AD2-EOC-96-054

ADEOS-II

MISSION OPERATIONS INTERFACE SPECIFICATION

(M O I S)

Common Part

Version 1.1

February 2002

NASDA
NATIONAL SPACE DEVELOPMENT AGENCY OF JAPAN

ADEOS-II Mission Operations Interface Specification (Common)

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Revision History

Ver.	Rev.	Date	Update Page	Change Point	Note
1.0	N/A	Aug. 2001			Final review version
1.1	N/A	Jan. 2002			Sign up version
			1-1, 1-2, 2-1~5, 2-7, 2-9, 3-1, 3-2, 3-14, 3-16, 5-27, 5-30	Word correction	
			1-6, 1-9, 1-11	NOAA was added as an applicable document of MOIS.	For NASA/NOAA only
			2-7, 2-10, 2-11, 5-15, 5-16	Descriptions about AMSR L1A delivery from PO.DAAC to NOAA and SeaPAC were added.	
			3-20 ~ 3-30	Operation Scenario was updated.	
			4-2	Block diagram of network connection within U.S. is revised.	
			5-28	POL was deleted from sensor name list of OPLN file name definition.	
			6-9, 6-11	Description about orbit maneuver is clarified.	
			A2-3	Abbreviation list was updated.	

Note: Modifications made to this document are annotated as follows:

- Deletions are indicated by (e.g., ~~Project~~)
- Additions are indicated by bold (e.g., **Project**)
- Comments are indicated by italics (e.g., *Project*)

List of Remained TBD

No.	Page	Contents	Actionee
1	1-4, 1-7	MOIS and AGSID for the Foreign Ground Stations are not issued.	NASDA
2	3-29	Documentation work for authorization of the operation priority is not completed yet within NASDA.	NASDA
3	B6-8 ~ B6-9	Physical parameters of POLDER level 3 are not fixed yet.	CNES/POLDER
4	B6-11	Parameters of ILAS-II Level 2 research products.	NIES

ADEOS-II Mission Operations Interface Specification (Common)

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ADEOS-II Mission Operations Interface Specification (Common)

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1. Introduction

1.1 Purpose

The primary purpose of "ADEOS-II Mission Operations Interface Specification (Common Part)" (MOIS(Common)) is to give an outline of the Advanced Earth Observing Satellite II (ADEOS-II) mission operation and the interfaces between NASDA/EOC and related agencies. The detailed interface between NASDA/EOC and each related agency is clarified in the "ADEOS-II Mission Operations Interface Specification (Individual Part)" (MOIS(Individual)).

1.2 Scope

This document defines interface conditions, deliverables and schedules which are necessary for NASDA/EOC and related agencies to perform ADEOS-II Mission Operations. Routine operation functions include: 1) S/C tracking and control; 2) instrument monitoring and control; 3) mission data acquisition, processing and archiving; and 4) mission operation planning. Organizations performing ADEOS-II Mission Operations functions include the ADEOS-II Project by NASDA; the SeaWinds Project, EOSDIS Project and the NASA/NOAA Ground Network (NGN) by NASA; NOAA/NESDIS; the POLDER Project and ARGOS Next Project by CNES; the ILAS-II Project by MOE (for onboard instrument) and NIES (Ground segment); the TEDA Project by NASDA/TKSC/TEDA and the ADEOS-II MRT Data Capture and Utilization Projects by other agencies. The roles of these organizations are based on the contents of the MOUs and MOIPs described in section 1.4.

1.3 MOIS Control

1.3.1 Approval Authority

This document will become effective after approval and signing by the listed signatories.

1.3.2 Change Control

MOIS (Common) changes shall be controlled by NASDA/EORC before routine operation phase of ADEOS-II. Then, **during routine operation,** this document shall be controlled by NASDA/EOC. ~~during routine operation.~~ Therefore, **the preparing organization shall submit all change proposals to NASDA/EORC during pre-routine operations,** ~~all change proposals shall be submitted to NASDA/EORC (pre routine operation phase) or~~ **and to** NASDA/EOC **during** ~~(~~routine operation phase. ~~) by the preparing organization.~~ Changes shall require agreement among all listed signatories. Changes shall be discussed at an ADEOS-II Mission Operations Meeting or by exchanging Operations Coordination Letters

(OCLs) (see section 7.2). Changes shall be in agreement with the MOUs and the MOIPs, and shall be **incorporated via** ~~instituted by~~ MOIS Change Notices (MOISCNs).
Changes with no impact, such as misspellings, can be incorporated by NASDA using MOISCNs without discussion between NASDA and all signatory agencies.

The change procedure is as follows;

(1) Submission of MOIS Change Proposal

An agency requiring an MOIS change shall prepare the MOIS Change Proposal (MOISCP; see Appendix C-1) and submit it to NASDA. The proposal shall be immediately sent from NASDA to all affected agencies by an Operations Coordination Letter (OCL) using facsimile or mail.

(2) Discussion of MOIS Change Proposal

NASDA shall decide the need for an MOISCP by agreement among NASDA and affected agencies. NASDA and the affected agencies shall discuss the proposal and derive a consensus for accepting or rejecting the change.

OCLs may also be used instead of Mission Operations Meetings to discuss MOISCPs.

(3) Discussion of Programmatic MOIS Change Proposals

If a proposal is designated to be a programmatic change during the discussion of MOIS change proposals, the proposal shall be discussed at a program meeting between NASDA and the affected agencies.

A programmatic change is a change which may have a critical impact on the schedule or an instrument mission achievement, or which may lead to unexpected and additional budget impacts.

(4) Notice of result

(4-1) In Case of Approval

NASDA shall summarize the responses in the MOISCP. Signing by affected projects of the MOISCP will close the discussion of the MOISCP.

Approved changes will result in the NASDA preparation and distribution to all MOIS signatories of MOIS Change Notices (see Appendix C-1) that describe the MOIS change and instructions on how the changes should be incorporated into the affected documents. Until the document is revised, the distributed MOISCN(s) will be part(s) of the document.

(4-2) In Case of Rejection

NASDA will explain the rejection in the MOISCP. Signing by NASDA of the MOISCP will close the discussion of the MOISCP.

(5) Revision of MOIS

NASDA/EOC shall revise the MOIS based on the MOISCN(s) and distribute the revised MOIS to all MOIS signatories.

NASDA shall update MOIS approximately every 6 months until the RORR (Routine Operations Readiness Report Meeting), and after that on an as needed basis.

1.4 Applicable Documents

The MOIS is positioned in the document tree illustrated in Fig. 1.4.1.

The following (a) - (c) documents are the controlling documents for this MOIS. In case of conflict between any of the (a) - (c) documents and this MOIS, the former will govern.

The following (d) - (h) documents are the reference documents for this MOIS.

The following (i) - (l) documents are the applicable documents for this MOIS. In case of conflict between any of the (i) - (l) documents and this MOIS, this MOIS will govern.

The following document (m) (Individual part of MOIS) is same level as this document. The contents of the MOIS (Common) and the MOIS (Individual) should be synchronized.

(a) Memorandum of Understanding (MOU)

(a-1) "Memorandum of Understanding between the National Space Development Agency of Japan, the National Aeronautics Space Administration of the United States of America and the National Oceanic and Atmospheric Administration of the United States of America for cooperation in the Advanced Earth Observing Satellite-II Program"

(a-2) "Memorandum of Understanding between the National Space Development Agency of Japan and the Centre National d' Etudes Spatiales of France for cooperation in installation and operations of the Polarization and Directionality of the Earth’s Reflectance on the

Advanced Earth Observing Satellite-II "

(a-3) "Memorandum of Understanding between the National Space Development Agency of Japan and the Centre National d' Etudes Spatiales of France governing their cooperation for the development and the operations of the ARGOS Data Collection System on board the Advanced Earth Observing Satellite-II (ADEOS-II) "

(a-4) "Memorandum of Understanding between the National Space Development Agency of Japan and the Environment Agency of Japan for cooperation in the Advanced Earth Observing Satellite-II Program" (Japanese)[*1]

(b) Intentionally Deleted

(c) Mission Operations Implementation Plan (MOIP)

(c-1) "ADEOS-II Mission Operations Implementation Plan (NASDA/NASA/NOAA)" (AD2-EOC-96-055)

(c-2) "ADEOS-II Mission Operations Implementation Plan (NASDA/CNES POLDER)" (AD2-EOC-95-011)

(c-3) "ADEOS-II Mission Operations Implementation Plan (NASDA/CNES ARGOS)" (AD2-EOC-95-010)

(c-4) "ADEOS-II Mission Operations Implementation Plan (NASDA/EA)" (Japanese) (AD2-EOC-95-016)[*1]

(c-5) "ADEOS-II Mission Operations Implementation Plan (TKSC/TEDA)" (Japanese) (NEB-99012)

(c-6) "ADEOS-II Mission Operations Implementation Plan (NASDA/Kiruna Station)" (AD2-EOSD-97-004)

(d) ADEOS-II Mission Simulation Test Plan (AD2-EOSD-99-012)

(e) ADEOS-II to Ground Stations Interface Document (AGSID)

(e-1) "ADEOS-II to Ground Stations Interface Document" (AD2-EOC-96-123)

(e-2) "ADEOS-II to Ground Stations Interface Document for Foreign Ground Stations" (TBD)

(f) SOOH (each sensor portion)

(f-1) "ADEOS-II Spacecraft Orbital Operations Handbook (GLI portion)" (Vol. 8)

(f-2) "ADEOS-II Spacecraft Orbital Operations Handbook (SeaWinds portion)" (Vol. 12)

[*1] "EA (Environment Agency of Japan)" is reformed to "MOE (Ministry of the Environment)" at the beginning of January 2001

(f-3) "ADEOS-II Spacecraft Orbital Operations Handbook (POLDER portion)" (Vol. 9)

(f-4) "ADEOS-II Spacecraft Orbital Operations Handbook (DCS portion)" (Vol. 13)

(f-5) "ADEOS-II Spacecraft Orbital Operations Handbook (ILAS-II portion)" (Vol. 10)

(f-6) "ADEOS-II Spacecraft Orbital Operations Handbook (TEDA portion)" (Vol. 14)

(f-7) "ADEOS-II Spacecraft Orbital Operations Handbook (AMSR portion)" (Vol. 11)

(g) Mission Operation Requirements for ADEOS-II Ground Segment (ORD) (NASDA internal document)

(h) ADEOS-II Ground System Interface Requirements Document (SIRD)

(h-1) "ADEOS-II Ground System Interface Requirements Document (NASDA/NASA/NOAA)" (AD2-EOC-95-056)

(h-2) "ADEOS-II Ground System Interface Requirements Document (NASDA/CNES ARGOS)" (AD2-EOC-95-009)

(h-3) "ADEOS-II Ground System Interface Requirements Document (NASDA/NIES)" (Japanese) (AD2-EOC-95-017)

(i) Recording Subsystem Raw Data Format Specification (AD2RP-S-023)

(j) Level 0 Format Description

(j-1) "SeaWinds Level 0 Format Description" (AD2-EOC-96-119)

(j-2) "ADEOS-II/ARGOS DCS Level 0 Format Description" (AD2-EOC-97-044)

(j-3) "ILAS-II Level 0 Format Description" (Japanese/English)(AD2-EOC-96-121)

(j-4) "TEDA Level 0 Format Description" (AD2-EOC-97-003)

(j-5) "POLDER Level 0 Format Description" (AD2-EOC-97-042)

(j-6) "POLDER HK TLM Data Format Description" (AD2-EOC-97-043)

(j-7) "HK TLM Packet Format Description" (AD2-EOSD-97-012)

(j-8) "GLI 1km Level 0 Format Description" (AD2-EOSD-98-011)

(j-9) "AMSR Level 0 Format Description" (AD2-EOC-96-122)

(j-10) "DMS Level 0 Format Description" (AD2-EOSD-98-147)

(j-11) "VMS Level 0 Format Description" (AD2-EOSD-98-146)

(k) Format Description of Mission Operation Information Files (MOIF)

(k-1) "Format Description of Mission Operation Information Files (NGN/NOAA)" (AD2-EOSD-98-155)

(k-2) "Format Description of Mission Operation Information Files (SeaWinds)" (AD2-EOSD-99-019) (k-3) "Format Description of Mission Operation Information Files (POLDER)" (AD2-EOSD-98-202)

(k-4) "Format Description of Mission Operation Information Files (DCS)" (AD2-EOSD-98-205)

(k-5) "Format Description of Mission Operation Information Files (ILAS-II)" (AD2-EOSD-98-210)

(k-6) "Format Description of Mission Operation Information Files (TEDA)" (AD2-EOSD-99-103)

(k-7) "Format Description of Mission Operation Information (Kiruna)"

(l) Network Interface Document

(l1) Network Communications Interface Requirements Document (NIRD)

(l1-1) "Network Communications Interface Requirements Document Between NASDA and NASA/NOAA for the ADEOS-II Project" (EOIS/AD2-ND-008)

(l2) Network Communications Interface Control Document (NICD)

(l2-1) "Network Communications Interface Control Document Between NASDA and NASA/NOAA for the ADEOS-II Project" (EOIS/AD2-ND-009)

(l2-2) "Network Communications Interface Control Document Between NASDA and CNES for the ADEOS-II DCS Project" (EOIS/AD2-ND-037)

(l2-3) "Network Communications Interface Control Document Between NASDA and CNES for the ADEOS-II POLDER Project" (EOIS/AD2-ND-48)

(l2-4) "Network Communications Interface Control Document Between NASDA and NIES for the ADEOS-II Project" (EOIS/AD2-ND-102)

(l3) "ADEOS-II Catalogue Interoperability Interface Requirements Document (NASDA-NASA)" (CIRD) (EOIS/AD2-ND-007)

(l4) "ADEOS-II Catalogue Interoperability Interface Control Document (NASDA-NASA)" (CICD)

(l5) "Network Communication Interface Operation Agreement (NIOA) between NASDA and NASA/NOAA for ADEOS-II Project" (EOIS/AD2-ND-149)

(m) ADEOS-II Mission Operations Interface Specification (Individual

Part) (MOIS)

(m-1) ADEOS-II Mission Operations Interface Specification (NASDA/NASA/NOAA) (AD2-EOC-97-046)

(m-2) ADEOS-II Mission Operations Interface Specification (NASDA/CNES ARGOS) (AD2-EOC-97-040)

(m-3) ADEOS-II Mission Operations Interface Specification (NASDA/CNES POLDER) (AD2-EOSD-98-015)

(m-4) ADEOS-II Mission Operations Interface Specification (NASDA/NIES) (Japanese) (AD2-EOC-97-047)

(m-5) ADEOS-II Mission Operations Interface Specification (NASDA/Kiruna Station) (AD2-EOSD-97-102)

(m-6) ADEOS-II Mission Operations Interface Specification (NASDA/FGS) (TBD) (including MOIF format specification)

(m-7) ADEOS-II Mission Operations Interface Specification (TKSC TEDA) (NEB-99012)

(n) Standard Product Specification

(n1) For SeaWinds

(n1-1) SeaWinds Science Product User's Handbook

(n1-2) SeaWinds Met Data Format Description

(n2) For DCS

(n2-1) ADEOS DCS Processed Data Format

(n3) For POLDER

(n3-1) Data Format and User Manual for POLDER Level 1, 2 and 3 Product

(n3-2) Description of POLDER Standard Product Media

(n4) For ILAS-II

(n4-1) ILAS-II User's Hand Book

The applicable documents for each agency are summarized in table 1.4.1.

Table 1.4.1 Documents Matrix (1/3)

No.	Document	NGN	Kiruna	SeaPAC	CNES/ POLDER	CNES/ ARGOS	MOE/NIES	TKSC/ TEDA	EOSDIS	NOAA	FGS
a-1	MOU (NASA/NOAA)	O		O					O	O	
a-2	MOU (POLDER)				O						
a-3	MOU (ARGOS)					O					
a-4	MOU (ILAS-II)						O				
b	Deleted										
c-1	MOIP (NASA/NOAA)	O		O					O	O	
c-2	MOIP (POLDER)				O						
c-3	MOIP (ARGOS)					O					
c-4	MOIP (EA)						O				
c-5	MOIP (TEDA)							O			
c-6	MOIP (Kiruna)		O								
d	Mission Simulation Test Plan	O	O	O	O	O	O	O	O	O	
e-1	AGSID	O	O								
e-2	AGSID (FGS)										O
f-1	SOOH (GLI)									O	
f-2	SOOH (SeaWinds)			O						O	
f-3	SOOH (POLDER)				O						
f-4	SOOH (DCS)					O					
f-5	SOOH (ILAS-II)						O				
f-6	SOOH (TEDA)							O			
g	ORD										
h-1	SIRD (NASA/NOAA)	O		O					O	O	
h-2	SIRD (ARGOS)					O					
h-3	SIRD (NIES)						O				
i	Raw Data Format	O	O								

Table 1.4.1 Documents Matrix (2/3)

No.	Document	NGN	Kiruna	SeaPAC	CNES/ POLDER	CNES/ ARGOS	MOE/NIES	TKSC/ TEDA	EOSDIS	NOAA	FGS
j-1	L-0 Format (SeaWinds)	O	O	O						O	
j-2	L-0 Format (DCS)	O	O			O					
j-3	L-0 Format (ILAS-II)	O	O				O				
j-4	L-0 Format (TEDA)	O	O					O			
j-5	L-0 Format (POLDER)				O						
j-6	POLDER HK Format				O						
j-7	HK Packet Format	O	O								
j-8	L-0 Format (GLI)	O	O							O	
j-9	L-0 Format (AMSR)	O	O								
j-9	L-0 Format (DMS)	O	O								
j-9	L-0 Format (VMS)	O	O								
k-1	MOIF Format (NGN/NOAA)	O								**O**	
k-2	MOIF Format (SeaWinds)			O					O		
k-3	MOIF Format (POLDER)				O						
k-4	MOIF Format (DCS)					O					
k-5	MOIF Format (ILAS-II)						O				
k-6	MOIF Format (TEDA)							O			
k-7	MOIF Format (Kiruna)		O								
l1-1	NIRD (NASA/NOAA)	O		O					O	O	
l2-1	NICD (NASA/NOAA)	O		O					O	O	
l2-2	NICD (DCS)					O					
l2-3	NICD (POLDER)				O						
l2-4	NICD (NIES)						O				
l3	CIRD (NASA)								O		
l4	CICD (NASA)								O		
l5	**NIOA (NASA/NOAA)**	**O**		**O**					**O**	**O**	

Table 1.4.1 Documents Matrix (3/3)

No.	Document	NGN	Kiruna	SeaPAC	CNES/ POLDER	CNES/ ARGOS	MOE/NIES	TKSC/ TEDA	EOSDIS	NOAA	FGS
m-1	MOIS (NASA/NOAA)	O		O					O	O	
m-2	MOIS (ARGOS)					O					
m-3	MOIS (POLDER)				O						
m-4	MOIS (NIES)						O				
m-5	MOIS (Kiruna)		O								
m-6	MOIS (FGS)										O
m-7	MOIS (TEDA)							O			
n1-1	SeaWinds Science Product User's Handbook			O						**O**	
n1-2	SeaWinds Met Data Format Description									O	
n2-1	ADEOS DCS Processed Data Format					O				**O**	
n3-1	Data Format and User Manual for POLDER Products				O						
n3-2	Description of POLDER Standard Product Media				O						
n4-1	ILAS-II User's Handbook						O				

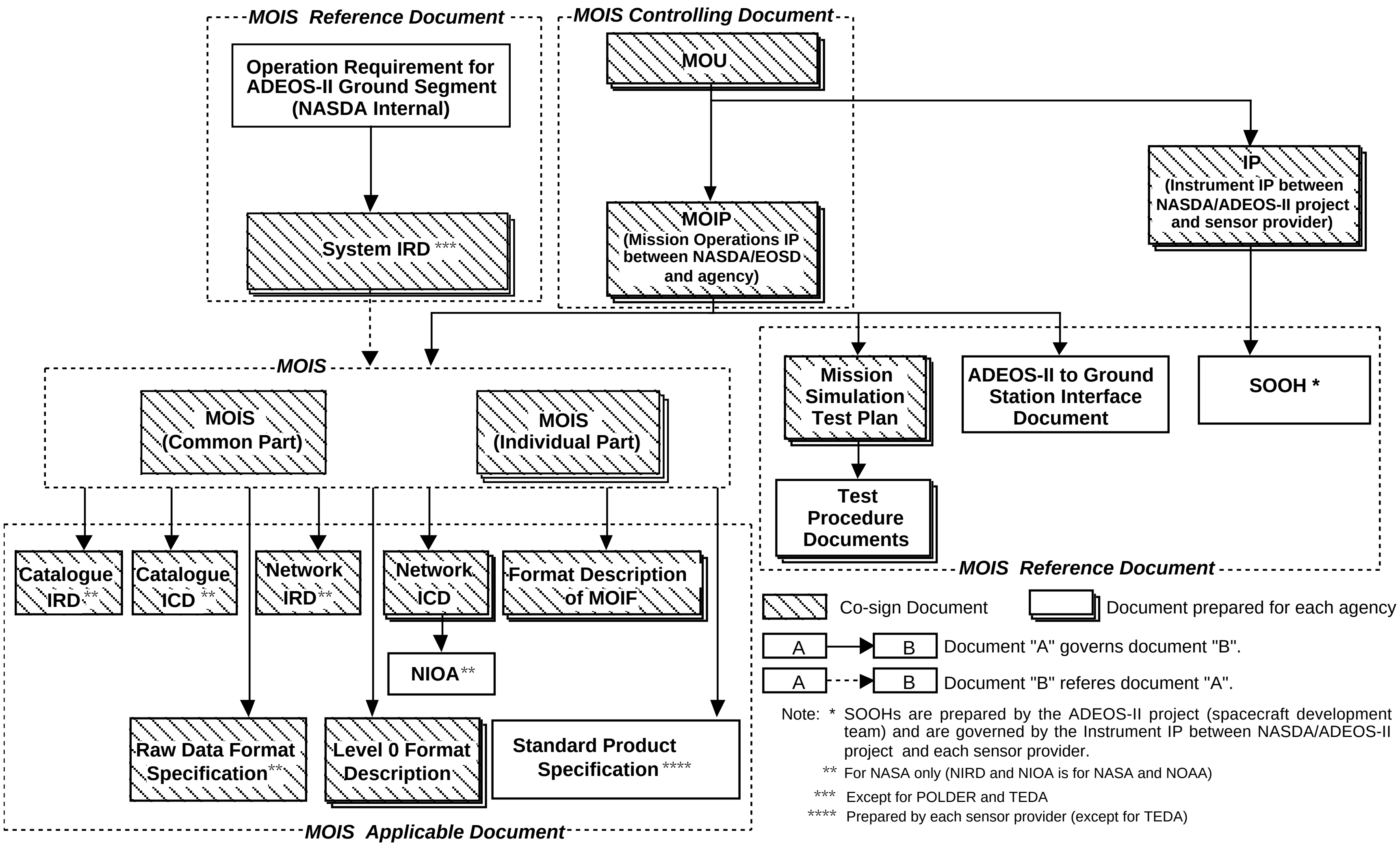


Fig. 1.4.1 Document Control Configuration

2. Configuration of ADEOS-II Operation

Advanced Earth Observing Satellite II (ADEOS-II) is scheduled for launch in ~~February~~ **November** 2002, and its designated lifetime is 3 years with 5 years expected for operations. The ADEOS-II Project is a part of NASDA's continuing Earth Observation Program and is a platform of the International Earth Observing System (IEOS). The Program's objectives are to continue the observing record of the initial ADEOS Project and to complement and supplement the Earth observation experiments of other IEOS partners that are planned for the same mission period. The Project will utilize the Inter-orbit Communication System (IOCS) for the transmission of Earth observation data, to monitor spacecraft health and safety, and for commanding of spacecraft operations. Management of flight operations is performed by NASDA.

2.1 Global System Configuration for ADEOS-II

The ADEOS-II system consists of the ADEOS-II spacecraft and ground segments as indicated in Figure 2.1.1. The ground segments include the Earth Observation Center (NASDA/EOC), Earth Observation Research Center (NASDA/EORC), the Tracking and Control Center (NASDA/TACC), the Tracking and Control Stations (NASDA/TACS), the NASDA Transportable Station-Kiruna (NTSK), the NASA ground stations, Kiruna Station, the sensor providers, and several data acquisition and processing ground stations located in Japan and other countries.

Additionally, the ground segments include Earth Observation Information System/Data Distribution and Management System (EOIS/DDMS) and Earth Observation System Data and Information System Network (EOSDIS Network) as the network system to connect each facility.

The data acquisition is made using both IOCS and X band link**s** ~~in term of~~ **during the** ADEOS-II mission life. There are two modes, mode 1 and mode 2, depending on the types of data capture. In mode 1, data is acquired using mainly IOCS, but X band link**s** **are** ~~is~~ also used for data acquisition. In mode 2, data is acquired using mainly X band link**s**, but IOCS is also used for data acquisition. (See section 3.6)

The DRTS data relay satellite is assigned to ADEOS-II IOCS. And, four ground stations, the Alaska SAR Facility (ASF), Wallops Flight Facility (WFF), Kiruna station and EOC are used for X band reception.

(1) NASDA Ground Segment for ADEOS-II

The NASDA Ground Segment for ADEOS-II consists of the ADEOS-II Mission Operation System, the ADEOS-II related part of Earth Observation Information System (EOIS) and the ADEOS-II related part of Tracking and Control System.

(a) ADEOS-II Mission Operation System

ADEOS-II Mission Operation System, located at the Earth Observation Center (EOC) in Hatoyama, is the main planning organization for ADEOS-II mission operations and consists of the Mission operation Management Organization (MMO), the ADEOS-II Data receiving subsystem, data recording subsystem, data processing subsystem (including data inspection and evaluation subsystem), and data archiving subsystem. In this role the ADEOS-II Mission Operation System makes the operation plan of ADEOS-II onboard instruments based on the operation requests from sensor providers and NASDA PIs. Sensor providers can request the mission operation of their sensor and NASDA PIs can request mission operation of GLI (observation area of GLI 250 m and tilting operation). ADEOS-II Mission Operation System also schedules data downlinks and plans mission data recorder operations (tape management).
The ADEOS-II Mission Operation System serves as a Feeder Link Station for DRTS which is the Inter Orbit Communication Satellite (IOCS via Ka-band), as a Direct Downlink Station (X-band), as a Direct Transmission Station (UHF), and as a backup Tracking Telemetry and Command Station (TT&C).
In addition, The ADEOS-II Mission Operation System archives all Raw data, POLDER level 0 data and high level standard products for NASDA instruments, processes all mission data to Level 0, processes house keeping data of all sensors, and processes NASDA sensor data to standard products.
Moreover, the ADEOS-II Mission Operation System exchanges mission operation information files, Level 0 data and near real time products with the Sensor providers and related organizations using the handshake protocol developed for ADEOS-II satellite data transfers and specified in Network Interface Control Document Between NASDA and related agencies for the ADEOS-II Project.
Finally, the ADEOS-II Mission Operation System obtains higher-level products from the sensor **providers** on a request basis.

(b) Earth Observation Information System/Data distribution and Management Subsystem (EOIS/DDMS)

NASDA's DDMS portion of the EOIS at the EOC provides network services for ADEOS-II operations, distributes standard product data sets and catalog information to users, and provides catalog system interoperability with EOSDIS.
Additionally, DDS (Data Distribution Subsystem) is a part of DDMS and the primary interface for ADEOS-II mission operations information and data flows between EOC and related agencies using network.

(c) Tracking and Control System

Tracking and Control System consists of the Tracking And Control Center (TACC), the Feeder Link Station at Tsukuba Space Center (TKSC), the Tracking And Control Station (TACS) and the NASDA Transportable Station-Kiruna (NTSK). The TACC, located at TKSC, verifies the EOC mission operations plan against satellite constraints and generates the satellite commands. Commands are transmitted from TACC to the satellite through the Feeder Link Stations at the TKSC or TACS/NTSK.
TACC acquires the satellite engineering telemetry and ranging data using the Feeder Link Station at TKSC or TACS/NTSK for orbit determination. TACC evaluates these data and monitors the safety of the instruments and activates emergency safing procedures according to the Spacecraft Orbital Operations Handbook (SOOH) instructions. Additionally, TACC processes Doppler tracking data to provide predict and definitive satellite ephemeris.

Moreover, TKSC serves as a backup Feeder Link Station for the IOCS to acquire the mission data.

(2) Earth Observation Research Center (EORC)

EORC is the responsible organization that develops higher level processing algorithms for Level 1 to Level 2 and 3. In the ADEOS-II program, EORC will develop higher level processing software for AMSR and GLI. EOC will start **distribution of the** standard products **after they are verified.**~~distribution when the quality is verified.~~

(3) Overseas Stations

(a) NASA/NOAA Ground Network

The NASA/NOAA Ground Network (NGN) is ~~the~~ **a** NASA management activity for the coordination of data acquisition from passes not available to EOC at Hatoyama, Japan or Kiruna, Sweden. The NGN Data Acquisition Stations (NASA Ground Stations) consist of Alaska SAR Facility located at Fairbanks, Alaska and Wallops Flight Facility at Wallops Island, Virginia.

In mode 1 operation, the NASA Ground Stations acquire the GLI 250 m data via X1 band and the Mission Real-Time (MRT) data via X3 band. Each station processes the ADEOS-II/ARGOS DCS (hereinafter refereed as "DCS") and GLI 1km real-time data to level 0 data. The DCS level 0 data is transmitted to EOC and the DCS and GLI 1km level 0 data to NOAA/NESDIS on a near real-time basis via EOSDIS network. The raw GLI 250 m data is transmitted to EOC **using D1 tapes.**~~by media.~~

In mode 2 operation, the NASA Ground Stations acquire the MDR data, GLI 250 m data and/or ODR data via X1 band and the MRT data via X3 band. Each station processes the MDR data (except for POLDER data) and the DCS, GLI 1km real-time data to level 0 data, and transmits the level 0 data to related agencies on a near real-time basis via EOSDIS network. The raw MDR data , GLI 250 m and/or ODR data is transmitted to EOC by media.

Additionally, NASA ground stations process Dynamics Monitoring System (DMS) and Visual Monitoring System (VMS) real time data to level 0 data and transmit them to EOC using network in both mode 1 and mode 2 operation on a request basis from NASDA.

(b) Kiruna Station

Kiruna Station serves as a Direct Downlink Station of NASDA.

In mode 1 operation, the Kiruna Station acquires the GLI 250 m data via X1 band and the MRT data via X3 band. Kiruna station processes the DCS real-time data to level 0 data, and transmits the level 0 data to EOC on a near real-time basis. The DCS level 0 data is forwarded to CLS/Japan and NOAA/NESDIS. The raw GLI 250 m data is transmitted to EOC **using D1 tapes.**~~by media.~~

In mode 2 operation, the Kiruna Stations acquires the MDR data, GLI 250 m data and/or ODR data via X1 band and the MRT data via X3 band. Kiruna station processes the MDR data (except for POLDER data) and the DCS real-time data to level 0 data, and transmits the level 0 data to EOC and related agencies on a near real-time basis through EOIS/DDS. The GLI 1km level 0 data generated at Kiruna station is processed to level 1 **product**~~data~~ at EOC for selected areas and bands and the data is transmitted to NOAA/NESDIS using network through EOIS/DDS on a near real time basis. The raw MDR data, GLI 250 m and /or ODR data is transmitted to EOC **using D1 tapes.** ~~by media.~~

Additionally, Kiruna station processes DMS and VMS real time data to level 0 data and transmits them to EOC using network in both mode 1 and mode 2 operation on a request basis from NASDA.

(4) Sensor Providers

The sensor providers include NASA/JPL/SeaPAC (SeaWinds Project), CNES (POLDER Project and ARGOS Project (CNES/CLS)), MOE and NIES (ILAS-II Project) and TKSC/TEDA (TEDA Project). After ADEOS-II is launched, they will receive level 0 processed data from NASDA/EOC, NASA Ground Stations and Kiruna station via network and perform higher level processing. CNES/POLDER will receive edited POLDER level 0 data from only EOC on media. Strictly speaking, TEDA is not sensor, but NASDA deals with TEDA as sensor and deals with TKSC/TEDA as an sensor provider. Each sensor provider can make mission operation requests only for its own sensor.

(a) Jet Propulsion Laboratory / SeaWinds Processing and Analysis Center (SeaPAC)

The NASA SeaWinds Scatterometer Project (SeaWinds) at the Jet Propulsion Laboratory is part of NASA's Earth Observation Program. The SeaWinds instrument is a specialized microwave radar and will be used to continue the observational record of the NASA Scatterometer (NSCAT) instrument flown on ADEOS for the frequent and accurate measurement of wind vectors over the global ocean. The SeaWinds Project will process and analyze the mission data and operate the instrument.

The SeaWinds Project at JPL operates the SeaPAC and receives and processes the SeaWinds Level 0 data. SeaPAC also uses the AMSR level 1A products for SeaWinds processing.

The SeaPAC analysts request commands for controlling the instrument and use Level 0 data to monitor the near real time health and safety of the instrument and to determine long term instrument engineering trends.

Additionally, the SeaPAC analysts monitor the calibration of the instrument to determine performance trends and create algorithm updates; and provides quality assurance of the higher level products. The SeaWinds Project also provides user support for answering algorithm related questions.

The SeaWinds Project administers a bulletin board/world wide web Home page for disseminating ADEOS-II/SeaWinds mission status.

(b) Centre National d'Etudes Spatiales (CNES)

1) POLDER Project

The Polarization and Directionality of the Earth's Reflectance (POLDER) Project, managed by Centre National d'Etudes Spatiales (CNES), is a part of CNES's Earth Observation Program. The POLDER instrument will observe intensity and polarization of solar radiation reflected by the earth atmospheric system under different viewing angles.
The POLDER instrument will be used to continue observations recorded by the same instruments flown on ADEOS and expected to be useful for improvement of radiation measurement accuracy concerning remote sensing, radiation budget, etc.
The POLDER Project receives the POLDER Level 0 data from EOC on media and processes the higher level product.

2) ARGOS Project

CNES manages ARGOS Project.
ARGOS-NEXT DCS "sensor" on board ADEOS-II has been supplied by CNES. CNES operates Downlink Message Management Center (DMMC) and Master Beacon Network. CNES also operates ARGOS on NOAA polar satellites.
CLS/Japan will run the DCS global and regional data of ADEOS-II and regional data collected at EOC from NOAA/ARGOS. CLS/Japan is the point of contact for ARGOS DCS users and in charge of the promotion of the system.

(c) Ministry of the Environment (MOE) & National Institute for Environmental Studies (NIES)

The Improved Limb Atmospheric Spectrometer-II (ILAS-II) project, is managed by MOE and NIES. ILAS-II Instruments is developed under management of MOE and will be used to continue the ILAS instruments flown on ADEOS.
The ILAS-II Ground Segment (ILAS-II Data Handling Facility: ILAS-II DHF) is developed under management of NIES. At this facility, ILAS-II Project receives the ILAS-II Level 0 data from EOC on a near real-time basis and processes the higher level products.

(d) Tsukuba Space Center (TKSC) / Technical Data Acquisition Equipment (TEDA)

TKSC/TEDA supplies mission equipment TEDA carried on ADEOS-II. TKSC/TEDA makes a source operation requests on a TEDA, and analyzes observation data.

(5) Earth Observation System Data and Information System /Physical Oceanography Distributed Active Archive Center (EOSDIS/PO.DAAC)

The NASA Earth Observing System Data and Information System (EOSDIS) is managed by the Earth Science Data and Information System (ESDIS) Project Office at the Goddard Space Flight Center (GSFC). EOSDIS supports NASA's Earth Observation Program with communication, processing, archive and distribution services. The Physical Oceanography Distributed Active Archive Center (PO.DAAC) at the Jet Propulsion Laboratory (JPL) is one of the data centers of EOSDIS.

For SeaWinds, EOSDIS/PO.DAAC generates catalog (inventory, directory) information, archives the data sets, and distributes standard products and catalog information. The EOSDIS/PO.DAAC also advertises SeaWinds Standard Product availability, services user requests for products, and provides user support for answering data format and distribution related questions.

Finally, EOSDIS/PO.DAAC receives AMSR L1A product from EOC**, distributes it to SeaPAC and NOAA, and arrange for its archiving** ~~and stores it to make available for SeaPAC .~~

(6) NOAA/NESDIS

The National Oceanic and Atmospheric Administration (NOAA) National Environmental Satellite, Data, and Information Service (NESDIS) will utilize global SeaWinds data obtained in near real-time for operational purposes. Selected data from the ADEOS-II GLI 1km will also be used for the US Coast Watch Program. DCS data will be relayed from both EOC **(including Kiruna)** and **NASA ground stations** ~~NESDIS~~ to CNES/CLS. These DCS data will be processed into environmental measurements at CNES and **will be** distributed to users worldwide.

NOAA processing of ADEOS-II data is managed and operated by NESDIS. NESDIS receives near real time SeaWinds Level 0 data and operationally processes and distributes SeaWinds Met data **and other products** for weather analysis and forecasting. Also, NESDIS receives selected GLI 1 km data on a near real-time basis and operationally processes and distributes ocean color products as ~~part~~ **parting support** of the US Coast Watch Program.

Finally, NOAA/NESDIS receives the DCS level 0 data from NASA Ground Stations and EOC**, both data captured in Kiruna and in Hatyama**, for relay to CNES/CLS (Largo), Maryland in support of EOC.

(7) Foreign Ground Stations

Foreign Ground Stations (FGS) is a direct receiving station to acquire GLI 250m data in real time within the visible coverage, and is operated by the agency for which an agreement is concluded with NASDA.

(8) Users

There are three categories of users..

(a) Principal Investigators (PIs)

ADEOS-II validation and verification program users, who also develop scientific application algorithms and can receive ADEOS-II datasets from NASDA/EORC.

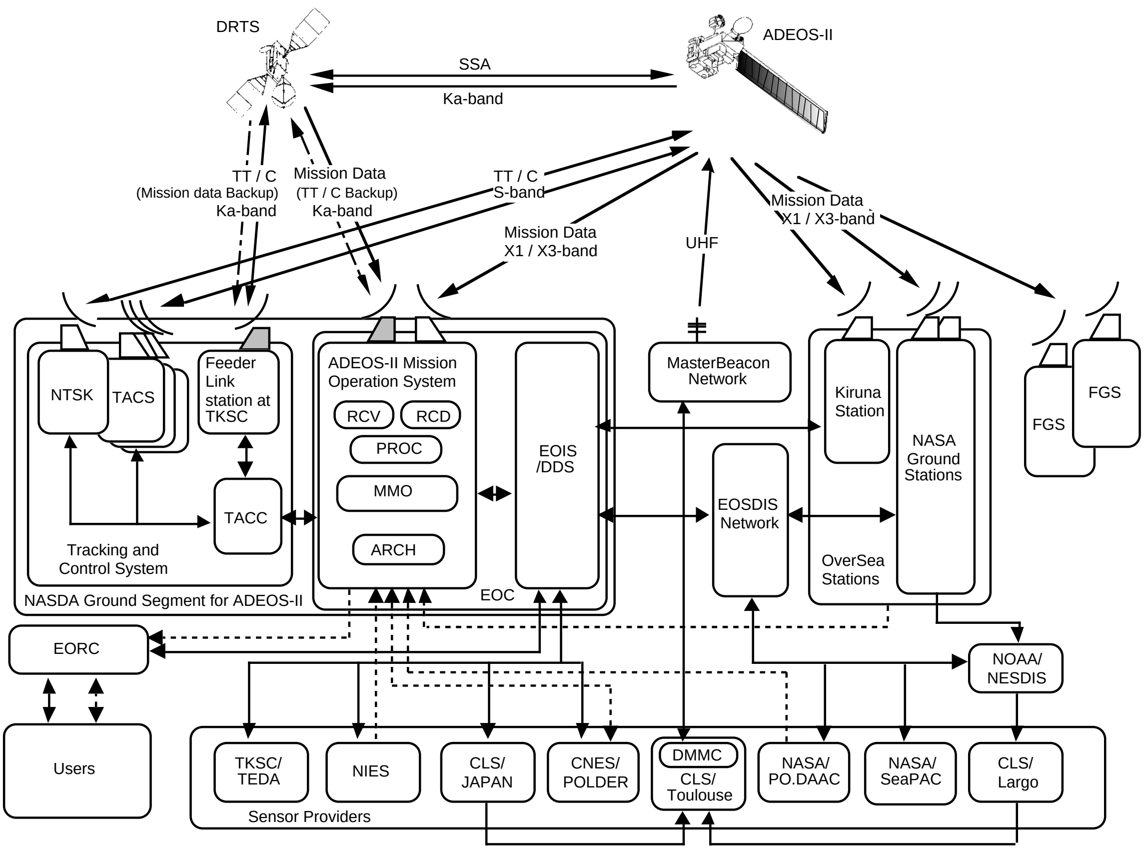
(b) Specific Organizations

Specific organizations have an ADEOS-II near real time products utilizing agreement with NASDA. Under the agreement, specific organizations can receive near real time products routinely from or through EOC via network.

(c) General Users

General users do not fall into the above categories and can get only ADEOS-II standard products on media.

ADEOS-II data flow is summarized in Fig 2.1.2.



EOC	: Earth Observation Center
EOIS	: Earth Observation and Information System
DDS	: Data Distribution Subsystem
RCV	: Receiving Subsystem
RCD	: Recording Subsystem
PROC	: Processing Subsystem
MMO	: Mission operation Management Organization
ARCH	: Archiving Subsystem
TACC	: Tracking And Control Center
TACS	: Tracking And Control Station
NTSK	: NASDA Transportable Station-Kiruna
EORC	: Earth Observation Research Center
EOSDIS	: Earth Observation System Data and Information System
TKSC	: Tsukuba Space Center
NIES	: National Institute for Environmental Studies
CNES	: Center National des Etude Spatiales
CLS	: Collecte Localisation par Satellite
DMMC	: Downlink Messages Management Center
PO.DAAC	: Physical Oceanography Distributed Active Archive Center
SeaPAC	: SeaWinds Processing and Analysis Center
NESDIS	: National Environmental Satellite Data and Information Service
FGS	: Foreign Ground Station

Ground Station   Feeder Link Station

On-Line   Off-Line

Fig. 2.1.1 System Configuration of ADEOS-II Operation

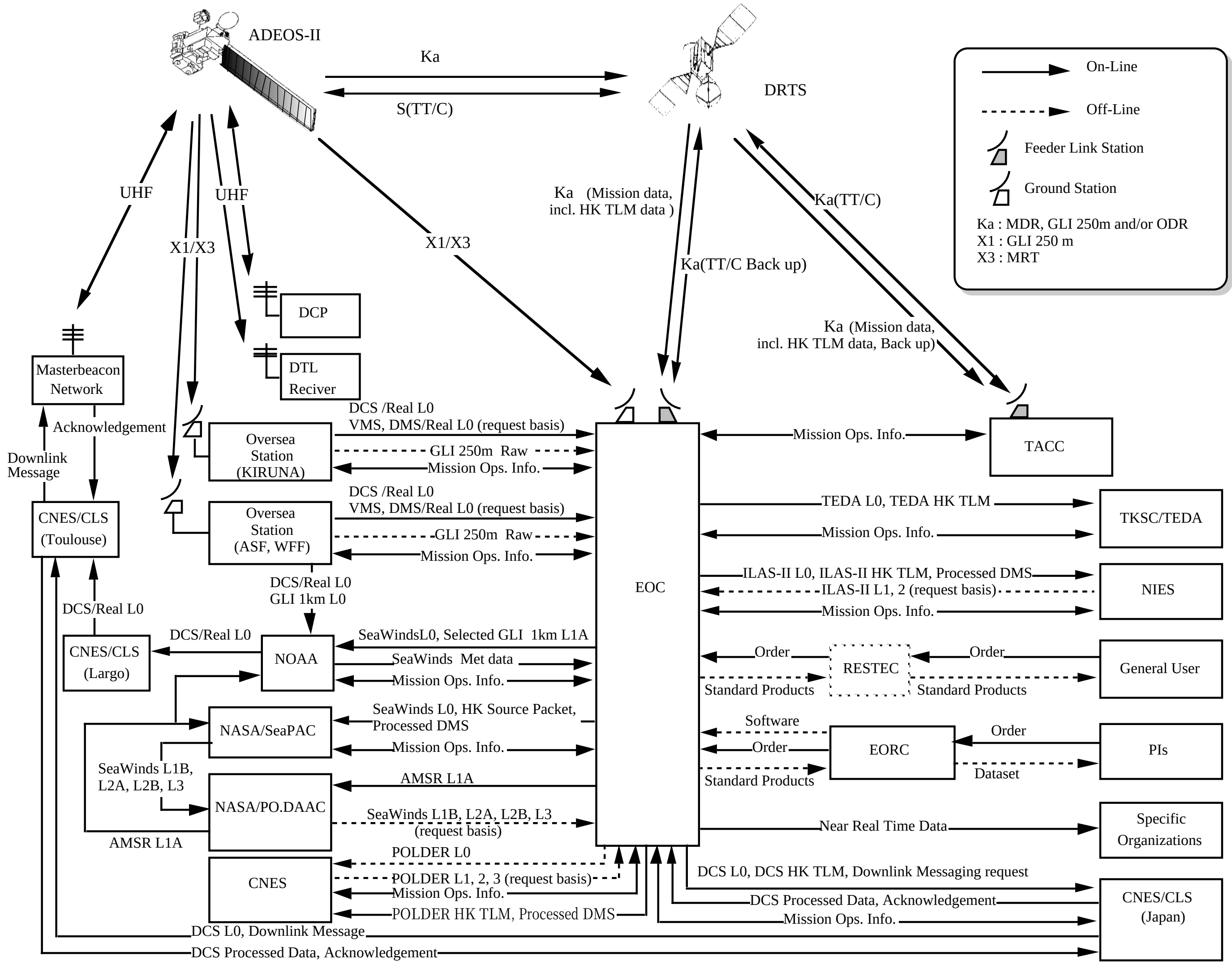


Fig. 2.1.2 (1/2) ADEOS-II Data Flow (Mode 1 Operation)

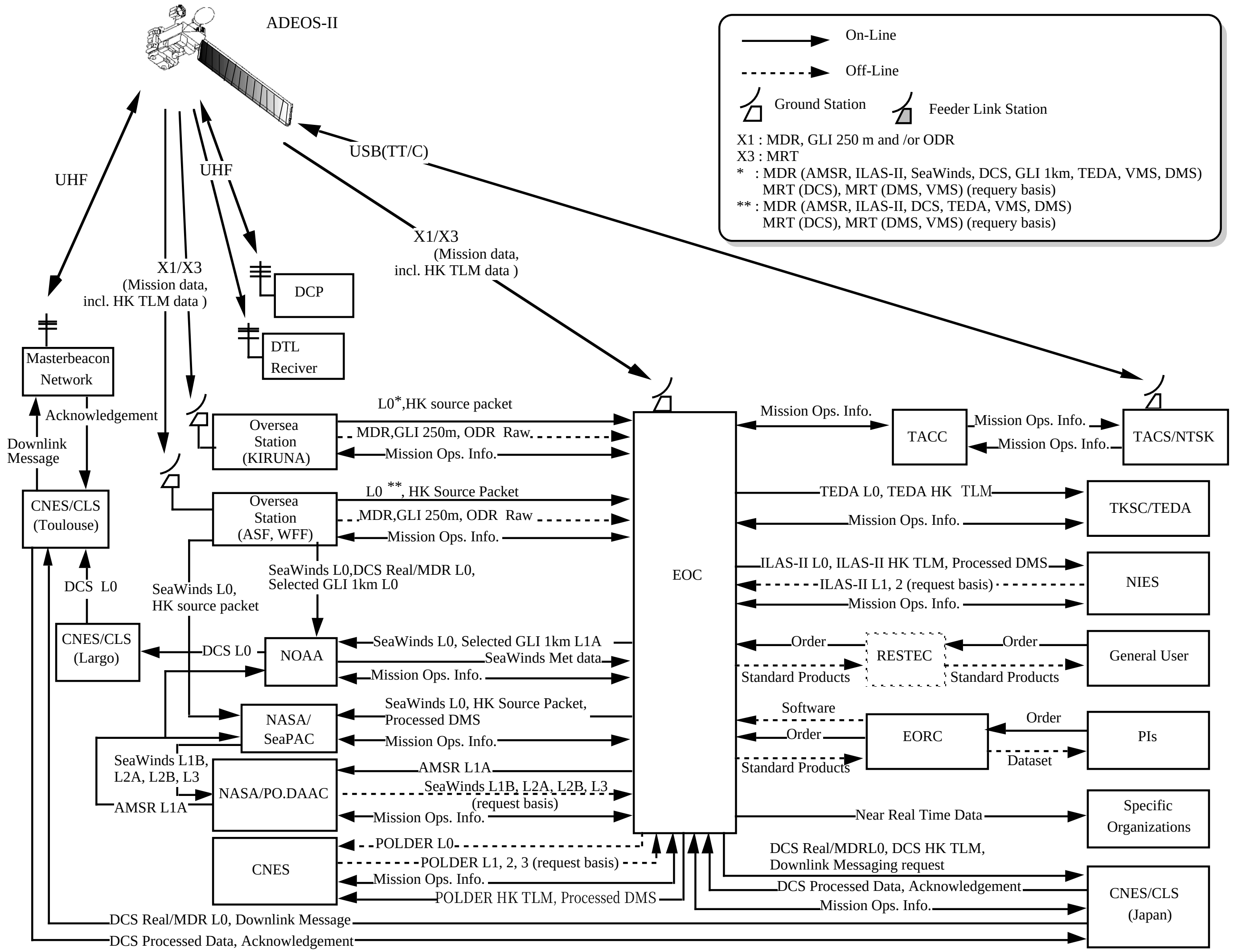


Fig. 2.1.2 (2/2) ADEOS-II Data Flow (Mode 2 Operation)

3. Operation Modes and Constraints

3.1 Mission Data Definition

(1) Multiplexed Data

Multiplexed data is **CCSDS** packetized data ~~based on CCSDS and including~~ **with different APIDs for** AMSR, GLI-1Km, ILAS-II, SeaWinds, POLDER, DCS, TEDA, VMS, DMS and HK telemetry**.** ~~data. It is separated into~~ **The two types of multiplexed data are** MDR data **from tape recorder readout** and MRT data**, which is broadcast in real time.** ~~according to its data transmission method.~~

(a) MDR data (Data rate: 60 Mbps)
It is multiplexed data in MDR reproduce mode and does not include GLI 250m data. MDR data **for each tape recorder read out event covers approximately 1 orbit (or in a few cases as much as ~ 2 orbits).** ~~includes multiplexed data of 1 orbit (or 2 orbits).~~

(b) MRT data (Data rate: 6Mbps)
It is multiplexed data and acquired by direct reception at each ground station via X3 or at EOC via IOCS.

(2) GLI 250m data (Data rate: 60 Mbps)

This data is observed **over** land areas in daytime, and **is** acquired at each ground station via X1 band, or at EOC via IOCS in real time. GLI 250m data is also recorded on to ODR.
GLI 250m data **transmitted** in real time ~~mode including telemetry~~ **includes signal** data, attitude data and orbit data.

(4) ODR data (Data rate: 60 Mbps)

Data recorded on ODR ~~recorded data~~ (mainly GLI 250 m data) is **read out and** acquired at each ground station via X1 or at EOC via IOCS.

3.2 Satellite Operation Modes

Table 3.2.1 shows operation modes of the ADEOS-II onboard sensors and data transmission instruments.

Table 3.2.1 Operation Modes of Sensors and Data Transmission Instruments

Data Resource														Data Transmission			
														IOCS Subsystem		DT Subsystem	
														Q	I	X1	X3
Total Data Rate (Mbps)	GLI		AMSR	SeaWinds	POLDER	ILAS-II	TEDA	VMS	DMS	DCS	MDR Reproduce	ODR Reproduce	Day Time/ Night Time	By way of DRTS (Mbps) UQPSK		Direct Transmission (Mbps)	
	1 km	250 m															
6 (case1)	ON		ON	ON			ON	ON	ON	ON			Night Time	-	-	-	6
	ON		ON	ON	ON	ON	ON	ON	ON	ON			Day Time				
6+60 (case2)	ON	**ON**	ON	ON	ON	ON	ON	ON	ON	ON			Day Time	60	6	60	6
	ON		ON	ON	ON	ON	ON	ON	ON	ON	**ON**						
	ON		ON	ON	ON	ON	ON	ON	ON	ON		**ON**					
	ON		ON	ON			ON	ON	ON	ON	**ON**		Night Time				
	ON		ON	ON			ON	ON	ON	ON		**ON**					
6+6+ 60+60 (case3)	ON	**ON**	ON	ON	ON	ON	ON	ON	ON	ON	**ON**		Day Time	60	6	60	6
	ON	**ON**	ON	ON	ON	ON	ON	ON	ON	ON		**ON**					

Note: 1."ON" and "**O N**" on a line are simultaneously operational.

2. ON ; 6 Mbps multiplexed transmission

   O N ; 60 Mbps transmission

   In case ~~that~~ **both the** GLI 250m and MDR and/or ODR are simultaneously operational, different transmission subsystems must be used for each data transmission.
3. IOCS subsystem and DT subsystem are able to **operate** simultaneously**.** ~~operate.~~
   (The simultaneous operation can be performed within electrical power budget.)
4. 6 Mbps multiplexed data includes HK telemetry data.
5. GLI 250m data includes HK telemetry data.
6. ILAS-II and POLDER must not operate in same time.
7. One of IOCS and DT is operational for "6+60 Mbps" transmission.
8. ILAS-II, TEDA and VMS must not operate in same time.
   (operation priority: ILAS-II > VMS > TEDA)
9. ILAS-II operates at sunrise and sunset of satellite on each orbit.

1) Case 1: Total data rate is 6 Mbps (mode 2)
In this case, only MRT data is transmitted to ground stations via X3 band within the coverage of EOC, ASF, WFF and Kiruna station.

2) Case 2: Total data rate is 60+6 Mbps (mode 1 or mode 2)
In this case, there are three patterns for data transmission.

a) MDR, GLI 250m or ODR data is transmitted to ground stations via X1 band, and MRT data is transmitted simultaneously via X3 band within the coverage of EOC, ASF, WFF and Kiruna station.
b) MDR, GLI 250m or ODR data is transmitted to the Feederlink Station at EOC via Q channel, and MRT data is transmitted simultaneously via I channel within the contact of IOCS.

3) Case 3: Total data rate is 60+60+6+6 (mode 1 or mode 2)
In mode 1 case, MDR, GLI 250m or ODR data is transmitted to the Feederlink Station at EOC via Q channel, and MRT data is transmitted simultaneously via I channel within the contact of IOCS. And also, GLI 250 m data is transmitted to ground stations via X band, and MRT data is transmitted simultaneously via X3 band within the coverage of EOC, ASF, WFF and Kiruna station.

In mode 2 case, MDR, GLI 250m or ODR data is transmitted to ground station via X1 band and MRT data is transmitted simultaneously via X3 band within the coverage of EOC, ASF, WFF and Kiruna station.

3.3 Sensor Operation Pattern

Operation pattern of each sensor onboard ADEOS-II is shown in Table 3.3.2 and Fig 3.3.1.

Table 3.3.2 Operation Pattern of each Sensor onboard ADEOS-II

Sensor	Coverage	Operation Condition	Remark
AMSR	Global	Continuous	
GLI (1km)	Global	Continuous	MTIR (Middle and Thermal Infrared)
		Daytime	VNIR (Visible and Near Infrared) SWIR (Short-Wavelength Infrared)
GLI (250 m)	Land area	Daytime	VNIR (Visible and Near Infrared) SWIR (Short-Wavelength Infrared)
ILAS-II	high latitudes	Sunrise and sunset of ADEOS-II	Within sun elevation angle ≤ 7˚ (Sun zenith angle ≥ 83˚)
SeaWinds	Global	Continuous	
POLDER	Global	Sun Elevation ≥ 15˚	Normal condition.
		Sun Elevation > 7˚	Maximum condition, (Sun zenith angle < 83˚)
TEDA	Global	Continuous	without ILAS-II operation and VMS images transferring from its own memory to MDR.
DCS	Global	Continuous	
VMS	Local	On demand	
DMS	Global	Continuous	

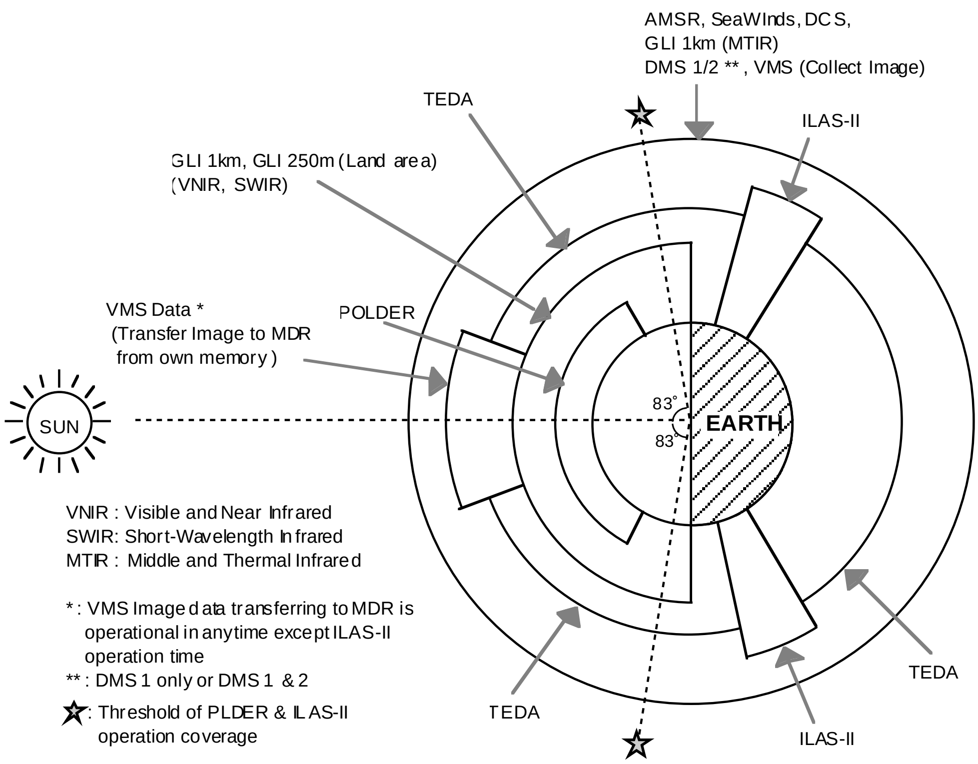


Fig. 3.3.1 Operation Pattern of ADEOS-II Sensors

3.4 Onboard Instruments Operation and Constraints

(1) AMSR

(a) The specification of instrument is as follows.

Frequencies	8 frequency bands
Swath width	1600 Km
Data rate (=L/T)	111.09 Kbps (Actually 87.38 Kbps*)
Packet length (L)	8192 bit
Packet Interval (T)	73.744 msec

*: There is no packet distribution time during 1 scan of AMSR instrument.

(b) AMSR collects data globally.

(c) AMSR operates continuously.

(d) AMSR operates in parallel with the other sensors.

(e) AMSR data and HK telemetry data are recorded on the MDR as multiplexed data which includes other sensor data, and the high speed playback MDR data is transmitted to EOC via DRTS, or to Ground Stations using X1 band direct transmission.

(2) GLI

(a) The specification of instrument is as follows.

	1km resolution	250m resolution
Number of spectral bands	19 (VNIR) 4 (SWIR) 7 (MTIR)	4 (VNIR) 2 (SWIR)
Scanning angle	< ± 45 degrees (scene width: < 1600 Km)	
Instantaneous Field of View (IFOV)	1.25 mrad	0.3125 mrad
Tilt angle	+ 20 , 0 , -20 degrees	
Data rate	3.8676 Mbps (=L/T)	16 Mbps*
Packet length (L)	7536 bit	N/A
Packet Interval (T)	1948.5 μsec	N/A

* Data downlink rate is 60 Mbps with dummy data.

(b) GLI (1Km mode) collects data globally.

(c) GLI (1Km mode) operates continuously. All bands operate in daytime, only middle and thermal infrared (MTIR) bands operate in nighttime.

(d) GLI (6 Km mode) transmits browse data, which local users can receive and analyze in real time. Browse data is transmitted directly using UHF band DTL.

(e) GLI (1Km mode) operates in parallel with the other sensors.

(f) GLI (1Km mode) data and HK telemetry data are recorded on the MDR as multiplexed data which includes other sensor data, and the high speed playback MDR data is transmitted to EOC via DRTS, or to Ground Stations using X1 band direct transmission.

(g) GLI (250m mode) operates only over land area within daytime. Observation data is transmitted to EOC in real time by way of DRTS, or to Ground Stations using X1 band direct transmission. Moreover, GLI (250m mode) data is recorded on ODR and its playback data is transmitted to EOC by way of DRTS, or to Ground Stations using X1 band direct transmission.

(3) ILAS-II

(a) The specification of instrument is as follows.

Spectral Coverage	6.2 ~ 11.8 μm 3.0 ~ 5.7 μm 12.78 ~ 12.85 μm 753 ~ 784 nm
Field of View (FOV)	Interference View - Center is Rising and Setting Sun Direction Vertical Views - ±10 degrees Horizontal Views - ±10 degrees
Data Rate (= L/T)	453.62 Kbps
Packet length (L)	4224 bit
Packet Interval (T)	9.312 msec

(b) ILAS-II operates at sunrise and sunset on each orbit. (Sun zenith angle is more than 83 degrees)

(c) ILAS-II operates in parallel with the other sensors (except for POLDER).

(d) ILAS-II data and HK telemetry data are recorded on the MDR as multiplexed packet data which includes other sensor data, and the high speed playback MDR data is transmitted to EOC via DRTS, or to Ground Stations using X1 band direct transmission.

(4) POLDER

(a) The specification of instrument is as follows.

Number of Spectral Bands	9 bands from 443 nm to 910 nm
Field of view (FOV)	± 43 x ±51 degrees
Pixel Size (sub-satellite size)	6 km x 7 km
Swath width	1800 km x 2400 km
Data Rate	882.352 Kbps

(b) POLDER collects data globally.

(c) POLDER operates within daytime (Sun zenith angle is less than 83 degrees, as maximum condition).

(d) POLDER operates in parallel with the other sensors (except for ILAS-II).

(e) POLDER data and HK telemetry data are recorded on the MDR as multiplexed packet data which includes other sensor data, and the high speed playback MDR data is transmitted to EOC via DRTS, or to Ground Stations using X1 band direct transmission

(5) DCS

(a) The specification of instruments is as follows.

Data rate (= L/T)		10 Kbps
Packet length (L)		400 bit
Packet Interval (T)		40 msec
Data Receiving system from an DCP	Frequency	401.65 MHz
	Data Rate	400 bps/ DCP
Data Transmitting system to an DCP	Frequency	465.9875 MHz
	Data Rate	200 bps

(b) DCS operates continuously.

(c) DCS data and HK telemetry data are recorded on the MDR as multiplexed packet data which includes other sensor data, and the high speed playback MDR data is transmitted to EOC via DRTS or to Ground Stations using X1 band direct transmission. Also, DCS data is included in MRT data and directly transmitted to Ground Stations using X3 band in real time.

(6) SeaWinds

(a) The specification of instrument is as follows.

Frequency	13.402 GHz ±500 kHz		
Spatial Resolution	25 Km		
Swath width	1800 km		
Data Rate (= L/T)	35.378 Kbps (default)	38.208 Kbps	31.840 Kbps
Packet length (L)	6368 bit x 3		
Packet Interval (T)	540 msec (default)	500 msec	600 msec

(b) SeaWinds collects data globally.

(c) SeaWinds operates continuously.

(d) SeaWinds operates in parallel with the other sensors

(e) SeaWinds data and HK telemetry data are recorded on the MDR as multiplexed packet data which includes other sensor data, and the high speed playback MDR data is transmitted to via DRTS, or to Ground using X1 band direct transmission. .

(7) TEDA

(a) The specification of instrument is as follows.

Item	Radioactive Rays Absorption, Charged Electric Potential, Heavy Ion, etc.
Data Rate (= L/T)	672 bps
Packet length (L)	336 bit
Packet Interval (T)	500 msec

(b) TEDA operates continuously.

(c) TEDA data and HK telemetry data are recorded on the MDR as multiplexed packet data which includes other sensor data, and the high speed playback MDR data is transmitted to EOC via DRTS, or to Ground Stations using X1 band direct transmission.

(8) VMS

(a) The specification of instrument is as follows.

Component	Camera system - 3 wide angle cameras - 1 telephoto camera Control system Lightning system
Pixel Size	692 x 504 (Effective: 659 x 494)
Frequency	1 image / sec.
Memory Capacity	> 100 Mbit (40 images can be stored temporarily)
Data Rate (=L/T)	97.66 Kbps
Packet length (L)	6144 bit
Packet Interval (T)	62.91 msec

(b) VMS collects images of satellite and instrument according to the requirements from NASDA.

(c) The collected images are stored temporarily on its own memory.

(d) The temporarily stored images are transferred to MDR at once per orbit without ILAS-II operation time, and recorded as packet data which includes other sensor data.

(4) The high speed playback MDR data is transmitted to EOC via DRTS, or to Ground Stations using X1 band direct transmission.

(9) DMS

(a) The specification of instrument is as follows.

Component	Accelerometer	Star Tracker	
	Body Mount Acc. Paddle Mount Acc. Paddle Scroll Monitor Paddle Tension Monitor	Attitude data	Image data
Data Rate (=L/T)	3.02 Kbps	1.06 Kbps	4.99 Kbps
Packet length (L)	504 bit		
Packet Interval (T)	166.67 msec	476.19 msec	101 msec

(b) DMS operates continuously.

(c) DMS operates in parallel with the other sensors

(d) DMS data is recorded on the MDR as packet data which includes other sensor data, and the high speed playback MDR data is transmitted to EOC via DRTS, or to Ground Stations using X1 band direct transmission.

(e) The difference APID is applied for the packet of accelerometer data and star tracker data.

(e) As nominal operation, accelerometer data and attitude data are collected from DMS globally. In this case, total data rate of DMS is 4.08 Kbps (3.02 Kbps for accelerometer packets and 1.06 Kbps for star tracker packets).

(g) In addition, star tracker image data will be acquired around 25 minutes per month on a request basis. During this operation, total data rate of DMS is 9.07 Kbps (3.02 Kbps for accelerometer packets and 6.05 Kbps for star tracker packets).

(10) MDR

(a) The specification of instrument is as follows.

Unit	3
Recording Speed	6Mbps
Reproducing Speed	60Mbps
Recording Capacity	9 Gbyte (72Gbits)
Recording Data Contents	CCSDS Formatted Multiplexed Data

(b) The ADEOS-II spacecraft carries three MDRs. All ADEOS-II mission data and HK telemetry data, except GLI 250m, are multiplexed and recorded on MDR.

(c) Operation Patterns

There are two operation patterns on the MDR operation. Three MDRs will be used routinely as illustrated in Fig. 3.4.1. This pattern is the normal MDR operation.

When one MDR is operated in a reproducing mode, the other is in a recording mode for an orbit. Recording and reproducing operations will be performed orbit by orbit. The MDR reproduction is typically planned once a orbit.

MDR recorded data will be reproduced in reverse order and dumped to a ground station.

If the downlink of MDR reproduced data is not available during the following orbit because of some downlink limitations, the data recording will continue one more orbit.

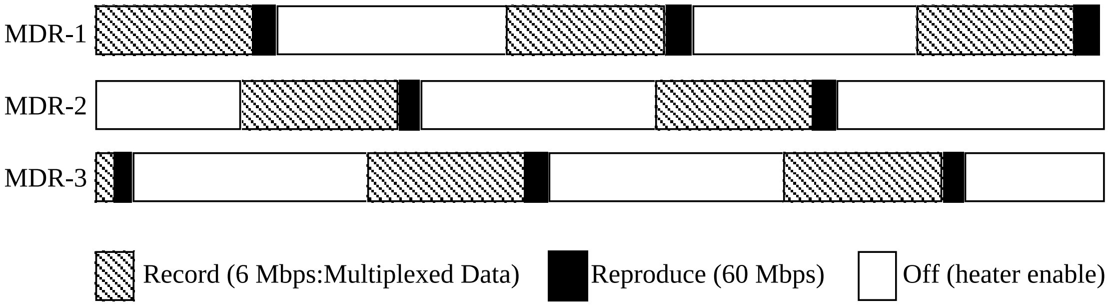


Fig. 3.4.1 Three MDRs Operation Pattern

In case of one of three MDRs has an anomaly, the MDR operation pattern will be shifted to two MDRs operation pattern as illustrated in Fig. 3.4.2. In this operation pattern, two of three MDRs will be used to record a mission data.

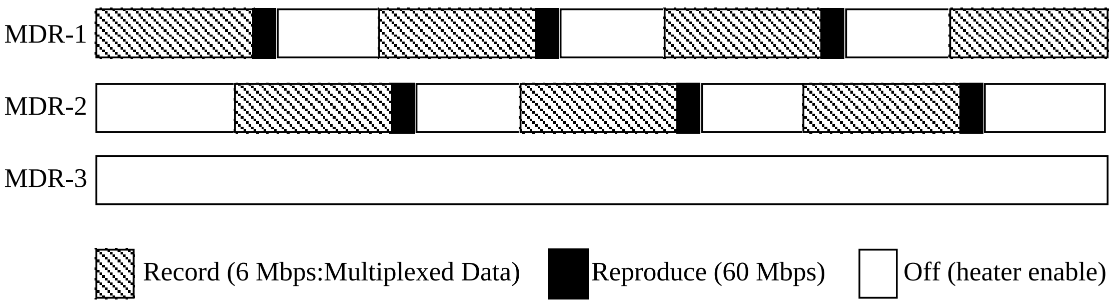
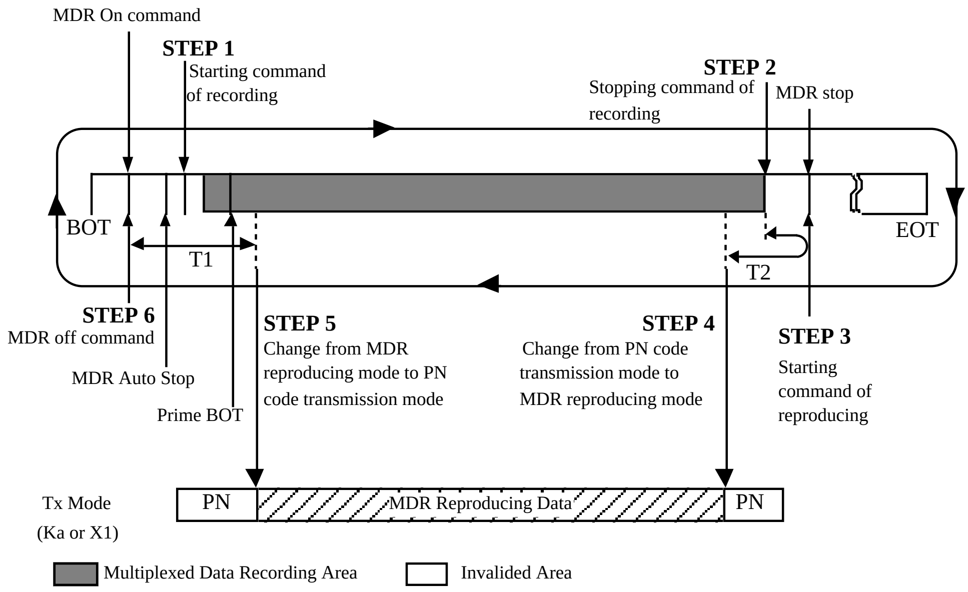


Fig. 3.4.2 Two MDRs Operation Pattern

(d) MDR Recording / Reproducing Method

Fig. 3.4.3 shows the recording and reproducing method of MDRs.

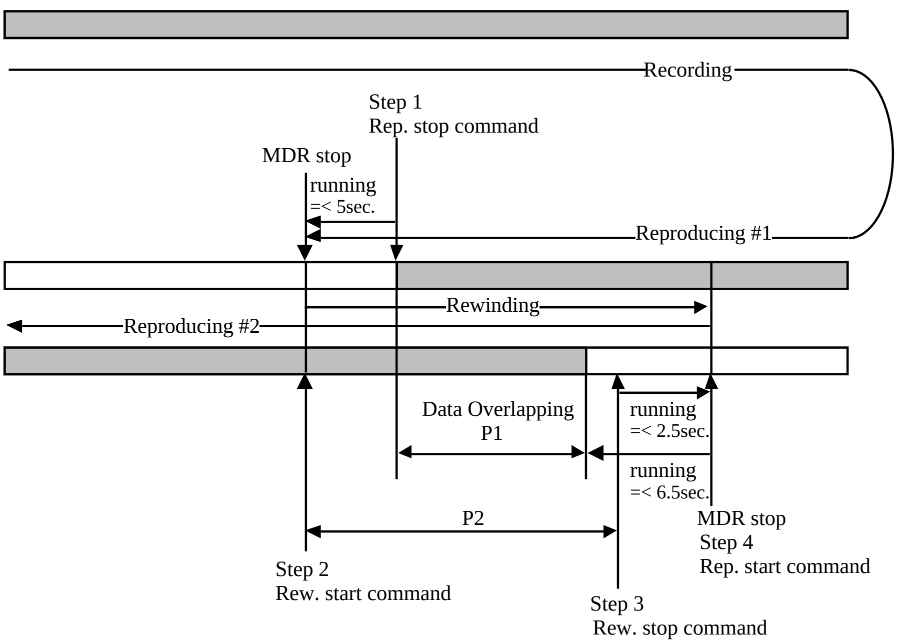


T1 : Time from MDR/PN mode transition to MDR off =15 sec.
T2 : Time from Rec. stop command to PN/MDR mode transition after Rep. start = 17 sec.

Fig. 3.4.3 MDR Recording / Reproducing Method

(e) Rewind Operation

In Mode 2, MDR data may be divided into two parts due to the restriction of visible time at each ground station. When the MDR data is divided, the rewind operation will be applied as illustrated in Fig. 3.4.4.



P1 (data overlapping time) = about 80 sec. (recording time)
P2 (rewinding time) = 10 sec.

Fig. 3.4.4 MDR Rewind Operation

(f) Overlap time of recording between the two MDRs should be within 8 min.

(g) The limitations of MDR recording time are 200 minutes in three MDRs operational, or 106 minutes in two MDRs operational.

(h) The MDR is kept in off mode (heater enable) for no recording or reproducing.

(11) ODR

(a) The specification of instrument is as follows.

Unit	1
Recording Speed	6Mbps and 60Mbps
Reproducing Speed	60Mbps
Recording Capacity	3 Gbyte

(b) ODR is used for recording GLI 250 m data mainly.

(c) **ODR is experimental equipment, but it is used for routine operation, after the capability is checked as good.** ~~The ODR will be operated during the first half of the ADEOS-II Mission when power is at full capacity (TBD)~~.

(12) X-Band Transmitter

(a) The specification of instrument is as follows.

X1 band	Frequency	8150 MHz
	EIRP	>3.7 dBW (EL=90°), >19.6 dBW (EL=5°)
	Data rate	60 Mbps
	Modulation	DPCM-QPSK
	Data	MDR data, GLI 250m data or ODR data
	Ground Station	EOC, ASF, WFF and Kiruna
X3 band	Frequency	8250 MHz
	EIRP	>– 10.3 dBW (EL=90°), >5.6 dBW (EL=5°)
	Data rate	6 Mbps
	Modulation	DPCM-QPSK
	Data	MRT data
	Ground Station	EOC, ASF, WFF and Kiruna

(b) X-band transmitter (X1 and X3) is available with Ka-band transmitter simultaneously.

(c) In case ODR is off in an orbit, the limitation of X-band (X1 and X3) transmission time is 30 minutes in the same orbit.

(d) In case ODR recording and reproducing operation is performed 4 minutes respectively in an orbit, the limitation of X1-band transmission time is 15 minutes and X3-band is 30 minutes.

(e) In case ODR recording and reproducing operation is performed during 7 minutes respectively in an orbit, the limitation of X-band (X1 and X3) transmission time is 10 minutes in the same orbit.

(13) S-Band Transmitter

(a) The specification of instrument is as follows.

USB	Frequency	2220 MHz
	EIRP	Low Gain > -26.2 dBW (EL=90°), > -18.2 dBW (EL=5°) High Gain > -16.9 dBW (EL=90°), > --8.9 dBW (EL=5°)
	Data rate	4096 bps (for real time HK telemetry) 32768 bps (for stored HK telemetry)
	Modulation	PCM (Bi ϕ -L) - PSK/PM
	Data	Real time HK telemetry Stored HK telemetry
	Ground Station	TACS, NTSK
SSA	Frequency	2220 MHz
	Data rate	4096 bps (I channel for real time HK telemetry) 32768 bps (Q channel for stored HK telemetry)
	Modulation	SQPN
	Data	Real time HK telemetry Stored HK telemetry
	IOCS	DRTS

(b) Common equipment is used as USB and SSA transmitter.

(c) Nominally, S-band transmitter of ADEOS-II is in SSA transmission mode.

(d) During USB is uplinked from TACS/NTSK to ADEOS-II within there visible area, S-band transmitter mode is change to USB transmission. After finish of USB transmission at the end of TACS/NTSK visible pass, the transmission mode is returned to SSA.

(e) Basically, USB high gain mode is not be used in nominal operation.

(14) DTL

(a) The specification of instrument is as follows.

Frequency	467.7 MHz
EIRP	2.1 dBW (+Z axis), 2.4 dBW (+Z axis ±40°)
Data rate	23.5294 kbps
Modulation	PCM-BPSK
Data	Subsampled GLI data

(b) DTL operates in conjunction with GLI

(15) Ka-Band Transmitter

(a) The specification of instrument is as follows.

Frequency	19.685 GHz
Data rate	66 Mbps Q ch - 60 Mbps (MDR data, GLI 250m data or ODR data) I ch - 6 Mbps (MRT)
Modulation	UQPSK
IOCS	DRTS

(b) Ka-band transmitter is available with X-band transmitter simultaneously.

(c) Ka-band transmitter is available ~~within~~ **for** 45 minutes ~~per an~~ **in every** orbit including 5 minutes of link establishment time.

3.5 Ground Stations Operation and Constraints

3.5.1 Inter-Orbit Communication

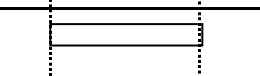
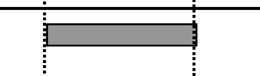
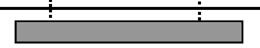
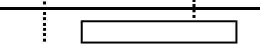
ADEOS-II data via DRTS is transmitted only to the NASDA Feeder Link Stations which are installed in NASDA/EOC and NASDA/TKSC.
For ADEOS-II operation, mission data which includes MDR, MRT, GLI-250m and ODR data are acquired using EOC Feeder Link Station.
TKSC Feeder Link Station is used for tracking and commanding operation.
Additionally, in anomaly case of TKSC Feeder Link Station, EOC station will be used for tracking and commanding operation as back up. And in anomaly case of EOC Feeder Link Station, TACC station will be used for mission data acquisition as back up.

3.5.2 Direct Transmission

3.5.2.1 NASDA/EOC

EOC has 3 or 4 visible passes per day for direct transmission from ADEOS-II, and the maximum visible time (from AOS to LOS) in a pass is 12 minutes.
When MRT data is transmitted to EOC via I channel and X3 band simultaneously, the redundant X3 band data is ignored (case 1 in the table 3.5.1). However, if I channel data does not cover the X3 data coverage, the I channel data will be ignored and X3 band data will be acquired as valid data (case 2 in the table 3.5.1).

Table 3.5.1 MRT Data Acquisition Policy at EOC

	Case 1: Ich data is valid	Case 2: X3 data is valid
EOC Visible Area		
X3 Data Coverage		
Ich Data Coverage		

(grey box) : Valid data (white box) : Invalid data

3.5.2.2 NASA Ground Stations

(1) ASF

ASF has 10 or 11 visible passes per day for direct transmission from ADEOS-II, and the maximum visible time (from AOS to LOS) in a pass is 12 minutes.

(2) WFF

WFF has 3 visible passes per day for direct transmission from ADEOS-II, and the nominal visible time (from AOS to LOS) in a pass is 12 minutes.

3.5.2.3 Kiruna Station

NASDA assigns 6 visible passes **(6 contacts)** per day for ADEOS-II data acquisition at Kiruna station, and the maximum visible time (from AOS to LOS) in a pass is 12 minutes. Data acquisition at Kiruna station will be done within operators working time (from 6:30 to 23:00 UT).

3.5.2.4 Foreign Ground Stations

As described in the section 3.4 (10), X band transmission time is limited within an orbit due to the constraints of ADEOS-II X band transmitter. Additionally, the limited resources are assigned preferentially to EOC, ASF, WFF and Kiruna station.

The remained resources can be used to transmit GLI-250m data to FGSs.

The details of the operation constraints are described in the MOIS (FGS part).

3.6 Data Capture Modes

There are two modes, modes 1 and 2, depending on the types of data capture for the routine operation phase. Data capture mode 1 is MDR, real time GLI 250m, ODR and MRT data acquisition using IOCS. The X-band downlink is also done to acquire GLI real time 250m and MRT data. Data capture mode 2 is MDR, real time GLI 250m, ODR and MRT data acquisition using X-band downlink.

(1) Data Capture Mode 1 (IOCS Main Mode)

- DRTS will be used to acquire a global set of multiplexed data recorded on the MDR. The MDR data will be acquired at the EOC Feeder Link Station.
- Real time GLI 250m data and ODR data will be acquired via DRTS as long as it will not affect the acquisition of MDR data. In the other words, GLI 250m data and/or ODR data transmission via IOCS will not be available during MDR data transmission.
- MRT data transmission will be available via DRTS during MDR, GLI 250 m and/or ODR data transmission.
- Real time GLI 250m data will be acquired directly at the each ground station in real time using X1 band.
- MRT data will be acquired at the each station in real time using X3 band, even when MRT is being acquired via DRTS.
- At EOC, MRT data of X3 data and I channel data can not be acquired simultaneously (see section 3.5.2.1).

(2) Data Capture Mode 2 (X-band Main Mode)

- To acquire multiplexed data globally, MDR reproduced data containing the multiplexed data will be received at each ground station using X1 band.
- GLI 250m data and/or ODR data will be acquired at each ground stations using X1 band as long as it will not affect the acquisition of MDR data.
- MRT data will be acquired at each ground station in real time using X3 band.
- If MDR recorded data can not be reproduced during one visible pass over ground station, the MDR data will be reproduced separately over two stations.(rewind operation of MDR; see section 3.4)

There are three phases for mission data acquisition during ADEOS-II mission life as follows;

a) Phase 1 (Initial check out phase and/or Early Routine Operation Phase)

Before confirmation of data relay function of DRTS, ADEOS-II data acquisition is made using Mode 2.

Mode 2 (X band Only)	100 %

b) Phase 2 (IOCS Inspection Phase)

In this phase, ADEOS-II data acquisition is basically made using Mode 2. And, data acquisition using IOCS is also performed to inspect reliability of data relay function. But, the data acquired via IOCS is provided to Sensor providers and related agencies as utilizable data.

The IOCS inspection plan will be basically made by NASDA. However, as needed, NASDA will coordinate with all related agencies about the inspection plan, including procedure and schedule.

c) Phase 3 (IOCS Operational Phase)

In this phase, ADEOS-II data acquisition is mainly made using Mode 1. In the event that the IOCS link is not available by any constraints, data acquisition is made using Mode 2.

Mode 1 (DRTS and X band)	80 %
Mode 2 (X band Only)	20 %

(3) Role of Ground Station

- EOC (NASDA)	: DRTS Feeder Link and X Band Direct Down Link.
- TACC (NASDA)	: DRTS Feeder Link (back up for mission data acquisition)
- Kiruna Station (NASDA)	: X Band Direct Down Link (X1 and X3)
- ASF (NASA/NOAA)	: X Band Direct Down Link (X1 and X3)
- WFF (NASA/NOAA)	: X Band Direct Down Link (X1 and X3)

Tables 3.6.1 and 3.6.2 explain data acquisition on Modes 1 and 2 at each ground station.

Table 3.6.1 Data Capture Mode 1

Transmission		Data	Ground Stations			
			EOC	ASF	WFF	Kiruna
DT	X1 (60Mbps)	GLI 250m	MO	MO	MO	MO
	X3 (6Mbps)	MRT Data	MO	MO	MO	MO
IOCS	Q ch (60Mbps)	MDR Data *1	MO	-	-	-
		ODR Data *1	SO	-	-	-
		GLI 250m *1	SO	-	-	-
	I ch (6Mbps)	MRT Data	SO *2	-	-	-

Note: MO; Main Operation, SO; Sub Operation,
*1 ; One of three data types is operational.
*2; At EOC, MRT data of X3 data and I channel data can not be acquired simultaneously.

Table 3.6.2 Data Capture Mode 2

Transmission		Data	Ground Stations			
			EOC	ASF	WFF	Kiruna
DT	X1 (60Mbps)	MDR data *	MO	MO	MO	MO
		ODR Data*	SO	SO	SO	SO
		GLI 250m *	SO	SO	SO	SO
	X3 (6Mbps)	MRT data	MO	MO	MO	MO
IOCS	Q ch (60Mbps)	GLI 250m	-	-	-	-

Note: MO; Main Operation, SO; Sub Operation, * ; One of three data types is operational.

3.7 Operation Scenario

In this section, the result of the ADEOS-II operation analysis is summarized as a reference information to understand typical operation scenario of ADEOS-II.
This operation analysis is performed for both Mode 1 and Mode 2 operation in accordance with the following parameters and constraints.

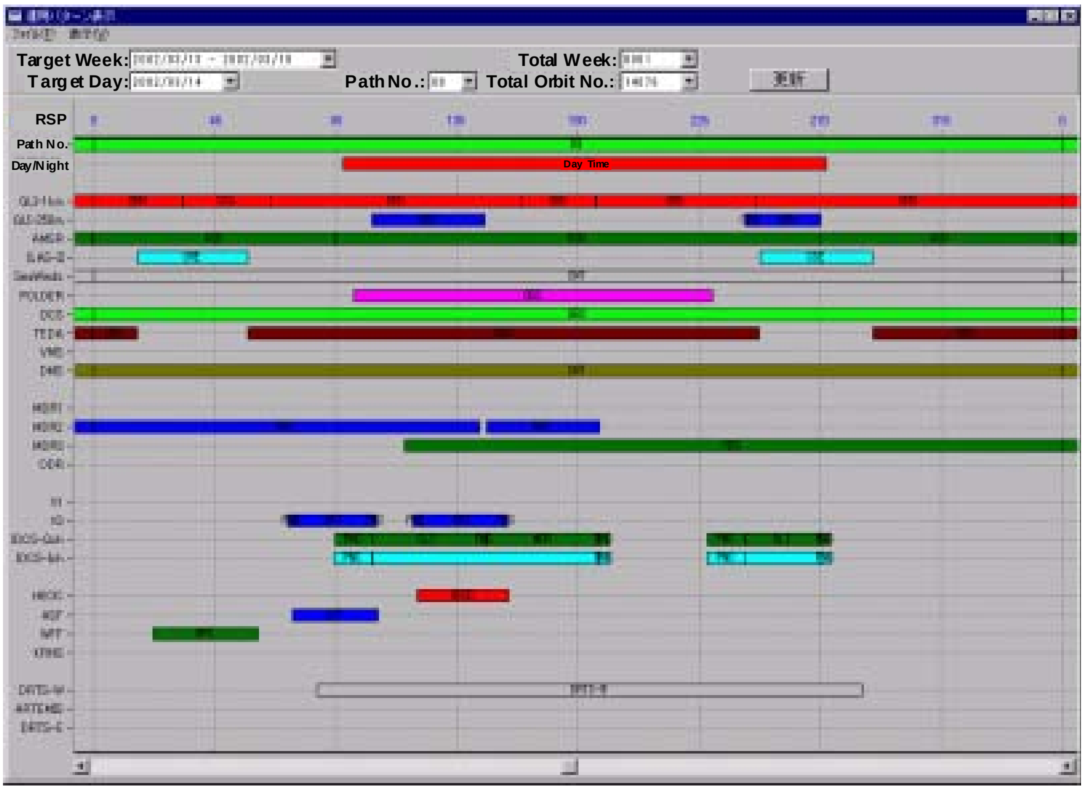
Table 3.7.1 Operation Analysis Parameters & Constraints

Items		Parameter	Note
MDR Operation	Overlap time	≥ 8 min.	Rec. time between 2 MDRs.
	Interval time	≥ 35 sec.	From Rec. stop to Rep. start.
	No. of units	3	3 MDRs operate alternately.
IOCS Operation	Marginal time	≥ 5 min.	Link establishment time from AOS of IOCS contact.
		~~> 6 min.~~	~~Switching time between two data relay satellite.~~
	Available time	45 min./path	Including the above marginal time.
DT Operation	**Pass Interval**	**> 11 min.**	**Between a pass and the next pass**
	Marginal time	20 sec. x 2	From AOS and LOS respectively.
	Masking	skyline	At EOC**, WFF and Kiruna station**
		El = 5 deg.	At ASF~~, WFF and Kiruna station.~~
	Limitation of Available Pass	3~4 passes /day	At EOC (No limitation)
		10~11 passes /day	At ASF (No limitation)
		3 passes /day	At WFF
		6 passes /day	At Kiruna station

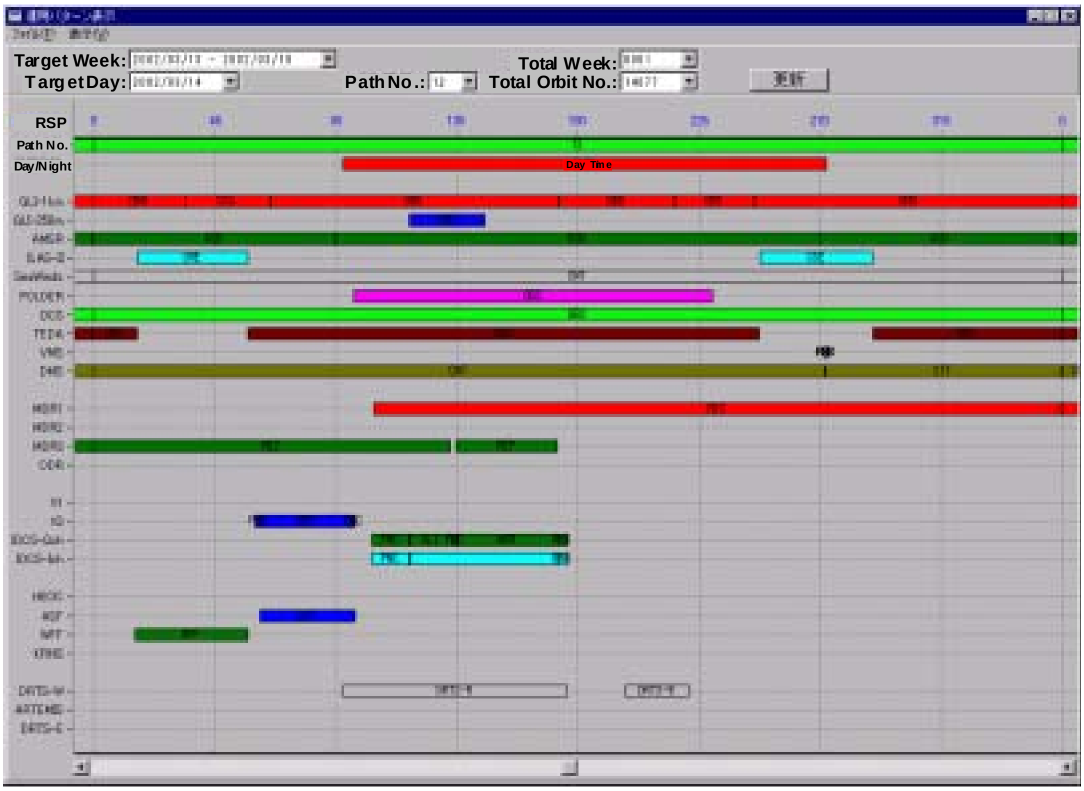
The above parameters and constraints will be applied for actual mission operation planning during routine operation phase of ADEOS-II. But, the actual operation pattern of ADEOS-II may be different from the result of this analysis due to various reasons, such as sensor operation requirement, available IOCS/DT resources for data transmission and so on.

(1) Sample of ADEOS-II Operation Pattern

Figure 3.7.1 and figure 3.7.2 show the 4 orbits sample of typical operation pattern of the ADEOS-II space segment and ground segment for both mode 1 and mode 2.

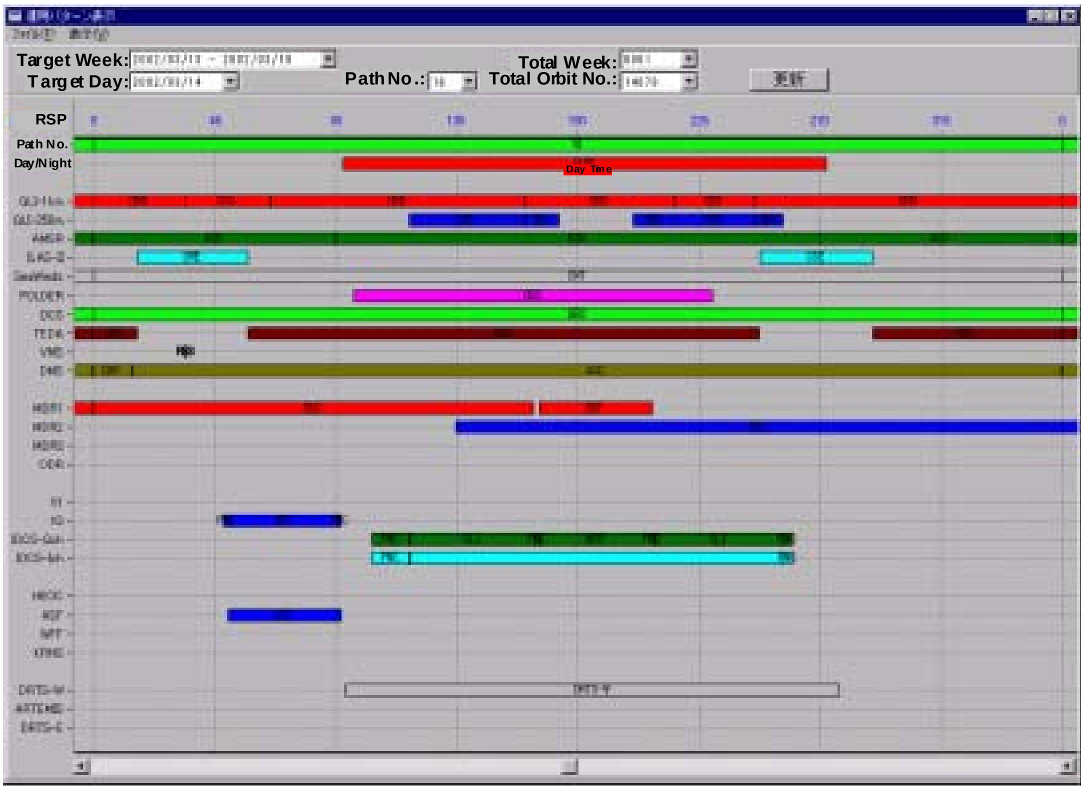


(a) Path = 08

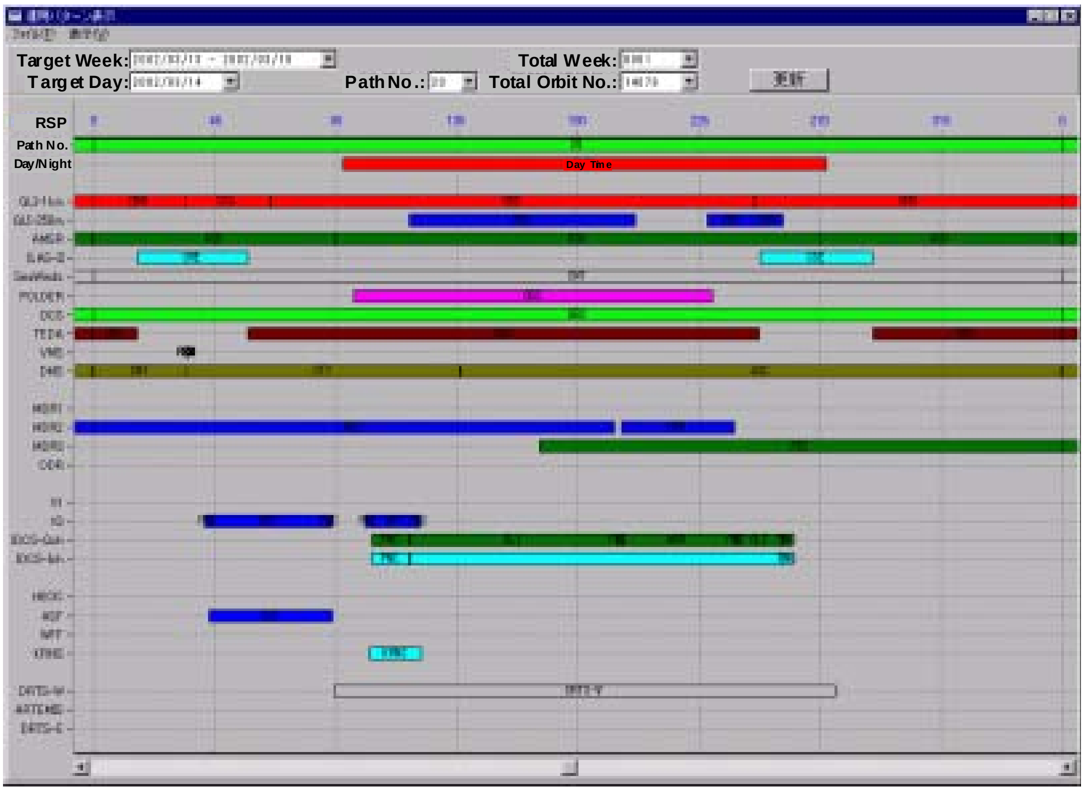


(b) Path = 12

Fig. 3.7.1 Sample of ADEOS-II Operation Pattern for Mode 1 (1/3)

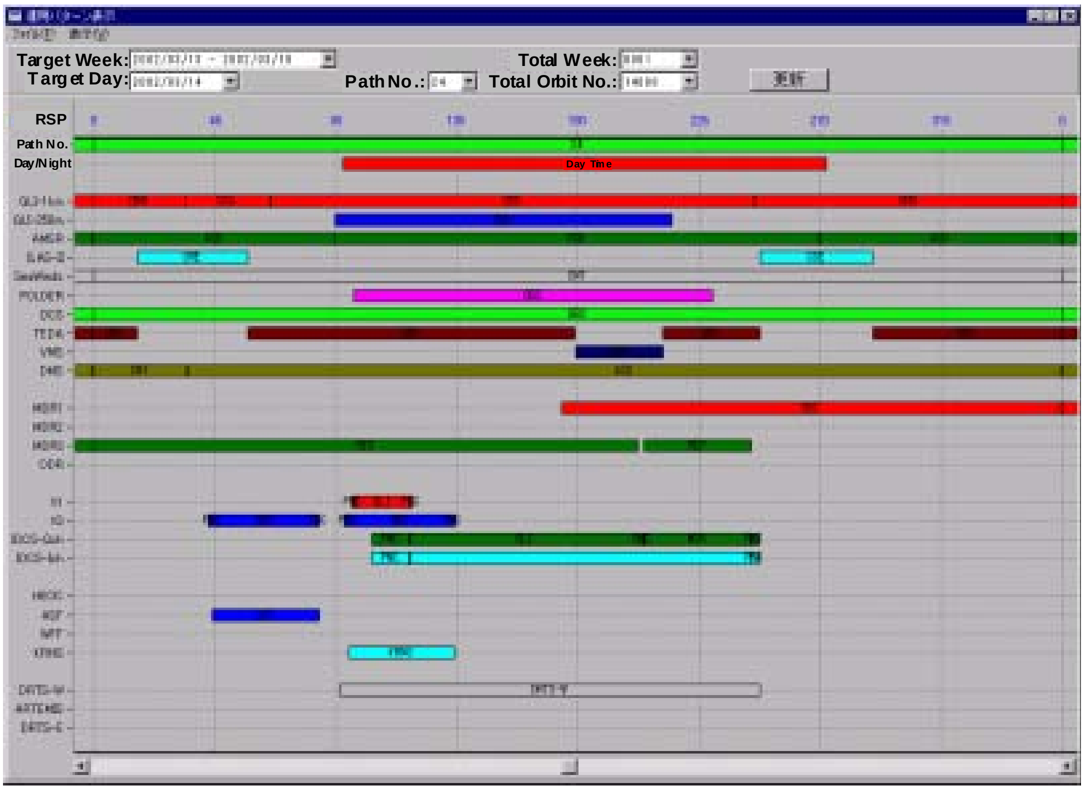


(c) Path = 16

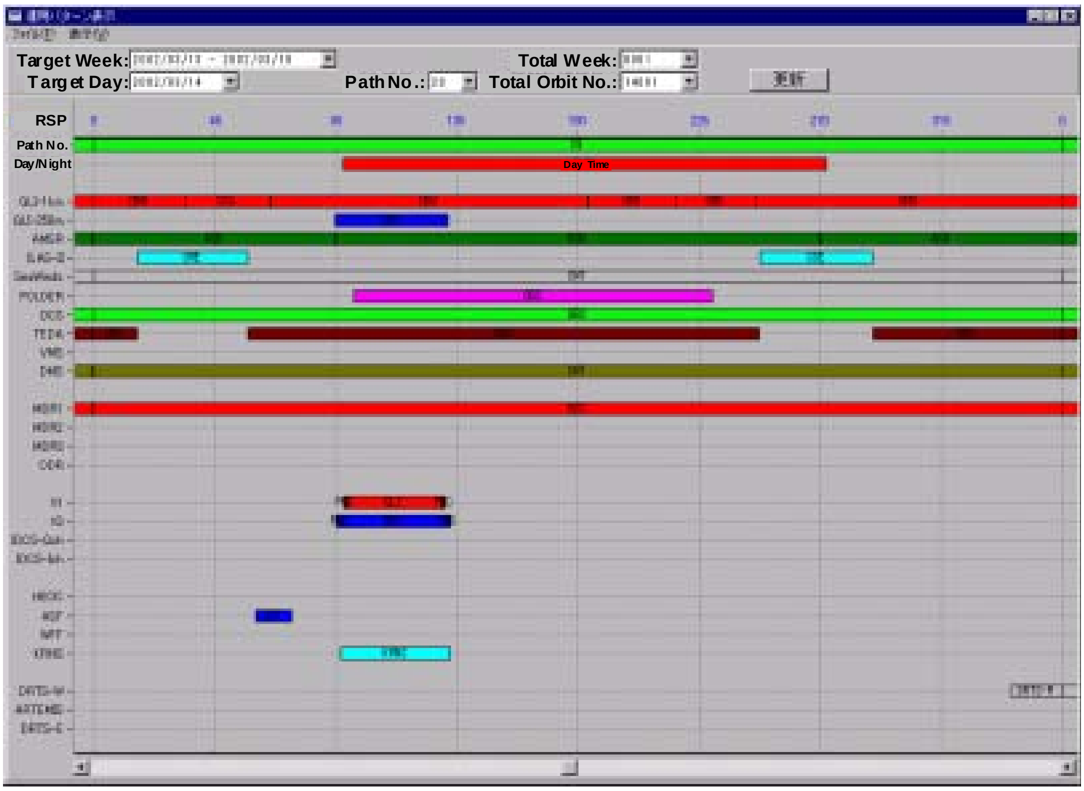


(d) Path = 20

Fig. 3.7.1 Sample of ADEOS-II Operation Pattern for Mode 1 (2/3)

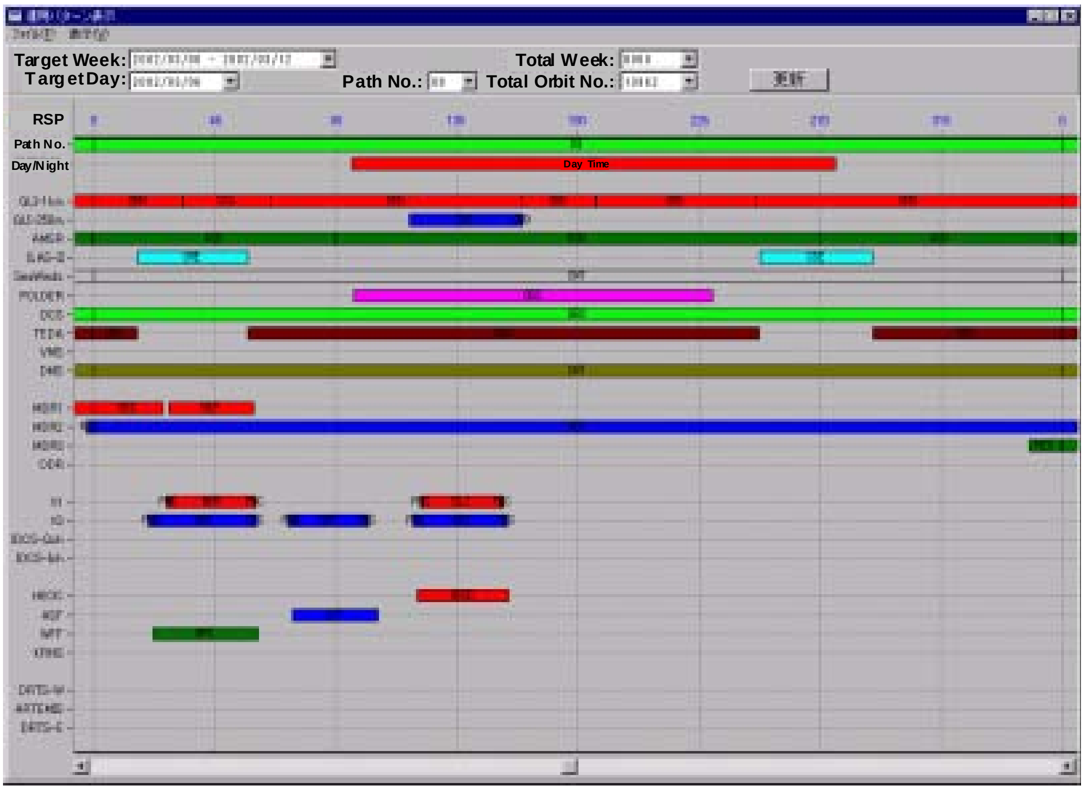


(e) Path = 24

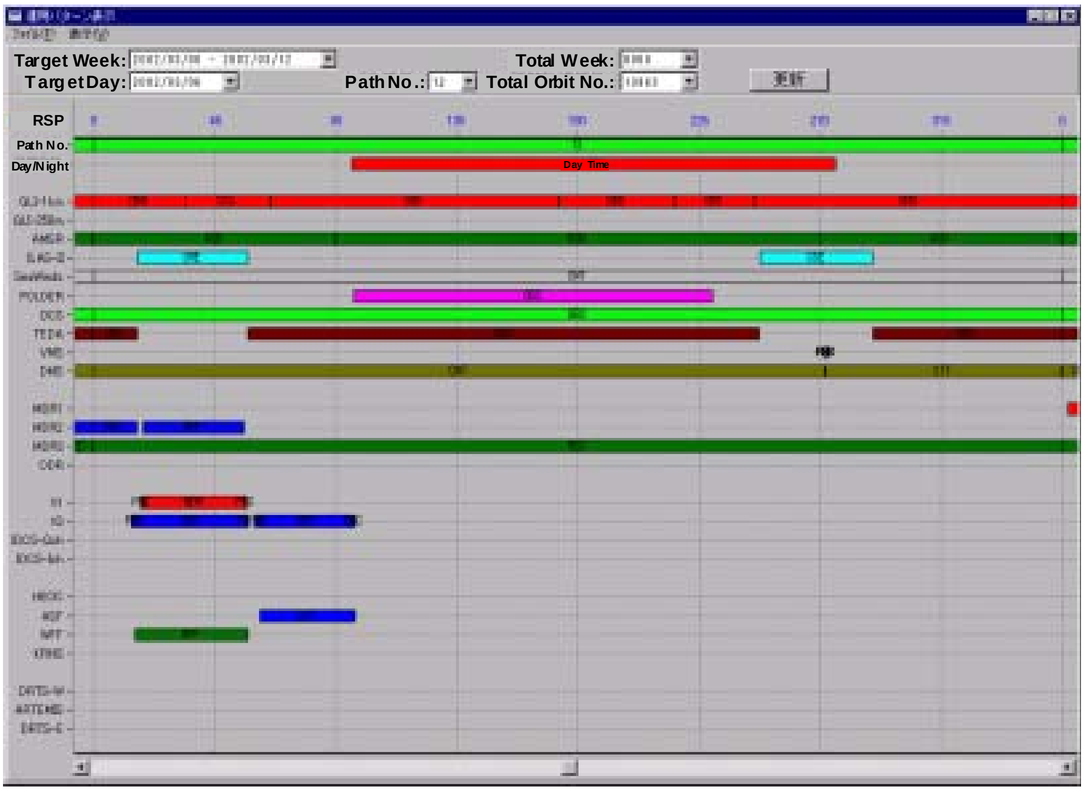


(f) Path = 28

Fig. 3.7.1 Sample of ADEOS-II Operation Pattern for Mode 1 (3/3)

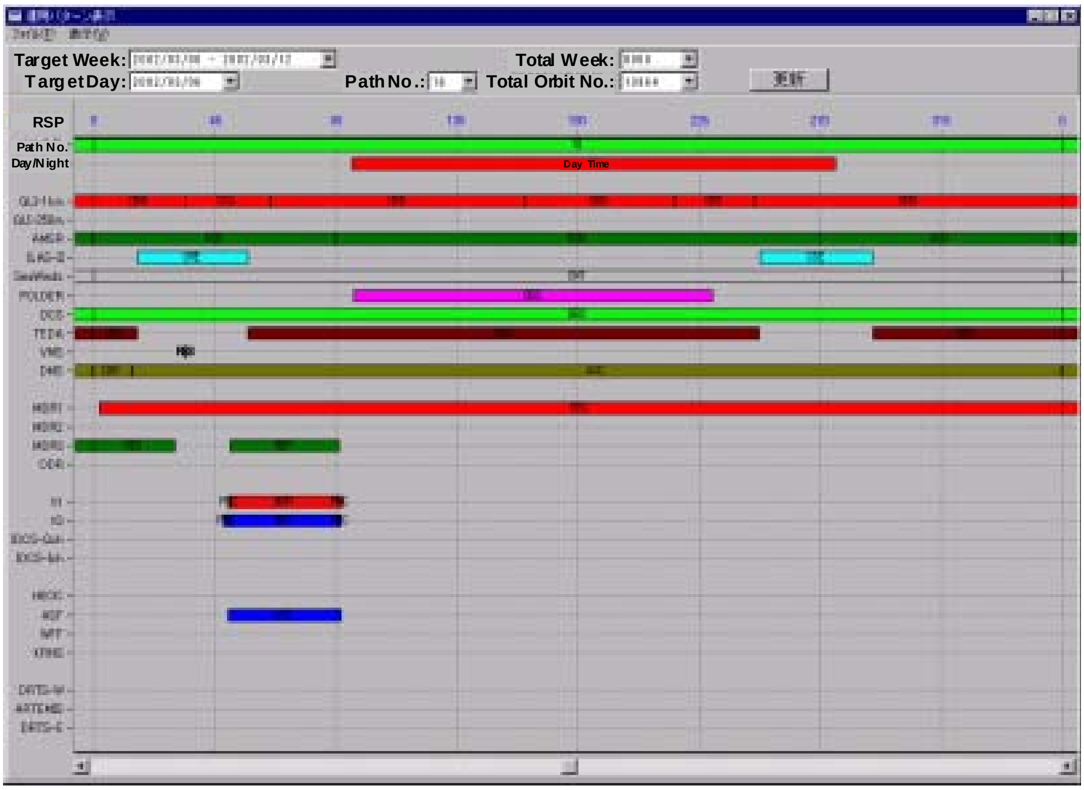


(a) Path = 08

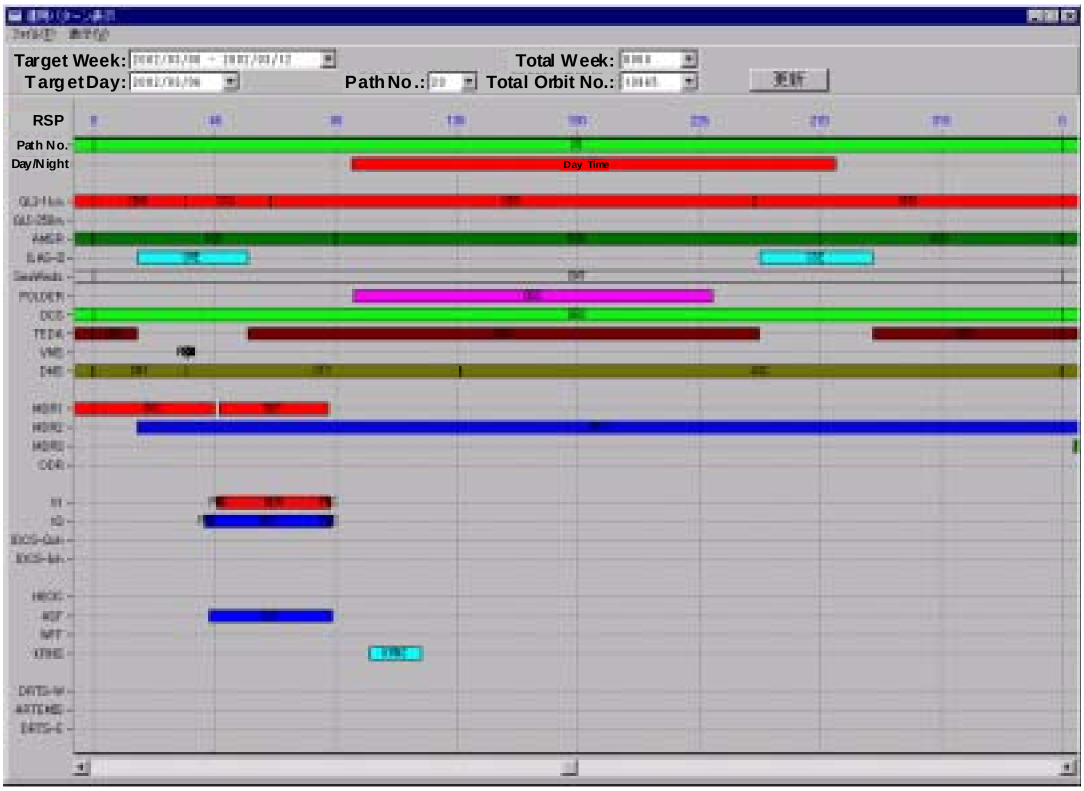


(b) Path = 12

Fig. 3.7.2 Sample of ADEOS-II Operation Pattern for Mode 2 (1/3)

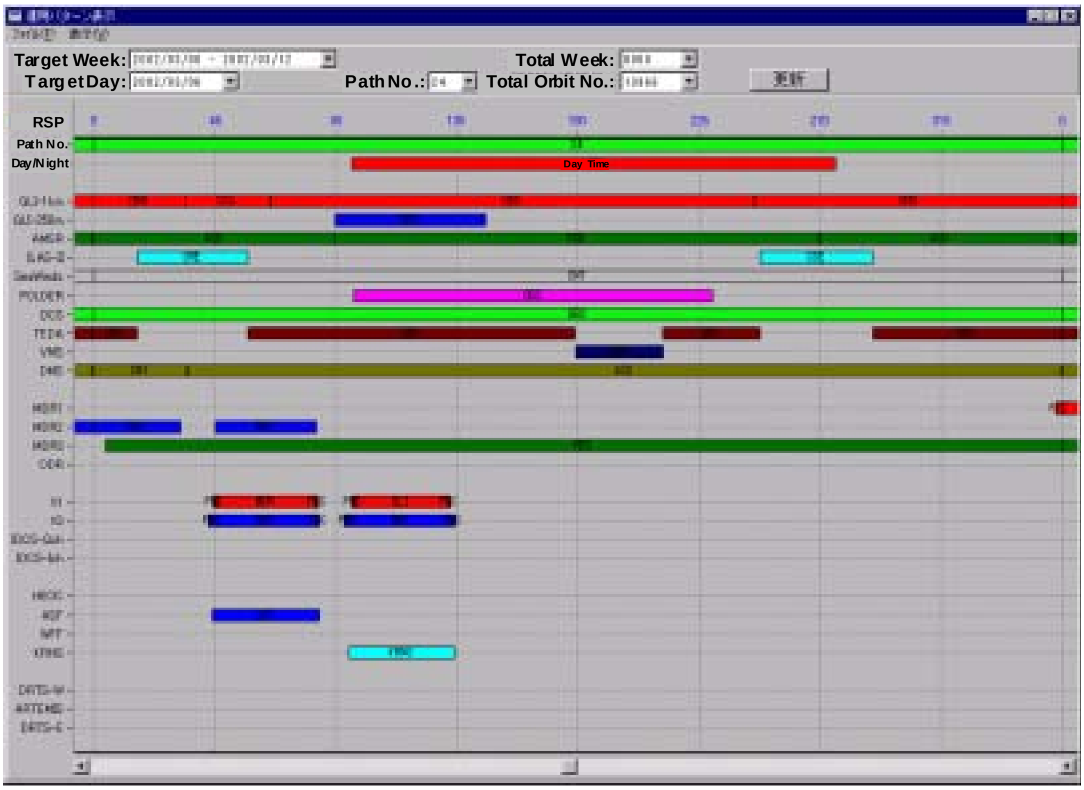


(c) Path = 16

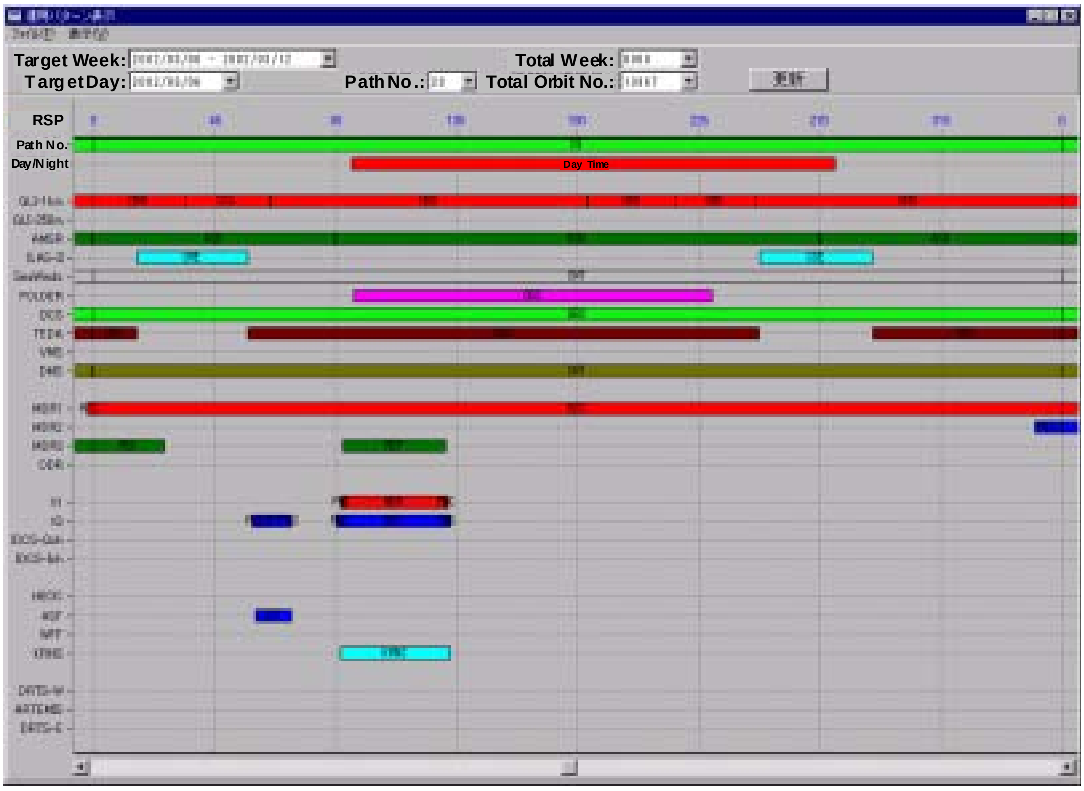


(d) Path = 20

Fig. 3.7.2 Sample of ADEOS-II Operation Pattern for Mode 2 (2/3)



(e) Path = 24



(f) Path = 28

Fig. 3.7.2 Sample of ADEOS-II Operation Pattern for Mode 2 (3/3)

(2) Sample of MDR, MRT and GLI250m Data Acquisition Pattern

In this section, the result of operation analysis is summarized about MDR and GLI 250 m data acquisition pattern for each ground station.

In this analysis, "MDR Data Latency" is defined as time gap between MDR recording start and MDR reproducing stop.

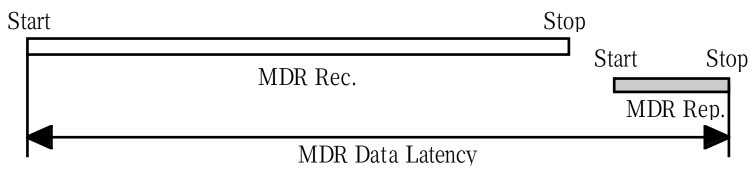


Fig. 3.7.3 Definition of MDR Data Latency

(a) Mode 1 Operation

During mode 1 operation, all MDR data will be transmitted from ADEOS-II to EOC Feeder Link Station through DRTS. Table 3.7.2 and figure 3.7.4 show the relationship between MDR data latency and number of data acquisition for each recurrent day.

Table 3.7.2 MDR Data Acquisition Pattern for Mode 1

Recurrent Day	MDR Data Latency (min.)														Total
	80 ~90	90 ~100	100 ~110	110 ~120	120 ~130	130 ~140	140 ~150	150 ~160	160 ~170	170 ~180	180 ~190	190 ~200	200 ~210	210 ~220	
1st Day	1			4	3	3						1	1		13
2nd Day				4	3	5					1				13
3rd Day	1		1	3	5	4					1				15
4th Day	1	2		7	4										14
Total	3	2	1	18	15	12					2	1	1		55

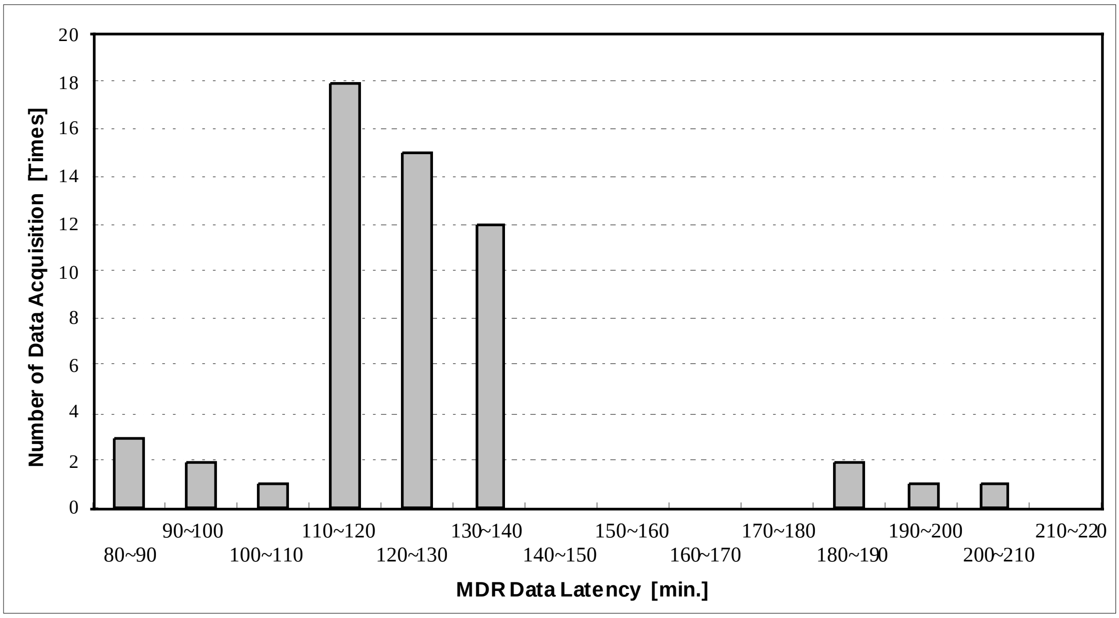


Fig. 3.7.4 MDR Data Acquisition Pattern for 1 Recurrent in Mode 1

Moreover, in mode 1 operation, GLI 250m data **and MRT data** will be acquired at EOC Feeder Link Station via DRTS and each DT ground station via X-band. Table 3.7.3 **and table 3.7.4** shows the number of GLI 250m **and MRT** data acquisition of each station for each recurrent day. **At ASF and WFF, MRT data is processed to level 0 data of GLI 1km, when it includes areas of interest to NOAA. Table 3.7.4 also shows the number of acquisition at ASF and WFF for MRT data containing the GLI 1km data of interest to NOAA.**

Table 3.7.3 GLI 250m Data Acquisition Pattern for Mode 1

	IOCS	DT				Total
	DRTS-W	EOC	ASF	WFF	KRNS	
1st Day	11	1	4	2	4	22
2nd Day	13	1	4	1	3	22
3rd Day	13	1	6	2	2	24
4th Day	11		3	2	4	20
Total	48	3	17	7	13	88

Table 3.7.4 MRT Data Acquisition Pattern for Mode 1

	IOCS	DT				Total
	DRTS-W	EOC	ASF	WFF	KRNS	
1st Day	18	4	7 (5)	3 (2)	6	38
2nd Day	18	4	9 (6)	3 (3)	6	40
3rd Day	20	5	10 (7)	2 (2)	5	42
4th Day	20	4	8 (6)	3 (2)	6	41
Total	76	17	34 (24)	11 (9)	23	161

( ): GLI 1km data of interest to NOAA is contained.

(b) Mode 2 Operation

During mode 2 operation, MDR data will be acquired at each DT ground station via X-band. Table 3.7.54 and figure 3.7.5 show the relationship between MDR data latency and number of data acquisition of each ground station for each recurrent day. Moreover, during mode 2 operation, GLI 250m data will be acquired at each ground station via X-band. The number of GLI 250m data acquisition of each station is also shown in the table 3.7.54 for each recurrent day.

Table 3.7.54 MDR and GLI 250m Data Acquisition Pattern for Mode 2

Recurrent Day	Station		MDR Data Latency (min.)									GLI 250m	Total
			~100	100 ~110	110 ~120	120 ~130	130 ~140	140 ~150	150 ~160	160~	Total		
1st Day	DT	EOC			2		1				3	1	4
		ASF			1	2	2	1			6	1	7
		WFF	1		1	1					3		3
		KRNS	1	1			1				3	2	5
2nd Day	DT	EOC			1	1		1			3	1	4
		ASF			1	4	2				7	2	9
		WFF	1		1				1		3		3
		KRNS	1			1	1				3	3	6
3rd Day	DT	EOC			1		1	1			3		3
		ASF				3	3				6	1	7
		WFF	2				1				3		3
		KRNS			1		1	1			3	3	6
4th Day	DT	EOC					2				2	1	3
		ASF			1	3	3				7	1	8
		WFF	2				1				3		3
		KRNS		1			1	1			3	3	6
1 Recurrent	DT	EOC			4	1	4	2			11	3	14
		ASF			3	12	10	1			26	5	31
		WFF	6		2	1	2		1		12		12
		KRNS	2	2	1	1	4	2			12	11	23
	Total		8	2	10	15	20	5	1		61	19	80

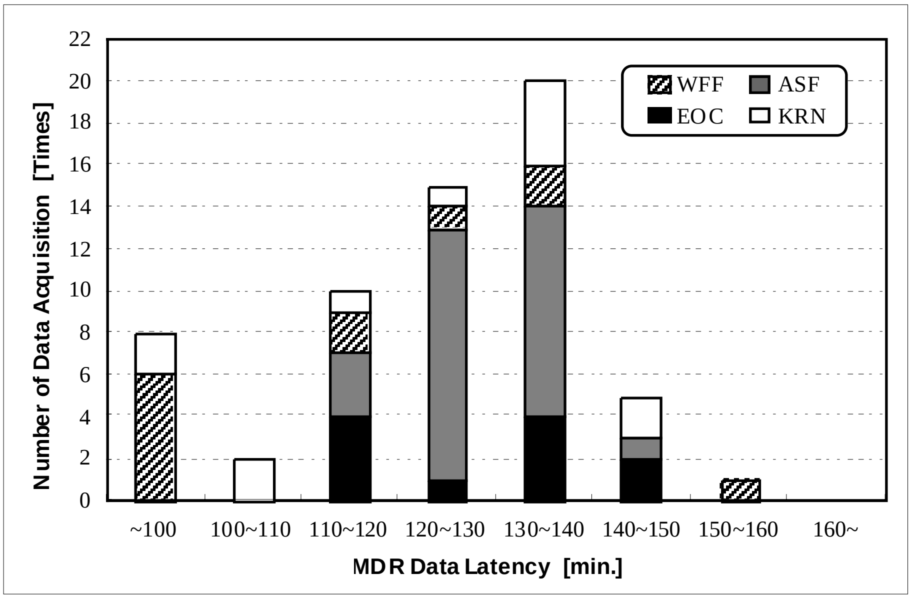


Fig. 3.7.5 MDR Data Acquisition Pattern for 1 Recurrent in Mode 2

Table 3.7.6 shows the number of MRT data acquisition of each station for each recurrent day in mode 2 operation, and also shows the number of acquisition at ASF and WFF for MRT data containing the GLI 1km data of interest to NOAA.

Table 3.7.6 MRT Data Acquisition Pattern for Mode 2

	DT				Total
	EOC	ASF	WFF	KRNS	
1st Day	4	10 (6)	3 (1)	6	23
2nd Day	5	11 (7)	3 (2)	6	25
3rd Day	4	10 (7)	3 (2)	6	23
4th Day	5	10 (6)	3 (2)	6	24
Total	18	41 (26)	12 (7)	24	95

( ): GLI 1km data of interest to NOAA is contained.

3.8 Operation Priority

(1) Mission Operation Planning Priority

ADEOS-II mission operation planning will be performed according to the following priorities. The list is in descending order of priority (TBD).

(1) Immediate Safeing Operations;
emergency operations to shift into the safety mode as a general rule in order to protect the spacecraft hardware

(2) Housekeeping operation;
routine operation to keep spacecraft and instruments in good condition, including orbit maneuvers

(3) Troubleshooting operation;
corrective actions to investigate causes of nonconformance and recover nominal operations after securing safety of instruments

(4) Simultaneous observation;
observation with time constraint such as simultaneous observation with ground truth experiment

(5) Routine sensors operations;
mission operation reception at NASDA/EOC, Kiruna station and the NASA stations.

(6) Real time operation for foreign ground stations;
GLI operation for real time receiving at foreign ground stations

(2) Data Acquisition Priority

ADEOS-II data acquisition will be performed according to the following priorities. The list is in descending order of priority.

1) MDR data acquisition
2) GLI 250m or ODR data acquisition
3) MRT data acquisition

4. Data System Interface Definition

4.1 Network Interface

Each related agency, including sensor providers, overseas stations, NOAA, specific organizations and NASDA EORC, shall be able to access the directory located in EOIS/DDS using an electronic communications network to exchange mission operation files HK TLM date and mission data.
The outline of network interface is shown in Fig. 4.1.1 and Fig. 4.1.2.

There are two directories on the DDS, the MMOFE directory for mission operation files and the NRT directory for HK TLM data and mission data.

The detailed network interface, including protocol, handshake procedure, directory structure and back-up method, will be specified in the Network Interface Control Documents and MOIS (individual) of each agency.

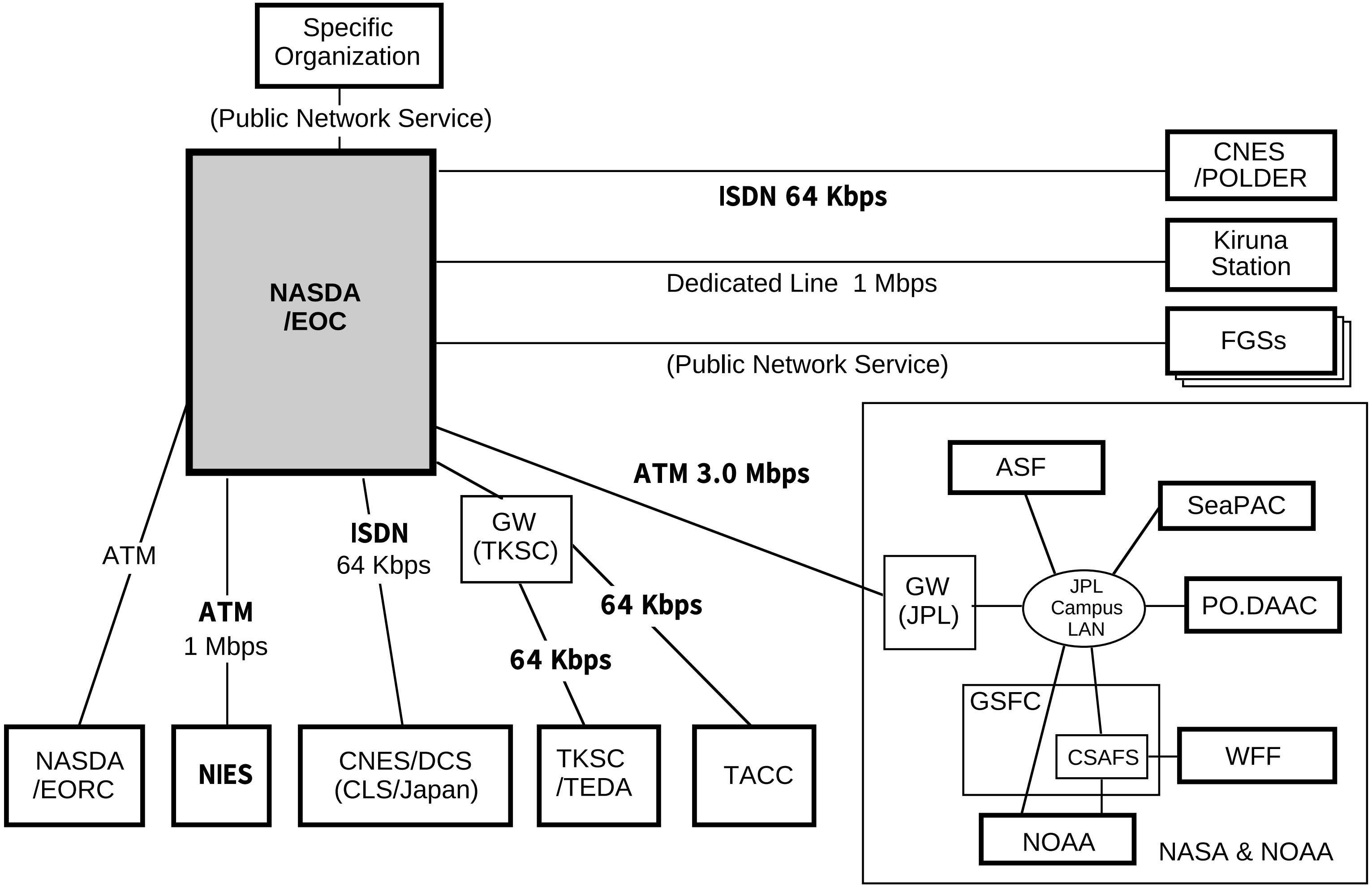


Fig. 4.1.1 Functional Block Diagram of Communication Network for ADEOS-II Operation

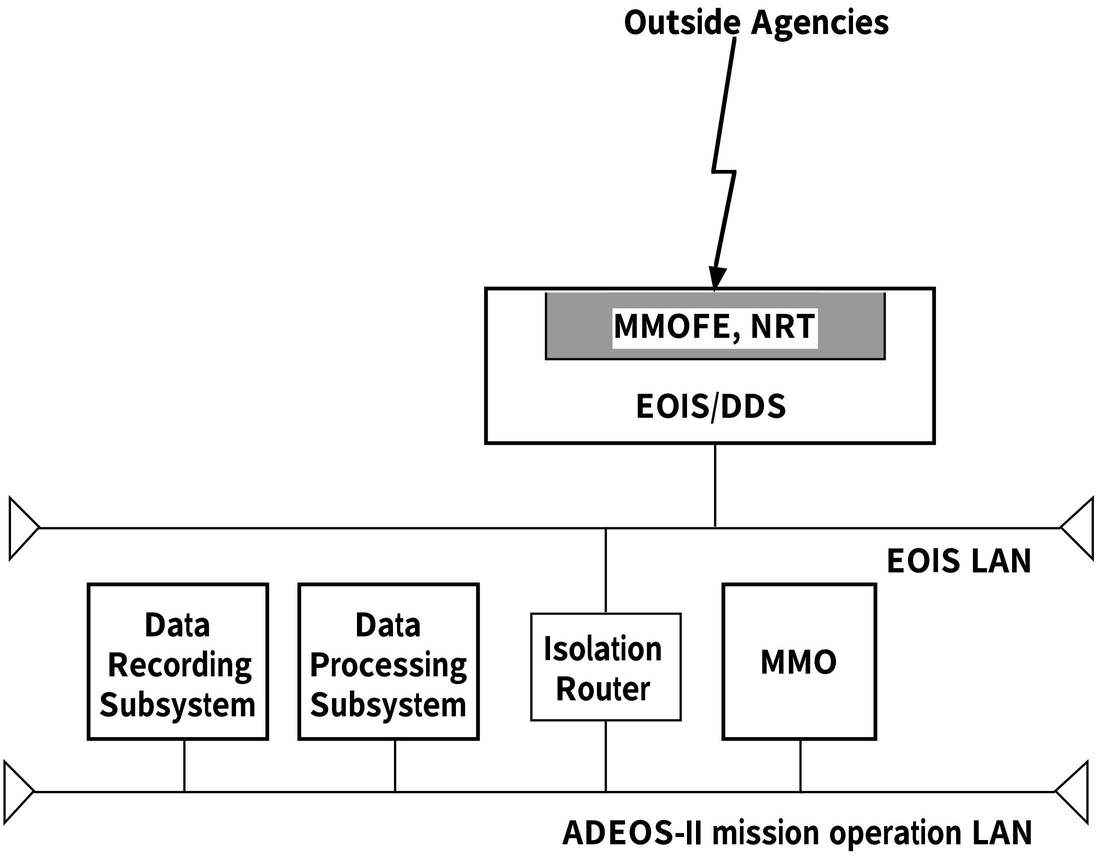


Fig. 4.1.2 Point of Access to NASDA EOC

5. File Interface Definition

5.1 Mission Operation Information Files

5.1.1 Mission Operation Information Files Summary

All files exchanged between NASDA/EOC and related agencies are summarized in Table 5.1.1. There are a total of 22 different file types. And, file matrix is shown in Table 5.1.2. The detailed description of each file's contents and structure are given in "Format Description of Mission Operation information Files", which will be developed between NASDA and each agency.

Table 5.1.1 Mission Operation Files

Category	File		Contents
Operation Request	REQQ		Sensor operation request of 1 weeks
	REQA		Reply of each REQQ (only on REQQ format error case)
	REQR		Operation request of 1 weeks for overseas stations
Operation Plan	OPLN		Actual operation plan of each sensor
	OPL1		Actual operation plan of POLDER for CNES
	SHAQ		Data acquisition plan for overseas stations
Orbit Data	ELMD (ED)		Definitive ephemeris data
	ELMP	EP	Predictive ephemeris data
		EL	Predictive ephemeris data with IERS data (for Kiruna station)
	TMDF (TD)		Relation of spacecraft time and UTC time
Acquisition and Recording Result	RERC (RERB)		Acquisition and Recording result at overseas stations (RERB is for back up recording)
	ORST		Operation result of all ground stations
Processing Information	LV0P		Information for Level 0 data processing
	L0RL		Result of Level 0 data processing
	RTIG		Information for selected GLI 1km data processing
Shipment and Readability Report	SRRM		Shipment report of raw data tape
	RDRM		Readability report of raw data tape
	SRZD		Shipment report of level 0 data tape (for POLDER)
	RDZD		Readability report of level 0 data tape (for POLDER)
Messages	STGS		Reply to REQR
	STAD		ADEOS-II Maneuver information, Status of ADEOS-II, Ground Stations, etc.
Command Request	SWPF		SeaWinds parameter file

Table 5.1.2 File Matrix

	NASA/ASF NASA/WFF	NOAA/ NESDIS	Sensor Providers NASA/JPL (SeaWinds)	CNES (DCS)	CNES (POLDER)	NIES (ILAS-II)	TKSC/TEDA (TEDA)	Kiruna Station	FGS
REQQ	-	-	○	-	○	○	-	-	○
REQA	-	-	○	-	○	○	-	-	○
REQR	○	-	-	-	-	-	-	○	-
OPLN	○	○	○	○		○	○	○	○
OPL1	-	-	-	-	○	-	-	-	-
SHAQ	○	-	-	-	-	-	-	○	-
ELMP (EP)	◎	◎	◎	◎	◎*	◎	◎	◎	◎
ELMP (EL)	-	-	-	-	-	-	-	○	-
ELMD (ED)	◎*	◎	◎	◎	◎*	◎	◎	◎	◎
TMDF (TD)	◎	◎	◎	◎*	◎*	◎	◎	◎	◎
RERC	○	-	-	-	-	-	-	○	○
ORST	◎	◎	◎	◎	◎	◎	◎	◎	◎
LV0P	○	-	-	-	-	-	-	○	-
L0RL	○	-	-	-	-	-	-	○	-
RTIG	○	○	-	-	-	-	-	○	-
STGS	○	-	-	-	-	-	-	○	-
STAD	◎	◎	◎	◎	◎	◎	◎	◎	◎
SRRM	○	-	-	-	-	-	-	○	-
RDRM	○	-	-	-	-	-	-	○	-
SRZD	-	-	-	-	○	-	-	-	-
RDZD	-	-	-	-	○	-	-	-	-
SWPF	-	-	○	-	-	-	-	-	-

○: individual files for respective agencies (individual use file). ◎ : files common to related agencies (common use file).
– : not applicable. * files not to be used during the operation period.

5.1.2 Operation Request

(1) REQQ

Each sensor provider, foreign ground station will send operation requests for 1 week to the MMO using an REQQ file, which is an individual use file. Each sensor provider will be able to send this file from Wednesday 4 weeks prior to the beginning of each target week period. However, this file must be sent to the MMO before 5:00UT on Thursday 2 weeks prior to the beginning of each target 1 week period (see Fig. 5.1.1). Foreign ground station will send this file before 7:00 UT on Thursday 3 weeks prior to the beginning of each target 1 week period.
An REQQ covers 1 week of data from the first path after 0:00 UT on Wednesday to the last path including 24:00 UT on next Tuesday. The coverage of REQQ is fixed 1 week in any case.

(2) REQA

REQA is an individual use file prepared by the MMO to reply to each REQQ, based on the results of a format check for the submitted REQQ. If any format errors are found in an REQQ file, the MMO will prepare an REQA file to inform its requesting agency of the error as soon as possible (typically 2 hours*) after receipt of corresponding REQQ file, at least, before 6:00 UT on Thursday 2 weeks before the target week. If any errors of REQQ are informed by REQA, its requesting agency must send improved REQQ file to the MMO before 0:00 UT on Friday next day of REQA submitted. (see Fig. 5.1.1)
In case that there is no error in REQQ file, REQA is not prepared by MMO.
The coverage of REQA is same as REQQ file and fixed 1 week in any case.

*: Detailed rules for REQQ/REQR interface are specified in the MOIS (individual) for NASA/NOAA (SeaPAC), CNES/POLDER and NIES.

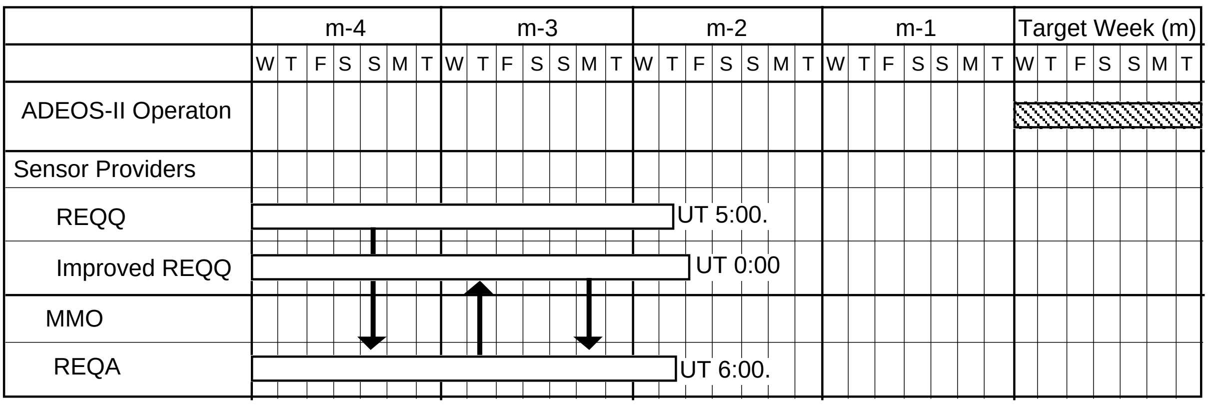


Fig. 5.1.1 REQQ/REQA Interface between MMO and Sensor Providers

(3) REQR

REQR is an individual use file prepared by the MMO to inform the Kiruna station and NASA ground stations of 1 week ADEOS-II raw data acquisition plans for the following 1 week. MMO will prepare the first REQR before 8:00 UT on Thursday 3 weeks before the target 1 week period.

An REQR covers 1 week of data from the first path after 0:00 UT on Wednesday to the last path including 24:00 UT on next Tuesday. The coverage of REQR is fixed 1 week in any case.

It contains passes of data acquisition and designations of X band transmitter/acquisition modes. The NASA ground stations and Kiruna station will promptly send STGS to the MMO as the reply to REQR.

(4) STGS

STGS is an individual use file prepared by the Kiruna station and the NASA ground stations to inform the MMO of the status of each station in response to an REQR. The Kiruna station and the NASA ground stations will place the first STGS in the system designated by each station for EOC retrieval as soon as possible after receipt of first REQR. At least, the first STGS must be prepared before 1:00 UT on Friday (the next day after receipt of the first REQR).

In case that coordination between NASDA/EOC and the overseas stations by REQR and STGS are repeated until the overseas stations approve an REQR, each STGS is submitted as soon as possible after receipt of corresponding REQR. However, the last STGS must be submitted before 1:00 UT on the next Wednesday.

The coverage of STGS is same as REQR and fixed 1 week in any case.

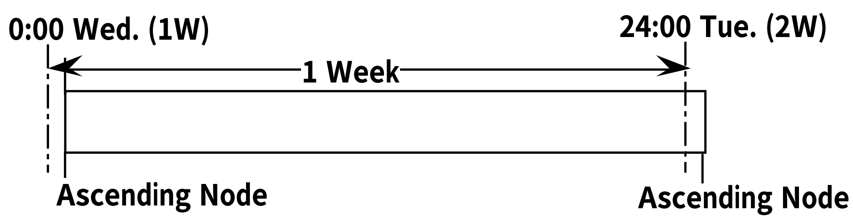


Fig. 5.1.2 Coverage of REQQ, REQA, REQR, SHAQ and STGS

5.1.3 Operation Plan

(1) OPLN

OPLN is an individual use file prepared by MMO to inform each agency, except POLDER, of the actual operation plan in response to the target 1 week of REQQ which each agency submitted. OPLN informs each agency of the newest operation plan for ADEOS-II mission instruments and data dumps. MMO will prepare an OPLN before 8:00 UT on Thursday before the target week.

An OPLN covers 1 week of sensor operation segments information from the first path after 24:00 UT on Tuesday to the last path including 24:00 UT on the next Monday as illustrated in Fig. 5.1.3. Moreover, if observation data of last day of OPLN period (on Monday) is acquired at ground station on next Tuesday, OPLN file contains data acquisition information of next Tuesday.

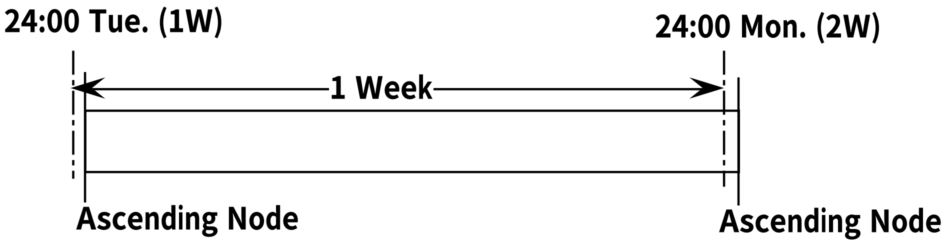


Fig. 5.1.3 Coverage of OPLN

(2) OPL1

OPL1 is an individual use file prepared by MMO to inform POLDER of the actual operation plan in response to the target week of POLDER REQQ. OPL1 informs POLDER of the newest operation plan for ADEOS-II mission instruments and data dumps. The MMO will prepare an OPL1 before 8:00 UT on Thursday before the target week.
An OPL1 covers eight days of data acquisition information from the first path after 0:00 UT on Tuesday to the last path including 24:00 UT on the next Tuesday (Observation information can include the information on Monday just before the OPL1 target period). There is one day of overlapping (on Tuesday) between an OPL1 and the next OPL1 in order to maintain the continuity of mission operation planning.

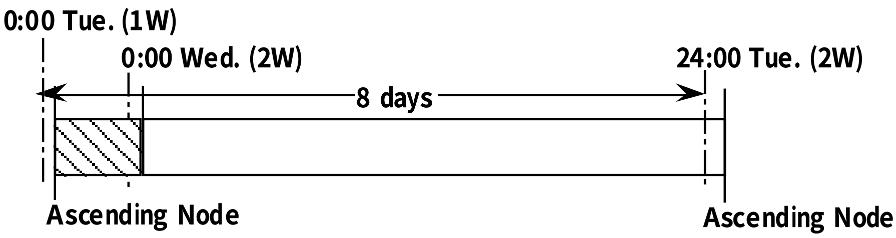


Fig. 5.1.4 Coverage of OPL1

(3) SHAQ

SHAQ is an individual use file prepared by the MMO to inform the NASA ground stations and the Kiruna station of direct data acquisition schedule for 1 week. The MMO will prepare an SHAQ before 8:00 UT on Thursday before the target week.
X band transmitter/acquisition modes in REQR is not changed by SHAQ in any case, and only time accuracy is improved for each pass.
The coverage of SHAQ is same as REQR file and fixed 1 week in any case as illustrated in Fig 5.1.2.

Where, the preparation of OPLN, OPL1 and SHAQ file to related agencies may be delayed 1 day caused by any reason, e.g.: TACC-EOC coordination is repeated. In the OPLN, OPL1 and SHAQ delay case, EOC will inform related agencies of the reason, expected delivery date and so on before 8:00 UT of Thursday before the target week using OCL. The notification format of OPLN, OPL1 and SHAQ is attached to the MOIS (individual) for each agency.

5.1.4 Orbit Data

(1) ELMD (ED), ELMP (EP, EL)

EP and ED are common use files prepared by the MMO to inform all agencies of orbital data. EL is individual use file prepared by the MMO to inform Kiruna station of orbital data and IERS data.
EP and EL file includes predictive ephemeris data and ED file includes definitive ephemeris data. Each file covers one day of data with one minute intervals. EP, EL and ED files are updated before 8:00 UT on Monday, Wednesday and Friday. The MMO makes 5 EP and EL files (which include the data of the same day and the next 4 days) and 3 ED files (which include the data of the previous 3 days) available each time updates are performed.

During period of high solar flux, NASDA will determine orbital parameter everyday to keep enough accuracy of predictive orbit data for tracking of ADEOS-II at each ground station. Additionally, if NIES requires everyday orbit data delivery for earlier processing of ILAS-II data during their scientific campaign and NASDA accepts the requirement, orbital data will be determined by NASDA every day and delivered to all agencies. Where, the change procedure of orbital data delivery frequency is described in section 6.2.3.3 of this document in detail.

The frequency of orbit determination will be changed due to solar activity or requirement from NIES. But, it will be performed on Monday, Wednesday and Friday at least. And, 3 ED files and 5 EP/EL files will be prepared on each delivery day in both normal and additional delivery cases. Except for 4 ED files will be prepared on Monday after the maneuvering in normal delivery case.

Moreover, the delivery time of EP, EL and ED files will be 10:30 UTC on Monday and Wednesday, when 10 days and 1 day before the day of Maneuver.

The update schedule of orbit data is shown in Fig. 5.1.5.

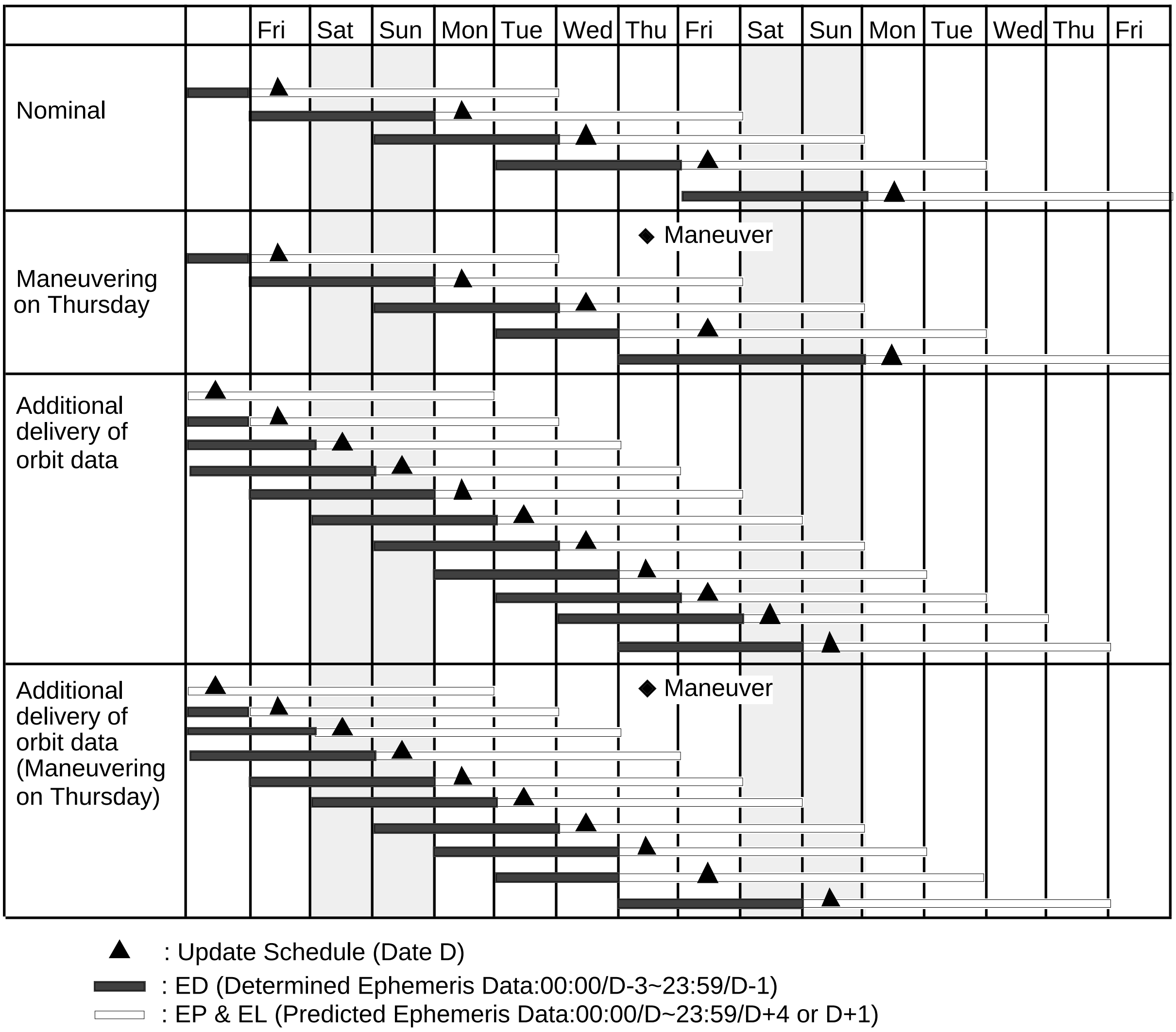


Fig. 5.1.5 Update Schedule of Orbit Data

If orbit maneuvering is performed on Thursday, the orbital data of the maneuvering day, delivered on next Friday, will be prepared as EP and EL files. The first half part of these EP and EL files will consist of the definitive orbital data of the maneuvering day, and the last half part of these files will consist of the predictive orbit data considering orbit maneuver.

The complete definitive orbital data of the maneuvering day will be delivered by ED file on next Monday in normal delivery case, or next Sunday in additional delivery case. (see Fig. 5.1.6) NASDA will use this complete definitive orbital data to generate POLDER level 0 data of the maneuvering day.

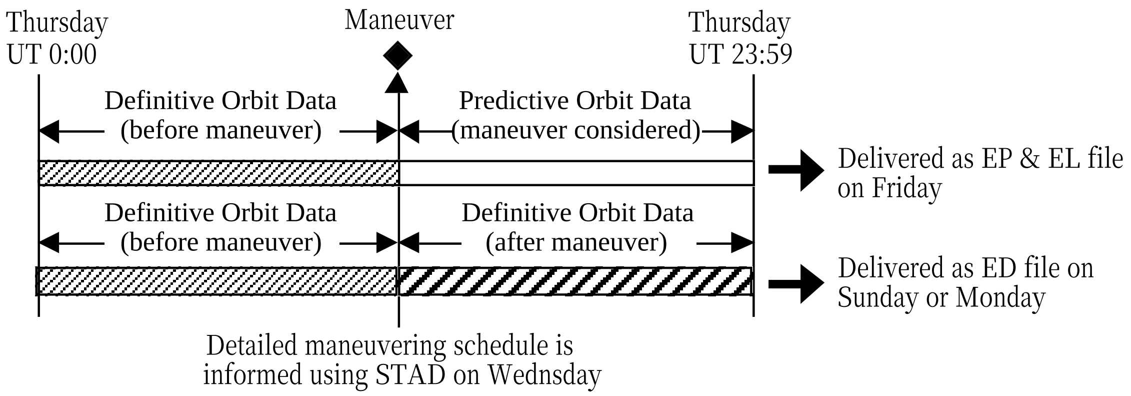


Fig. 5.1.6 Contents of Orbit Data file for Maneuvering Day

(2) TMDF (TD)

TD is a common use file prepared by the MMO to inform all agencies of the relation between spacecraft time code and UTC time.

In mode 1 operation, the relation is calculated by TACC and provided to the MMO. In mode 2 operation, it is done by the MMO.

The MMO prepares a TD file before 7:00 UT everyday.

5.1.5 Acquisition Results

(1) RERC/RERB

RERC is an individual use file prepared by the Kiruna station, the NASA ground stations and foreign ground stations to inform MMO of the ADEOS-II raw data acquisition and recording result of each pass. These ground stations will place an RERC in the system designated by each station for EOC retrieval as soon as possible after completion of data acquisition and recording in each pass.

The RERC file informs the acquisition result (GOOD, POOR, NO DATA) and recording result (0~100%: percentage of actual data recording time compared with planned time) of each station (see section 5.2.1). If data loss occurs, the reason should be reported to EOC by the station by FAX on a best effort basis. EOC reports the data loss to all related agencies by FAX or e-mail.

Moreover, the Kiruna station and the NASA ground stations will prepare RERB file which includes ADEOS-II raw data recording result of back up tape. The contents of RERB file are same definition as RERC file.

(2) ORST

ORST is a common use file prepared by the MMO to inform all agencies of the operational results of all mission instruments onboard ADEOS-II spacecraft for one day based on RERC files. ORST includes the data acquisition and recording results of NASDA/EOC, Kiruna station, NASA ground stations and foreign ground stations. The MMO prepares an ORST file before 8:00 UT every day.

5.1.6 Processing Information

(1) LV0P

LV0P is an individual use file prepared by the MMO to inform which level 0 data should be generated from acquired data at Kiruna station and NASA ground stations.
The MMO prepares LV0P file before 8:00 UT on every Monday, Wednesday and Friday.
Monday delivery file covers level 0 processing information for next Wednesday and Thursday. Wednesday delivery file is for next Friday and Saturday, and Friday delivery file is for next Sunday, Monday and Tuesday.
The delivery schedule and data coverage of LV0P is illustrated in Fig. 5.1.7.

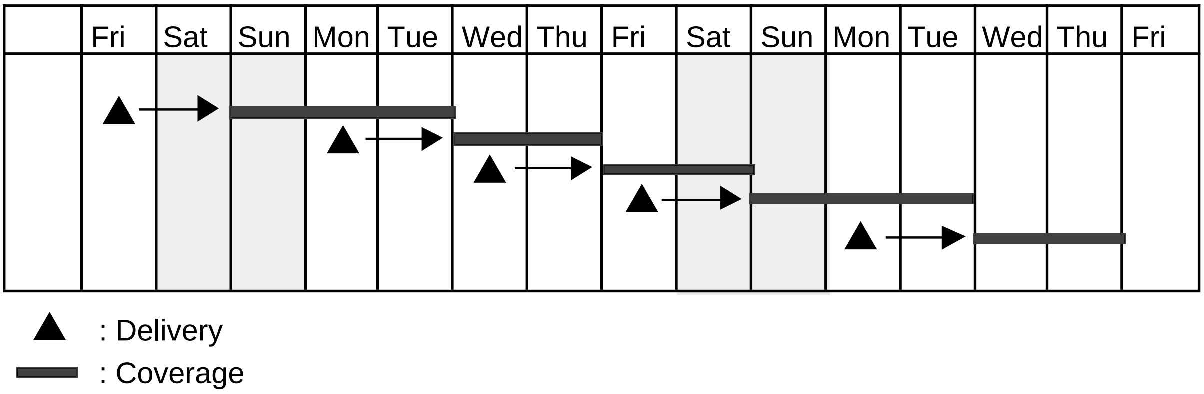


Fig. 5.1.7 Delivery Schedule and Coverage of LV0P and RTIG

(2) L0RL

L0RL is an individual use file prepared by Kiruna station and NASA ground stations to inform the MMO of the level 0 data processing result as response to LV0P. The L0RL also includes the result of level 0 data transmission to the system designated by each station.
Kiruna station and NASA ground station will place an L0RL in the system designated by each station for EOC retrieval as soon as possible after completion of level 0 processing in each pass.

(3) RTIG

RTIG is an individual use file prepared by the MMO to process selected GLI 1km level 0 data at NASA ground stations and Kiruna station for NOAA Coast Watch Program.
RTIG file will be prepared by the MMO before 8:00 UT on every Monday, Wednesday and Friday. And each file includes the information of NOAA requesting areas for same coverage of LV0P.

5.1.7 Shipment and Readability Report

(1) SRRM

SRRM is an individual use file prepared by the Kiruna station and the NASA ground stations to inform the MMO of shipment of a raw data recorded D-1 cassette to NASDA/EOC. The NASA ground stations and the Kiruna station will place an SRRM in the system designated by each station on the raw data shipment day for EOC retrieval.

(2) RDRM

RDRM is an individual use file prepared by the MMO to inform the Kiruna station and the NASA ground stations of the readability of a received D-1 cassette. The MMO will prepare an RDRM within 10 days after receipt of raw data from the NASA ground stations and the Kiruna station.

(3) SRZD

SRZD is an individual use file prepared by the MMO to inform POLDER of transmission of Level 0 data by tape. The MMO will prepare an SRZD at the time of Level 0 data shipment.

(4) RDZD

RDZD is an individual use file prepared by POLDER to inform the MMO of the readability of received Level 0 data by tape. CNES/POLDER will place an RDZD in its designated system before 1:00 UT within 10 days after receipt of the Level 0 data.

5.1.8 Messages

(1) STAD

STAD is a common use file prepared by MMO to inform all agencies of the status of an ADEOS-II flight segment (spacecraft emergency (preliminary report), accurate orbit maneuvering schedule) and the status of an ADEOS-II ground segment (maintenance, anomaly, etc.). The MMO will prepare an STAD to inform agencies of a nominal maneuver ($+\Delta V$) schedule before 9:00 UT on Wednesday 1 day before the maneuver scheduled date and to inform agencies of an anomalous status as needed.

5.1.9 Command Request

Command request file is an individual use file prepared, as needed, by a sensor provider to provide the MMO with data portion of a real time command. The command request file is shown as follows.

SWPF: SeaWinds parameter file prepared by the SeaWinds Project

The detailed description of command request file is given in MOIS (individual) of related agencies.

5.1.10 File Structure

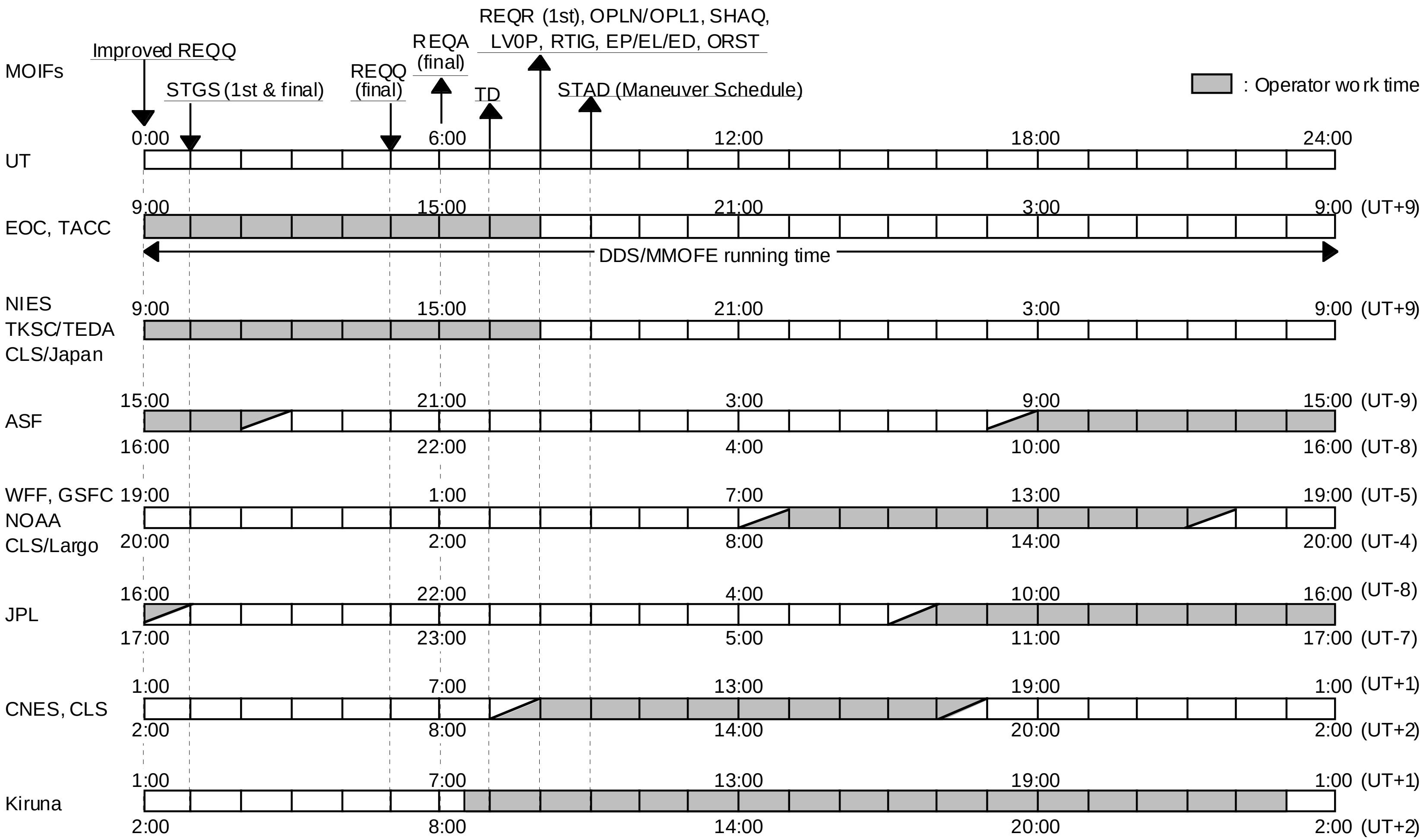
Briefly, each file consists of two parts, a "Header record" and a "Data record". The structure of the file is indicated in Fig. 5.1.8. Each sensor provider and ground station has a separate subdirectory for all files. The header for each file has a common format consisting of project name, agency code, etc. as listed below. The format of each record is defined in the "Format Description of Mission Operation Information Files", which will be developed between NASDA and each agency.

```
Each File   ----Header record                                    (e.g.)
            |      |-----  File name                        =   REQQ000001
            |      |-----  Project name                     =   ADEOS2 (fixed)
            |      |-----  Sending agency Code              =   JPL
            |      |-----  Receiving agency Code            =   HMMO
            |      |-----  File Creation Date (UTC)         =   20020502
            |      |-----  File Creation Time (UTC)         =   12:30:00
            |      |-----  Length of Data Record            =   74
            |      |-----  Number of Data Records           =   10
            |      |-----  Beginning Date (UTC)             =   20020516
            |      |-----  End Date (UTC)                   =   20020522
            |      |-----  File Format Version (date)       =   19990301
            |      |-----  File Format Version (number)     =   V01
            |
            |----Data records
                   |-----
                   |-----
```

Fig. 5.1.8 File Structure of Mission Operation Information File

5.1.11 Due Date

Fig. 5.1.9 shows the time difference of normal work shifts between related agencies for exchanging of the typical mission operation information files.



The time on the lower line indicates day-light saving time.
In the USA, day-light saving time is adopted from the first Sunday in April to the last Sunday in October.
In Europe, day-light saving time is adopted from the last Sunday in March to the last Saturday in September.

Fig. 5.1.9 Normal Work Shift Difference among Related Agencies

5.2 Data Product Interface

In mode 1 operation, MDR data and MRT data will be transmitted from ADEOS-II to EOC Feeder Link Station via DRTS, and it will be processed to level 0 data and delivered to related agencies. The MDR data will also be processed to HK TLM data (including HK source packet) and delivered to sensor providers (HK source packet is for SeaPAC). GLI 250m data and MRT data will be also transmitted via X band and acquired at EOC and overseas station, including NASA ground stations and Kiruna station. The MRT data will be processed to level 0 data and delivered to related agencies. The GLI 250m data will be recorded on D1 cassette at each overseas station, and shipped to EOC as raw data.

In mode 2 operation, MDR data, GLI 250m data and MRT data will be transmitted via X band and acquired at EOC and overseas station, including NASA ground stations and Kiruna station. The MDR data and the MRT data will be processed to level 0 data and delivered to related agencies. The MDR data will also be processed to HK TLM data (including HK source packet) and delivered to sensor providers (HK source packet is for SeaPAC). The MDR data and the GLI 250m data will be recorded on D1 cassette at each overseas station, and shipped to EOC as raw data.

Moreover, EOC will process AMSR and GLI data to near real time products and deliver them to related agencies. NOAA will process SeaWinds data to near real time product and deliver it to EOC. CNES/CLS will process DCS data to extract NASDA DCP data and deliver it to EOC.

Finally, each sensor provider will process level 0 data to standard product and provide it to NASDA on demand.

The ADEOS-II data product interface between related agencies is summarized in the table 5.2.1 and the table 5.2.2. Moreover, the detailed interface specifications are described in MOIS individual part for each agency.

Table 5.2.1 Data Product Interface for Mode 1

Source	Destination	Data Products		Receiving Station	Media	Note
EOC	SeaPAC	MDR	SeaWinds L0	EOC	On-line	
			HK Source Packet	EOC	On-line	
			DMS Processed Data	EOC	On-line	
	PO.DAAC	MDR	AMSR L1A	EOC	On-line	**Forwarded to SeaPAC and NOAA**
	NOAA	MDR	SeaWinds L0	EOC	On-line	
			GLI 1km L1A	EOC	On-line	Selected areas and bands
	CNES /POLDER	MDR	POLDER L0	EOC	D1	
			POLDER HK TLM	EOC	On-line	
			DMS Processed Data	EOC	On-line	
	CLS/Japan	MDR	DCS L0	EOC	On-line	
			DCS HK TLM	EOC	On-line	
		MRT	DCS L0	EOC	On-line	
	CLS/Largo	MDR	DCS L0	EOC	On-line	via NOAA
		MRT	DCS L0	EOC	On-line	via NOAA
	NIES	MDR	ILAS-II L0	EOC	On-line	
			ILAS-II HK TLM	EOC	On-line	
			DMS Processed Data	EOC	On-line	
	TKSC /TEDA	MDR	TEDA L0	EOC	On-line	
			TEDA HK TLM	EOC	On-line	
ASF/WFF	EOC	GLI	Raw Data	ASF/WFF	D1	250m data
		MRT	DCS L0	ASF/WFF	On-line	
			DMS L0	ASF/WFF	On-line	Request basis
			VMS L0	ASF/WFF	On-line	Request basis
	NOAA	MRT	GLI 1km L0	ASF/WFF	On-line	Selected areas
	CLS/Japan	MRT	DCS L0	ASF/WFF	On-line	via EOC
	CLS/Largo	MRT	DCS L0	ASF/WFF	On-line	via NOAA
Kiruna	EOC	GLI	Raw Data	Kiruna	D1	250m data
		MRT	DCS L0	Kiruna	On-line	
			DMS L0	Kiruna	On-line	Request basis
			VMS L0	Kiruna	On-line	Request basis
	CLS/Japan	MRT	DCS L0	Kiruna	On-line	via EOC
	CLS/Largo	MRT	DCS L0	Kiruna	On-line	via EOC & NOAA
NOAA	EOC	MDR	SeaWinds Met Data	EOC	On-line	
CLS/Japan	EOC	MDR	DCS Processed Data	EOC	On-line	NASDA DCP
		MRT	DCS Processed Data	All *1	On-line	NASDA DCP

*1: EOC, ASF, WFF and Kiruna station.

Table 5.2.2 Data Product Interface for Mode 2 (1/2)

Source	Destination	Data Products		Receiving Station	Media	Note
EOC	SeaPAC	MDR	SeaWinds L0	EOC	On-line	
			HK Source Packet	EOC	On-line	
			DMS Processed Data	All *1	On-line	
	PO.DAAC	MDR	AMSR L1A	All *1	On-line	**Forwarded to SeaPAC and NOAA**
	NOAA	MDR	SeaWinds L0	EOC	On-line	
			GLI 1km L1A	EOC, Kiruna	On-line	Selected areas & bands
	CNES /POLDER	MDR	POLDER L0	All *1	D1	
			POLDER HK TLM	All *1	On-line	
			DMS Processed Data	All *1	On-line	
	CLS/Japan	MDR	DCS L0	EOC	On-line	
			DCS HK TLM	All *1	On-line	
		MRT	DCS L0	EOC	On-line	
	CLS/Largo	MDR	DCS L0	EOC	On-line	via NOAA
		MRT	DCS L0	EOC	On-line	via NOAA
	NIES	MDR	ILAS-II L0	EOC	On-line	
			ILAS-II HK TLM	All *1	On-line	
			DMS Processed Data	All *1	On-line	
	TKSC/TEDA	MDR	TEDA L0	EOC	On-line	
			TEDA HK TLM	All *1	On-line	
ASF /WFF	EOC	GLI	Raw Data	ASF/WFF	D1	250m data
		MDR	Raw Data	ASF/WFF	D1	
			AMSR L0	ASF/WFF	On-line	
			DCS L0	ASF/WFF	On-line	
			DMS L0	ASF/WFF	On-line	
			VMS L0	ASF/WFF	On-line	
			HK Source Packet	ASF/WFF	On-line	
		MRT	DCS L0	ASF/WFF	On-line	
			DMS L0	ASF/WFF	On-line	Request basis
			VMS L0	ASF/WFF	On-line	Request basis
	SeaPAC	MDR	SeaWinds L0	ASF/WFF	On-line	
			HK Source Packet	ASF/WFF	On-line	
	NOAA	MDR	SeaWinds L0	ASF/WFF	On-line	
			GLI 1km L0	ASF/WFF	On-line	Selected areas
		MRT	GLI 1km L0	ASF/WFF	On-line	Selected areas
	CLS/Japan	MDR	DCS L0	ASF/WFF	On-line	via EOC
		MRT	DCS L0	ASF/WFF	On-line	via EOC
	CLS/Largo	MDR	DCS L0	ASF/WFF	On-line	via NOAA
		MRT	DCS L0	ASF/WFF	On-line	via NOAA
	NIES	MDR	ILAS-II L0	ASF/WFF	On-line	via EOC
	TKSC/TEDA	MDR	TEDA L0	ASF/WFF	On-line	via EOC

*1: EOC, ASF, WFF and Kiruna station.

Table 5.2.2 Data Product Interface for Mode 2 (2/2)

Source	Destination	Data Products		Receiving Station	Media	Note
Kiruna	EOC	GLI	Raw Data	Kiruna	D1	250m data
		MDR	Raw Data	Kiruna	D1	
			AMSR L0	Kiruna	On-line	
			GLI 1km L0	Kiruna	On-line	
			DCS L0	Kiruna	On-line	
			DMS L0	Kiruna	On-line	
			VMS L0	Kiruna	On-line	
			HK Source Packet	Kiruna	On-line	
		MRT	DCS L0	Kiruna	On-line	
			DMS L0	Kiruna	On-line	Request basis
			VMS L0	Kiruna	On-line	Request basis
	SeaPAC	MDR	SeaWinds L0	Kiruna	On-line	via EOC
			HK Source Packet	Kiruna	On-line	via EOC
	NOAA	MDR	SeaWinds L0	Kiruna	On-line	via EOC
	CLS/Japan	MRT	DCS L0	Kiruna	On-line	via EOC
	CLS/Largo	MRT	DCS L0	Kiruna	On-line	via EOC & NOAA
	NIES	MDR	ILAS-II L0	Kiruna	On-line	via EOC
	TKSC/TEDA	MDR	TEDA L0	Kiruna	On-line	via EOC
NOAA	EOC	MDR	SeaWinds Met Data	All *1	On-line	
CLS /Japan	EOC	MDR	DCS Processed Data	All *1	On-line	NASDA DCP
		MRT	DCS Processed Data	All *1	On-line	NASDA DCP

*1: EOC, ASF, WFF and Kiruna station.

5.2.1 Raw Data

(1) Data Definition

NASDA/EOC will use HDDT (D1 cassette) to record raw data. The Kiruna station and the NASA ground stations are required to adopt the same track assignment and the same multiplexing method as that of NASDA, for compatibility. Details are described in the document "Raw Data Format Specification (AD2RP-S-023)" which will be provided from NASDA to Kiruna station and NASA ground stations.

(2) Data Acquisition and Recording Status

Each ground station will decide the acquisition result (GOOD, POOR, NO DATA) and recording result (0~100%: percentage of actual data recording time compared with planned time) per each downlink segment and inform MMO of them using RERC and RERB file.
Where, recording result will be calculated for only 60 Mbps data (MDR, ODR and GLI 250m), because it is not necessary to record 6 Mbps data (MRT) on D1 cassette at each station.

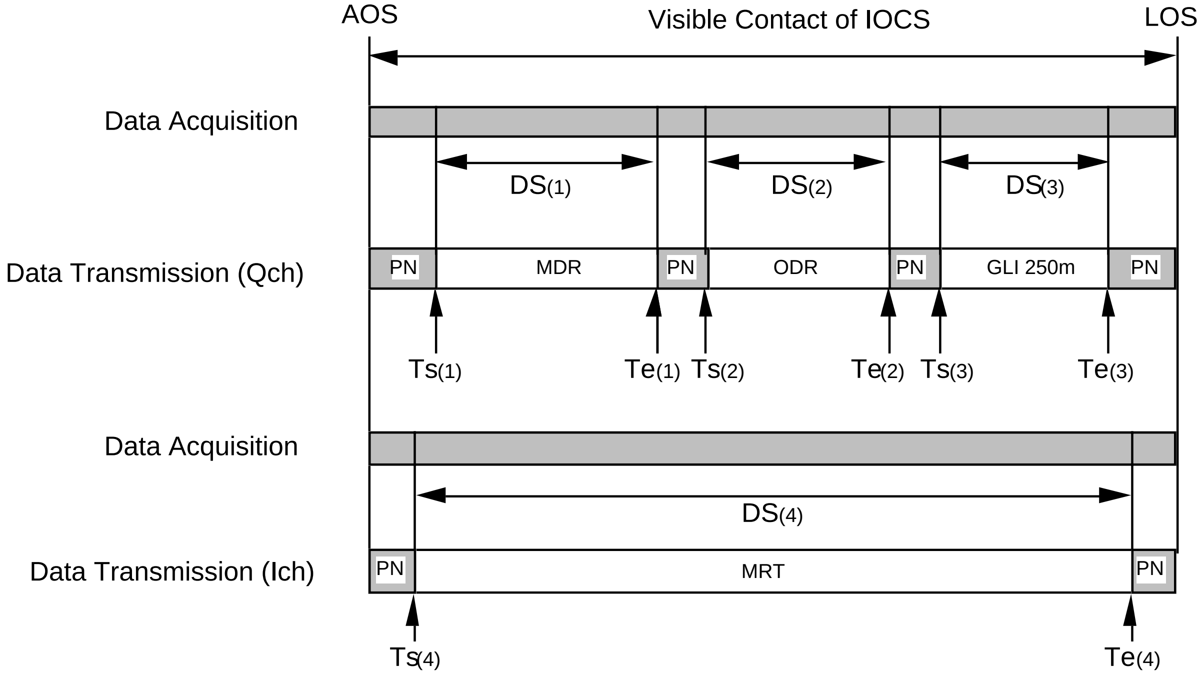
The acquisition result is defined as follows.

$N_{Ac} >= 0.98$: GOOD
$0.98 > N_{Ac} > 0$: POOR
$N_{Ac} = 0$: NO DATA

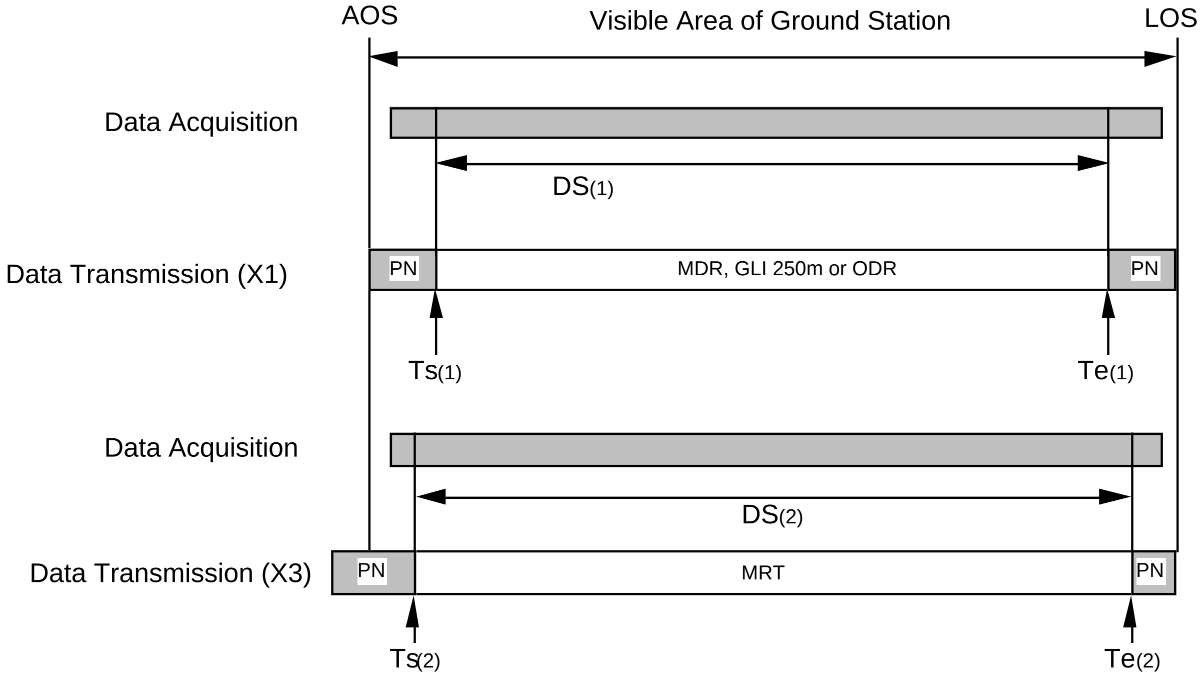
where

$$N_{Ac} = DS_{(n)} / (Te_{(n)} - Ts_{(n)})$$

$DS_{(n)}$: Time of lock on in downlink segment #n
(definitive time based on bit synchronization)
$Ts_{(n)}$: Time of begin date of downlink segment #n
(predictive time included in SHAQ file prepared from MMO: record No. 25)
$Te_{(n)}$: Time of end date of downlink segment #n
(predictive time included in SHAQ file prepared from MMO: record No. 27)



(a) IOCS



(b) X band Direct Downlink

Fig. 5.2.1 Data Acquisition Status

Moreover, the recording result is defined as follows.

$$Nrc = (Re_{(n)} - Rs_{(n)}) / (Pe_{(n)} - Ps_{(n)}) \text{ X } 100 \ (\%)$$

$DPs_{(n)}$: Predictive start time of downlink path #n

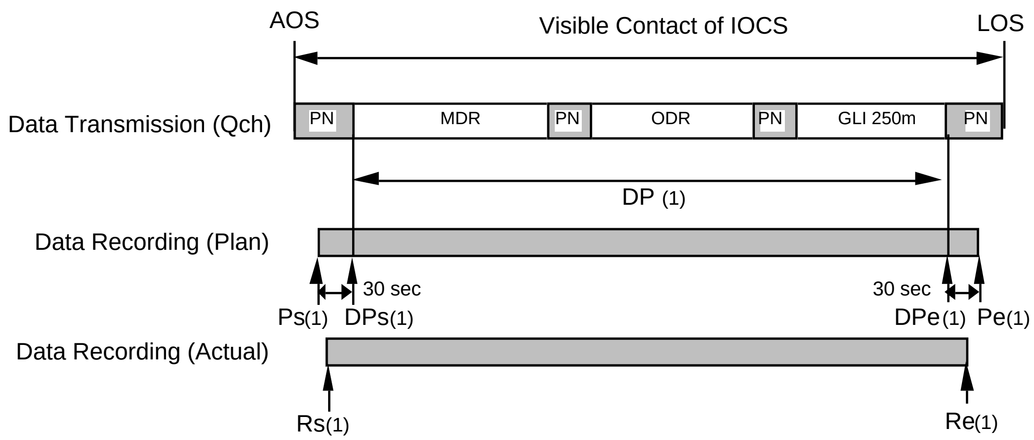
$DPe_{(n)}$: Predictive end time of downlink path #n
(predictive start time and end time of Downlink Path #n ($DP_{(n)}$) is included in SHAQ file prepared by MMO: record No. 15 and 17)

$Rs_{(n)}$: Actual start time of recording

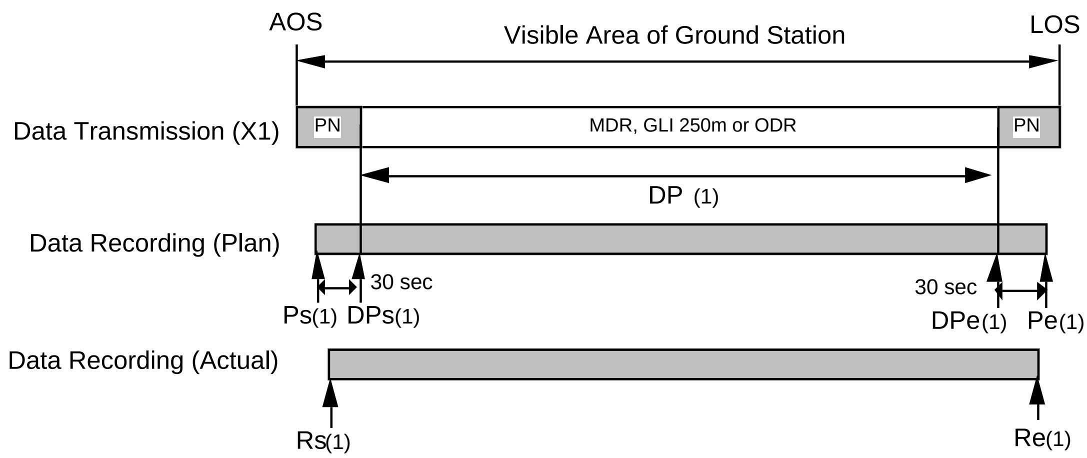
$Re_{(n)}$: Actual end time of recording

$Ps_{(n)}$: Planned start time of recording ($DPs_{(n)}$ - 30 sec.)

$Pe_{(n)}$: Planned end time of recording ($DPs_{(n)}$ + 30 sec.)



(a) IOCS



(b) X band Direct Downlink

Fig. 5.2.2 Data Recording Status

Above acquisition result and recording result including result of EOC will be sent from the MMO to all agencies using ORST file.

(3) Interface Definition

The interface definition of raw data is described in MOIS (individual) of related agencies.

5.2.2 Level 0 Data

(1) Data Definition

Level 0 data is defined as follows except for POLDER:

- Level 0 data is source packets data of each sensor (except POLDER) extracted from packet synchronized ADEOS-II raw data.

Level 0 data consists of two data files.

- "Level 0 Processing Status Report File" includes the information about data acquisition and level 0 generation with data quality information.
- " Level 0 Signal Data File" consists of source packets of each sensor.

Contents of Level 0 Signal Data File are as follows:

- Each file consists of source packets from an IOCS transfer frames or DT transfer frames.
- Each file includes overlapped data with other files. There is no overlapped data within a file.
- Data are time ordered within a file.

The coverage of each Level 0 data is illustrated in Fig. 5.2.3 as an example of MDR reproduced data.

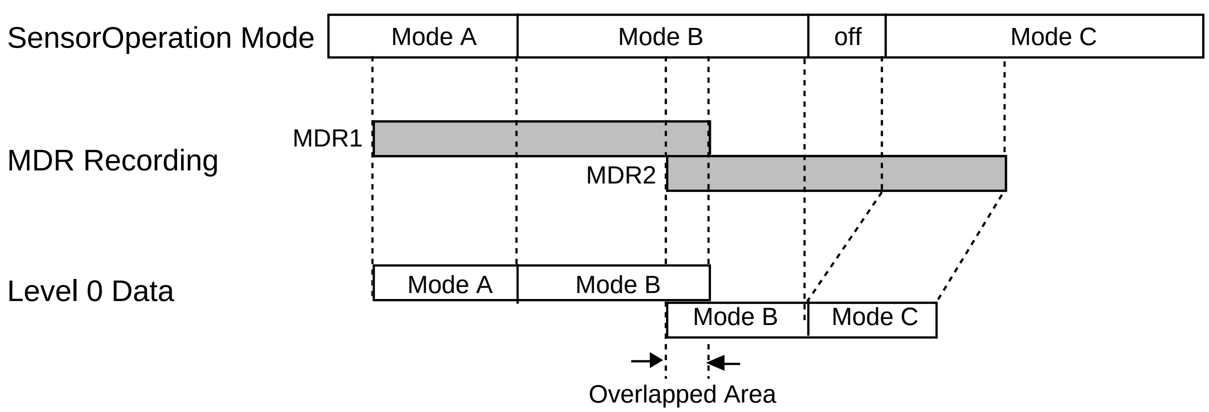


Fig. 5.2.3 Coverage of Level 0 Data

The detailed format of the level 0 data is defined in the "Level 0 Format Description" prepared for each sensor providers and overseas stations.
POLDER Level 0 data is the same as ADEOS, and the detailed definition including data quality is described in the "MOIS (NASDA/CNES POLDER)" and the "POLDER Level 0 Format Description".

(2) Data Quality

The Level 0 Processing Status Report File shows the number of source packets and the continuity of the VCDU (Virtual Channel Data Unit) counter and packet sequence counter. (except POLDER)
On the other hand, the data quality information of POLDER level 0 data is the same as ADEOS and is included in the corresponding level 0 data.

(3) Interface Definition

The interface definition of level 0 data is described in MOIS(individual) of related agencies.

5.2.3 HK TLM Data

(1) Data Definition

HK TLM data of each sensor is defined as follows:

- HK TLM data is housekeeping telemetry data of each sensor extracted from ADEOS-II HK TLM source packet data, which is extracted from packet synchronized ADEOS-II raw data and includes HK TLM data of all sensors.

The coverage of each HK TLM data is illustrated in Fig. 5.2.4 (except for POLDER).
POLDER HK TLM data is edited to 1 file per day. The data coverage of each file is 200~300 min. between fixed time specified previously to always cover fixed 1 orbit.

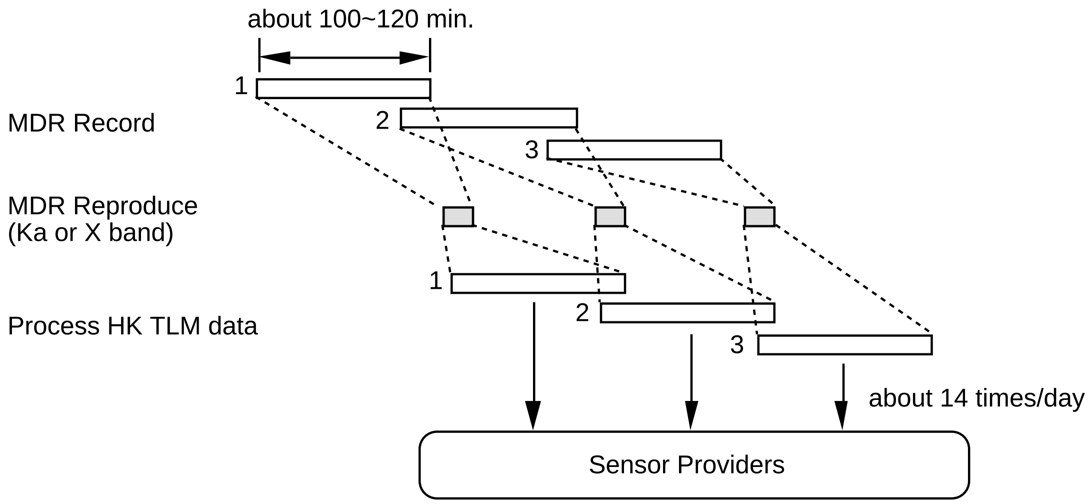


Fig. 5.2.4 Coverage of HK TLM Data

The format of the HK TLM data is the same as ADEOS and defined in the "Level 0 Format Description" of each sensor (except for POLDER), and the "POLDER HK TLM data format description".

On the other hand, TACC also acquire HK TLM data via S band, and process them. During nominal operation, this HK TLM data is not provided to sensor providers. However, for anomaly case shown below and for the on-orbit initial checkout period, NASDA will provide sensor providers with this HK TLM data processed by TACC as contingency plan.
Anomaly cases of HK TLM data processed by EOC is that mission data can not be transmitted from Spacecraft to ground station via Ka band or X band.

The both HK TLM data from EOC and TACC have the same format and same file name, but have different data coverage. The HK TLM data of TACC is shown in section 6.3.

(2) Interface Definition

In ADEOS-II routine operation, HK TLM data of all instruments is multiplexed with all sensor data and transmitted to ground stations using Ka band (in mode 1) or X band (in mode 2).
In mode 1 operation, HK TLM data is acquired globally at EOC via Ka band. EOC processes each sensor HK TLM data and provides it to the sensor providers.
In mode 2 operation, HK TLM data is acquired globally at EOC, NASA ground stations and Kiruna station via X band. NASA ground stations and Kiruna station process HK TLM source packet and provide it to EOC. Then EOC processes each sensor HK TLM and provides it to the sensor providers.
For SeaWinds, however, HK TLM source packet data is provided from each ground station to SeaPAC directly.
For POLDER, moreover, EOC edits HK TLM data to one day per a file in both mode 1 and 2, and provides it to CNES on the next day of data receiving.
The HK TLM data flow is shown in following Fig. 5.2.5 and Fig. 5.2.6.

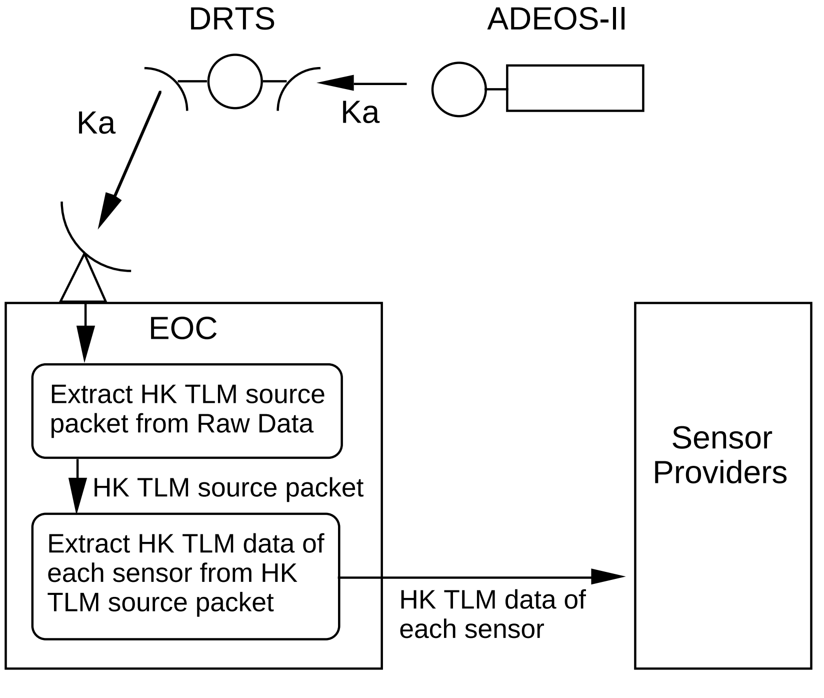


Fig. 5.2.5 HK TLM Data Flow (Mode 1 Operation)

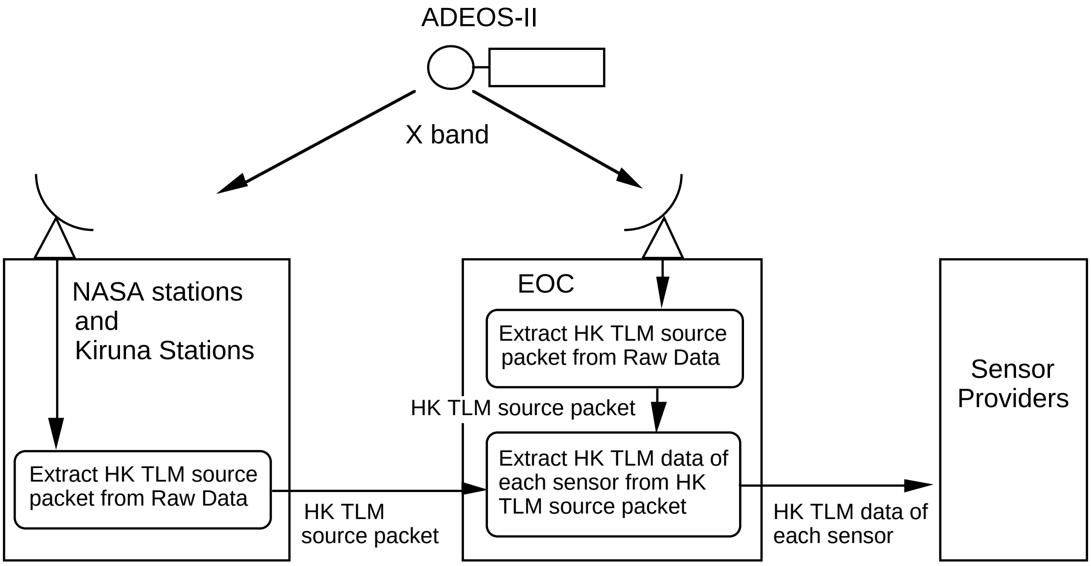


Fig. 5.2.6 HK TLM Data Flow (Mode 2 Operation)

The detailed interface definition of HK TLM data is described in the MOIS (individual) of related agencies.

5.2.4 Standard Product

(1) Data Definition

The standard product will be processed by each sensor provider routinely and provided to EOC on demand.

The definition of each standard product is summarized in Appendix B6.

~~The details of each standard product are described in the Standard Product Specification document provided by each sensor provider.~~**Each sensor provider describes the details of each standard product in the Standard Product Specification document.**

(2) Interface Definition

The interface definition of standard product is described in MOIS(individual) of related agencies.

5.3 File Naming Definition

5.3.1 Mission Operation Information

The file name of OPLN is defined using file type, sensor name in 3 characters and sequential number as follows;

OPLN (File type) + xxx (Sensor name) + nnn (Sequential number)
where xxx ;

GL1	: GLI 1km
GL2	: GLI 250m
AMS	: AMSR
SEA	: SeaWinds
POL	: POLDER
IL2	: ILAS-II
TED	: TEDA
DCS	: DCS
VMS	: VMS
DMS	: DMS

OPLN file of POLDER (xxx = POL) is delivered to NGN. Operation plan of POLDER is informed to CNES by using OPL1 file. OPL1 file for POLDER is defined using file type and sequential number, as well as REQQ file shown in below.

~~However, OPL1 file for POLDER is defined using file type and sequential number.~~

The file name of ED, EP, EL and TD is defined using file type and file generation date (UTC) as follows;

File type + YYYYMMDD (Date of the data)
e.g.) ED20020502

The file name of another files is defined using file type and sequential number as follows;

File type + nnnnnn (Sequential number)
e.g.) REQQ000001

5.3.2 Level 0 data

The file name of Level 0 data is defined as follows (except POLDER Level 0 data);

XX_XXX_XXX_XXXX_XX_XXX_YYYYMMDD_pnnn

where

First :Satellite ID

A2	:ADEOS-II (fixed)

Second :Sensor ID

GL1	: GLI 1km
GL2	: GLI 250m
AMS	: AMSR
SEA	: SeaWinds
IL2	: ILAS-II
TED	: TEDA
DCS	: DCS
DM1	: DMS (Accelerometer data)
DM2	: DMS (Star tracker data)
VMS	: VMS
HKT	: HK TLM (for only source packet data)

Third :Acquisition mode

MDR	: MDR reproduced data
MRT	: Real time data
GLI	: GLI 250m real time data
ODR	: ODR reproduced data (GLI 250m)
ODM	: ODR reproduced data (Multiplexed data)

Fourth : File generation facility ID

HEOC	: Earth Observation Center in Hatoyama
ASF-	: Alaska SAR Facility
WFF-	: Wallops Flight Facility
KRNS	: Kiruna Station

Fifth : Data type

L0	: Level 0 data
PK	: Source Packet data

Sixth : Data sub type
SIG : Signal data file
STR : Status report file

Seventh : File generation date
p : Processor ID (0~9)
nnn : Sequential number (for each processor ID and each sensor ID) (000~999)

For example, the file name of SeaWinds Level 0 signal data processed by ASF from MDR recorded data at May 02, 2002 is as follows;

~~e.g.)~~ A2_SEA_MDR_ASF-_L0_SIG_20020502_1001

5.3.3 HK TLM data

The file name of HK TLM data is defined as follows. (except POLDER HK TLM data)

HKSSPYYMMDDnn

where HK : HK TLM data (fixed)
SS : Sensor ID
IL : ILAS-II
TE : TEDA
DC : DCS
SW : SeaWinds (only for TACC processed HKTLM data)
P : Processor ID
1~9 : EOC processor ID
T : TACC processor ID
YYMMDD : File generation date
nn : Sequential number for each processor per day

The file name of POLDER HK TLM data is defined as follows.

HKDTPOLDEnnnn

where nnnn : Sequential number
0000~4999 : processed at EOC
5000~9999 : processed at TACC

6. Operation Interface Procedure

This section describes normal mission operations procedure.

6.1 Procedure for Mission Planning and Scheduling

6.1.1 General

The procedure of mission operation planning and scheduling for ADEOS-II follows in the ADEOS procedure and includes the six phases.

(1) Pre-launch assessment
(2) Space Network (SN) assessment
(3) Weekly assessment
(4) TACC-EOC coordination
(5) Pre-pass preparation
(6) Post pass actuals reporting phase

The flow chart of mission operation planning and scheduling is shown in Fig 6.1.1. An outline of each phases is as follows;

(1) Pre-launch assessment

NASDA/EOC is responsible for the overall ADEOS-II mission operation plan for the ADEOS-II mission life based on the request from the sensor providers, NOAA, the mission team of each sensor, specific organizations (JMA etc.) and foreign ground stations. The overall ADEOS-II mission operation plan will be made through a variety of meetings before launch and it includes the following items:

(a) observation (including HK telemetry data) and calibration plan for each sensor.
(b) mission data acquisition plan at EOC, Kiruna station and NASA ground stations for real-time data acquisition and for MDR/ODR dump acquisition.
(c) Constraints of data acquisition plan for Foreign Ground Stations.
(d) Operation priority for ADEOS-II operation.

(2) Space Network (SN) assessment

IOCS operation is controlled by Space Network Planning System (SNP) at TKSC. For ADEOS-II, TACC is primary interface point for SN assessment between EOC and SNP.

The SN assessment is performed two months prior to target 1 week period. In this phase, EOC and SNP will coordinate, with TACC support, ADEOS-II operation windows of IOCS necessary for MDR, GLI 250m and ODR operation within the constraints of IOCS resources and conflict with the other IOCS users.

(3) Weekly assessment

Weekly assessment is performed during the period from 28 days to 13 days before the first day of target week. In this phase, EOC and overseas stations will coordinate available passes for X band downlink necessary for MDR, GLI 250m and ODR operation.
Sensor providers will send the observation request to EOC during this phase.

At the end of this phase, the necessary information for making command request is ready for all instruments.

(4) TACC-EOC coordination

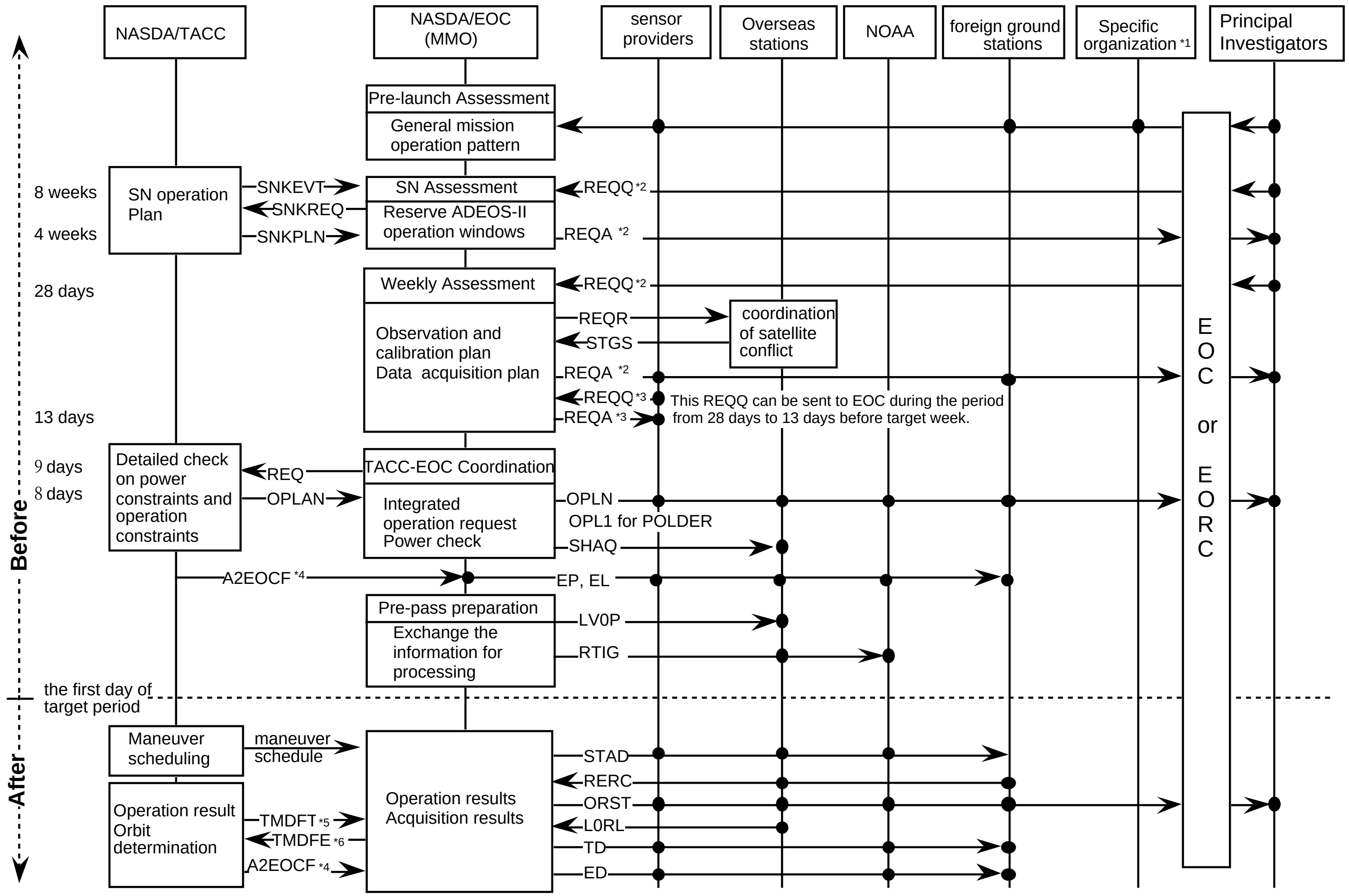
EOC provides TACC with the 1week operation plan as requirement for generating actual commands. After TACC considers the operation constraints (electric power analysis, command constraints and so on), the final weekly operation plan is provided to EOC by TACC.
EOC will provide the final weekly operation plan to sensor providers, NASA ground stations, NOAA, Kiruna station, foreign ground stations, PIs and general users.

(5) Pre-pass preparation

EOC will provide the information of level 0 processing to Kiruna station and NASA ground stations. EOC will also provide NASA ground stations and Kiruna station with the information to process selected GLI 1km data for NOAA.

(6) Post pass actuals reporting phase

Kiruna station, NASA ground stations and foreign ground stations will report actual operation, acquisition and recording events to EOC. EOC informs related agencies of the acquisition and recording results, including NASDA/EOC results.
Kiruna station and NASA ground stations will report the result of level 0 processing to EOC.



*1 : Specific organization indicate Japan Meteorological Agency, etc. *2: Requirement for GLI observation *3 : Operation Requirement from Sensor Providers Except for TEDA and DCS
*4 : Orbit data file (from TACC to EOC) *5 : Time difference data in Mode 1 (from TACC to EOC) *6 : Time difference data in Mode 2 (from EOC to TACC)

Fig. 6.1.1 Work Flow of ADEOS-II Operation Planning and Scheduling

6.1.2 Routine Operation Coordination

6.1.2.1 SN Assessment

The SNP will prepare an SNKEVT file to inform the constraints of IOCS for ADEOS-II, and send it to the MMO through TACC two months prior to target 1 week.
On the same time, requirement for GLI 250 m data acquisition using IOCS will be coordinated within NASDA and PIs, and the requirement will be sent to the MMO using REQQ file.

After the receipt of REQQ for GLI 250 m, the MMO evaluates the contents of the REQQ and optimizes the assignment of MDR, GLI 250m data and ODR operation within the constraints of IOCS.

The MMO provides SNP through TACC with SNKREQ file which includes 1 week request for ADEOS-II operation windows of IOCS necessary for the MDR, GLI 250m and ODR operation.
On the same time, all IOCS users will also provide SNP with the requirement for operation windows of their satellite.

The SNP will coordinate these requirements, and send SNKPLN file to the MMO through TACC to inform IOCS operation plan for ADEOS-II. The SNKPLN file will be prepared by SNP 4 weeks prior to the beginning of target week.
In the IOCS operation plan, some operation requests of ADEOS-II may be rejected caused by conflict with another satellite.

6.1.2.2 Weekly Assessment

Requirement for GLI 250 m data acquisition using X band will be coordinated within NASDA and PIs, and the requirement will be sent to the MMO using REQQ file. On the same time, foreign ground station will prepare request for GLI 250 m data acquisition within their visible area and send it to the MMO using REQQ file. These REQQ files for GLI 250 m will be prepared until 20 days before the first day of target week.

After the receipt of REQQ for GLI 250 m, the MMO evaluates the contents of the REQQ and optimizes the assignment of MDR, GLI 250m data and ODR operation using X band direct transmission over each ground station for target 1 week.
Where, MDR operation using X band is planned to recover the rejected MDR operation using IOCS.

The MMO prepares data acquisition request (REQR) for target week based on the X band operation plan and send it to overseas stations 20 days before the first day of target week. If it is impossible to acquire raw data from ADEOS-II because of anticipated conflicts with another satellite, overseas stations inform the MMO by STGS as soon as possible after receipt of REQR.

The above coordination between EOC and overseas stations by REQR and STGS is repeated until approval of the overseas stations is achieved. The overseas stations must inform the MMO of approval by STGS until 14 days before the first day of target week.

Sensor providers (except for DCS and TEDA) will prepare 1 week observation plan of their own sensor and send it to the MMO during the period from 28 days to 13 days before the first day of target week.

After receipt of REQQ file from sensor providers, the MMO evaluates the contents of the REQQ and makes sensor operation plan in accordance with the final MDR operation plan. If an REQQ contains some format errors, the MMO immediately informs its agency of them by REQA file. And the sensor provider corrects the REQQ and must send the revised REQQ to the MMO as soon as possible after receipt of REQA.

The weekly assessment is completed up to 12 days prior to the first date of each target week.

6.1.2.3 TACC-EOC Coordination

TACC-EOC coordination starts 9 days prior to the beginning of the target week. This phase determines the weekly operations plan for the next week.

The MMO sends the weekly plan to TACC. TACC fully checks the plan on power constraints, command sequence, system constraints and command constraints. After approval by TACC, the MMO informs the related agencies of the weekly plan of sensors by OPLN files and OPL1 file. The MMO also informs overseas stations of the weekly plan of X band direct transmission over each station by SHAQ file.

OPLN is developed separately for each sensor and OPL1 is for POLDER. Each agency can review the final operation plan of its sensor by reading the OPLN, OPL1. In case that an agency finds any problem in the OPLN or OPL1, the agency discusses it with EOC.

6.1.2.4 Pre-Pass Preparation

The MMO sends the level 0 processing information to Kiruna station and NASA ground stations using LV0P.
The MMO sends the information to NASA ground stations and Kiruna station using RTIG for processing selected GLI 1km data.

6.1.2.5 Post Pass Actuals Reporting

6.1.2.5.1 Recording Results

NASA ground stations, Kiruna station and foreign ground stations provide ADEOS-II data acquisition and recording results to the MMO using RERC and RERB. The MMO informs each agency of the recording results, including the NASDA/EOC results, using ORST.

6.1.2.5.2 Processing Results

NASA ground stations and Kiruna station provide level 0 data processing results to the MMO using L0RL.

6.2 Orbit Operation

6.2.1 Nominal Orbit Parameters

Orbit Type	sun-synchronous, ground track repeat, near-circular orbit
Recurrent period	4 days
Revolutions per day	14+1/4 rev./day
Local sun time at descending node	10:15-10:45 (AM)
Altitude above equator	802.9 km
Orbital Period	101.05 min.
Inclination	98.62 degrees (specification: the bias at the half of ADEOS-II mission life)
	98.69 degree (bias for initial orbit)
Equator Ground Track Longitude Repeatability	± 5 km

ADEOS-II orbit data corresponding to initial orbit is indicated as follows:
These parameters will be updated after launch according to the actual launch date.

ADEOS-II Mission Orbital Parameters

EPOCH Time (on an ascending node)	00H 00M 00.000S Nov. 1, 2001 (UTC)
corresponding RSP	(Path,γ) = (57, 0.00)
corresponding total orbit number	57

Keplerian Osculating Elements (in true-of-date coordinates)

Semi-Major Axis	7183.42317584 km
Eccentricity	0.00101419356
Inclination	98.6885854016 deg
Argument of Perigee	60.1636972148 deg
Right Ascension of Ascending Node	17.8496739548 deg
Mean Anomaly	157.3273212614 deg

Cartesian Osculating Elements (in true-of-date coordinates)

X	-5629.98389972 km
Y	-1117.75349047 km
Z	-4330.37150016 km
X dot	4.040367924 km/sec
Y dot	2.237937750 km/sec
Z dot	-5.835427415 km/sec

Satellite Constants

Satellite Mass	3730	kg
Cross Sectional Area	53.55	m^2

6.2.2 Orbit Maneuvering Strategy and Frequency

6.2.2.1 Altitude Control

Orbit Recurrent Accuracy : ±5 km

For the RSP to remain consistent and to keep the recurrent orbits that allows periodic data acquisition from the same area, the nodal period (Pn) of the spacecraft is controlled to stay within a permitted range. Altitude changes dominate change of nodal period (Pn). If the nodal period decreases because of decreased altitude, the ground track is shifted eastward. Therefore, altitude maneuvering will be performed to compensate for degradation of the semi-major axis caused by atmospheric drag over the mission. Preliminary analysis results are described in Appendix B.1.

6.2.2.2 Inclination Control

Local Meantime : 10:30 ± 15 min. (AM)

In order to maintain the sun-synchronous orbit, the local mean time (T_{LMT}), defined as the crossing time of the descending node, must be kept constant or within a permitted range. From the relationship between the change of local mean time (T_{LMT}) and inclination, the requirement for inclination adjustment can be computed.

The results from the preliminary assessment show that local mean time (T_{LMT}) changes as a quadratic function of time (see Fig. B.1-2). If the appropriate inclination bias is established for nominal orbit parameters by inclination maneuvers at the beginning of the mission, ADEOS-II will maintain a sun-synchronous orbit within the permitted range of ± 15 min. for the local mean time without additional inclination control during the ADEOS-II mission life.

Moreover, maneuvering for inclination control requires a large amount of fuel. Therefore, it will be conducted only for the initial inclination correction.

6.2.2.3 Onboard Clock Adjustment

The ADEOS-II onboard clock is not adjusted. The relation between spacecraft time code and UTC time are reported to agencies using the TMDF file and also included in POLDER level 0 data. The relation will be accurate to ±10 ms.

6.2.3 Orbit Computation

6.2.3.1 Orbit Control and Orbit Determination at TACC

(1) Ranging and orbit determination

Using range and range rate data obtained by the Feeder Link Station at TKSC (in mode 1) or NASDA/TACS and NTSK (in mode 2), current orbit elements are determined and stored in UNOCS (Unified NASDA Orbit Computation System).

(2) Orbit Prediction

Orbit prediction is performed by numerically integrating the satellite equations of motion including the perturbing accelerations which are currently modeled in UNOCS. The perturbing accelerations are:

- The geopotential (Geopotential Model; GEM-T3)
- The luni-solar potentials
- Solar radiation pressure
- Atmospheric drag (Air density model; Jacchia-Nicolet)

(3) Orbit monitoring

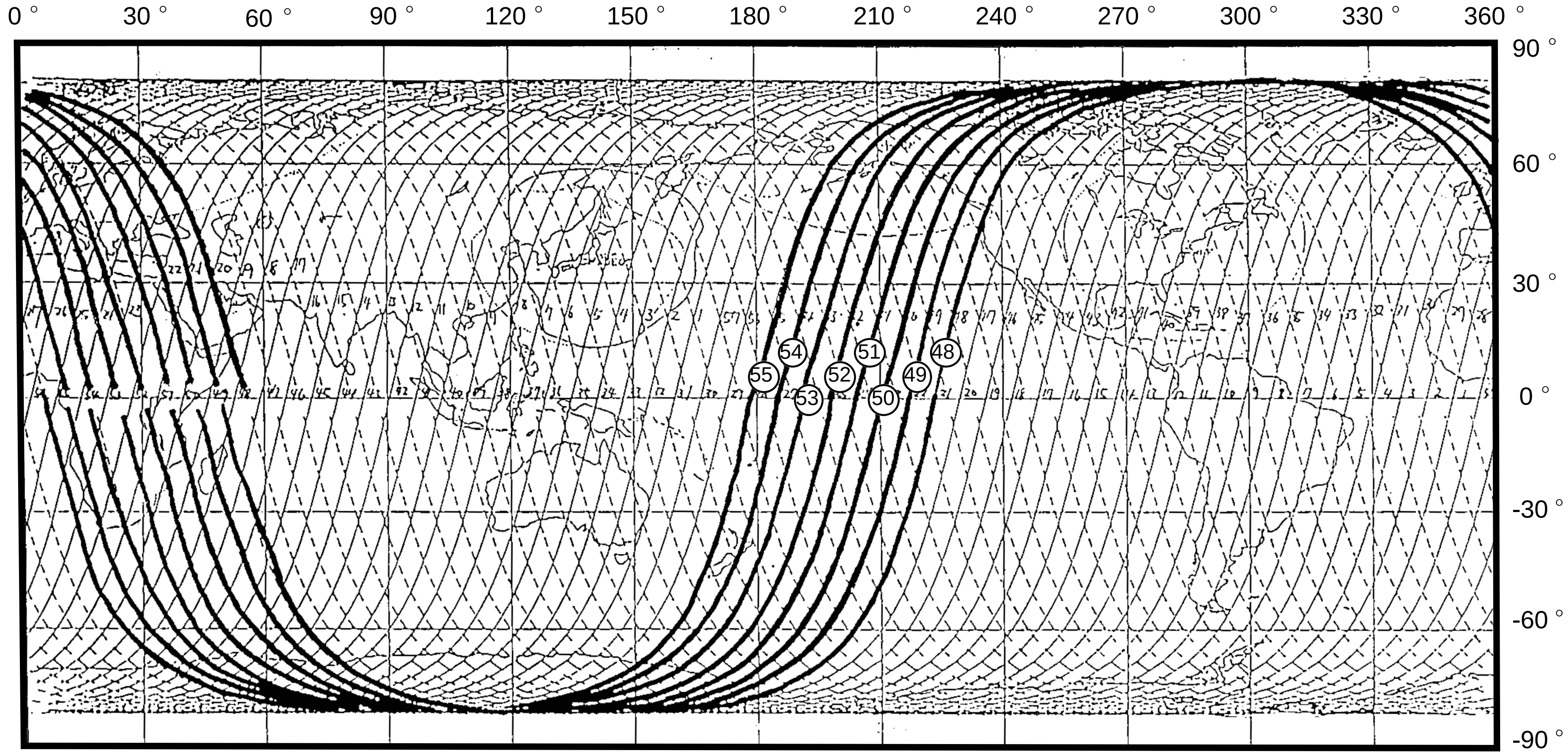
The predicted orbit elements will be compared with the desired sun-synchronous recurrent orbit. If the predicted orbit elements exceed the acceptable difference, an orbit maneuver will be planned.

(4) Orbit maneuvering

a) +ΔV Maneuver

Normal orbit maneuver (+ΔV) is typically performed on Thursday every week. However, it is often skipped due to low solar activity. TACC will make decision every Monday whether +ΔV maneuver is necessary to keep orbit recurrent accuracy or not. If TACC decides to perform +ΔV maneuver on Thursday, MMO will prepare a STAD file on Wednesday (1 day before the day of maneuvering) to inform related agencies of the maneuver schedule.

TACC will assign 2 orbits as window for +ΔV maneuver, and these 2 orbits are selected from fixed 8 orbits (path 48 ~ path 55: see Fig. 6.2.1).
In the 2 orbits of +ΔV maneuver window, sensor operations are not suspended, but mission data acquisition through IOCS can not be performed. So, MMO will make data acquisition plan to use X band direct transmission for this +ΔV maneuver window.



Note: Each orbit is numbered as Path No.
(The definition of Path No. is described in the Appendix B5.)

: Descending Orbit (Day)
: Ascending Orbit (Night)
: Window for Normal Maneuver

Fig. 6.2.1 Normal Orbit Maneuver Window

b) Unexpected Maneuver

A yaw maneuver is performed to change the satellite yaw angle before and after -ΔV or ±Δi maneuvers (see Fig. 6.2.2). There are two possible types of angle changes, ± 90 deg. or ± 180 deg. During yaw maneuvering, the satellite only uses batteries as the power source. Therefore, all instrument operations and data acquisition are suspended to save electrical power during unexpected maneuver, which includes yaw maneuver. The operation mode of each sensor for unexpected maneuver is specified in the MOIS individual part. Normal S/C operations resume after battery recharging is completed.

The -ΔV maneuver is needed when the satellite speed is increased too much by a +ΔV maneuver. There may be one or two times when this -ΔV maneuver is used in the early normal operation phase.

The ±Δi maneuver is expected to be unnecessary during the 3 years routine operation, and the detailed plan and schedule will be decided with the agreement of all related agencies.

~~For unexpected maneuver, which includes yaw maneuver, all instrument operations and data acquisition are suspended to save electrical power. The operation mode of each sensor for unexpected maneuver is specified in the MOIS individual part.~~

~~Unexpected maneuver is expected to be unnecessary during the 3 years routine operation, and the detailed plan and schedule will be decided with the agreement of all related agencies.~~

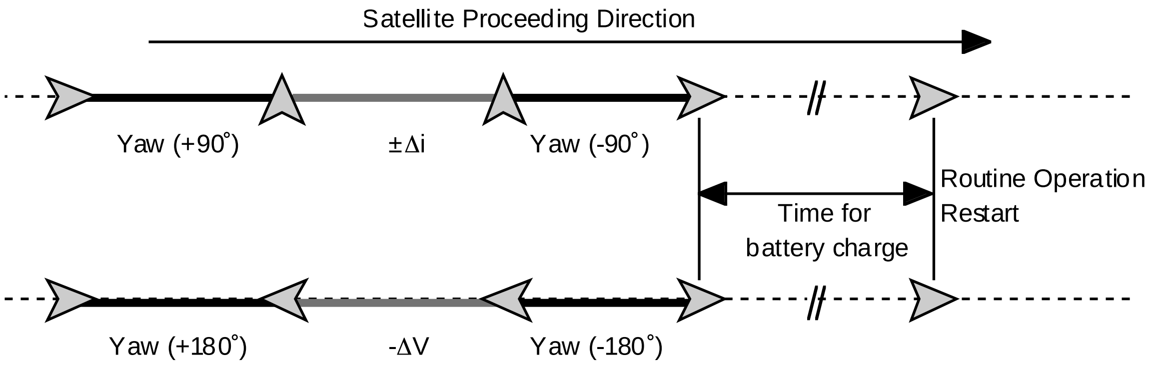


Fig. 6.2.2 Sequence of Unexpected Maneuver

6.2.3.2 Orbit Parameters

Distribution frequency	8:00 UTC	Mon., Wed., Fri. (Nominal)
		Every day (high solar flux or user requirement)
For future paths	to 5 days after the current day (EP, EL)	
For past paths	from 3 days before the current day (ED)	
Interval	1 minute	
Coordinate system	ECI (True of date)	
Elements	Epoch	(UTC)
	Position	(X,Y,Z)
	Velocity	$(\dot{X},\dot{Y},\dot{Z})$
Accuracy of position (3σ)	3 km	(predictive 3 days before*)
	150 m	(definitive)
Accuracy of velocity (3σ)	1 m/sec	(predictive 3 days before*)
	15 cm/sec	(definitive)

*: During high solar flux period, this accuracy of predictive data is kept within 1 day.

6.2.3.3 Orbit Parameters Distribution Method

As described in section 6.2.3.1, NASDA/TACC monitors and controls the ADEOS-II orbit and also computes predictive and definitive orbital elements for distribution. Data sets of orbital elements computed by TACC will be sent to EOC where the data sets are stored into the data base at EOC. MMO edits the data sets and places them in the MMOFE directory as the EP, EL and ED file, which each agency can access. The availability schedule for the orbit data files is summarized in Fig. 5.1.5.
Definitive orbit data is also included in POLDER Level 0 data.

Moreover, TACC will determine orbital parameter every day, when the accuracy of orbit data can not be kept within a specified value due to solar flux or NIES requires to change orbit data delivery frequency and NASDA accepts it.
Orbit data delivery frequency is changed on only Monday, and NASDA will provide all related agencies with the notification until Thursday 4 days before the day of change by using OCL.
When NIES provides the request to change orbit data delivery frequency, the start and end day of the term which offers orbit data every day must be fixed to Monday. And the request should be provided to NASDA until Monday 2 weeks prior to the request day of orbit data delivery frequency change.
The details of request rules and procedure for orbit data delivery frequency change between NASDA and NIES, and request sheet format are specified in the MOIS (individual part) for

MOE/NIES. Moreover, the OCL format, which is used to announce orbit data delivery frequency change, is attached in the MOIS (individual part) for each agency.

The change procedure of orbital data delivery frequency is illustrated in Fig. 6.2.32.

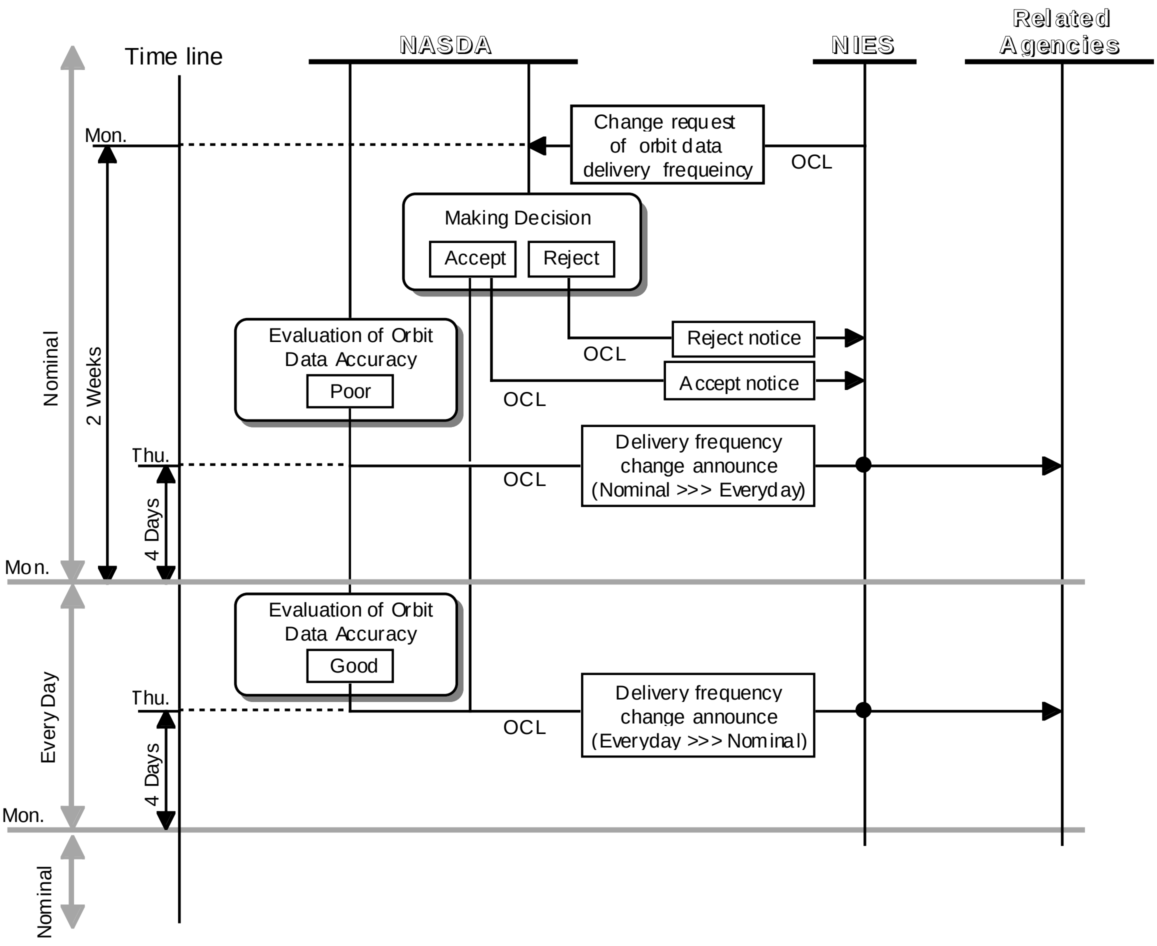


Fig. 6.2.3 Procedure for Orbit Data Delivery Change

6.2.4 Orbit Data Exchange

Each orbit data file covers the data for one day at one minute intervals. These data are expressed in the True of date coordinate system and Universal Time Coordinated (UTC) time. The coordinate systems are given in Appendix B.2.

The True of date coordinate system is a right-handed, Cartesian, geocentric coordinate system with the X axis directed along the True equinox of the reference time and with the Z axis simultaneously directed along the Earth's spin axis toward north.

6.3 Housekeeping Telemetry and Command Operation

6.3.1 Prepass Operation

EOC will provide TACC with operation requests of onboard instruments. TACC will check power limitation, thermal conditions and command capacity for the operation request.
Then, TACC will generate the sequence of commands according to EOC requests. Commands for routine operations will plan to use automatic operation mode (OBC-command).

6.3.2 Pass Operation

Real time HK TLM data will be dumped to the Feeder Link Station at TKSC in mode 1, or to TACS and NTSK in mode 2. The real time HK TLM data will be transferred to TACC in real time and recorded on disk at TACC.
TACC will monitor the real time HK TLM data according to the rules given by the SOOH. The monitoring system will provide functions such as Trend Display and Limit Detection.
If any anomalies are detected, the operator will respond according to the rules given by the SOOH.

Stored HK TLM data for an orbit, which is recorded on the HKMU(House Keeping Memory Unit), will also be dumped to the Feeder Link Station at TKSC in mode 1, or to TACS and NTSK in mode 2. In mode 1, the stored HK TLM data will be transferred from the Feeder Link Station and recorded at TACC. It will be recorded at TACS and NTSK in mode 2.

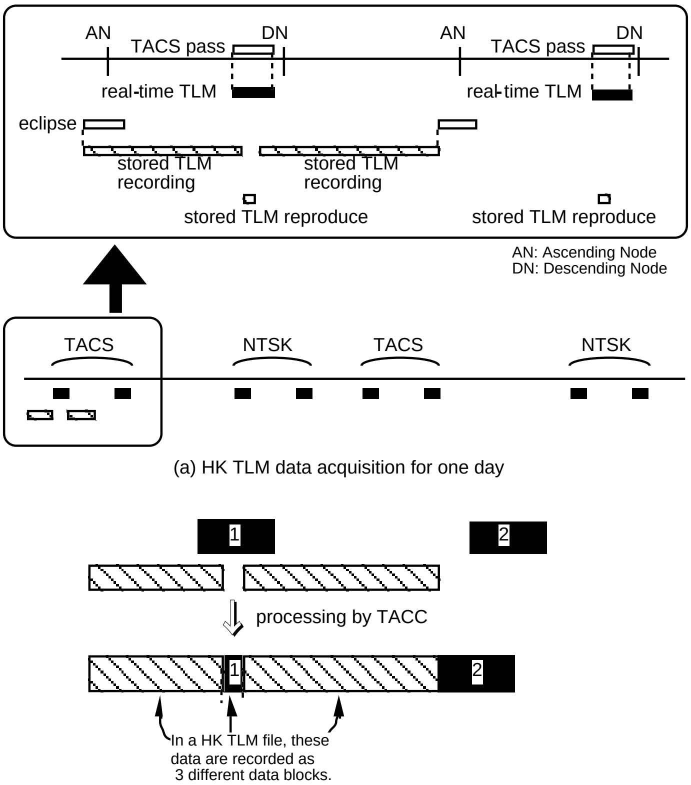
Moreover, the mission module commands will be activated by OBC commands in this phase.

6.3.3 Post Pass Operation

The stored HK TLM data recorded at TACS and NTSK in mode 2 will be sent to TACC after the pass operation.
TACC will edit the real time and stored HK TLM data in time order, and will extract the HK TLM data of each sensor.

TACC will maintain the HK TLM data and command history.
Moreover, TACC will evaluate and analyze the bus systems as principle function.

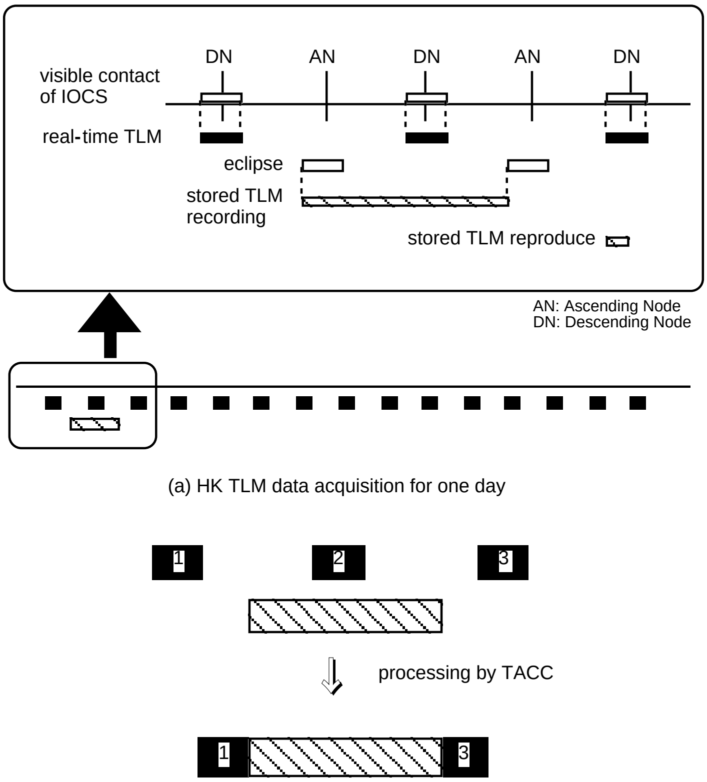
The housekeeping telemetry operation performed by TACC is illustrated in Fig. 6.3.1 for both mode 1 and mode 2.



(a) HK TLM data acquisition for one day

(b) Editing of HK TLM data

Fig. 6.3.1 (1/2) Housekeeping Telemetry Operation (Mode 2)



(a) HK TLM data acquisition for one day

(b) Editing of HK TLM data

Fig. 6.3.1 (2/2) Housekeeping Telemetry Operation (Mode 1)

In mode 1 operation, TACC will typically receive daily about 13 hours HK TLM data, including 110 minutes of TLM data recorded by HKMU and 11 hours of real time HK TLM data, using the Feeder Link Station at TKSC.
The Feeder Link Station at TKSC will acquire about 45 minutes consecutive real time HK TLM data during IOCS contact on each pass. There are 15 visible passes for IOCS in a day. The Feeder Link Station at TKSC will also acquire about 110 minutes of stored HK TLM data in the third pass of each day.

In mode 2 operation, TACC will typically receive daily about 170 minutes of HK TLM data, including 90 minutes of TLM data recorded by HKMU and 80 minutes of real time HK TLM data, using TACS and NTSK.
TACS and NTSK will acquire about 10 minutes of consecutive real time HK TLM data during the visibility part of each pass. There are 4 visible passes at TACS and 4 visible passes at NTSK in a day.

In both mode 1 and mode 2, TACC deletes the real time HK TLM data that is redundant with stored HK TLM data and sorts all telemetry data in time order.

The HK TLM data processed by TACC is not provided to sensor providers in nominal operation (see section 5.2.3).

6.4 Catalog System

NASDA, NASA, CNES and NIES will create and maintain the inventory information of the ADEOS-II mission data higher level products which each agency acquired and/or processed at its facility and will operate their own catalogue system for access from users.

NASDA and NASA will establish catalog interoperability among the inventory systems each other. NASDA and NIES will make an effort to provide linking capabilities of their inventory information system with one of the CEOS-IDN nodes.

Each agency will create and maintain the directory information of the ADEOS-II mission data in DIF (Directory Interchange Format) which each agency acquires and/or processes at its facilities and will load the information in one of the CEOS-IDN (International Directory Network) coordinating nodes.

7. Operation Interface Coordination

7.1 Contact Points

Contact point(s) for foreign ground stations, sensor providers, the Kiruna station, the NASA ground stations and NOAA/NESDIS and NASDA during pre-launch and routine operation phase are listed in the "ADEOS-II Contact Points Document" (AD2-EOC-96-124). The person who is designated as the contact point has coordination responsibility for operation interfaces between NASDA and the respective agency.

7.2 Mission Operations Coordination

All formal communications regarding the technical and operational interfaces between NASDA and each agency will use OCLs and will be discussed in ADEOS-II Mission Operations Meetings (MOMs).

(1) Mission Operations Meeting (MOM)

NASDA and each agency will coordinate the technical and operational interfaces between NASDA/EOC and the agency's ground systems at ADEOS-II Mission Operations Meetings (MOMs) from pre-launch to the end of mission.

Staff persons designated by the Project Managers of NASDA and each agency will attend MOMs, as will the contractors designated by NASDA and each agency. The MOM chairman shall be from NASDA. NASDA and each agency are authorized to convene a MOM when technical coordination is required. The date, place, duration and agenda of a MOM shall be determined by mutual consultation before the meeting.

(2) Mission Operations Coordination Letter (OCL)

The Operations Coordination Letter (OCL) shall be used as the primary means of communication between NASDA and each agency. The OCL will be utilized for the formal exchange of information that is necessary for the interface coordination between Projects. The OCL shall be sent by facsimile, e-mail or regular mail. The receiving side shall confirm the receipt of the OCL by a return facsimile, e-mail or regular mail.

note: An example of OCL cover format is attached in MOIS (Individual) of each agency.

8. Contingency Procedure

8.1 Anomalous Operation Coordination

For an anomaly occurrence related to sensor providers, NASDA and each agency will coordinate anomaly measures and perform them in accordance with the Nonconformance Reporting and Processing System for ADEOS-II Sensor in Orbit.

When an anomaly occurs in the ADEOS-II system, NASDA uses the following procedure to solve the anomaly.

(a) Autonomous function procedure using the ADEOS-II onboard computer.
(b) Procedure described in the SOOH/SOP.
(c) Procedure under Nonconformance Counterplan Meeting (NCM).

As soon as NASDA detects the occurrence of an anomaly in the ADEOS-II system, NASDA will contact the related agencies by e-mail, phone or fax.

8.2 Request of Recovery Command

8.2.1 Submission of Updated REQQ

(1) Contingency Operation Request by Updated REQQ

MMO will accept an updated REQQ submitted from SeaPAC, CNES/POLDER and NIES after the due date of original REQQ in order to compensate for anomalies of SeaWinds, POLDER and ILAS-II instrument.
The detailed interface specification to submit an updated REQQ is defined in the MOIS individual part of NASA/NOAA, CNES/POLDER and NIES.

(2) Updated REQQ for Routine Operation Restarting

If an anomaly occurs in ADEOS-II system and automatic operation is interrupted, an updated REQQ is also used to restart the routine operation of SeaWinds, POLDER and ILAS-II after the anomaly is recovered.
In this case, SeaPAC, CNES/POLDER and NIES send the updated REQQ to EOC in accordance with the request from NCM.
The requesting rules and constraints of the updated REQQ for restarting routine operation are specified in the MOIS individual part of NASA/NOAA, CNES/POLDER and NIES.

For restarting routine operation of TEDA and DCS, on the other hand, the instrument operation plan will be made by MMO in accordance with the request from NCM or the rules previously defined in the MOIS individual part of TKSC/TEDA and CNES/DCS.

8.2.2 Real Time Command Request

There are three types of ADEOS-II commands, such as OBC command, real time command and stored command. The principle of command operations is to have OBC automatic operations through the ADEOS-II routine operation phase. ADEOS-II mission instrument operations are performed by OBC commands in order to prevent possible human errors while command planning and to perform efficient operations. Real time commands or stored commands are considered as anomaly operation commands with some exceptions.

(1) Commanding for the Immediate Safeing Operations

Indispensable and prompt measures to maintain the safety of the spacecraft and mission instruments, as well as transmit condition and transmit procedure of the commands are previously defined in the SOOH and SOP. (Commands are executed by requests from a sensor provider or by judgment of the ADEOS-II operation side.)

(2) Commanding for the Trouble Shooting Operations

Under the condition that safety of the spacecraft and the mission instruments are ensured, command transmit condition and command transmit procedure of the trouble shooting, etc. are either specified by the SOOH and SOP or by the sensor provider. (It is necessary to confirm the command execution planning by the NCM which is staffed by both NASDA and the sensor provider.)

(3) Condition of Real Time Commanding for Routine Operations

As stated above, real time commands, normally, will be used only for anomaly operations. However, real time commands can be included in routine operations, if the following conditions are satisfied.

(a) There will be no interference with any other sensor' s observations, when the commands are sent to the requesting instrument.
(b) There will be no increase in power-thermal usage above the routine allocations for the requesting instrument.
(c) The commands can be sent independent of the instrument mode.

(d) The command transmission is not time critical (i.e. it is impossible to request a specific TACS pass).

(e) Command usage is defined in the SOOH.

(f) NASDA must approve the command usage.

For the real time command usage, the detailed interface procedure for command requesting and executing is specified in the concerned MOIS individual part.

Appendix A1 Definitions

(1) Target Week

ADEOS-II mission operation plan is divided to every week in accordance with the OBC design. "Target Week" refers to each ADEOS-II operation 1 week, and its coverage is from Wednesday to Tuesday.

(2) Multiplexed Data

Multiplexed data are packetized data based on CCSDS and include AMSR, GLI-1Km, ILAS-II, SeaWinds, POLDER, DCS, TEDA, VMS, DMS and HK telemetry data. The data are separated into MDR data and MRT data according to the data transmission method.

(2-a) MDR data (Data rate: 60Mbps)

MDR data are multiplexed data in MDR reproduce mode and does not include GLI 250m data. MDR data includes multiplexed data of 1 orbit (or 2 orbits).

(2-b) MRT data (Data rate: 6Mbps)

MRT data are multiplexed data acquired by direct reception at each ground station via X3 or at EOC via IOCS.

(3) GLI 250m data (Data rate: 60Mbps)

GLI 250m data contain observed land area data in daytime and are acquired at each ground station via X1 band, or at EOC via IOCS in real time. GLI 250m data are also recorded on the ODR.

GLI 250m data are acquired in the real time mode and include telemetry data, attitude data and orbit data.

(4) ODR data (Data rate: 60Mbps)

ODR recorded data (mainly GLI 250 m data) are acquired at each ground station via X1 or at EOC via IOCS.

(5) Mission Data

Mission data include the observation data of all onboard sensors and Housekeeping data of all onboard instruments.

(6) Raw Data

Raw data are the telemetry bit stream from the SC received at ground stations.

(7) Level 0 Data (except for POLDER)
Level 0 data are packet synchronized and time ordered data.

(8) POLDER Level 0 Data
Frame synchronized, gap filled, time ordered and non-redundant POLDER data obtained from a single pass with all available supplemental information to be used in subsequent processing including Payload Correction Data (PCD) data, definitive ephemeris data, SC time code correction value and quality, quantity and continuity (QQC) statistics for the Level 0 data.

(9) Standard Products
Standard Products are selected mission data products (Level 1, Level 2 and Level 3 data) processed routinely for science analysis and publication.

(10) Selected GLI data
Selected GLI data contain selected bands and area data of GLI 1km.

(11) Mission Operation Information
Mission operation information refers to the data and information such as mission operation request/plan/result, acquisition request/result, ground station operation plan, orbit data, time difference data, housekeeping telemetry data, satellite and station status information, and mission data shipment/readability reports. The information is used to make the mission operation plan and to perform mission operations.

(12) DDS (Data Distribution Subsystem)
DDS is the system designated by NASDA as the access point to exchange Mission Operation Information and Mission Data, including Level 0 data and processed data. DDS will be located in EOC and has two directories in which the data will be stored.

(13) MMOFE Directory
The sensor providers, NASA stations, NOAA and foreign ground stations shall contact the Mission operation Management Organization Front-End (MMOFE) directory on the EOIS/DDS at NASDA/EOC to get Mission Operation Information.
Additionally, CNES shall contact this directory to get POLDER HK TLM data.

(14) NRT Directory

The sensor providers except POLDER shall contact the Near Real Time data directory on the EOIS/DDS at NASDA/EOC to get Level 0 data, HK TLM data and processed data via network.

(15) Housekeeping

Housekeeping for the mission instrument includes all functions performed by the ADEOS-II Project during the mission operations period that are needed to monitor and protect the health, status and safety of the mission instrument and to conduct normal instrument operations.

(16) HK source packet data

HK source packet data are multiplexed housekeeping data of all onboard instrument.

Appendix A2 Acronyms and Abbreviations

A

ADEOS-II	:	Advanced Earth Observing Satellite-II
AGSID	:	ADEOS-II to Ground Stations Interface Document
AMSR	:	Advanced Microwave Scanning Radiometer
ANSI	:	American National Standard Institute
AOD	:	ADEOS-II Operational Document
AOS	:	Acquisition of Signal
ARCH	:	Archive Subsystem
ASF	:	Alaska SAR Facility (University of Alaska)

B

C

CCITT	:	International Telegraph and Telephone Consultative Committee
CCT	:	Computer Compatible Tape
CCSDS	:	Consultative Committee for Space Data Systems
CDR	:	Critical Design Review
CEOS	:	Committee On Earth Observation Satellites
CEOS-IDN	:	Committee on Earth Observations Satellites-International Directory Network
CLS	:	Collect Localisation Satellites
CNES	:	Centre National d Etudes Spatiales
COMETS	:	Communications and Broadcast Engineering Test Satellite
CTLG	:	Catalogue data file

D

DCS	:	Data Collection System
DDS	:	Data Distribution Subsystem
DDMS	:	Data Distribution and Management Subsystem
DLNG	:	Difference in the Longitude
DMMC	:	Downlink Messages Management Center
DRTS	:	Data Relay and Tracking Satellite
DSMC	:	Data Services Management Center (NASA)
DT	:	Direct Transmission
DTL	:	Direct Transmission subsystem for Local Users

E

EA	:	Environment Agency of Japan (Reformed to “MOE”)
ELMD	:	Definitive orbital Element (file name is ED)
ELMP	:	Predictive orbital Element (file name is EP or EL)
ECI	:	Earth Center Inertial coordinates
EOC	:	Earth Observation Center (NASDA)
EOIS	:	NASDA's Earth Observation data and Information System
EOM	:	End of Mission
EORC	:	Earth Observation Research Center
EOS	:	Earth Observing System
EOSDIS	:	EOS Data and Information System
ESDIS	:	Earth Science Data and Information System

F

FAX	:	Facsimile Message
FGS	:	Foreign Ground Station
FRR	:	Flight Readiness Review

FTAM : File Transfer Access and Management
FTP : File Transfer Protocol

G
GDR : Ground segment Design Report Meeting
GLI : Global Imager
GPS : Global Positioning Satellite System
GSFC : Goddard Space Flight Center (NASA)

H
HDDT : High Density Digital Tape
HDF : Hierarchical Data Format
HK : Housekeeping
HK TLM : Housekeeping Telemetry
HKMU : House Keeping Memory Unit

I
IEOS : International Earth Observing System
IF : Intermediate Frequency
IIP : Instrument Implementation Plan
ILAS-II : Improved Limb Atmospheric Spectrometer-II
IOCS : Inter-Orbit Communication Subsystem
IP : Implementation Plan
IPCN : Implementation Plan Change Notice
IPCP : Implementation Plan Change Proposal
IRD : Interface Requirements Document

J
JMA : Japan Meteorological Agency
JPL : Jet Propulsion Laboratory (California Institute of Technology)
JPRD : Joint Program Requirement Document

K

L
LOS : Loss of Signal

M
MDR : Mission Data Recorder
MMO : Mission operation Management Organization
MMOFE : Mission operation Management Organization Front-End (Directory)
MOA : Memorandum of Agreement
MOE : Ministry Of the Environment
MOIP : Mission Operations Implementation Plan
MOIS : Mission Operations Interface Specification
MOM : Mission Operations Meeting
MOU : Memorandum of Understanding
MRT : Mission Real Time

N
N/A : Not Applicable
NASA : National Aeronautics and Space Administration
NASDA : National Space Development Agency of Japan
NESDIS : National Environmental Satellite Data and Information Service
NGN : NASA/NOAA Ground Network

NIES : National Institute for Environmental Studies
NOAA : National Oceanic and Atmospheric Administration
NRT : Near Real Time Data (Directory)
NSCAT : NASA Scatterometer
NTSK : NASDA Transportable Station-Kiruna

O
OCL : Operations Coordination Letter
ODR : Optical Data Recorder
Opr. : Operational
OPL : Operation Plan (between EOC and an agency)
ORR : Operational Readiness Review
ORST : Operation Result Status
OS : Operating System
OSDPD : NOAA/NESDIS Office of Satellite Data Processing and Distribution

P
PCD : Payload Correction Data
PCM : Pulse Coded Modulation
PDR : Preliminary Design Review
PFM : Proto-Flight Model
PI : Principal Investigator
PO.DAAC : Physical Oceanography Distributed Active Archive Center
POLDER : Polarization and Directionality of the Earth's Reflectances
PROC : Processing Subsystem

Q
Q/L : Quick Look
QQC : Quality, Quantity and Continuity

R
RCV : Receiving Subsystem
RCD : Recording Subsystem
RDRD : Readability report of Raw Data
RDZD : Readability report of level Zero Data
REAC : Result of Acquisition
REQ : Request for Operation (between TACC and EOC)
REQA : Reply on 1 week Request (particular)
REQQ : Request for 1 week period
REQR : Request for Raw data record
RESTEC : Remote Sensing Technology Center of Japan
RF : Radio Frequency
RGS : Receiving Ground Station
RORR : Routine Operation Readiness Report meeting
RSP : Reference System for Planning
RTIG : Real Time processing Information for GLI data

S
SAR : Synthetic Aperture Radar
SC : Spacecraft
SeaPAC : SeaWinds Processing and Analysis Center
SeaWinds : NASA-JPL Scatterometer On ADEOS-II
SITE : System Integration and Test Building
SN : Space Network
SNKEVT : SN Ka band Event information
SNP : SN Planning System

SOOH : Spacecraft Orbital Operations Handbook
SOP : Spacecraft Operation Procedure
SRRD : Shipment Report of Raw Data
SRZD : Shipment Report of level Zero Data
STA : Science and Technology Agency
STAD : Status information on ADEOS
STGS : Status of Ground Station

T

TACC : Tracking And Control Center (NASDA)
TACS : Tracking And Control Station (NASDA)
TBD : To Be Determined
TCP/IP : Transmission Control Protocol/Internet Protocol
TEDA : Technical Data Acquisition Equipment
TKSC : Tsukuba Space Center (NASDA)
TL : Time of Launch
TLM : Telemetry
TMDF : Time Difference file (file name is “TD”)
TRR : Technical Readiness Review

U

UHF : Ultra High Frequency
USB : Unified S-Band
UTC : Universal Time Coordinated

V

W

WFF : Wallops Flight Facility

X

Y

Z

APPENDIX B1 Orbit Analysis

The following report provides the results of a preliminary analysis of the ADEOS-II orbit.
This orbit analysis is described as reference information. And the result of this analysis shows that orbit maneuvering will be performed every 30 days (or 45 days). In the real operation, however, orbit maneuvering will be performed every week due to solar activities.
Where, the epoch time is Nov. 1, 2001 as assumption of this analysis.
This analysis will be updated after launch according to the actual launch date.

Preliminary Study of ADEOS-II Orbit-Keeping Strategy

B.1.1 Purpose and Scope

In order to investigate the ADEOS-II orbit-keeping strategy, a preliminary study has been performed at NASDA/TACC.
It covers

-Prediction of ADEOS-II a-dot
-Local sun time keeping
-Semi-major axis correction maneuvers
-Eccentricity keeping

In this appendix, the results of the preliminary study are described.

B.1.2 Conditions

B.1.2.1 ADEOS-II Orbital Parameters

Orbit Type	: sun-synchronous, ground track repeat, near-circular orbit
Mean Altitude	: 802.9 km
Revolutions per day (n)	: 14+1/4 rev./day
Orbital Period (P)	: 101.05 min.
Recurrent period	: 4 days
Local Sun Time at Descending Node (T_S)	: 10:15~10:45 (AM)
Equator Ground Track Longitude Repeatability	: ± 5 km
Inclination	: 98.69 degrees (bias of initial orbit)

B.1.2.2 ADEOS-II Orbital Elements (in the true-of-date coordinates)

Epoch (UTC)	:	00H 00M 00.000S	Nov. 1, 2001
		Osculating	Mean
Semi-major Axis (a) (km)	:	7183.42317584	7181.130000
Eccentricity (e)	:	0.00101419356	0.0010000
Inclination (i) (deg)	:	98.6885854016	98.69000
Right Ascension of Ascending Node (W) (deg)	:	17.8496739548	17.85500
Argument of Perigee (w) (deg)	:	60.1636972148	90.00000
Mean Anomaly (M) (deg)	:	157.3273212614	127.4400

The above orbital elements are just assumptions of this analysis, and more actual orbit elements are described in the section 6.2.1 of this document.

B.1.2.3 Satellite Constants

Satellite Mass (m)	: 3730 kg
Cross Sectional Area (A)	: 53.55 m^2
Satellite Drag Coefficient (C_D)	: 2.5
Solar reflectivity coefficient (CR)	: 1.4

B.1.3 Prediction of ADEOS-II a-dot

Daily 2800 MHz (10.7 cm) solar flux, $F_{10.7}$, from 1947 to 2005 are shown in Fig. B.1-1 respectively.

According to a long-range solar-activity forecast (11-year cycle), the solar-activity during ADEOS-II mission life (Nov./2001-Oct./2004) is expected to be relatively very high.
$F_{10.7}$ is estimated to be approximately 150 ~ 300×10^{-22} $Wm^{-2}Hz^{-1}$.(See Fig.B.1-1)
Atmospheric density (ρ) will be calculated based on JACCHIA-NICOLET model considering $F_{10.7}$.

ADEOS-II Semi-major axis (a) decreases due to atmospheric drag.
a-dot is given by

$$\frac{da}{dt} = -C_D \rho \frac{A}{m} n a^2$$

where
n is the ADEOS-II mean motion (2π /P).

The values shown in Table B.1-1 were derived based on the assumption that $F_{10.7}$ is fixed to be 150,200,250,300.

Table B.1-1 Prediction of a-dot

$F_{10.7}$ ($\times 10^{-22}$ $Wm^{-2}Hz^{-1}$)	da / dt (m/day)
150	-2.15
200	-4.79
250	-10.57
300	-21.67

B.1.4 Orbit-Keeping Strategy

B.1.4.1 Local Sun Time Keeping

In the early orbit operation phase after the launch, inclination correction maneuver will be performed to maintain the given local sun time during the ADEOS-II mission life.
After that, it should be unnecessary in the data capture phase.

Local sun time (T_S) will change as a quadratic function of time, its secondary differential coefficient is given by

$$\ddot{T}_S = \frac{3}{2} n \frac{R_e^2}{a^2} J_2 (\sin i) \frac{di}{dt}$$
$$= -5.44 \text{ min./year}^2$$

where

R_e : Earth Radius (= 6378.138 km) (GEM10B)

J_2 : Second Zonal Harmonic Coefficient of Earth Gravitational Potential (= 1.08263×10^{-3})

$\frac{di}{dt}$: Secular Drift Rate of the Inclination
at T_S = 10:15 ~ 10:45 (AM).(= -3.2×10^{-2} deg/year)

a : Semi-major Axis (mean)

ADEOS- II local sun time and monthly mean inclination during ADEOS-II mission life are preliminarily shown in Fig. B.1-2, Fig. B.1-3 respectively.

The inclination has a secular drift, due to solar gravitational perturbation. (di/dt = -3.2×10^{-2} deg/year)

B.1.4.2 Ground Track Repeatability Keeping

B.1.4.2.1 Semi-Major Axis Correction Maneuvers

Considering maneuver errors, a-dot prediction errors and orbit determination errors, the operational keeping boundary should be set to be ± 5 km at the equator ground track.

The deviation of ground track, $\Delta\lambda$, is caused by a decrease of the semi-major axis due to atmospheric drag.

|a-dot| increases corresponding to the solar-activity as mentioned above.

If a-dot is constant, $\Delta\lambda$ will change as a quadratic function of time t.

$\Delta\ddot{\lambda}$ can be obtained by

$$\Delta\ddot{\lambda} = -\frac{3\omega_e}{2a}\left(\frac{da}{dt} - \frac{da_T}{di}\frac{di}{dt}\right)$$

where

ω_e : Earth Rotation Rate (=7.292115×10^{-5} rad/sec)

$\frac{da_T}{di}\frac{di}{dt}$: Drift Rate of the target Semi-Major Axis corresponding to the Secular Drift of i.
(= – 0.14 m/day)
(The target semi-major axis : semi-major axis to maintain the ground track repeatability)

Semi-major axis correction maneuvers will be performed periodically, if a-dot is constant, to keep the operational keeping boundary. See Fig. B.1-4.
Maneuver cycle and velocity increment of a maneuver, ΔV, are shown in Table B.1-2, in the case of low, middle, high solar-activity.

Table B.1-2 Maneuver Cycle and ΔV

$F_{10.7}$	da / dt (m/day)	Maneuver Cycle (day)	ΔV (m/s)
150	-2.15	69	0.071
200	-4.79	45	0.108
250	-10.57	30	0.162
300	-21.67	20	0.233

B.1.4.2.2 Eccentricity Keeping

Mean eccentricity vector (e_X, e_Y) turns clockwise round the frozen point (E) due to secular effects of J_2 term and J_3 term of Earth gravitational potential. See Fig. B.1-5.

Taking the secular effects into account, mean eccentricity vector should be kept close to the frozen point (E).

In the case of ADEOS-II orbit, the frozen point (E) is as follows.

$$e_X = 0.0000$$

$$e_Y = -\frac{1}{2}\frac{J_3}{J_2}\frac{R_e}{a}\sin i = 0.00103$$

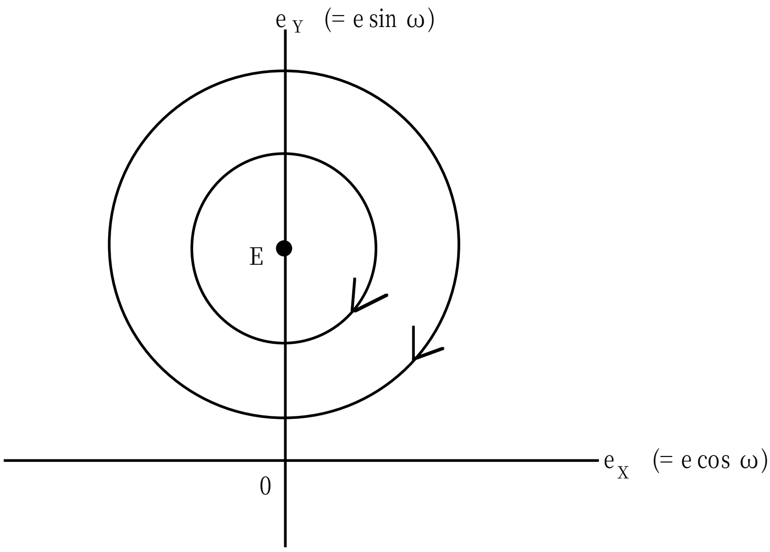


Fig. B.1-5 Rotation of ADEOS-II Eccentricity Vector

Execution time of the semi-major axis correction maneuvers will be planned to keep mean eccentricity vector close to the frozen point (E).

The change of eccentricity, Δe, due to a maneuver (ΔV) is very small, its value is given by

$$\Delta e = \frac{2}{na}\Delta V$$

If ΔV=0.041m/s, Δe will be 1.1×10^{-5}

Mean eccentricity prediction of ADEOS-II from 1st Nov. 2001 to 31st Oct.2004 is shown in Fig. B.1-6 for reference.

B.1.5 Conclusion

-ADEOS-II a-dot is predicted to be approximately −2.15 ~−21.67 m/day during ADEOS-II mission life.

-The inclination correction maneuver will be unnecessary in the data capture phase, if injection is normal.

-The semi-major axis correction maneuvers will be performed periodically with a period of approximately 20~69 days.

-Mean eccentricity will be kept to be less than 0.00106.

B.1.6 References

1. M. Utashima, M. Hirota, A. Tanaka, Dynamics for Sun Synchronous Near Recurrent Orbit (revised edition), NASDA/TACC TK-M15101, March 1986. (in Japanese)

2. Pascal Micheau, Survey on SPOT-System Orbit-Keeping Exploitation, 3rd. International Symposium on Spacecraft Flight Dynamics, ESOC, Darmstadt, Germany, 30 Sep. ~ 4 Oct., 1991.

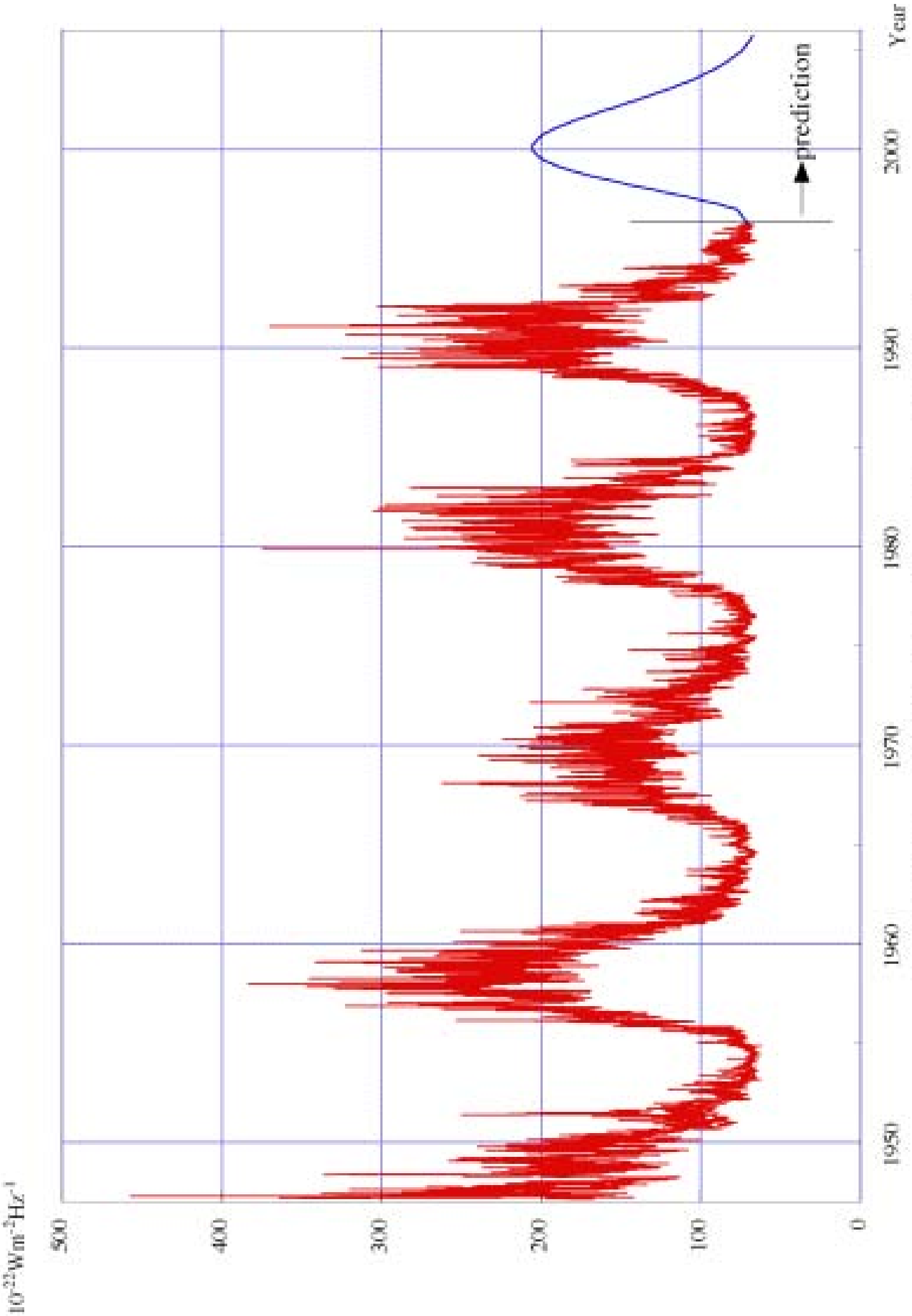
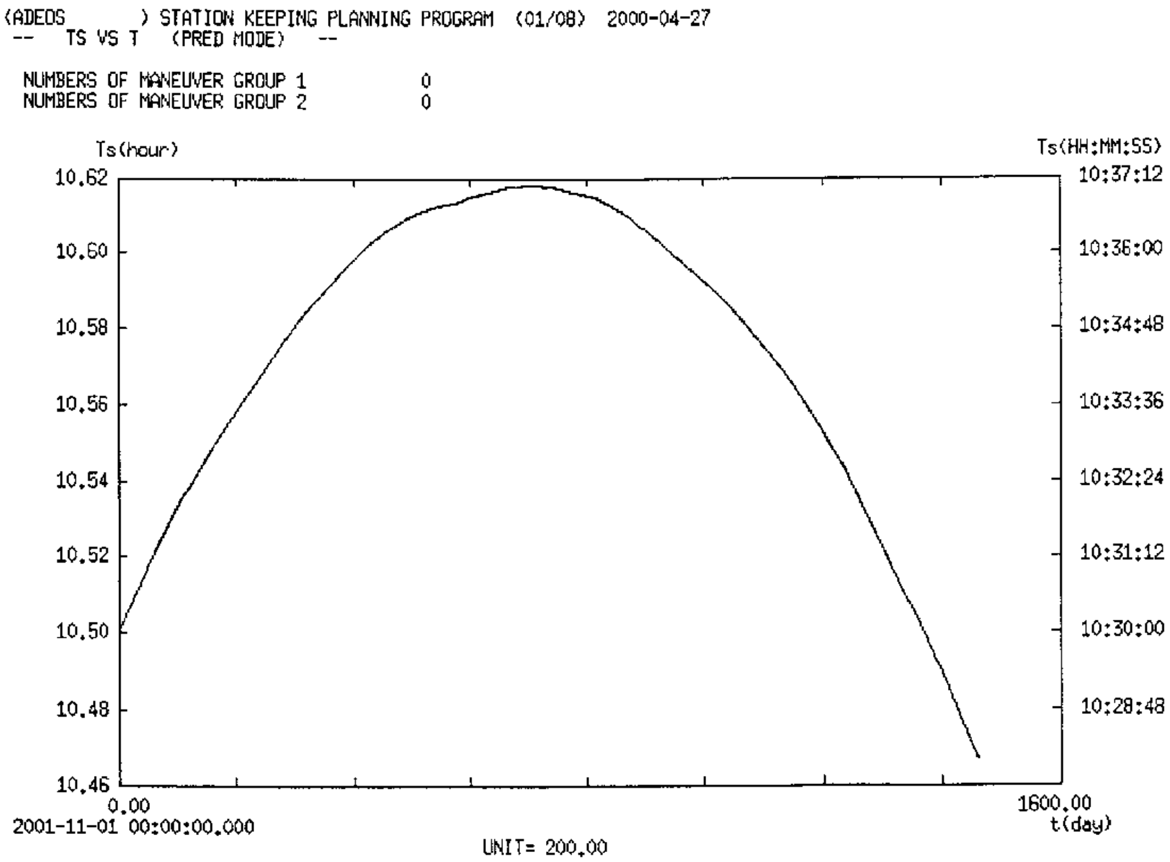


Fig.B.1-1 Daily 2800MHz Solar Flux Data Plot (F10.7)



Ts : Local Sun Time at Descending Node (Ts)

Fig. B.1-2 Local Sun Time

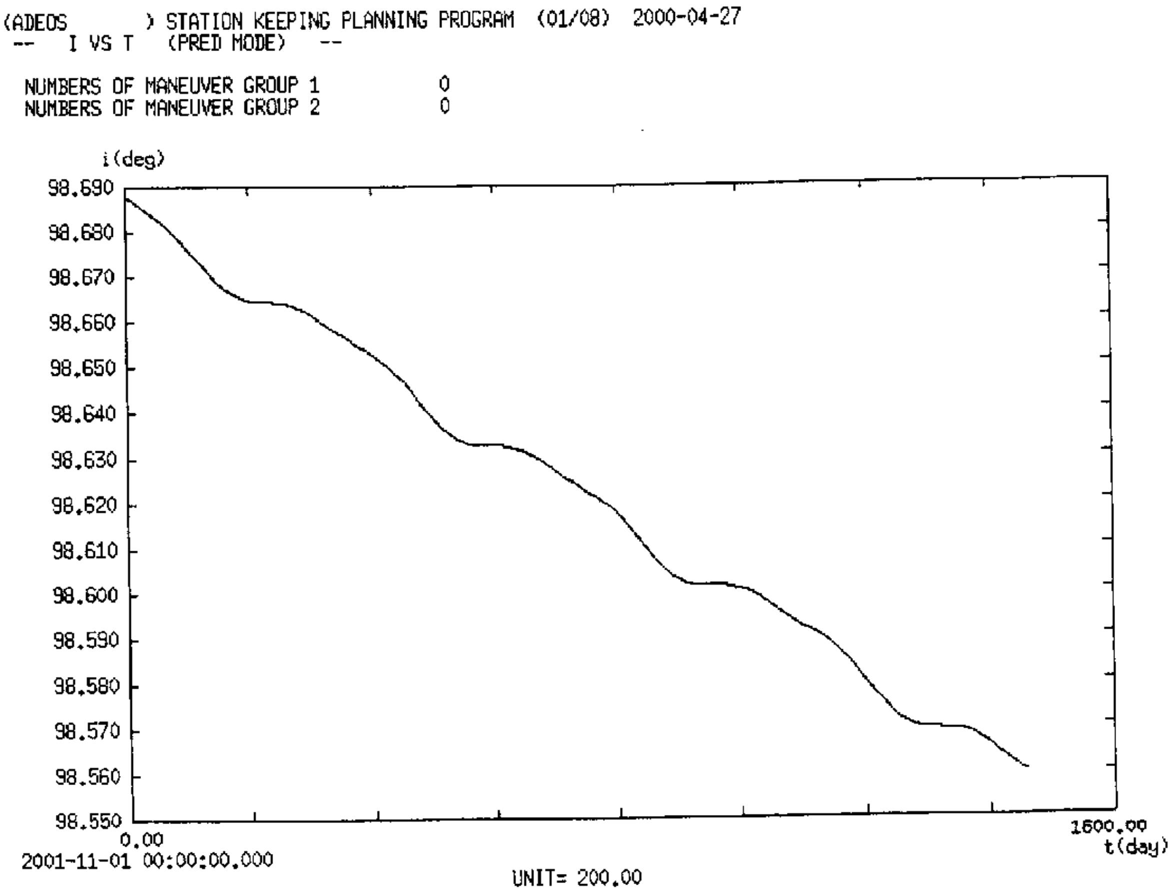


Fig. B.1-3 Monthly Mean Inclination

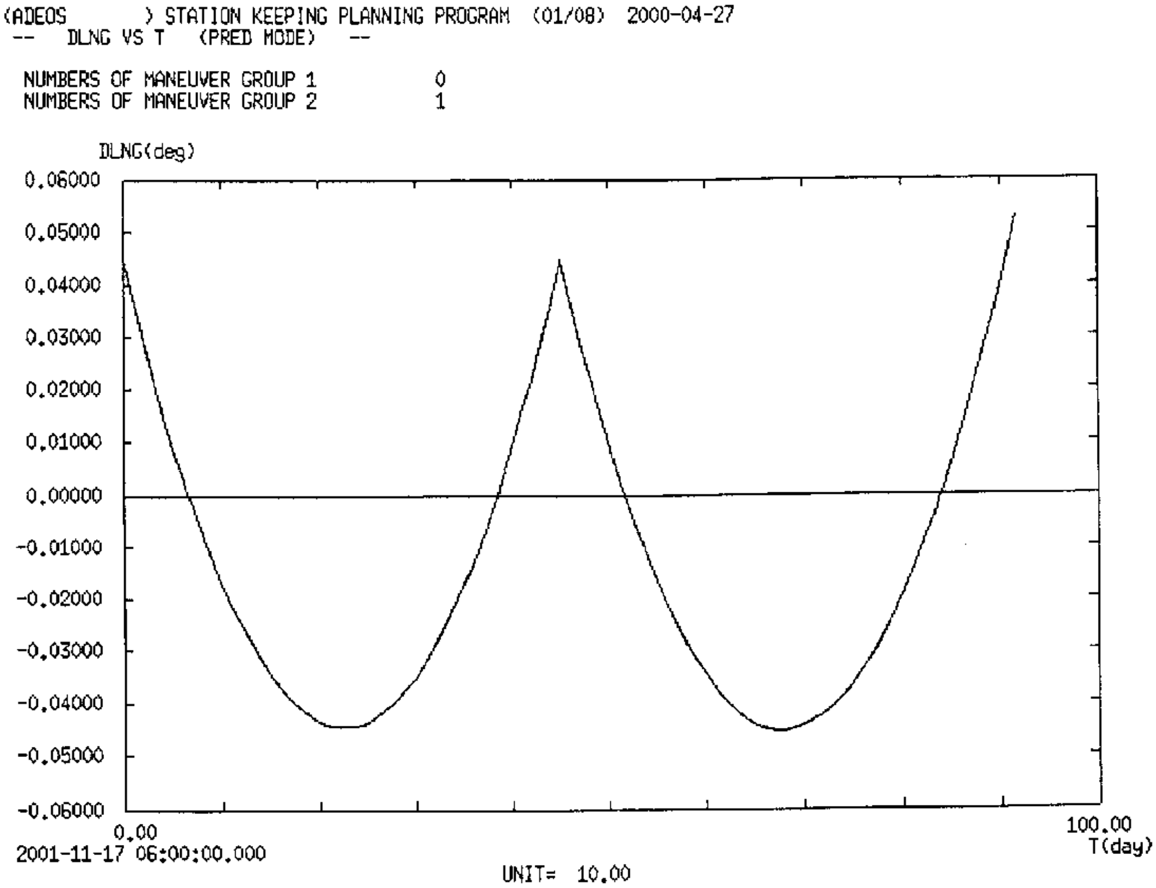


Fig. B.1-4 Ground Track Repeatability Keeping

(ADEOS) STATION KEEPING PLANNING PROGRAM (01/08) 2000-04-27
-- E-VECTOR (PRED MODE) --

NUMBERS OF MANEUVER GROUP 1 0
NUMBERS OF MANEUVER GROUP 2 0

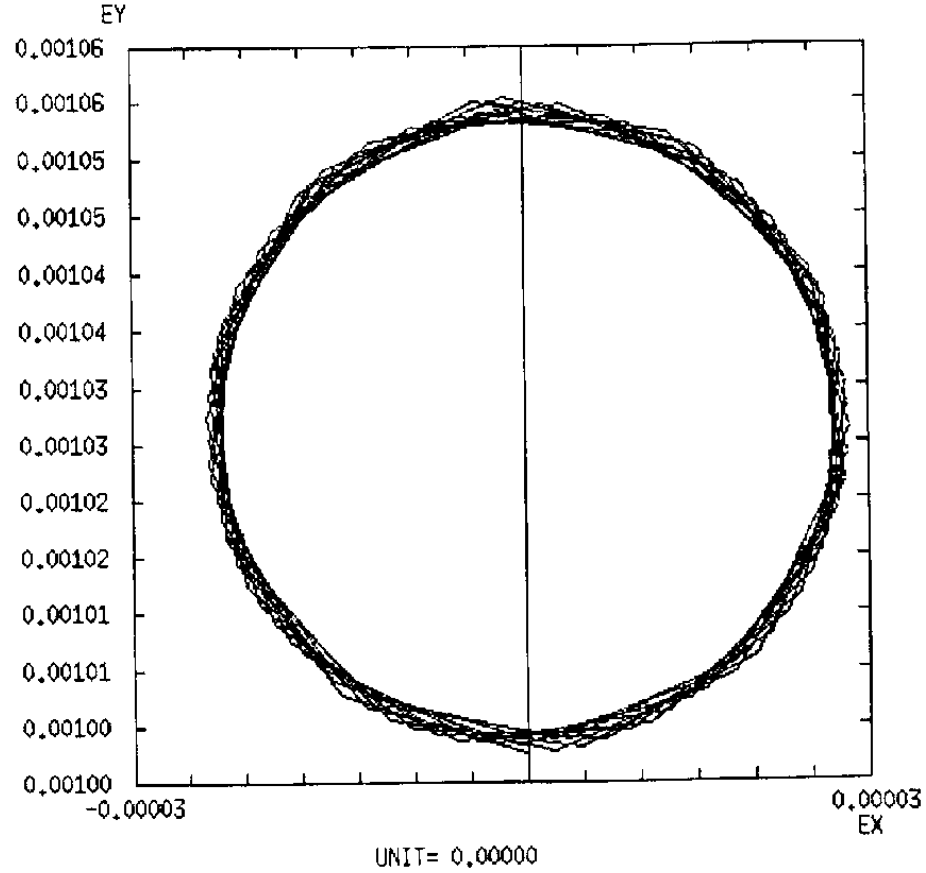


Fig. B.1-6 ADEOS-II E-Vector Data (prediction)

APPENDIX B2 Coordinate Systems

B.2.1 General

This appendix describes two kinds of coordinate systems used to express satellite position and velocity. They are called ECI (Earth-Centered Inertial Coordinate System) and ECR (Earth-Centered Rotating Coordinate System).

B.2.2 Definition

(1) ECI (Earth-Centered Inertial Coordinate System)

ORIGIN:	the center of the earth
ORIENTATION:	the X-Y plane is the true earth's equator of epoch
	the X axis points in the true vernal equinox direction of epoch
OTHERS:	Cartesian system
	right-handed system

(2) ECR (Earth-Centered Rotating Coordinate System)

ECR is divided into two kinds of coordinate depending on the orientation of the Z-axis.

a. Pseudo Earth-Centered Rotating Coordinate System

ORIGIN:	the center of the earth
ORIENTATION:	the X axis points in the earth prime meridian (Greenwich) direction
	the positive Z axis points in the direction of north along the earth's true rotational axis
OTHERS:	Cartesian system
	right-handed system

b. Earth-Centered Rotating Coordinate System

ORIGIN:	the center of the earth
ORIENTATION:	the X axis points in the earth prime meridian (Greenwich) direction
	the positive Z axis points in the direction of north through the IRP (IERS Reference Point)
OTHERS:	Cartesian system
	right-handed system

B.2.3 Transformation Between ECI and ECR

(1) Transformation Between ECI and Pseudo Earth-Centered Rotating Coordinate System

Because the Pseudo Earth-Centered Rotating Coordinate System is rotated with respect to ECI with the angle of earth's rotation, the former system is derived from the rotation of the latter system.
The Greenwich Apparent Sidereal Time is named GAST and the satellite position vector and velocity vector are defined as follows;

ECI:

Position Vector X = (X, Y, Z)
Velocity Vector V = (V_X, V_Y, V_Z)

Pseudo Earth-Centered Rotating Coordinate System:

Position Vector x = (x, y, z)
Velocity Vector v = (v_X, v_Y, v_Z)

Then the transformation between ECI and Pseudo Earth-Centered Rotating Coordinate System is obtained from

$$\mathbf{x} = Rz(GAST)\ \mathbf{X}$$
$$\mathbf{v} = Rz(GAST)\ \mathbf{V} + \dot{R}z(GAST)\ \mathbf{X}$$

where Rz(θ) is a rotation matrix about the z-axis through an angle θ.

$$Rz(\theta) = \begin{pmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

And,

$$GAST = GMST + \Delta\phi \cos\varepsilon$$

$$\dot{R}z(GAST) = \begin{pmatrix} -\sin GAST & \cos GAST & 0 \\ -\cos GAST & -\sin GAST & 0 \\ 0 & 0 & 1 \end{pmatrix} * \dot{GAST}$$

$$\dot{GAST} = 4.178 * 10^{-3}\ \text{deg/sec}$$

In the above equation, Δφ cos ε is the equation of equinoxes, which is derived from the earth's nutation. GMST is defined in Appendix B.3, B.3.2.

(2) Transformation Between Pseudo Earth-Centered Rotating Coordinate System and Earth-Centered Rotating Coordinate System

The Earth-Centered Rotating Coordinate System is defined as the Pseudo Earth-Centered Rotating Coordinate System where the polar motion is corrected.
The polar motion is a phenomena such that the position of pole moves by drawing a locus near a circle whose diameter is around 10 meters. This is caused by the irregular variation of the earth's rotation axis to the solid earth. This motion is so small that its correction is applicable to the very high accurate calculation of the earth's motion in case of astronomic observation, etc. This transformation is negligible if the required accuracy is met.
The polar motion is expressed by (x, y) and the satellite position vectors are defined as follows;

Pseudo Earth-Centered Rotating Coordinate System:

Position Vector x = (x, y, z)

Velocity Vector v = (v_X, v_Y, v_Z)

Earth-Centered Rotating Coordinate System:

Position Vector $x_T = (x_T, y_T, z_T)$

Velocity Vector $v_T = (v_{TX}, v_{TY}, v_{TZ})$

Then the transformation between Pseudo Earth-Centered Rotating Coordinate System and Earth-Centered Rotating Coordinate System is obtained from

$$x_T = Ry(-x)\, Rx(-y)\, x$$
$$v_T = Ry(-x)\, Rx(-y)\, v$$

where Ry(θ) and Rx(θ) are rotation matrices about the y-axis and x-axis through an angle θ respectively.

$$Ry(\theta) = \begin{pmatrix} \cos\theta & 0 & -\sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{pmatrix} \qquad Rx(\theta) = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & \sin\theta \\ 0 & -\sin\theta & \cos\theta \end{pmatrix}$$

The time derivatives of Ry(-x) Rx(-y) can be ignored because the velocity of the polar motion is negligibly small.

APPENDIX B3 Time Systems

B.3.1 General

This appendix describes the time systems to express the orbit and the earth rotation and revolution.

B.3.2 Definition

There are four kinds of major time systems.

(1) Sidereal Time and Universal Time, UT
Sidereal Time is defined as the hour angle of the vernal equinox. The hour angle is measured from the meridian of an observation point westward to the target direction. When it is measured from the Greenwich meridian, the sidereal time is called Greenwich Sidereal Time. When it is from the meridian of an arbitrary point, the sidereal time is called Local Sidereal Time.
The relation between Universal Time, UT1 and Greenwich Mean Sidereal Time, GMST is defined as follows;

$$GMST = UT1 + \alpha_m + 12^h$$

where α_m is the right ascension of a virtual celestial body moving uniformly on the equator (mean sun) which is measured from the mean vernal equinox of epoch. The following equation is given by S. Aoki et. al. (Astron. Astrophys., 105, 1982);

$$\alpha_m = 18^h 41^m 50^s.54841 + 8640184^s.812866\, T_u + 0^s.093104\, T_u^2 \\ - 0^s.0000062\, T_u^3$$

where T_u is the Universal Time measured from 12^h Jan. 1st, 2000 UT1 by unit of 36525 mean solar day.

UT1 is not a uniform elapsed time system, but expresses the earth's rotation most accurately.

(2) Dynamical Time, TD
Dynamical Time is used for the Celestial Dynamics and Astronomical Ephemeris, which corresponds to the existing Ephemeris Time. There are two kinds of Dynamical Time. Barycentric Dynamical Time, TDB is measured from the dynamical time scale with respect to the barycenter of the solar system. Terrestrial Dynamical Time, TDT is that with respect to the barycenter of gravity of the earth.

To make the accurate definition of the Dynamical Time, it is necessary to observe the motion of solar planets for a long time as well as the existing ephemeris time. At present the following approximate relationship with the International Atomic Time (TAI) is given for practical purposes;

$$TDT = TAI + 32^{s}.184$$

As TDB is not used for satellite orbit determination, its definition is omitted.

(3) International Atomic Time, TAI

The unit of second, which is a time interval of the atomic time, is defined in the 13th International Measuring Conference, 1967 as follows;

" The duration of 9192631770 cycles of radiation emitted in a hyperfine transition in the ground state of Cs^{133} atom"

This atomic second had been determined to be fit with the second of ephemeris time obtained from the lunar observation and was adopted as the definition of the second in the International Unit System.

The atomic clock data in the world are collected by Bureau International des Poids et Mesures, BIPM to synthesize the International Atomic Time, TAI.

(4) Coordinated Universal Time, UTC

Coordinated Universal Time, UTC, which has the same unit of second as the atomic time, is the artificial time system where the difference from Universal Time is managed to be converged within a range.

Since Jan. 1st, 1972, UTC is managed as follows;

a. To coordinate UTC-TAI=10sec at 0h Jan. 1st, 1972 UTC

b. To manage UT1-UTC not to exceed +/-0.9 sec by the 1 second offset

The 1 second offset is called leap second and the execution timing is prioritized as follows;

a. 1st priority: the last day of Dec. or June

b. 2nd priority: the last day of Mar. or Sept.

In each case one second is inserted after the last second (23h59m59s) of the last day or the last second is removed.

B.3.3 Transformation Between Time Systems

The time systems described in B.3.2 are quite independent from each other but the following parameters which relate each measurement are provided by the central bureau of International Earth Rotation Service, IERS;

a. UTC - TAI
b. predicted value of UT1 - UTC
c. determined value of UT1 - UTC

At first UTC is obtained from the local standard time, then UT1 can be calculated by b or c. From UT1 the Greenwich Sidereal Time is obtained by B.3.2 (1) and TAI can be calculated from UTC and a.

B.3.4 IERS Data

IERS data is the following parameters provided by the central bureau of IERS as very accurate observation data of the earth's rotation;

a. UTC - TAI
b. predicted value of UT1 - UTC
c. determined value of UT1 - UTC
d. predicted value of polar motion
e. determined value of polar motion

The polar motion of d and e is the position of north pole of the earth's rotation expressed as the coordinate value measured from its mean position (IRP).
This expresses the motion of the earth's rotation axis with the solid earth.
The parameters of a, a+b (predicted value of UT1 - TAI) and d are included in the Level 0 data.

B.3.5 Indication of Time Systems

There are two methods used to express the time systems of B.3.2.

(1) Christian Calendar or Gregorian Calendar
This is one of the solar calendars and the length of a year is 365 days or 366 days. The time is expressed by year, month, day, hour, minute and second.
The years which can be divided by 4 are called leap year except the years which can be divided by 100 and its quotient can't be divided by 4.
The leap year has 366 days.

(2) Julian Date, JD

The Julian date is a time period in days and fraction of a day from 12h Jan. 1st, BC 4713.

For example, the Julian Date of 0h Jan. 1st, 1994 is 2449353.5.

As the Julian Date of current time is such a large number, the Modified Julian Date, MJD is used as follows;

MJD = JD - 2400000.5

B.3.6 Transformation Between Calendar Date and MJD

Several different algorithms have been developed to transform between Calendar Date and MJD. They differ only in the base date, there are no computation errors.

The algorithm adopted depends on the user preference.

B.3.7 Reference

The following is the major document for the definition of time systems.

a. Astronomical Table

b. The American Almanac

c. IERS Technical Note No. 3**:** 1989, D.D. McCarthy (ed.), Observatoire de Paris

APPENDIX B4 GRS (Ground Reference System)

N/A

APPENDIX B5 RSP (Reference System for Planning)

B.5.1 Scope

This Appendix describes the Reference System for Planning (RSP) which is defined as the coordinate system for ADEOS-II mission operation planning. This coordinate system is used for mission planning of observation and data acquisition by NASDA/EOC, NASDA/TACC, Sensor Providers, NASA Ground Stations, Kiruna Station, NOAA NESDIS and other foreign ground stations.

The basics of RSP are:

(1) Coordinates are expressed by the path of the satellite's orbit and the argument of latitude defined as the angle between the ascending node and satellite position.

(2) The path number starts at the ascending node; numbering is westward for descending orbits.

(3) The ascending node of path 57 is defined as 0.924 degrees of West Longitude.

(4) Paths are not thinned out at high latitudes; path corresponds to the ground track of the satellite's orbit.

(5) RSP defines the subsatellite point (not observing point).

(6) Longitudes are counted eastwards from the Greenwich meridian from 0 degree to 360 degree.

B.5.2 Basic RSP Calculation

Latitude ϕ_{D0} and longitude λ_0 of RSP (path, γ) are given by the following equations;

$$\lambda_A = \lambda_{A0} - 360.0 * path / n$$

$$\phi_{C0} = \sin^{-1} (\sin\gamma * \sin I)$$

$$\phi_{D0} = \tan^{-1} ((a/b)^2 * \tan\phi_{C0})$$

$$\theta_0 = \tan^{-1} (\cos I * \tan\gamma) \quad (0<= \gamma <90)$$

$$= 90.0 \quad (\gamma = 90)$$

$$= \tan^{-1} (\cos I * \tan\gamma)+180.0 \quad (90< \gamma <270)$$

$$= 270.0 \quad (\gamma = 270)$$

$$= \tan^{-1} (\cos I * \tan\gamma)+360.0 \quad (270< \gamma <360)$$

$$\lambda_0 = \lambda_A - \theta_0 - W_e * \gamma / W$$

RSP (path, γ) of latitude ϕ_{D0} and longitude λ_0 is given by the following equations;

$$\phi_{C0} = \tan^{-1} (\tan (\phi_{D0}) / (a/b)^2)$$

$$\gamma = \sin^{-1} (\sin\phi_{C0} / \sin I) \quad (\text{ascending orbit and } \phi_{C0}>=0)$$

$$= 360.0 - | \sin^{-1} (\sin\phi_{C0} / \sin I) | \quad (\text{ascending orbit and } \phi_{C0}<0)$$

$$= 180.0 - \sin^{-1} (\sin\phi_{C0} / \sin I) \quad (\text{descending orbit and } \phi_{C0}>=0)$$

$$= 180.0 + | \sin^{-1} (\sin\phi_{C0} / \sin I) | \quad (\text{descending orbit and } \phi_{C0}<0)$$

θ_0 = $\tan^{-1}(\cos I * \tan\gamma)$ $(0 <= \gamma < 90)$
= 90.0 $(\gamma = 90)$
= $\tan^{-1}(\cos I * \tan\gamma) + 180.0$ $(90 < \gamma < 270)$
= 270.0 $(\gamma = 270)$
= $\tan^{-1}(\cos I * \tan\gamma) + 360.0$ $(270 < \gamma < 360)$

λ_A = $\lambda_0 + \theta_0 + W_e * \gamma / W$

path = $(\lambda_{A0} - \lambda_A) * n / 360.0$

if path ≤ 0 then path = path + 57

where,

n	:	number of orbits covering the whole earth surface (57)
path	:	path number of RSP (1 ~ 57)
γ	:	argument of latitude of RSP
I	:	180 - satellite orbit inclination (I = 81.38 degree)
λ_{A0}	:	longitude of the ascending node of path 57 (0.924 degree of West Longitude)
W_e	:	angular velocity of the earth rotation in the inertial system (0.25 degree/min)
W	:	satellite angular velocity around the center of the earth (3.5644 degree/ min)
λ_A	:	longitude of the ascending node of the subsattelite point
a	:	equatorial radius of the earth (6378.137km) (WGS 84)
b	:	polar radius of the earth (6356.752km) (WGS 84)
θ_0	:	angular difference between the ascending node longitude and subsatellite longitude
λ_0	:	geodetic longitude of the subsatellite point
ϕ_{C0}	:	geocentric latitude of the subsatellite point ($\lvert\phi_{C0}\rvert <= I$)
ϕ_{D0}	:	geodetic latitude of the subsattellite point

Time (UTC) is calculated from the RSP by the following equation;

Time (UTC) at the argument of latitude γ deg.
= time (UTC) at ascending node m + γ/360 deg. * orbit cycle (101.05 min.)

Note: This equation may be applicable for making a mission operation plan, but it should not be used for processing mission data because of its poor accuracy. This equation assumes that the argument of latitude γ is proportional with the lapse time from the ascending node.
If there is very severe requirement for the position where the command is issued, the true satellite movement should be taken into account to calculate γ from the latitude and longitude. For the data processing, the latitude and longitude should be calculated from the time (UTC) at γ by interpolating the ephemeris data.

B.5.3 Orbit Number and Path Number

The definition of orbit number and path number is as follows;

Orbit number: an orbit starts and ends at the ascending node
numbering is time sequential (1 - 399 (7 recurrent periods))
Path number: a path corresponds to a subsatellite track
a path starts and ends at the ascending node
numbering is westward for descending orbits (1- 57)

The relation between orbit number and path number is given by the following equation;
path = [4 * (orbit - 1)] mod 57 + 1

Orbit Number 1 will be adjusted to Path number 1, when orbit adjustment is completed after launch.

B.5.4 Orbit Total Number

Orbit total number is included in mission operation files. Orbit 1 begins at the first ascending node after launch.

The relation between orbit total number and path number is given by the following equation;
path = [4 * (Total orbit - α)] mod 57 + 1

The value of "α" depends on the initial orbit number, and it will be informed from NASDA to the related agencies after launch, as needed.

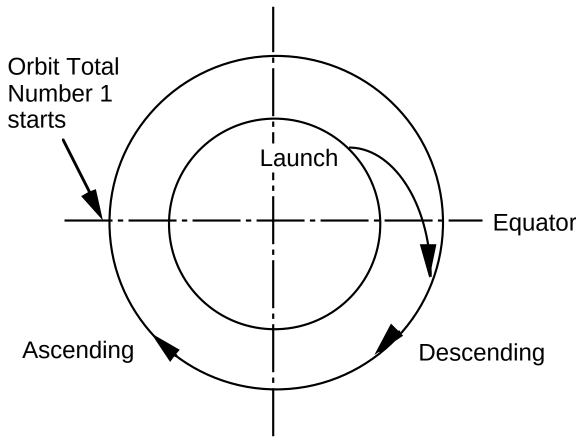


Fig. B.5.1 Definition of Orbit Total Number 1

APPENDIX B6 Product Level Definition

(1) AMSR Products

Level 0: (no distribution)

- Time ordered AMSR source packet data within a file. Each file includes overlapped area with other files.

Level 1A:

- 16 bit translated
- Dummy data appended for Level 0 missing packets
- Radiometric coefficients and geometric information appended
- Full ±90 deg. scanning range data remains

Level 1B:

- Radiometric corrected level 1A data.
- ±61 deg scanning range data (swath width: about 1600 km) extracted
- Brightness temperature data

Level 1B Map:

- Level 1B data resampled on a map projection (Projection Method : Mercator, Equi-rectangular, Polar Stereographic)

Level 2:

- Following physical contents are generated from Level 1B data.
  - Water Vapor
  - Cloud Liquid Water
  - Amount of Precipitation
  - Sea Surface Wind
  - Sea Surface Temperature
  - Sea Ice Concentration
  - Snow Water Equivalence

Level 2 Map:

- Level 2 data resampled on a map projection (Projection Method : Mercator, Equi-rectangular, Polar Stereographic)

Level 3:

- 1-day and 1-month binned data for Level 1 and Level 2 products.

Browse Data:

- Sampled Level 3 product.

(2) GLI Products

(2-1) GLI 1km Products

Level 0: (no distribution)

- Time ordered GLI 1km source packet data within a file. Each file includes overlapped area with other files.

Level 1A:

For each band data;

- Level 0 missing packets are fulfilled with dummies
- Bit string (13 bits) of Level 0 is transformed into byte unit (16 bits)
- To be cut into separate scenes (approx. 1600km×1600km)
- Image data are grouped in bands. All pixel data of a band are arranged in lines forming a contiguous image scene.
- Radiometric and Geometric correction coefficients are attached

Note: 250m-sampled data (used as 2km-resolution) are included

Level 1B:

For each band data, Level 1A with;

- Radiometric corrections applied
- Geometric corrections applied
- Band registrations done
- Projection coefficients attached
- Ocean/Land flags attached

Note: 250m-sampled data (used as 2km-resolution) are included

Registration Data;

- Contains information used for computation of satellite positions for each band (applied to scenes where registrations were made)

Level 1B Map:

- Level 1B data resampled on a map projection (Projection Method : Mercator, Equi-rectangular, Polar Stereographic)

Level 2A:

- Ocean and Atmospheric L2A (L2A_OA): 4 pixels X 4 lines sampled Level 1B.
- Land and Cryosphere L2A (L2A_LC): Cloud free composite data of every 16 days

Level 2:

Product		Processing Frequency	map projection	Corresponding Data Form	Brows
Atmos-pheric	Aerosol Angstrom Exponent	Every 4 days	E	-	O
	Aerosol Optical Thickness	Every 4 days	E	-	O
	Cloud Flag	Every scene	-	L1B	
	Cloud Fraction	Every 4 days	E	-	O
	Cloud Optical Thickness				
	pixel by pixel analysis	On demand	-	L1B	
	water cloud by reflection method	Every 4 days	E	-	O
	ice cloud by reflection method	Every 4 days	E	-	O
	ice cloud by emission method	Every 4 days	E	-	O
	Cloud Effective Particle Radius				
	water cloud by reflection method	Every 4 days	E	-	O
	ice cloud by emission method	Every 4 days	E	-	O
	Cloud Top Temperature				
	water cloud by reflection method	Every 4 days	E	-	O
	ice cloud by emission method	Every 4 days	E	-	O
	Cloud Top Height				
	water cloud by reflection method	Every 4 days	E	-	O
	Cloud Liquid/Ice Water Path				
	water cloud by reflection method	Every 4 days	E	-	O
Ocean	Atmospheric Correction Product				
	full resolution	On demand	-	L1B	
	low resolution	Every Path	-	L2A_OA	O
	In-water Particles Product				
	full resolution	On demand	-	L1B	
	low resolution	Every Path	-	L2A_OA	O
	SST Product				
	full resolution	On demand	-	L1B	
	low resolution	Every Path	-	L2A_OA	O
Land	Vegetation Index	Every 16 days	E, P	-	O
	Precise Geolocation	Every Path			
	Atmospheric Correction	Every 16 days	E, P	-	O
Cryo-sphere	Snow Grain Size/Impurities				
	global data	Every 16 days	E, P		O
	scene data	On demand		L1B	

E: Equi-rectangular, P: Polar Stereographic

Level 2 Map:

Product		Processing Frequency	map projection
Atmospheric	Cloud Flag	On Demand	E, M, P
	Cloud Optical Thickness (pixel by pixel analysis)	ditto	E, M, P
Ocean	Normalized water-leaving radiance	ditto	E, M, P
	Aerosol	ditto	E, M, P
	Chlorophyll-a	ditto	E, M, P
	Suspended solid weight	ditto	E, M, P
	Absorption of colored dissolved organic matter	ditto	E, M, P
	Attenuation coefficient at 490nm	ditto	E, M, P
	Sea surface temperature	ditto	E, M, P
	Quality flag (Ocean color)	ditto	E, M, P
	Quality flag (SST)	ditto	E, M, P
Cryosphere	Snow Grain Size/Impurities (scene data)	ditto	E, M, P

E: Equi-rectangular, M: Mercator, P: Polar Stereographic

Level 3 Binned:

Product		Coverage	Processing Frequency	map projection
Atmos-pheric	Aerosol Angstrom Exponent	Global	16 days, 1 month	E
	Aerosol Optical Thickness	Global	ditto	E
	Cloud Fraction	Global	ditto	E
	Cloud Optical Thickness			
	water cloud by reflection method	Global	16 days, 1 month	E
	ice cloud by reflection method	Global	ditto	E
	ice cloud by emission method	Global	ditto	E
	Cloud Effective Particle Radius			
	water cloud by reflection method	Global	16 days, 1 month	E
	ice cloud by emission method	Global	ditto	E
	Cloud Top Temperature			
	water cloud by reflection method	Global	16 days, 1 month	E
	ice cloud by emission method	Global	ditto	E
	Cloud Top Height			
	water cloud by reflection method	Global	16 days, 1 month	E
	Cloud Liquid/Ice Water Path			
	water cloud by reflection method	Global	16 days, 1 month	E
Ocean	Normalized water-leaving radiance	Global	1 day, 8 days, 1 month	A
	Aerosol	Global	ditto	A
	In-water Particles Product	Global	ditto	A
	SST Product	Global	1 day, 8 days, 1 month	A
Cryosphere	Snow grain size	Global	16 days, 1 month	E
		S-hemisphere N-hemisphere	ditto	P
	Snow Impurities	Global	ditto	E
		S-hemisphere N-hemisphere	ditto	P

E: Equi-rectangular, A: Equal-area, P: Polar Stereographic

Level 3 STA (statistics) Map

Product		Coverage	Processing Frequency	map projection	Brows
Atmos-pheric	Aerosol Angstrom Exponent	Global	16 days, 1 month	E	O
	Aerosol Optical Thickness	Global	ditto	E	O
	Cloud Fraction	Global	ditto	E	O
	Cloud Optical Thickness				
	water cloud by reflection method	Global	16 days, 1 month	E	O
	ice cloud by reflection method	Global	ditto	E	O
	ice cloud by emission method	Global	ditto	E	O
	Cloud Effective Particle Radius				
	water cloud by reflection method	Global	16 days, 1 month	E	O
	ice cloud by emission method	Global	ditto	E	O
	Cloud Top Temperature				
	water cloud by reflection method	Global	16 days, 1 month	E	O
	ice cloud by emission method	Global	ditto	E	O
	Cloud Top Height				
	water cloud by reflection method	Global	ditto	E	O
	Cloud Liquid/Ice Water Path				
	water cloud by reflection method	Global	16 days, 1 month	E	O
Ocean	Normalized water-leaving radiance	Global	1 day, 8 days, 1 month	E	O
	Aerosol	Global	ditto	E	O
	Chlorophyll-a	Global	ditto	E	O
	Suspended solid weight	Global	ditto	E	O
	Absorption of colored dissolved organic matter	Global	ditto	E	O
	Attenuation coefficient at 490nm	Global	ditto	E	O
	Sea surface temperature				
	Day Night	Global	1 day, 8 days, 1 month	E	O
	All	Global	ditto	E	O
Land	Vegetation Index	Global	16 days	E	
Cryo-sphere	Snow grain size	Global	16 days, 1 month	E	
		S-hemisphere N-hemisphere	ditto	P	
	Snow Impurities	Global	ditto	E	
		S-hemisphere N-hemisphere	ditto	P	

E: Equi-rectangular, P: Polar Stereographic

Browse Data:

- Sampled Level 1B, Level 2 and Level 3 STA Map data. (see the above tables of Level 2 and Level 3 STA Map data.)

(2-2) GLI 250 m Products

Level 0: (no distribution)

- Frame synchronized, dummy data removed and time ordered data with information of flame loss and amount of flames.

Level 1A:

For each band data;

- Level 0 missing frames are fulfilled with dummies
- Bit string (13 bits) of Level 0 is transformed into byte unit (16 bits)
- To be cut into separate scenes (approx. 1600km×1600km)
- Image data are grouped in bands. All pixel data of a band are arranged in lines forming a contiguous image scene.
- Radiometric and Geometric correction coefficients are attached

Level 1B:

For each band data, Level 1A with;

- Radiometric corrections applied
- Geometric corrections applied
- Band registrations done
- Projection coefficients attached
- Ocean/Land flags attached

(3) SeaWinds Products

Level 0: (no distribution)

Time ordered, within a file, SeaWinds Mission Science source packets. Each file includes overlapped data with other files.

Level 1B:

Rev-based, time-ordered, earth-located, global sigma 0's: each pulse has one full footprint sigma 0 and "best 8" sub-footprint sigma 0's.

Level 2A:

Sub-footprint composite sigma 0's flagged for land and ice, collocated with AMSR atmospheric attenuation's organized in 25 km x 25 km cells in cross track rows.

Level 2B:

Ocean vector winds (multiple solutions with selection and quality indicators) organized in 25 km x 25 km cells in cross track rows.

Level 3:

Ocean vector winds organized into a grid of cells which span the entire globe. Earth grid cell is 1/4 degree on each side.

(4) POLDER Products

Level 0: (no distribution)

Frame synchronized, gap filled, time ordered and non-redundant POLDER data obtained from single pass with all available supplemental information to be used in subsequent processing including PCD (Payload Correction Data), determined orbit, on-board time versus Universal Time relation, quantity, quality and continuity statistics (QQC)).

Level 1:

Geocoded and registered spectral radiances and Stokes parameters characterizing the linear polarization of the light reflected at the top of the atmosphere.

Each product is generated from a single satellite pass, and the data are resampled at a 6km x 6km resolution on a fixed earth reference grid.

Level 2:

Level 2 products are split into three "product lines" corresponding to the following research topics:

* Ocean Primary Production and Aerosols over the Ocean (3 products (TBD))
* Land Surface and Aerosols over Land (2 products (TBD))
* Earth Radiation Budget, Water Vapor and Clouds (1 product (TBD))

The different level 2 products include the following geophysical parameters (TBD), derived from level 1 (single pass and same reference grid):

Directional radiance corrected for atmospheric effects
Water vapor amount
Aerosol amount
Best fit aerosol model
Spectral ocean radiances
Phytoplancton concentration
Water type
Cloud cover
Cloud albedo
Cloud optical thickness
Cloud top pressure
Cloud phase (Water/Ice)

Level 3:

Level 3 products are divided into three "product lines (TBD)" corresponding to the following research topics:

* Ocean Primary Production and Aerosols over the Ocean (2 products (TBD))
* Land Surface and Aerosols over Land (3 products (TBD))
* Earth Radiation Budget, Water Vapour and Clouds (1 product (TBD))

The products contain time and space averaged geophysical parameters obtained from several satellite passes (global maps, typical time period for averaging is one month), including the following (TBD):

Water vapor amount
Aerosol amount
Best fit aerosol model
Land surface spectral albedo
Reflectance directional signature
Vegetation indices
Phytoplancton concentration
Water type
Cloud cover
Cloud albedo
Cloud optical thickness
Cloud top pressure
Cloud phase (Water/Ice)
Earth reflectance directional signatures (for various cloud covers and types)

Browse:

Subsampled from level 1 product, with 3 spectral measurement per pixel.

(5) DCS Products

Level 0: (no distribution)

Time ordered ADEOS-II/ARGOS DCS source packet data within a file. Each file includes overlapped area with other files.

Processed Data:

There are two types of DCS processed data, one is the "Location data" and the other is "Collect data".

The "Location data" consists of the information of longitude and latitude at where a DCP transmitted the data to ADEOS-II/DCS.

The "Collect data" consists of the observation data, which is collected by a DCP.

Both data includes data collection date and quality information.

(6) ILAS-II Products

Level 0: (no distribution)

Time ordered ILAS-II source packet data within a file. Each file includes overlapped area with other files.

Level 0a: (no distribution)

Available data (including 100% reference and Zero data) selected from Level 0

Level 0b: (no distribution)

Data loss and errors corrected level 0a data

Level 0c: (no distribution)

IR bands data selected and deconvolved level 0b data

Level 1:

Limb transmittance as calibrated with exoatmospheric level 0b or level 0c. Measurement location information is attached.

Level 2:

Vertical profile of the following parameters with estimation of error bars as a function of altitude.

Standard Products

a) O_3
b) HNO_3
c) NO_2
d) N_2O
e) H_2O
f) CH_4
g) Aerosol extinction coefficient (calculated from visible channel)
h) Temperature (calculated from visible channel)
i) Pressure (calculated from visible channel)

Research Products (TBD)

a) CFC-11
b) CFC-12
c) COF_2

d) CO_2

e) CO

f) OCS

g) C_2H_6

h) N_2O_5

i) $ClONO_2$

j) Aerosol extinction coefficient (calculated from IR and mid-IR channel)

k) Temperature (calculated from mid-IR channel)

l) Pressure (calculated from mid-IR channel)

(7) DMS Products

Level 0: (no distribution)

Time ordered DMS source packet data within a file. Each file includes overlapped area with other files.

Processed Data (Time Tagged Data): (experimentally distribution)

GPS time is attached to the following data collected by DMS.

- Star Tracker Attitude Data (DMS-STT-ATT)
- Star Tracker Image Data (DMS-STT-IMG)
- Accelerometer Data (DMS-ACC)
- DMS dump data (DMS-DMP)

Processed Data (Attitude Data): (experimentally distribution)

DMS data is processed to attitude data in accordance with the same format as the attitude data in PCD.

Appendix C1 MOIS Change Control

C1.1 MOIS Change Proposal (MOISCP)

(1) MOISCP Instructions

When it is clear that changes will affect only Japanese agencies, an MOISCP can be written in Japanese.

1. MOISCP Number
   (This number will be supplied by NASDA.)

2. Date Issued
   (The date of initiation of the MOISCP.)

3. Proposing Organization
   (Name of the MOISCP proposing organization, responsible person, and address.)

4. MOIS Version Number
   (Version Number of MOIS affected by this MOISCP)

5. Title of the MOISCP
   (Title of this MOISCP. The title shall be descriptive of the contents of the MOISCP.)

6. Necessity of the MOISCP
   (Justification (including pertinent history) of this MOISCP.)

7. Contents of the MOISCP
   (The contents of change proposed.)

8. Affected Documents
   (Titles of documents affected by the change. ex. "IP")

9. Attached Documents List
   (Titles, document numbers and issued dates of attached documents shall be listed.)

10. Signature
    (Approval by the proposing Project Manager or his designee.)

NOTE: The following requires coordination between the affected agencies.

11. Response

(The response shall be classified into the following categories by mutual agreement between the affected agencies.)

( ) a. Approved
( ) b. Rejected

12. Summary of the Response

(In case of Approved (11. (a)), summary of the response shall be described here.
In case of Rejected (11. (b)), explanation of the rejection shall be described here.)

13. Signature for Close Out

(In case of Approved (11. (a)), the affected agencies shall sign here.
In case of Rejected (11. (b)), NASDA shall sign here.)

(2) MOISCP Form

ADEOS-II MOIS **Change Proposal (MOISCP)**	*1. MOISCP No. :* 2. Date Issued :
3. Proposing Organization :	
4. Affected MOIS Version Number : ADEOS-II MOIS Version ____________________.	
5. Title of the MOISCP :	
6. Necessity of the MOISCP :	
7. Contents of the MOISCP :	
8. Affected Documents :	9. Attached Documents List :
10. Signature :	
RESPONSE	
11. Response : ( ) a. Approved or ( ) b. Rejected	
12. Summary of the Response :	
13. Signature for Close Out :	

C.1.2 MOIS Change Notice (MOISCN)

(1) MOISCN Instructions

(This MOISCN will be prepared by NASDA.)

1. MOISCN Number

2. Date Issued
   (The date of initiation of the MOISCN.)

3. Affected MOIS Version Number
   (Version Number of the MOIS changed.)

4. Number of Related MOISCP
   (The number of the MOISCP that caused this MOISCN.)

5. Pages Affected
   (The pages to be substituted by this MOISCN.)

6. Signature
   (Approval by the ADEOS-II Ground Segment Project Manager or his designee.)

(2) MOISCN Form

ADEOS-II MOIS Change Notice (MOISCN)	1. MOISCN No. : 2. Date Issued :
3. Affected MOIS Version Number : ADEOS-II MOIS Version ______________________.	
4. No. of Related MOISCP :	
5. Pages Affected : *Please substituted the following Pages.* <u>Section No.</u> <u>Page to be deleted</u> <u>Page to be inserted</u>	
6. Signature :	