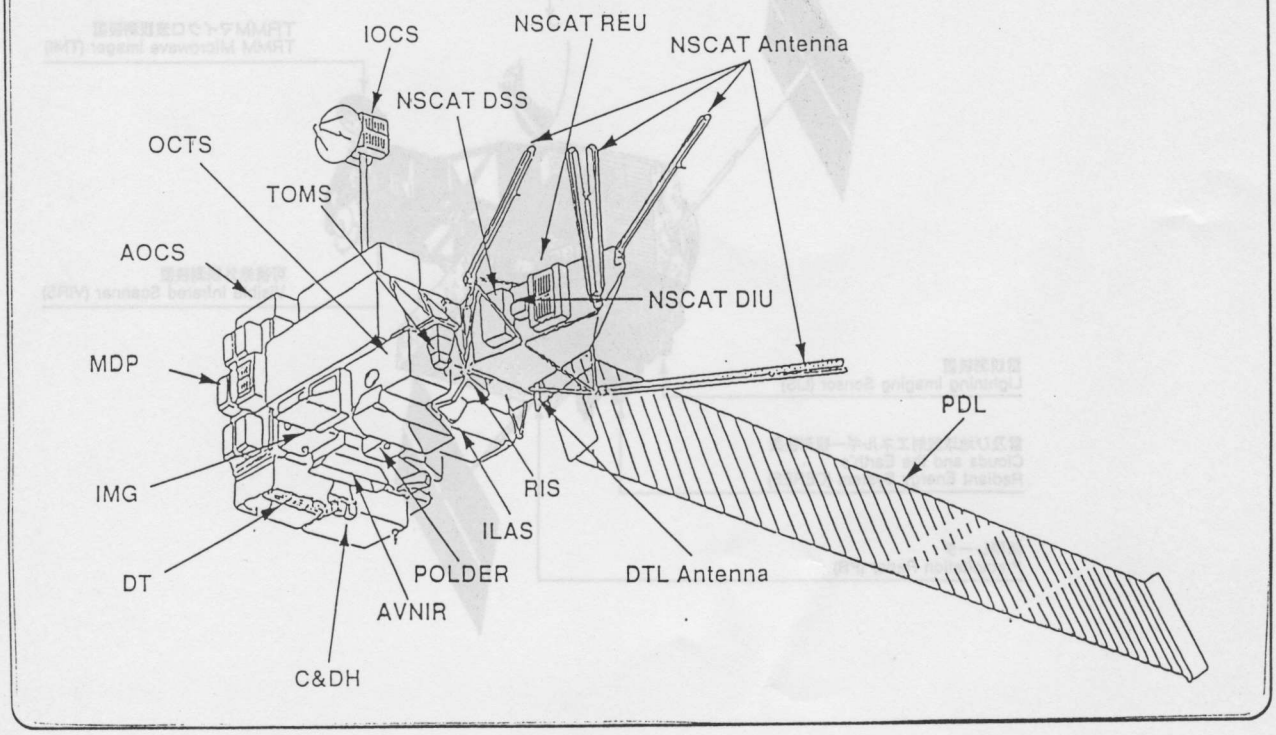
Summary of ADEOS Mission Instruments (2)

NASDA NATIONAL SPACE DEVELOPMENT AGENCY OF JAPAN

Name of Instrument / Provider	Main Characteristics	Observing Feature
RIS (Retroreflector In Space) / EA	Effective Diameter : 50cm Reflectivity : ≧ 0.8 Wavelength Region : 0.4～14 μm	Atmosphere (O_3,CO_2,CH_4,etc) / Local
NSCAT (NASA Scatterometer) / NASA / JPL	Radio Frequency : 14GHz Wind Observation Accuracy : Velocity 2 m/s, Direction 20°, Location 25km Swath Width : 1550km	Ocean (Wind Vector) / Global
TOMS (Total Ozone Mapping Spectrometer) / NASA / GSFC	Spectral Bands : 6 Wavelengths : 308.6～360.0nm Total Ozone Accuracy : ＜2% Sulfur Dioxide Accuracy : ±25% IFOV : 3deg FOV : ±55.5deg	Atmosphere (O_3,SO_2,etc) / Global
POLDER (Polarization and Directionality of the Earth's Reflectance) / CNES	Spectral Bands : 8 Wavelengths : 443～910nm Absolute Accuracy : 2%×Wavelength IFOV : 0.37deg FOV : 110deg	Atmosphere (Aerozols) Ocean (Color) Land / Global

In Orbit Cofiguration of ADEOS

NASDA NATIONAL SPACE DEVELOPMENT AGENCY OF JAPAN



TROPICAL RAINFALL MEASURING MISSION (TRMM)

TRMM IS A JOINT PROGRAM BETWEEN NASDA AND NASA.

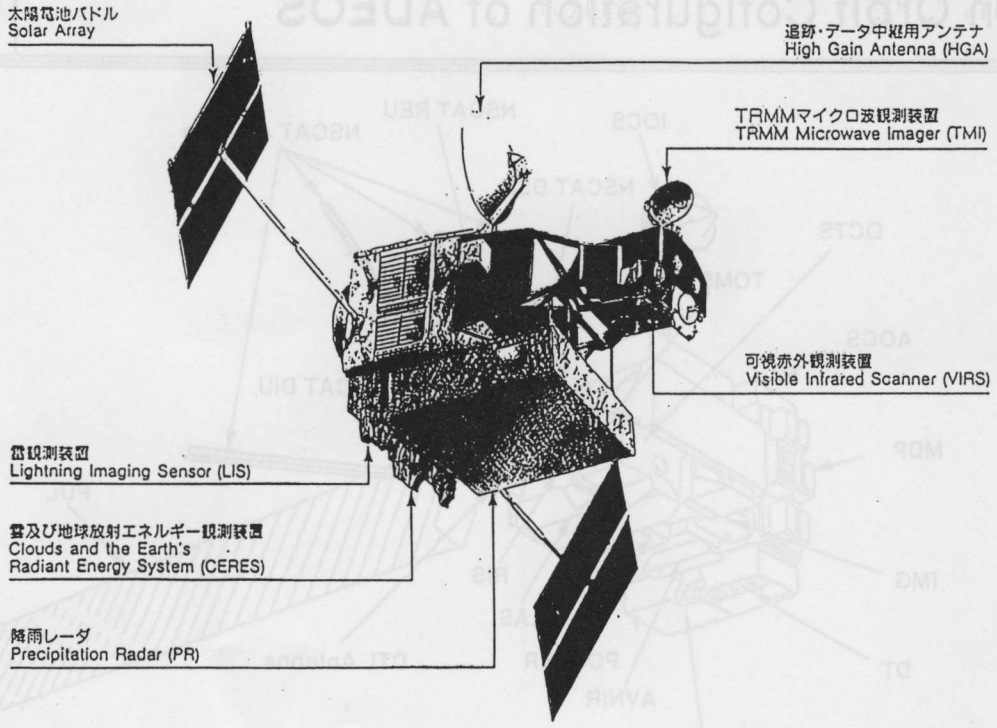
- o NASDA RESPONSIBILITIES
  PROVIDING A PRECIPITATION RADAR (PR), LAUNCHING THE SATELLITE BY H-II ROCKET, GROUND PROCESSING OF PR DATA

- o NASA RESPONSIBILITIES
  PROVIDING PLATFORM AND SEVERAL INSTRUMENTS, OPERATION OF THE SATELLITE

LAUNCHING TARGET DATE

- o SUMMER 1997

熱帯降雨観測衛星（TRMM）
Tropical Rainfall Measuring Mission



The major feature of the TRMM instruments

Sensor	Observation Objectives	Frequency	Horizontal resolution	Swath width
Precipitation Radar (PR; NASDA)	3-D rainfall distribution	13.8 GHz	4.3 km (nadir)	~ 220 km
TRMM Microwave Imager (TMI; NASA)	Vertically integrated rainfall distribution	10.7, 19.4, 22, 37, and 85~91 GHz	5 ~ 45 km	~ 680 km
Visible Infrared Scanner (VIRS; NASA)	Cloud distribution and height, rain estimation from brightness temp.	0.63, 1.6, 3.75, 10.8, and 12 μm	2 km (nadir)	~ 720 km
Cloud and Earth Radiant Energy System (CERES; NASA)	Radiation from cloud and the Earth, energy budget	0.3 ~ 3.5 μm 8 ~12 μm 0.3 ~ 50 μm	25 km (nadir)	Scan angle: ±80 degrees
Lightning Imaging Sensor (LIS; NASA)	Lightning distribution	0.7774 μm	4 km (nadir)	~ 660 km

Description of TRMM

Orbit	Non Sun-Synchronous
Altitude	350 km
Inclination	35 deg.
Weight	3.5 ton (approx.)
Launch Vehicle	H-II Rocket
Design Life	3 Years
Launch Date	Summer 1997

ADEOS-II (Advanced Earth Observing Satellite-II)

1. Mission Concept:

- Global Change Observation
- Dedicated of WCRP/GEWEX & CLIVER, IGBP and GCOS

2. Characteristics

(1) Instruments:

NASDA core sensors

- AMSR (Advanced Microwave Scanning Radiometer)
- GLI (Global Imager)
- DCS (Data Collection System)

Other agency's sensors candidates

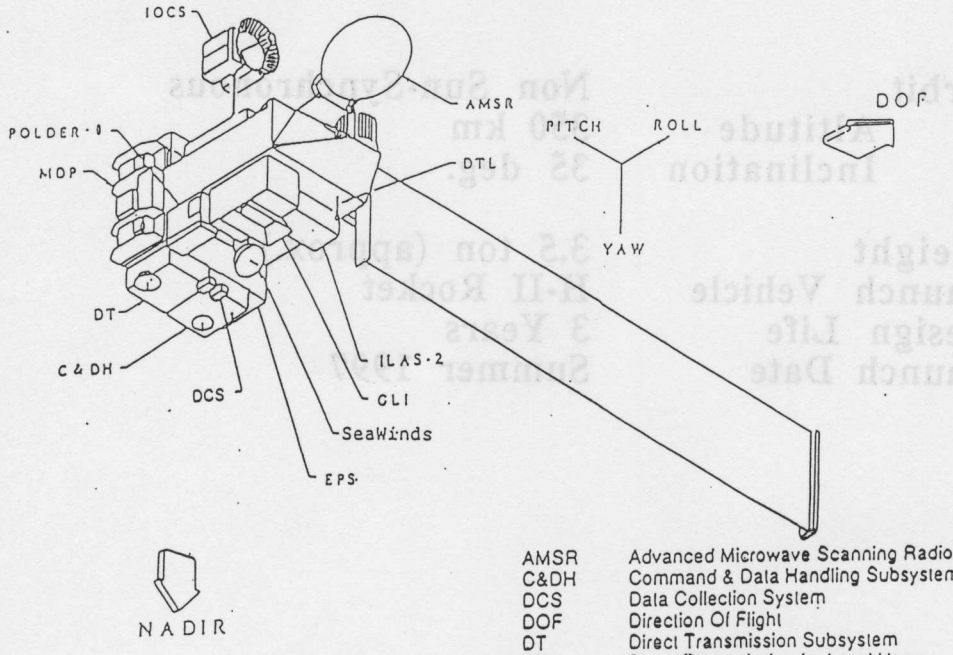
- ILAS-II (Improved Limb Atmospheric Spectrometer) : JEA
- SeaWinds (Modified NSCAT) : NASA/JPL
- ~~TOMS (Total Ozone Mapping Spectrometer) : NASA/GSFC~~
- POLDER (Polarization and Directionality of the Earth's Reflectances) : CNES

(2) Launch: - Launch year : February 1999
- Launch vehicle : H-II

(3) Mission Life: - 3 year (minimum) --- 5 year (Goal)

(4)Orbit: - Sun Synchronous Subrecurrent
- Altitude : 802.92 Km

3. In orbit configuration of ADEOS-II (one candidate)



AMSR	Advanced Microwave Scanning Radiometer
C&DH	Command & Data Handling Subsystem
DCS	Data Collection System
DOF	Direction Of Flight
DT	Direct Transmission Subsystem
DTL	Direct Transmission for Local Users
EPS	Electrical Power Subsystem
GLI	Global Imager
ILAS-2	Improved Limb Atmospheric Spectrometer
IOCS	Inter Orbital Communication Subsystem
MDP	Mission Data Processing Subsystem
POLDER	Polarization and Directionality of the Earth's Reflectance

Main Characteristics of ADEOS-II

Shape	Module type with a deployable solar array paddle Body Approx. 4 x 4 x 5 (m)
Total Weight	Approx. 3.5 ton
Mission Payload	Approx. 1.2 ton
Generator Power	5.0 kw (Approx. 1.2kw for mission instruments) at EOL
Design Life	3 year (minimum) --- 5 year (goal)
Launch Vehicle	H-II rocket (with 5 m Ø fairing), single launch
Launch Site	Tanegashima Space Center, Kagoshima
Launch Date	February 1999
Orbit Type	Sun synchronous subrecurrent
Altitude	Approx. 800 km
Inclination	Approx. 99 deg.
Period	Approx. 101 min.
Recurrent Period	4 days
Local time	Am 10:30 + 15 min.
Data Transmission	Inter-orbit communication and direct transmission (equipped with mission data recorder)

- Mission
  - -- Global mapping
  - -- Contribution to regional "sustainable development"
  - -- Disaster observation

- System Study is underway.
- Budget for Phase B is being requested for JFY 1996.

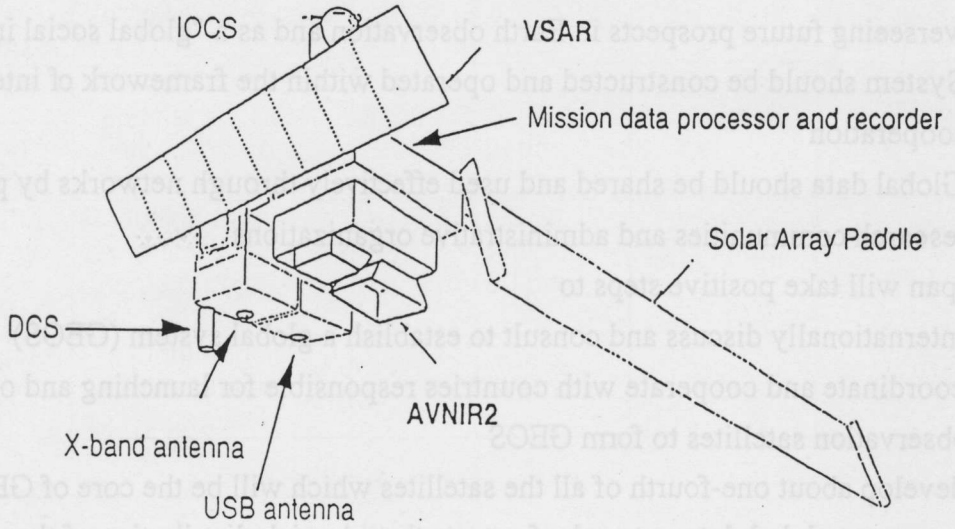
- Target for launch in 2002

ADVANCED LAND OBSERVING SATELLITE (ALOS)

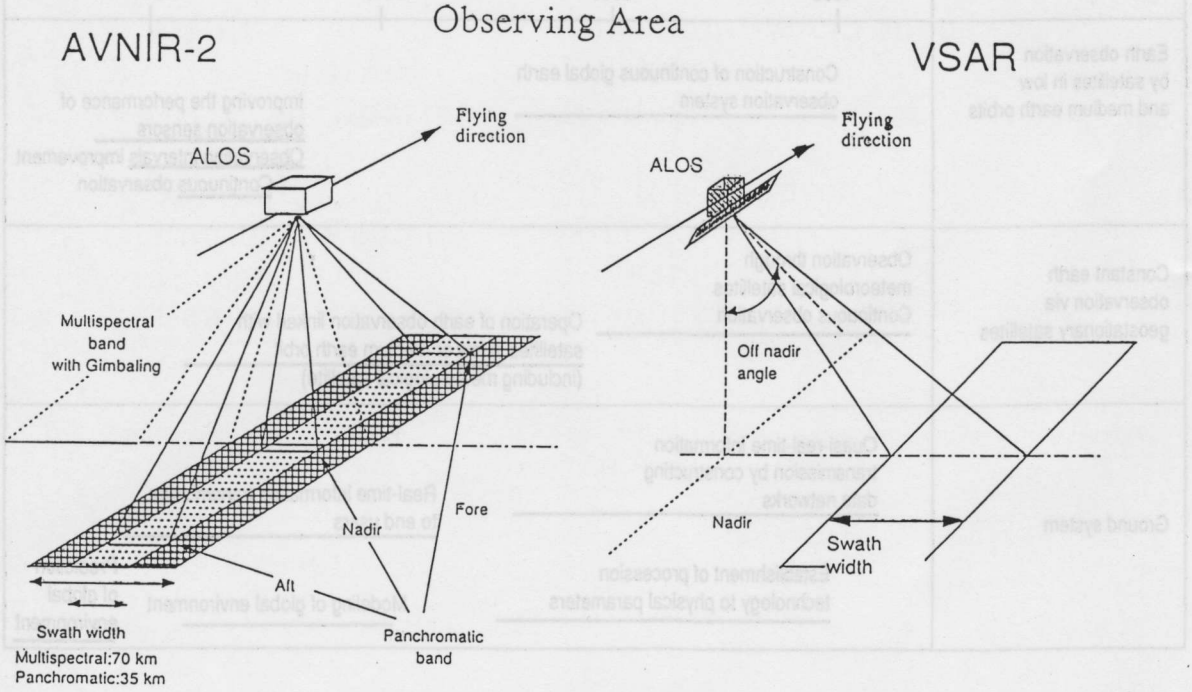
NASDA 宇宙開発事業団

ALOS MISSION OBJECTIVES

MISSION OBJECTIVES		Sensors	REMARKS
Mapping	Digital Terrain Elevation Map (2 and 3 Dimensional) -Resolution: 2.5 m (Horizontal) 3-5 m (Vertical)	AVNIR-2 (Pa)	-Equivalent to 1/25,000 scale maps. -Contribution to quick revision of current "paper" maps provided by Geographical Survey Institute of JAPAN.
	Land Usage Data -Resolution: 10 m (Horizontal)	AVNIR-2 (Mu) PSAR	
Regional Environmental Monitoring	Environmental Data -Resolution: 10 m (Horizontal)	AVNIR-2 (Mu) PSAR	-Contribution to regional "sustainable development" especially in Asia-Pacific region.
Hazard monitoring	Hazard Data -Resolution: 10 m (Horizontal)	AVNIR-2 (Mu) (Gimbal) PSAR (Var off-Ndr)	Quick monitoring - Flood, Volcanic eruption, Earthquake, Oil spill etc.
Technology Experiment	SAR Interferometry Experiment	PSAR	Precision orbit determination and control is required.



ADVANCED LAND OBSERVING SATELLITE (ALOS) NASDA 宇宙開発事業団



Global Earth Observation System (GEOS)

Overseeing future prospects in Earth observation and as a "global social infrastructure"

- System should be constructed and operated within the framework of international cooperation
- Global data should be shared and used effectively through networks by proper research communities and administrative organizations

Japan will take positive steps to

- internationally discuss and consult to establish a global system (GEOS)
- coordinate and cooperate with countries responsible for launching and operation of observation satellites to form GEOS
- develop about one-fourth of all the satellites which will be the core of GEOS by 2010
- construct global data networks for smooth and quick distribution of the observation data domestically and internationally including the Asia-Pacific regions

Table 1 Research and Development in the Fields of Earth Observation / Earth Science in Japan

	1995	2000	2010	2020 ~
Earth observation by satellites in low and medium earth orbits	Construction of continuous global earth observation system		Improving the performance of observation sensors Observation intervals improvement Continuous observation	
Constant earth observation via geostationary satellites	Observation through meteorological satellites Continuous observation	Operation of earth observation linked with satellites in low or medium earth orbit (including meteorological satellite)		
Ground system	Quasi-real-time information transmission by constructing data networks Establishment of procession technology to physical parameters		Real-time information transmission to end users Modeling of global environment	Prediction of global environment

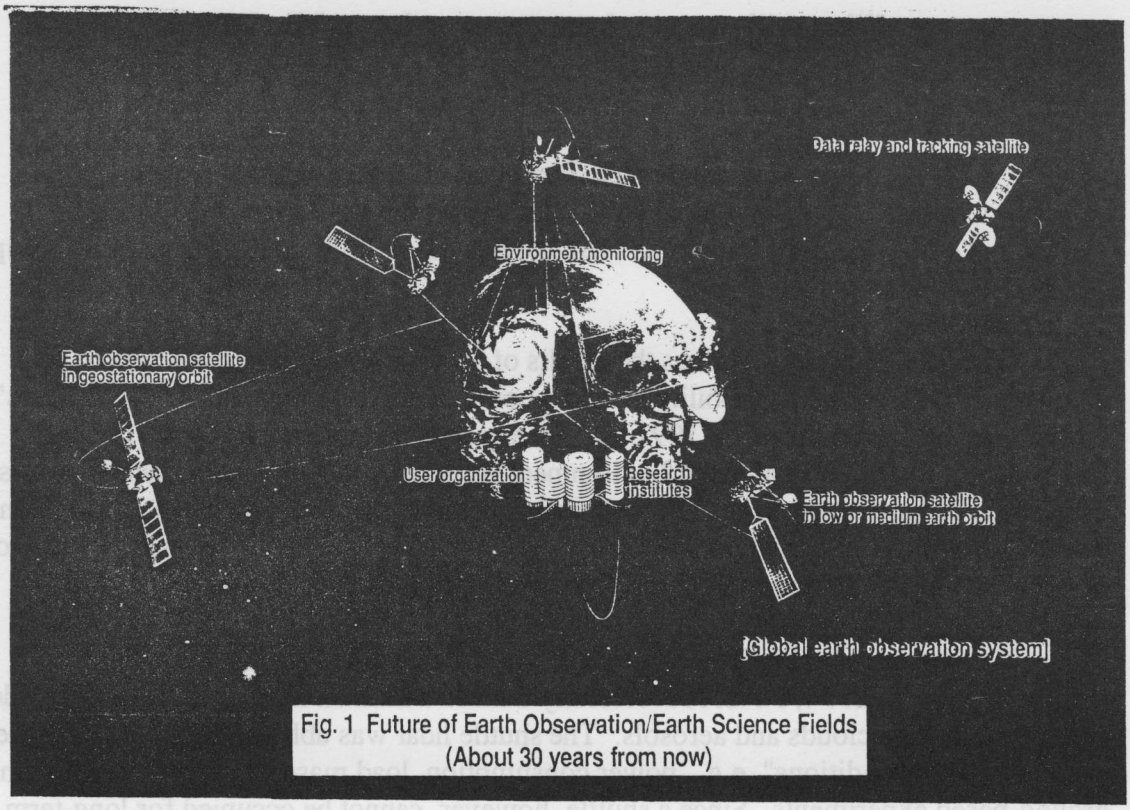


Fig. 1 Future of Earth Observation/Earth Science Fields
(About 30 years from now)

Japanese Scenario of Long Term Earth Observation(Draft)

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