625-CD-029-001 (E013)

EOSDIS Core System Project

EMOS Flight Operation Team (FOT) Training Material

ASTER Project

September 1999

Raytheon Systems Company
Upper Marlboro, Maryland

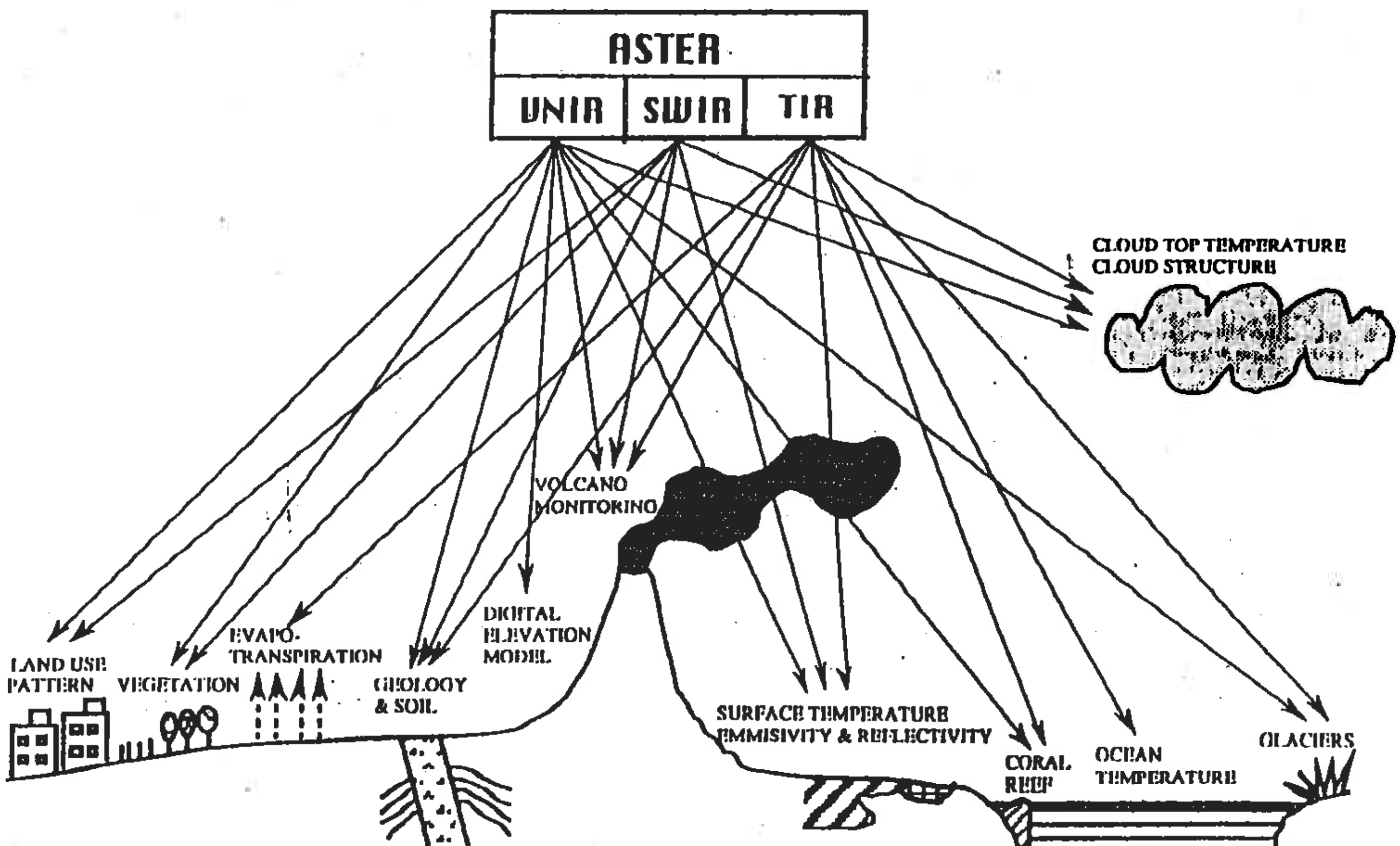
E 1178

ASTER PROJECT

The Ministry of International Trading and Industry (MITI) launched a Japanese Earth Resource Satellite (JERS-1) in 1992, its primary purpose, to investigate Earth resources. JERS-1 users of geology and resource remote sensing have since then requested MITI to develop more advanced sensors than those of JERS-1 in order to obtain more detailed geological data and to understand phenomena such as volcanic activities which would significantly impact the global environment. Responding to their desire MITI developed ASTER (Advance Space-borne Thermal Emission and Reflection Radiometer). ASTER will be on board of the first spacecraft of EOS Project, EOS AM-1 to be launched in June, 1998. MITI designated Japan Resources Observation Systems (JAROS) for the sensor development and Earth Remote Sensing Data Analysis Center (ERSDAC) for development of the data applications and ground data processing systems.

The ASTER Project established the ASTER Science Team comprised of Japanese and American researchers in a wide spectrum of fields including geology, geological resources, meteorology, agriculture and forestry, and environmental science. ASTER Science Team takes initiative to define the purpose of ASTER Project and to coordinate its user requirements, which are the basis to define specifications for the sensors, the ground data processing systems, and sensor operations.

APPLICATIONS OF ASTER



PURPOSE OF ASTER PROJECT

The purpose of the ASTER Project is to make contributions to extend the understanding of local and regional phenomena on the Earth surface and its atmosphere. The goals are as follows.

(1) To promote research of geological phenomena of tectonic surfaces and geological history through detailed mapping of the Earth topography and geological formation. (This goal includes contributions to applied researches of remote sensing.)

(2) To understand distribution and changes of vegetation.

(3) To further understand interactions between the Earth surface and atmosphere by surface temperature mapping.

(4) To evaluate impact of volcanic gas emission to the atmosphere through monitoring of volcanic activities.

(5) To contribute understanding of aerosol characteristics in the atmosphere and of cloud classification.

(6) To contribute understanding of roles the coral reefs play in the carbon cycle through coral classification and global distribution mapping of corals.

ASTER DEVELOPMENT AND ITS MAJOR FEATURES

ASTER development is carried out by Japan Resources Observation System Organization (JAROS), Tokyo, Japan, which is nonprofit organization under the control of Ministry of International Trade and Industry, (MITI).
The contracting companies are NEC Corporation, for the overall system and the VNIR subsystem, Mitsubishi Electric Corporation, for the SWIR subsystem, Fujitsu Limited, for the TIR subsystem, and Hitachi Limited, for the Master Power Supply. The fabrication and the characterization of the protoflight model (PFM) was completed and delivered to NASA at the end of February 1997 for integration on the EOS-AM1 spacecraft.

ASTER major features are shown in the followings

- simultaneous earth surface images from the visible to the thermal infrared,
- higher geometric and radiometric resolution in each band than current satellite sensors,
- near infrared stereoscopic image pairs collected during the same orbit,
- exquisite optics that allow the instrument axis to move as much as ± 24 degrees for VNIR and ± 8.55 degrees for SWIR and TIR cross-track derection from the nadir, and
- highly reliable cryocoolers for the SWIR and TIR sensors (50,000 hours operation life). 5 YRS

ASTER

PERFORMANCE REQUIRMENTS

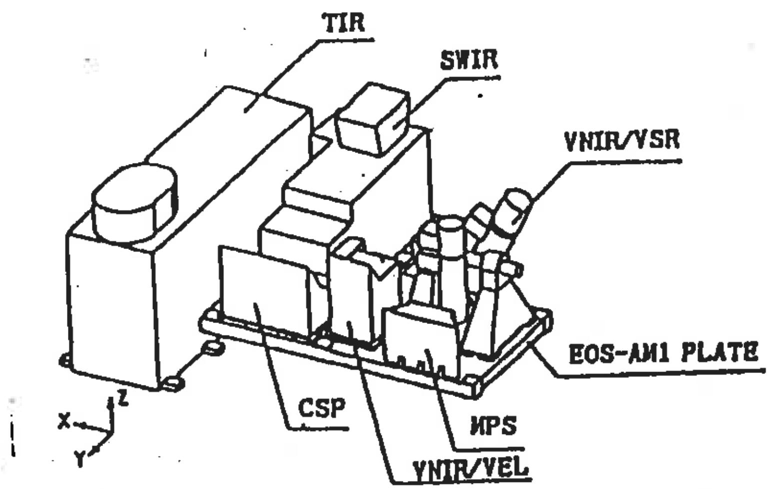
Spectral coverage	0.53 - 11.65µm
Spatial resolution (VNIR / SWIR / TIR)	15m (Bands 1 - 3) 0.52 - 0.86µm 30m (Bands 4 - 9) 1.60 - 2.43µm 90m (Bands 10 - 14) 8.125 - 11.65µm
Radiometric resolution	≤ 0.5% NEΔρ(Bands 1 - 3) ≤ 0.5 - 1.3% NEΔρ(Bands 4 - 9) ≤ 0.3K NEΔT(Bands 10 - 14)
Absolute radiometric accuracy	≤ ±4%
Absolute temperature accuracy	≤ 3k(200 - 240 K) ≤ 2k(240 - 270 K) ≤ 1k(270 - 340 K) ≤ 2k(340 - 370 K)
Signal quantization levels	8 bits (Bands 1 - 9) 12 bits (Bands 10 - 14)
Base-to-height ratio of stereo capability	0.6(along-track)
Swath width	60km
Total coverage in cross-track direction by pointing function	232km
Mission life	5 Years
MTF at Nyquist frequency	0.25(cross-track) 0.20(along-track)
Peak data rate	89.2Mbps
Weight	406kg
Power (Max.)	726W

SYSTEM CONCEPT AND LAYOUT

In order to cover the wide spectral range of the ASTER instrument, the components have been separated into three subsystems, visible and near infrared radiometer(VNIR) subsystem, short wave infrared radiometer (SWIR) subsystem and thermal infrared radiometer (TIR). The VNIR subsystem has two telescopes, a nadir looking telescope and a backward looking telescope. The pointing function is provided for global coverage in the cross-track direction by changing the center of the swath, since the swath width of ASTER is 60 km and the distance between the neighboring orbit is 172 km.

All components will be integrated on the spacecraft as shown in Fig. 5-1. The configuration can be divided into six blocks; (1) VSR block (two telescopes of VNIR), (2) VEL block (electronics of VNIR), (3) SWIR block, (4) TIR block, (5) CSP block and (6) MPS block. The thermal control of the SWIR and the TIR subsystems is carried out mainly by the cold plates with capillary pumps and partly by radiators. Other blocks employ independent thermal control by radiation.

ASTER LAYOUT AND SIGNIFICANT COMPONENTS



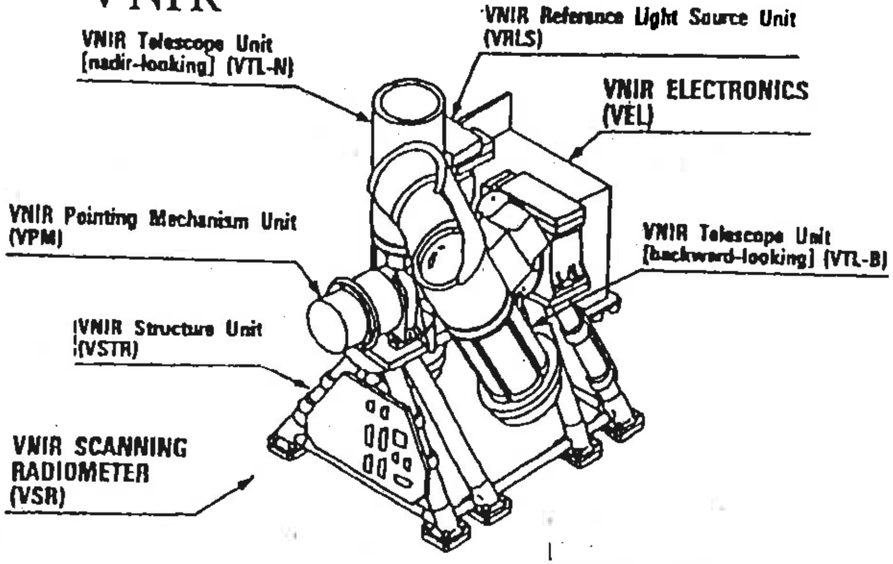
Configuration Layout of ASTER

REFRACTIVE Significant ASTER Function and Components

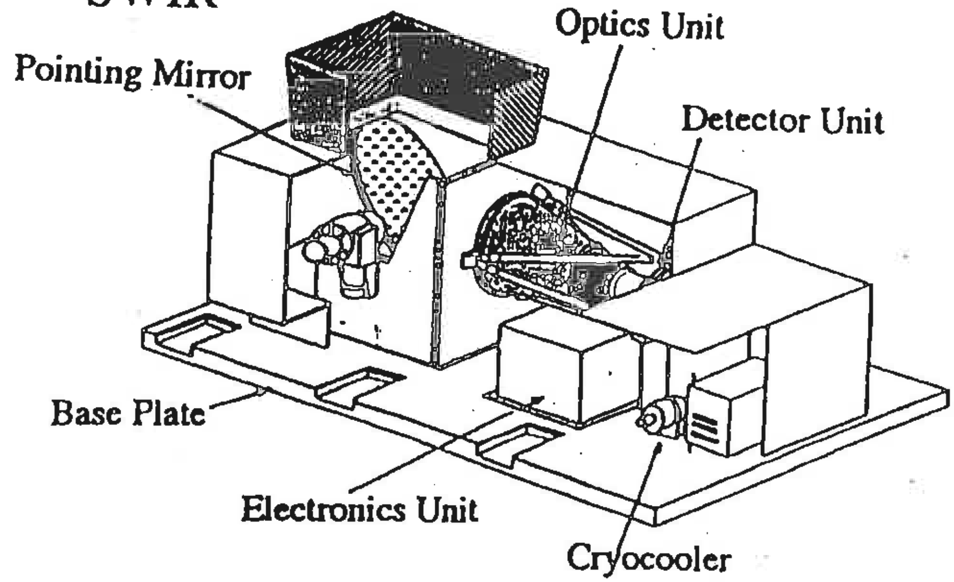
Sub System	Scan	Telescope optics	Spectrum separation	Focal plane (Detector)	Cooler (Temperature)	Cross-track Pointing
VNIR	Pushbroom	Reflective (Schmidt) D = 82.25 mm (N) D = 94.28 mm (B)	Dichroic and band pass filter (BPF)	Si – CCD 5000 x 4	No cooler	Telescope rotation (± 24°)
SWIR	Pushbroom	Refractive D = 190 mm	Band pass filter (BPF)	PrSi – CCD 2048 x 6	Stirling cycle (80° K)	Pointing mirror (± 8.55°)
TIR	Whiskbroom	Reflective (Newtonian) D = 240 mm	Band pass filter (BPF)	HgCdTe (PC) 10 x 5	Stirling cycle (80° K)	Scan mirror (± 8.55 °)

ASTER RADIOMETERS

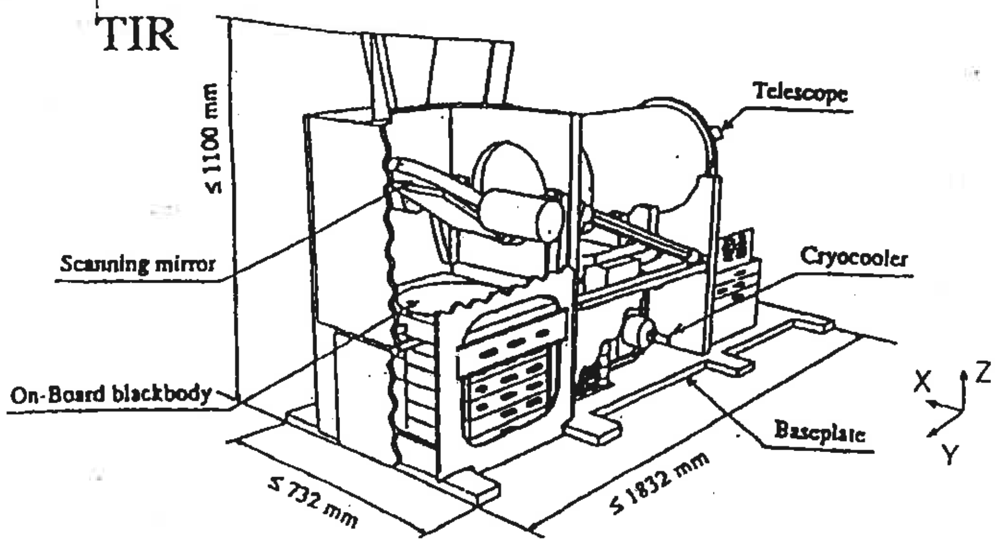
VNIR



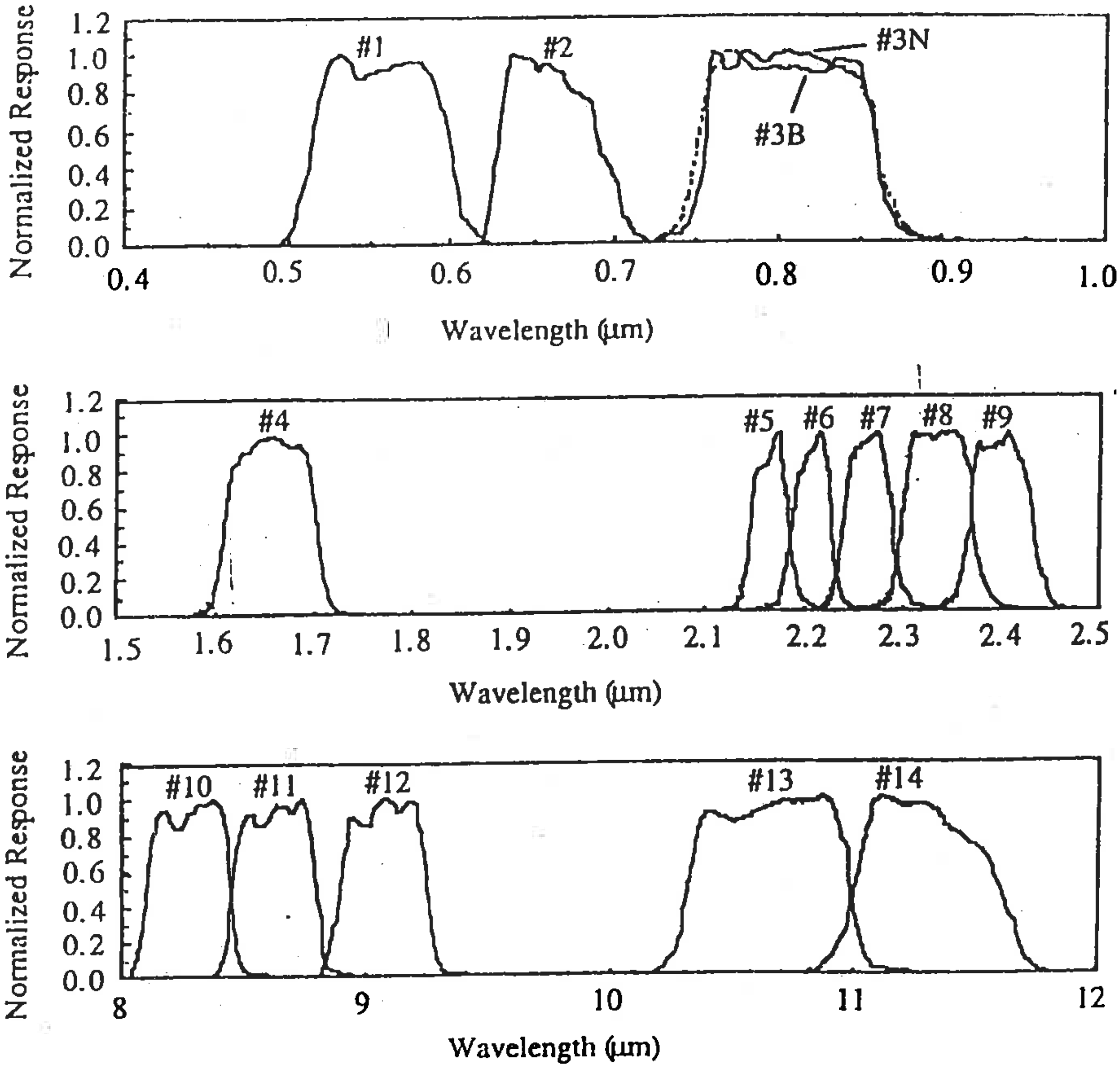
SWIR



TIR



SPECTRAL RESPONSE



GAIN SWITCHING FUNCTION

Though unspecified in the basic requirements, the S/N value is defined for the low-level input radiance equivalent to 20 percent of the high-level level input radiance, allowing for presence of objects have low reflectance, such as rocks. Besides, in consideration of the diversity of objects to be observed, the subsystem incorporates a gain switching function which facilitates selection of desired gains by band as shown in the table. The SWIR's "Low gain-2" mode is used for observing lava.

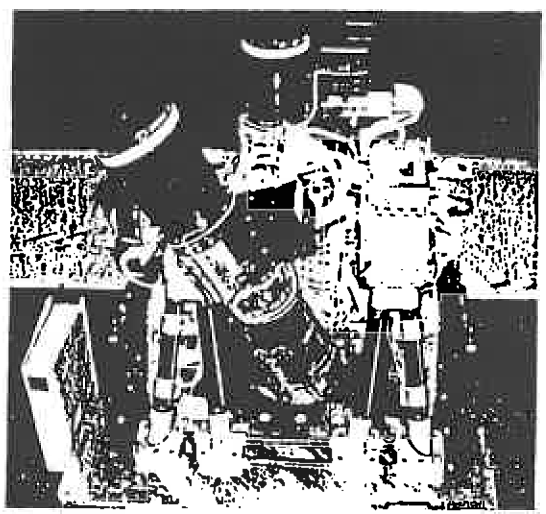
Band No.	High gain	Normal gain	Low gain-1	Low gain-2
1	2.5	1.0	0.75	N/A
2	2.0	1.0	0.75	N/A
3	2.0	1.0	0.75	N/A
4	2.0	1.0	0.75	0.75
5	2.0	1.0	0.75	0.165
6	2.0	1.0	0.75	0.157
7	2.0	1.0	0.75	0.171
8	2.0	1.0	0.75	0.162
9	2.0	1.0	0.75	0.116
10 - 14	N/A	N/A	N/A	N/A

WHAT IS VNIR ?

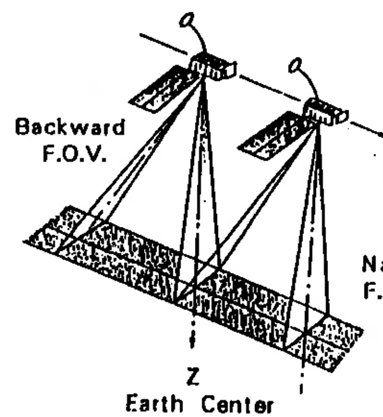
VNIR high-resoulution ratiometer observes the targets using solar radiation reflected from the earth sunfaces in three visible and near-infrared bands. Its main objectives are land survey, vegetation assessment, environmental protection, and disaster detection. VNIR data can be combined with data from SWIR and TIR to provide synergistic interpretation.

The stereoscopic image sensor views 27.6 degrees backward of the Band 3 sensor in the same orbit. VNIR has the wide cross track pointing capability of ± 24 degrees in cross-track from nadir direction. Stereoscopic observation capability will be useful for geomorphology and creation of digital elevation models (DEM). VNIR automatically corrects, onboard, for the geometric aberration between the backword field of view (FOV) and the nadir FOV caused by the rotation of the earth.

Each band has a linear charge-coupled device (CCD) array that sweeps 60Km swath over the earth's surface in a pushbroom manner. The radiometer will be calibrated in orbit using halogen lamps.



VNIR External View



Stereoscopic Imaging Concept

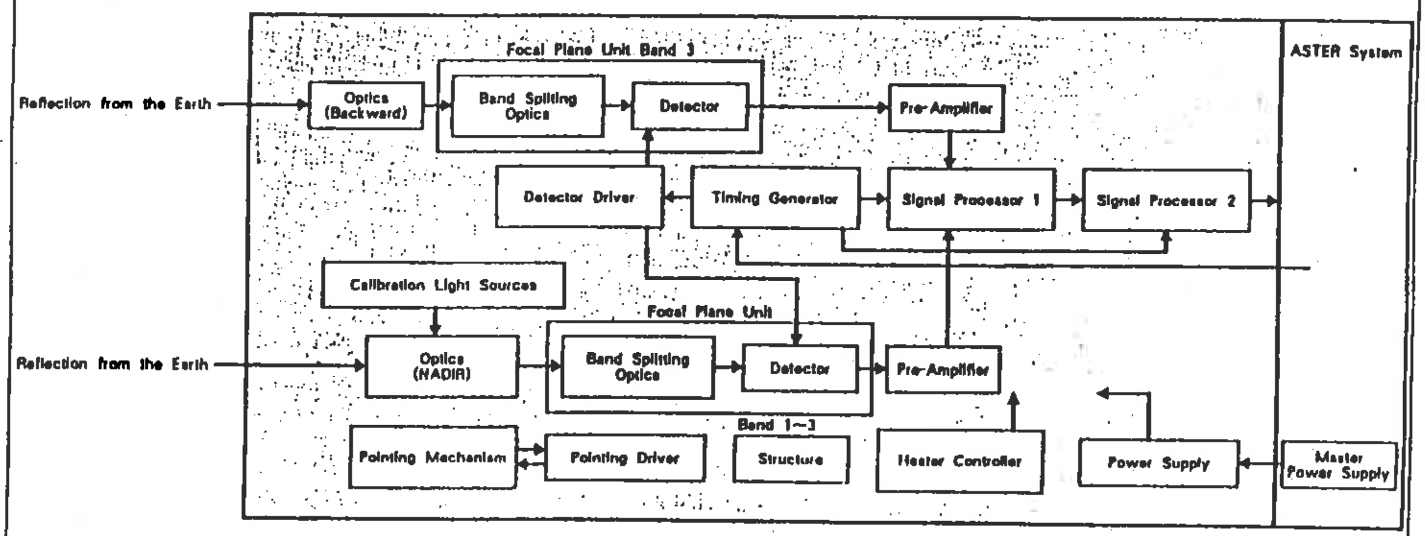
VNIR FUNCTION

VNIR Functional Parameters

- Spectral Bands
  - Band 1 — 0.52~0.60 μm — Nadir looking
  - Band 2 — 0.63~0.69 μm — Nadir looking
  - Band 3 — 0.76~0.86 μm — Nadir looking
  - Stereoscopic band — 0.76~0.86 μm — Backward looking
- Radiometric Resolution — 0.5% NEΔρ
- Geometric Resolution — 15 m
- Pointing Coverage — ±24 deg
- IFOV — 21.3 μrad (nadir viewing); 18.6 μrad (backward viewing)
- Stereoscopic Imaging — B/H* = 0.6
- Detector — 5,000 elements CCD sensor**
- Radiometric Accuracy — ±4%
- Quantization Bit Number — 8 bits
- Scan Period — 2.2 msec
- MTF (at Nyquist frequency) — >0.25 (cross-track); >0.2 (along-track)

*B/H: Base to Height Ratio
**VNIR selects 4,100 elements corresponding to 60 km

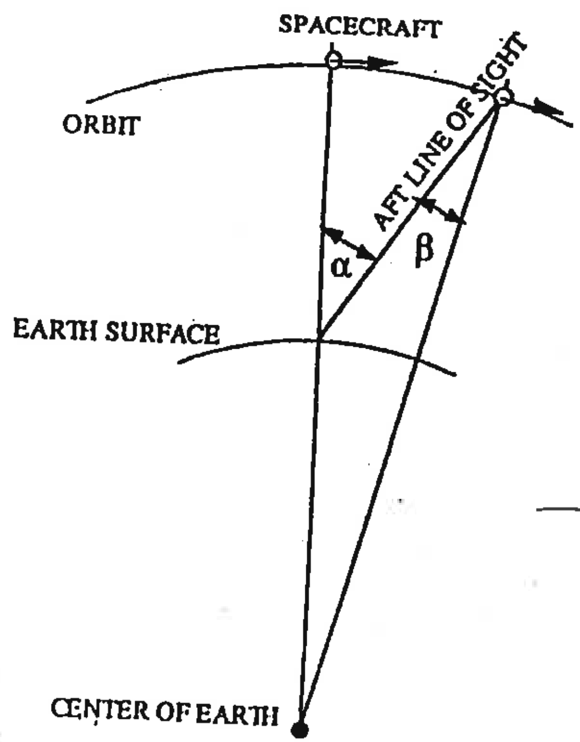
VNIR Block Diagram



B/H RATIO

BASE / HEIGHT

Figure shows the stereo configuration for which the backward telescope is adopted. The relation between B/H ratio and α is B/H = tan α, where α is the angle between the nadir and the backward direction at a point on the earth's surface. The angle α that corresponds to the B/H ratio of 0.6 is 30.96° . By considering the curvature of the earth's surface, the setting angle between the nadir and the backward telescope is designed to be 27.60° .

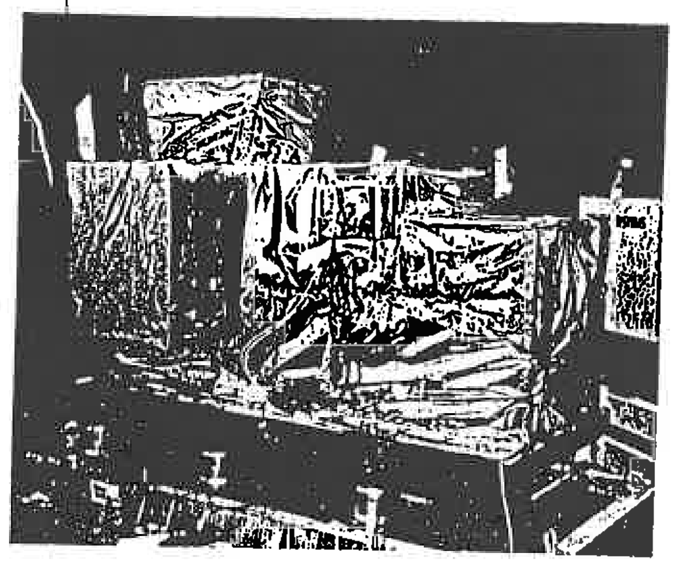


WHAT IS SWIR ?

SWIR is an advanced high resolution multispectiral radiometer which detects reflected solar radiation from the earth surfaces in the wavelength region of 1.6 - 2.43 μ m . SWIR is especially advantageous for resources descriminations such as rocks and minerals and for enviromental survey such as vegitations and volcanoes.

The detector consists of six band PtSi Schottky barrier type CCDs integrated on a chip and each band row has 2048 effective pixels. Spectral ramificatios are performed through stripe shaped bandpass fillters placed on the chip.

During observation and calibration period, the detector is refigerated around 80K by a Stirling cycle cryocooler which has an operation time of more than 50000 hours and cylinder axis disturbances less than 0.1N. Calibration is achieved by detecting the standard radiation of halogen lamp installed in the SWIR, SWIR also has a capability to change the boresight in the range of ± 8.55 degrees from nadir direction by the pointing mechanism.



SWIR External View

SWIR FUNCTION

SWIR Functional Parameters

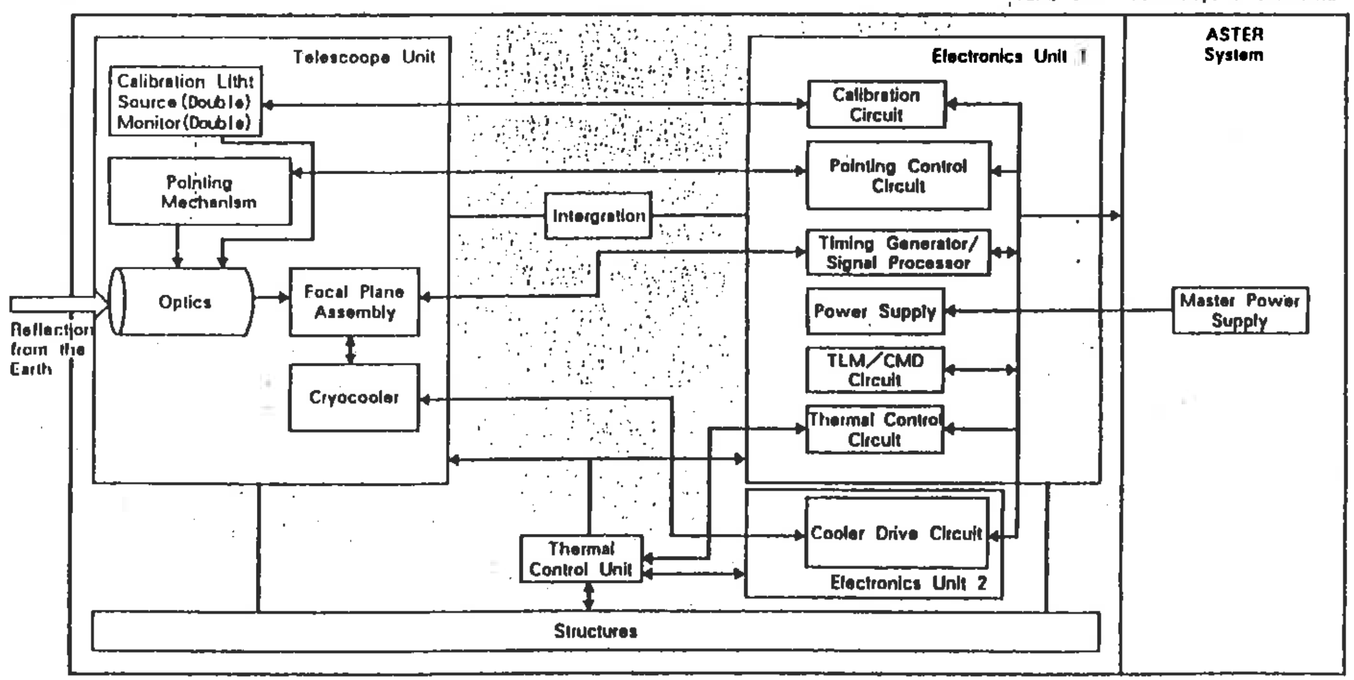
- Spectral Bands and Radiometric Resolution

Band 4	1.600 — 1.700	μm/0.5 %NEΔρ
Band 5	2.145 — 2.185	μm/1.3 %NEΔρ
Band 6	2.185 — 2.225	μm/1.3 %NEΔρ
Band 7	2.235 — 2.285	μm/1.3 %NEΔρ
Band 8	2.295 — 2.365	μm/1.0 %NEΔρ
Band 9	2.360 — 2.430	μm/1.3 %NEΔρ

- Geometric Resolution: 30m
- Pointing Coverage: ±8.55 deg
- IFOV: 42.6 μrad
- Detector: 2,048 effective pixels × 6 bands (PtSi Schottky barrier type CCD)
- Radiometric Accuracy: ±4%
- Quantization Bit Number: 8 bits
- Scan Period: 4.398 msec
- MTF (at Nyquist frequency): >0.25 (cross-track), >0.20 (along-track)
- Cooler: Linear Drive Stirling Cycle Cryocooler

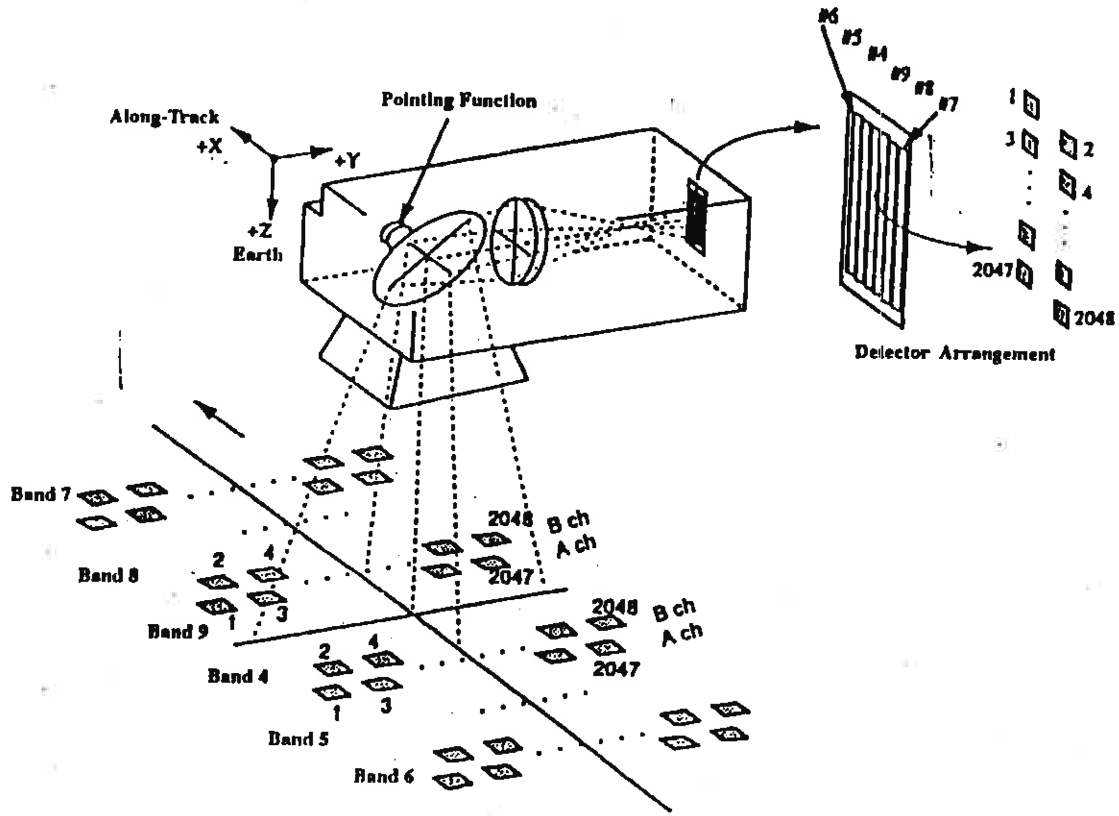
SWIR Block Diagram

TLM/CMD : Telemetrye & Command



SWIR OBSERVATION

The SWIR incorporating linear array covering six bands on each detector separates light components using rectangular spectral filter. For this reason, at given time, Band 7 observes relatively forward region and Band 6, relatively backward region, as shown in the figure. When stationary ground objects are observed, observation is made in the sequence of bands 7,8,9,4,5 and 6.

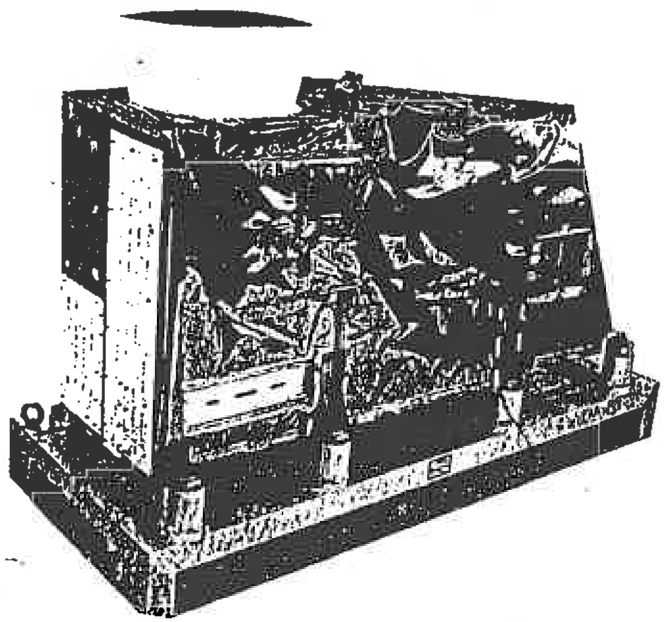


WHAT IS TIR ?

TIR is an advanced space-borne radiometer with five spectral bands in the thermal infrared（8-12 μ m）. Its ability to measure thermal emission properties will be useful for locating mineral resources, characterizing the land and sea surface, and observing the atmosphere.

TIR's advanced performance will enable it to achieve demanding scientific objectives, such as classifying rocks（felsic of mafic）, studying clouds and evapotranspiration and monitoring volcanoes. TIR uses high-sensitivity mercury-cadmium-telluride（HgCdTe） detector arrays. The detectors are cooled to approximately 80 K by a long-life linear-drive Stirling-cycle cryocooler to achieve high performance.

TIR has a high accurancy scanning mechanism using a oscillating mirror.



TIR External View

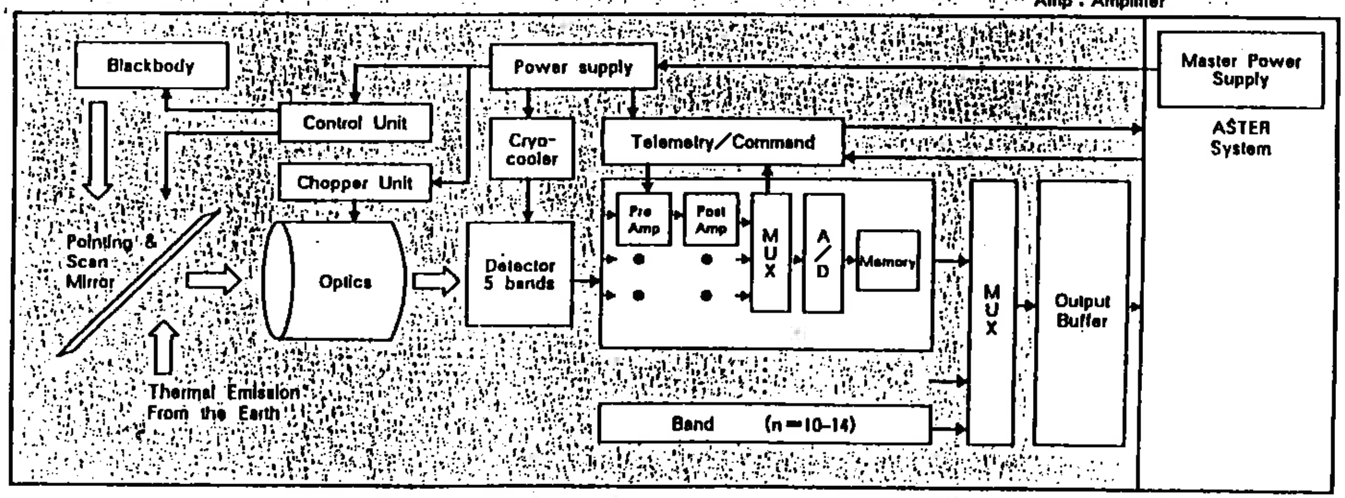
TIR FUNCTION

TIR Functional Parameters

• Spectral Bands	Band10	8.125 – 8.475 μm
	Band11	8.475 – 8.825 μm
	Band12	8.925 – 9.275 μm
	Band13	10.25 – 10.95 μm
	Band14	10.95 – 11.65 μm
• Radiometric Resolution		NEΔT : 0.3 K
• Geometric Resolution		90 m
• Pointing Coverage		±8.55 deg
• IFOV		127.8 μrad
• Detector		50 elements (HgCdTe)
• Quantization Bit Number		12 bits
• MTF (at Nyquist frequency)		>0.25 (cross track) >0.20 (along track)
• Scanning Method		Mechanical Scanning (Oscillating Mirror)
• Cooler		Linear Drive Stirling Cycle Cryocooler

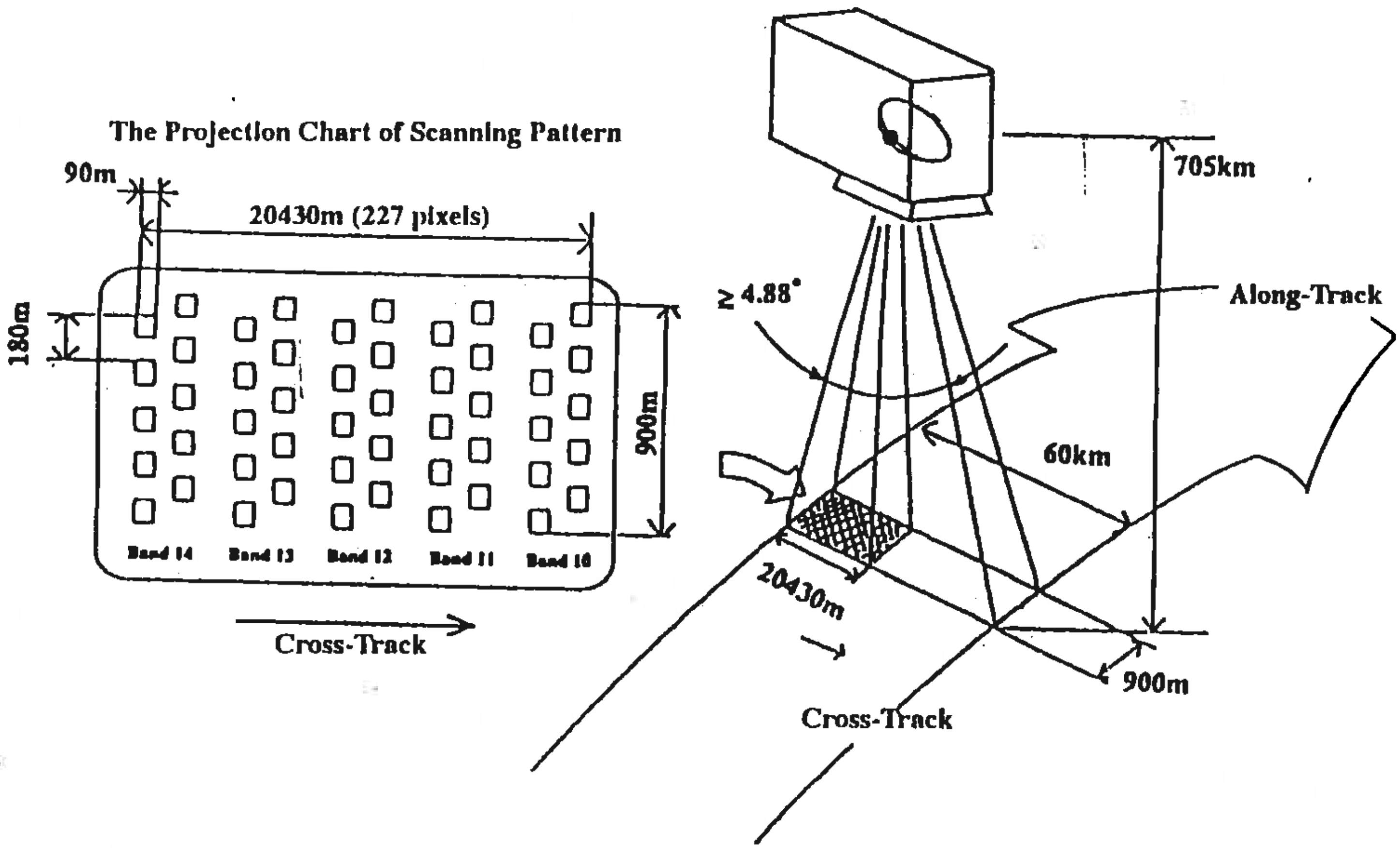
TIR Block Diagram

MUX : Multiplexer
A/D : Analog Degital Converter
Amp : Amplifier



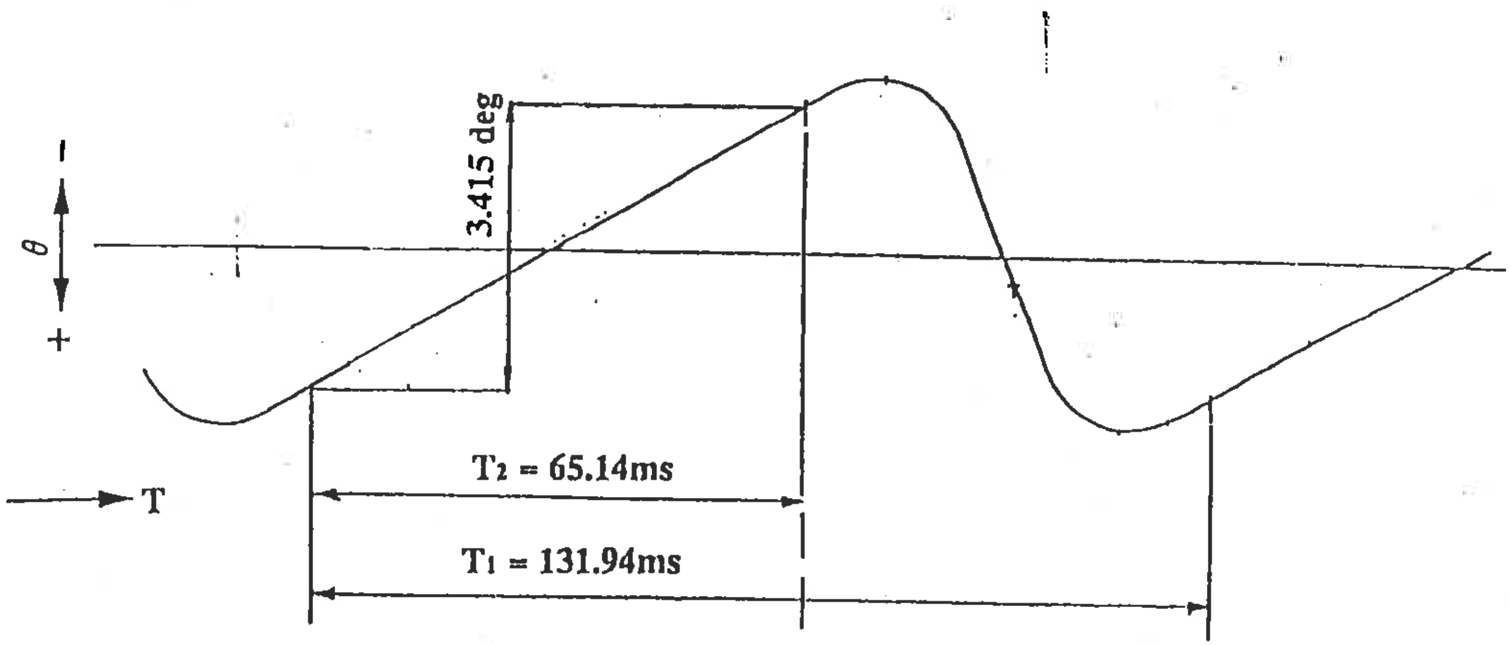
TIR OBSERVATION

Sensor scanning angle is specified by the effective scanning angle in a cross-track direction capable of covering the entire bands of TIR system, specifically in excess of 4.88 degrees in nadir view. TIR operates on the mechanical scanning system.



ASTER

TIR SCANNING PROFILE

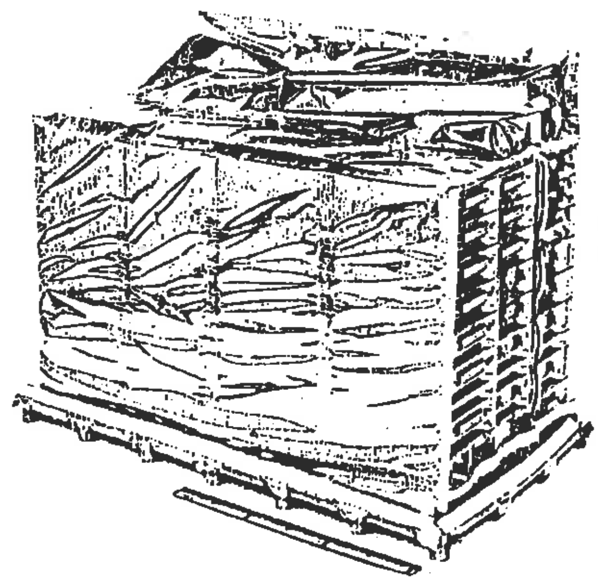


WHAT IS CSP ?

(1) High–Rate Science Link Interface
CSP adds system telemetry to science and supplement data from each radiometer of ASTER. The system telemetry consists of the spacecraft ancillary data. The supplement data and the system telemetry are treated as the engineering data. CSP packetizes the science data and the engineering data into CCSDS Version 1 Source Packet.

(2) Command and Telemetry Bus Interface
CSP receives Synchronize–With–Data Word Message, Command, 1MOK, Safe Mode Command, Ancillary Data and Time Code Data Messages from Command and Telemetry Bus, and transmits Housekeeping Telemetry Messages to Command and Telemetry Bus.

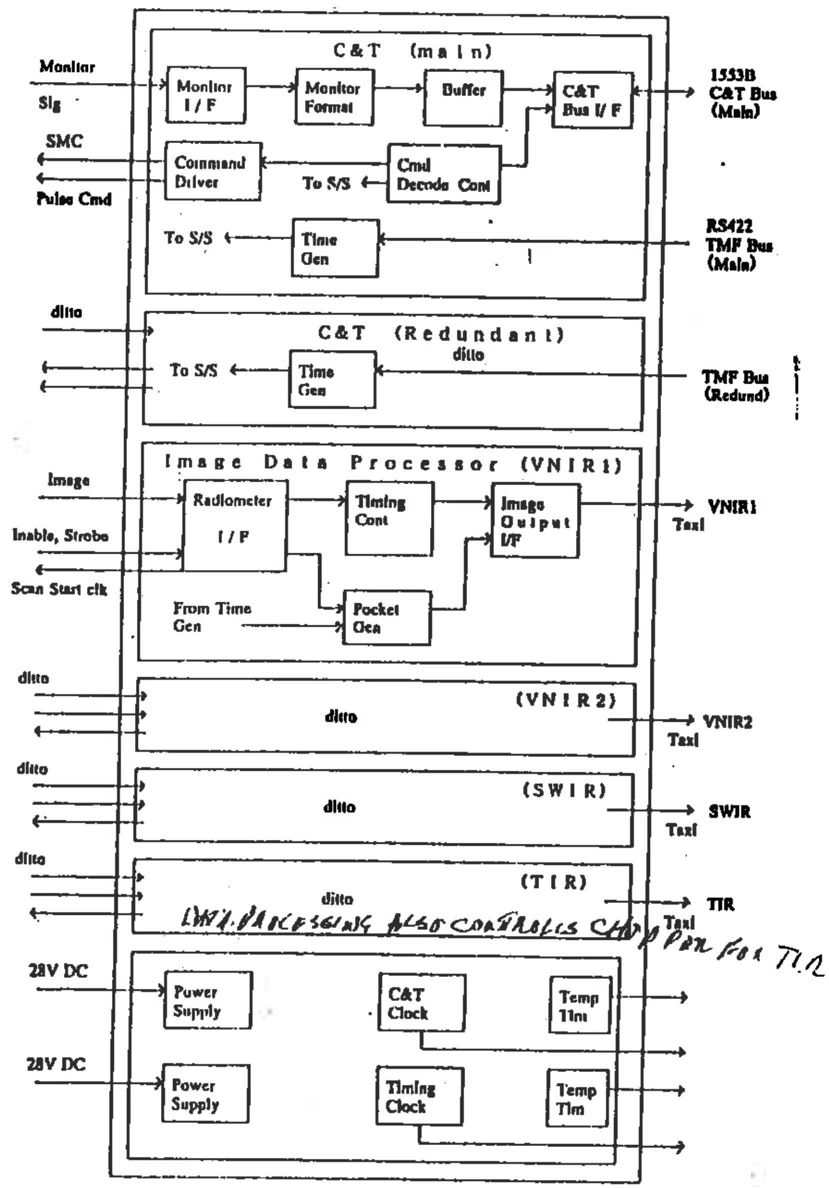
(3) Time Mark and Frequency Bus Interface
CSP uses this time mark encoded reference frequency of 1MHz for internal clock of ASTER.



CSP External View

CSP BLOCK GIAGRAM

[CSP]



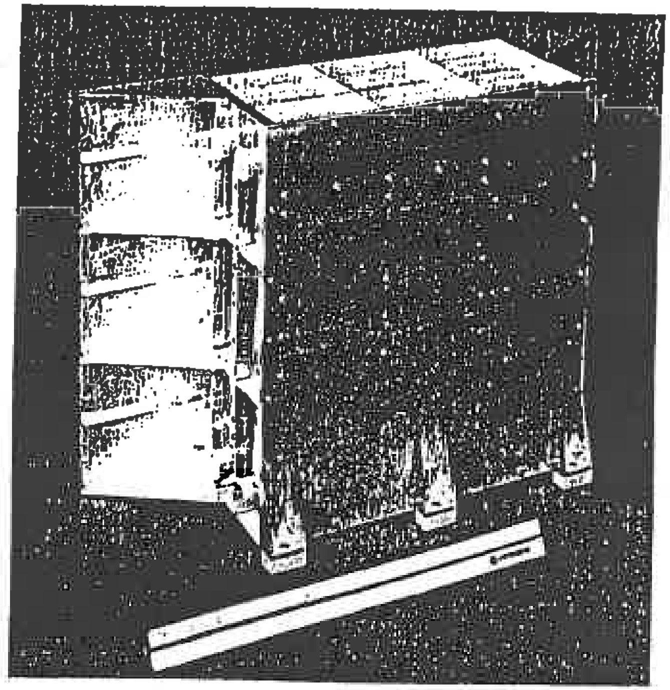
WHAT IS MPS ?

MPS provides the VNIR, SWIR, TIR and CSP with 28 V DC converted from 120 V DC output of the spacecraft power bus. MPS also provides survival heater power for every subsystem and cooler power for SWIR and TIR directly from 120 V DC power bus.

MPS Functional Parameters

Primary input voltage : 120V DC ± 4%

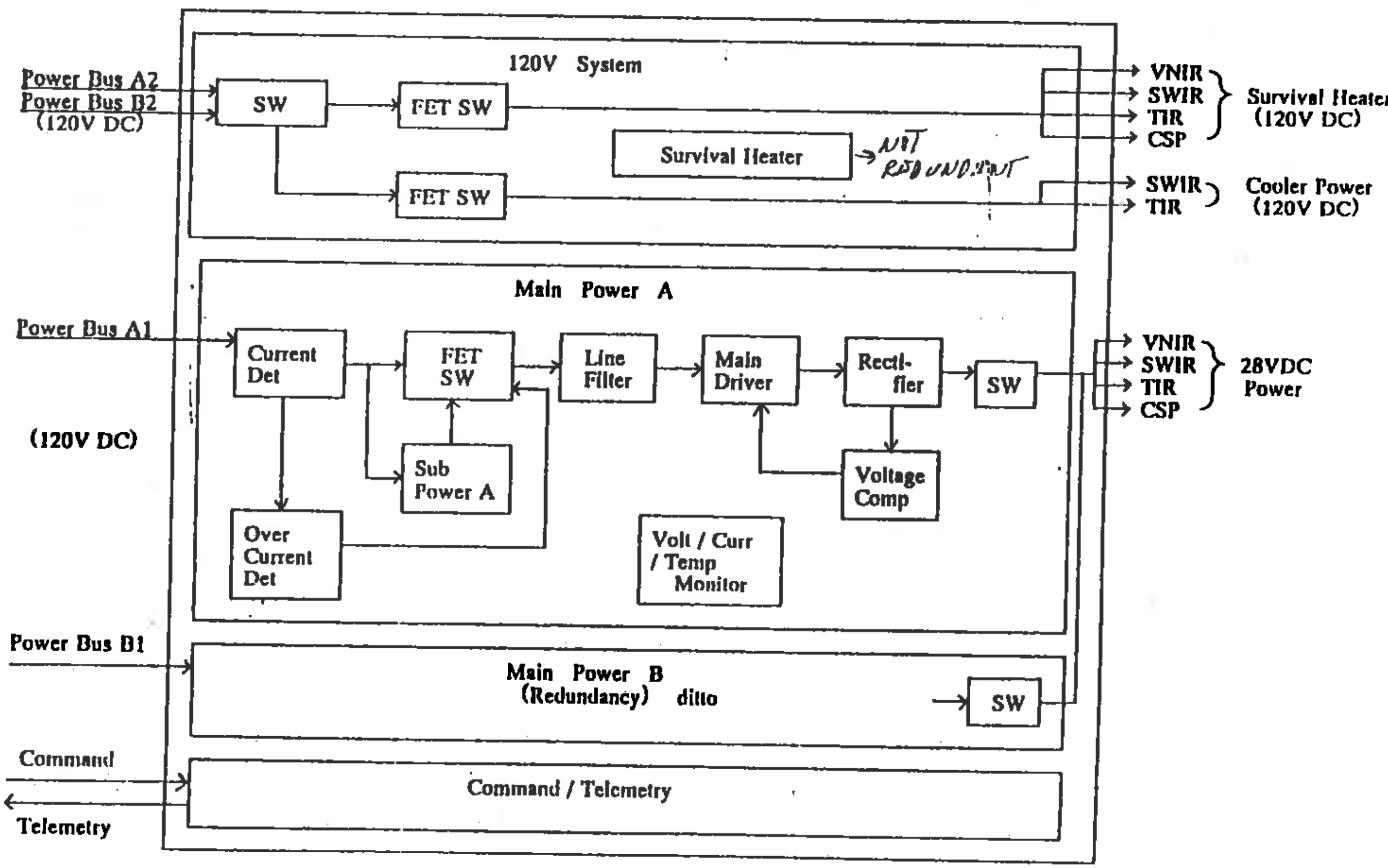
- Output Voltage
  - 28V DC system +28.0VDC (+0.82/−0.68VDC)
  - Survival heater +120VDC (+4.8/−6.5VDC)
  - Cooler system +120VDC (+4.8/−6.0VDC)
- Output power
  - 28V DC system 530W
  - Survival heater 340W
  - Cooler system 140W



MPS External View

MPS BLOCK DIAGRAM

[MPS]

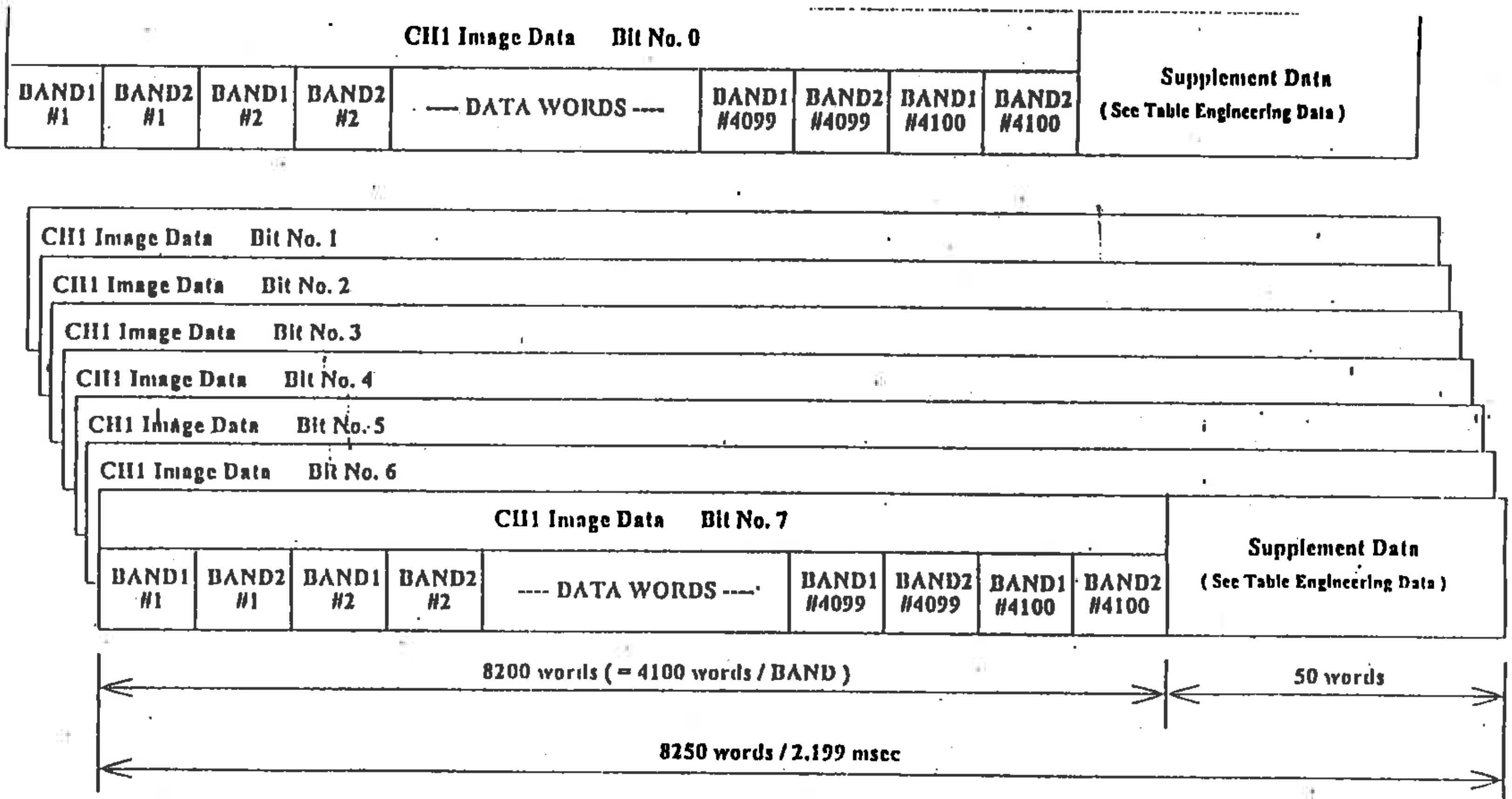


OBSERVATION MODE

Table 10-1 defines ASTER operation modes. Basic modes include a "Full mode" whereby data are acquired from all the bands in daytime, TIR mode for nighttime data acquisition, VNIR mode for daytime data acquisition, STEREO mode whereby VNIR nadir-looking band 3N and its backward-looking band 3B alone operate, and TIR solo mode. Besides, during the nighttime, SWIR+TIR mode is used for observation of high-temperature objects such as lava of active volcanoes.

	Mission mode	Subsystem			Data rate
		VNIR	SWIR	TIR	
Day	Full mode	*	*	*	89.2 Mbps
	VNIR mode	*			62.038 Mbps
	TIR mode			*	4.109 Mbps
	Stereo mode	** (3N & 3B)			31.019 Mbps
Night	TIR mode			*	4.109 Mbps
	SWIR + TIR mode		*	*	27.162 Mbps

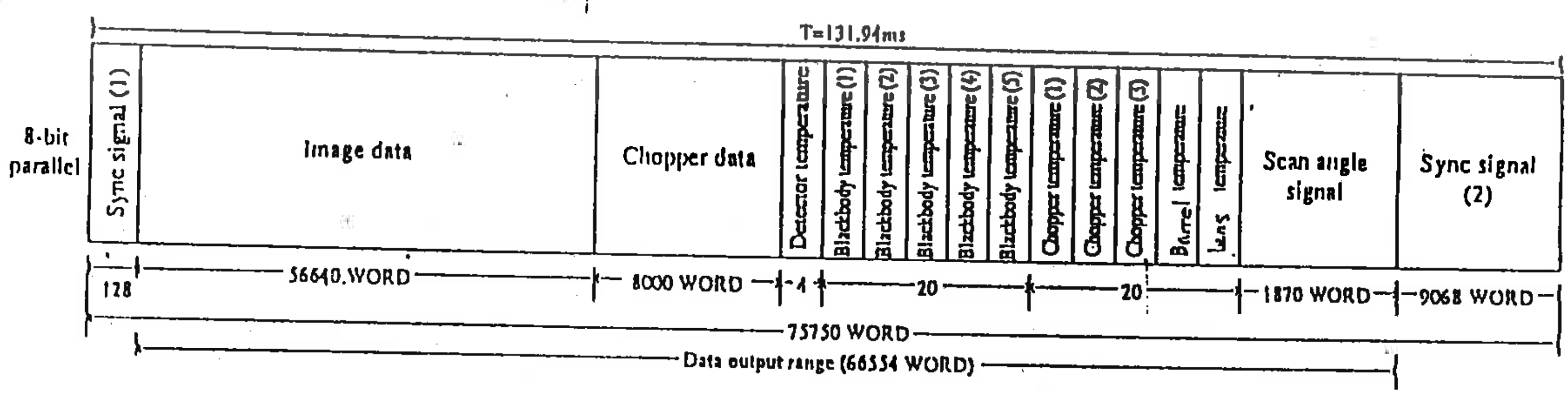
VNIR INPUT DATA



Note: Data format for 3N and 3B (CH2) is the same as above format.
Data rate : 30.044 Mbps

TIR INPUT DATA

TIR image data format

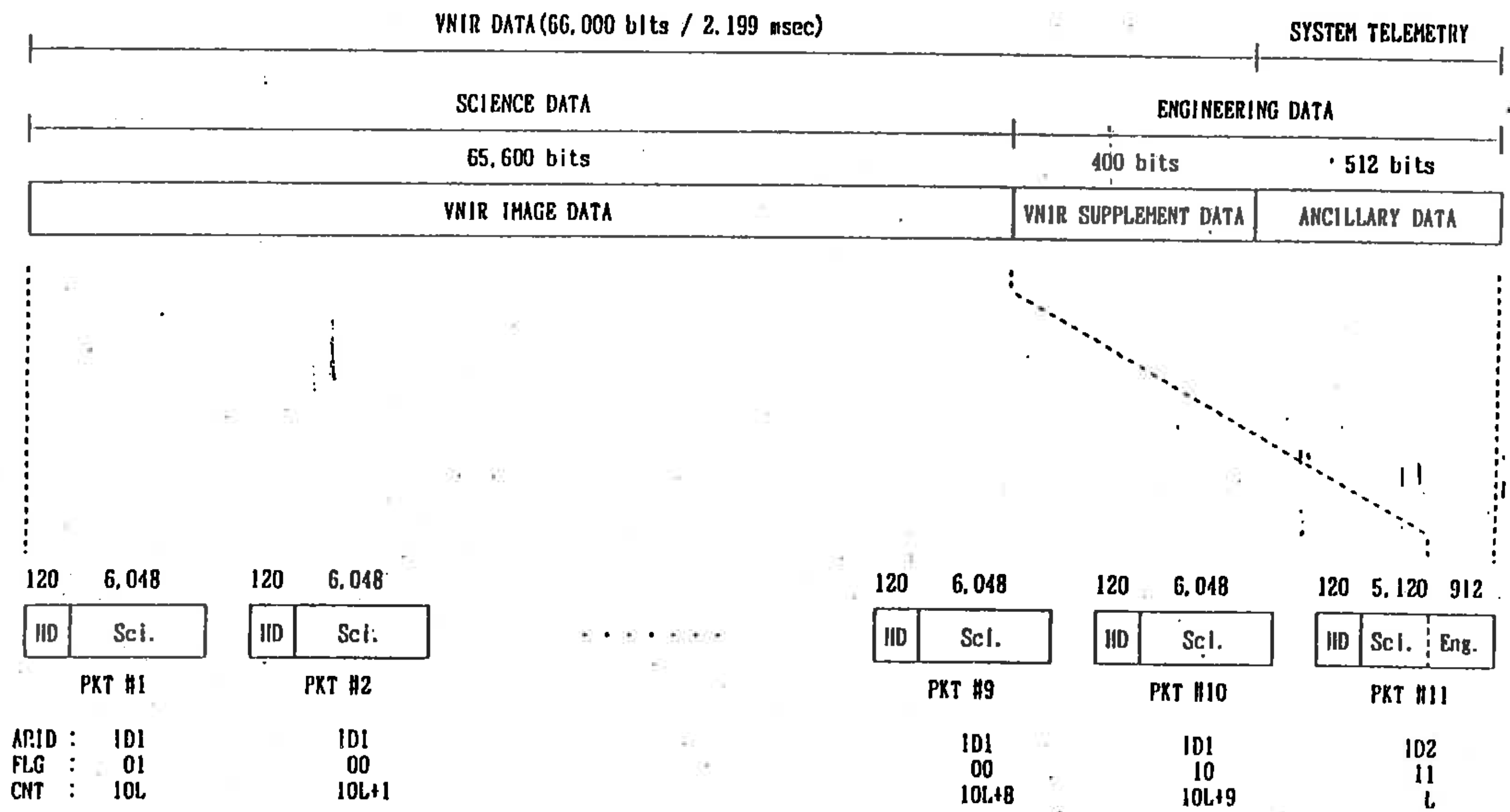


1	Sync signal (1) (*1)	128 WORD			
2	Image data	708 SAMPL. X 10 PIXELS X 12 bit X 5 BAND X 64/60 = 453120 bit	⇨	56640 WORD	Data from 2) to 7) fetched into CSP
3	Chopper data	100 SAMPL. X 10 PIXELS X 12 bit X 5 BAND X 64/60 = 64000 bit	⇨	8000 WORD	
4	Detector temperature	2 SAMPL. X 12 bit X 16/12 = 32 bit	⇨	4 WORD	
5	Blackbody temperature (1) to (5)	2 SAMPL. X 12 bit X 5 X 16/12 = 160	⇨	20 WORD	
6	Chopper temperature (1) to (3)	2 SAMPL. X 12 bit X 3 X 16/12 = 96 bit	⇨	12 WORD	
7	Barrel Temperature	2 SAMPL X 12 bit X 16/12 = 32 bit	⇨	4 WORD	
8	Lens Temperature	2 SAMPL X 12 bit X 16/12 = 32 bit	⇨	4 WORD	
9	Scan angle signal	1870 WORD	⇨	1870 WORD	
10	Sync signal (2) (*1)	9068 WORD			

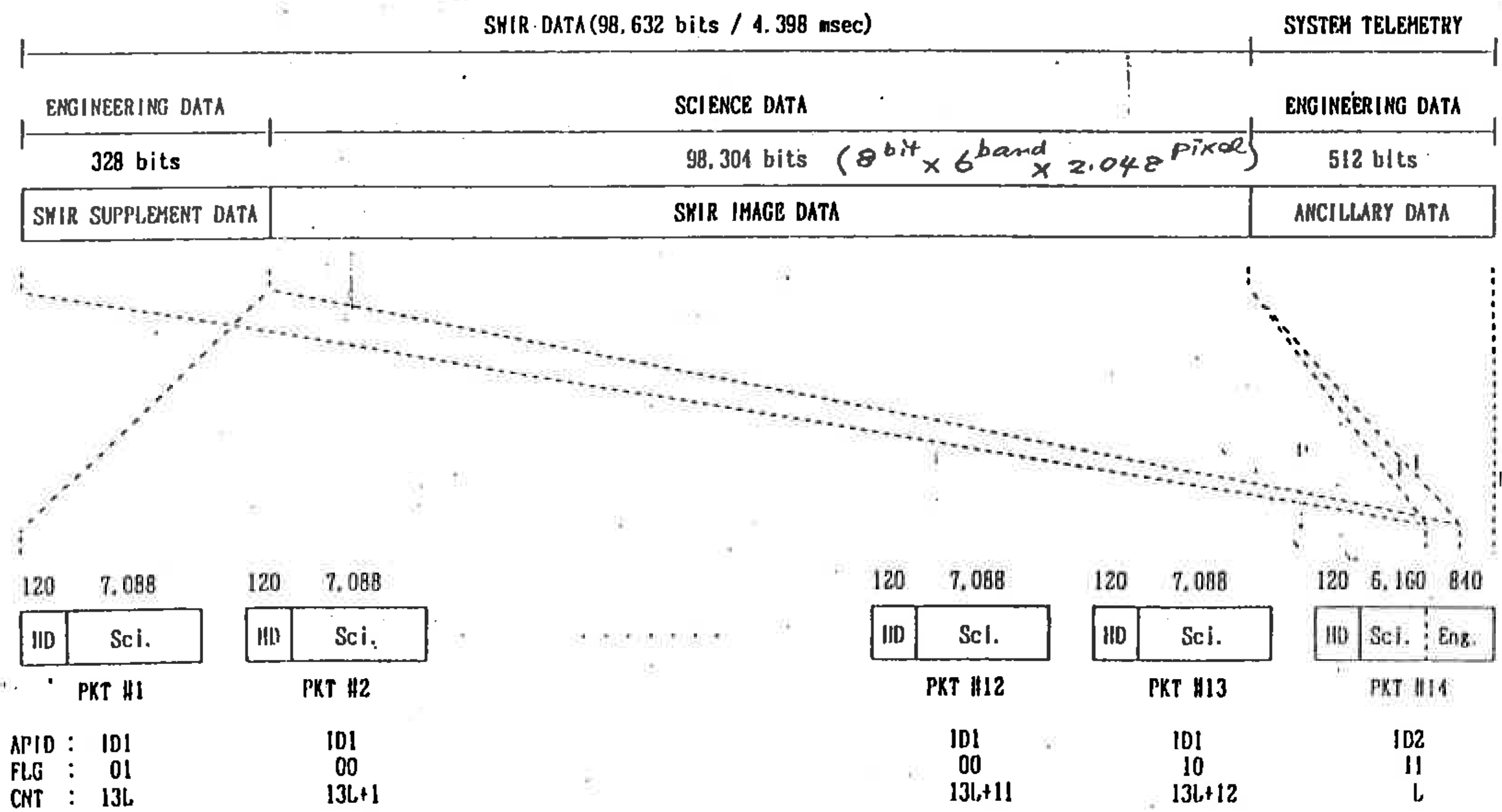
*1 Not fetched into CSP

*1 Not fetched into CSP

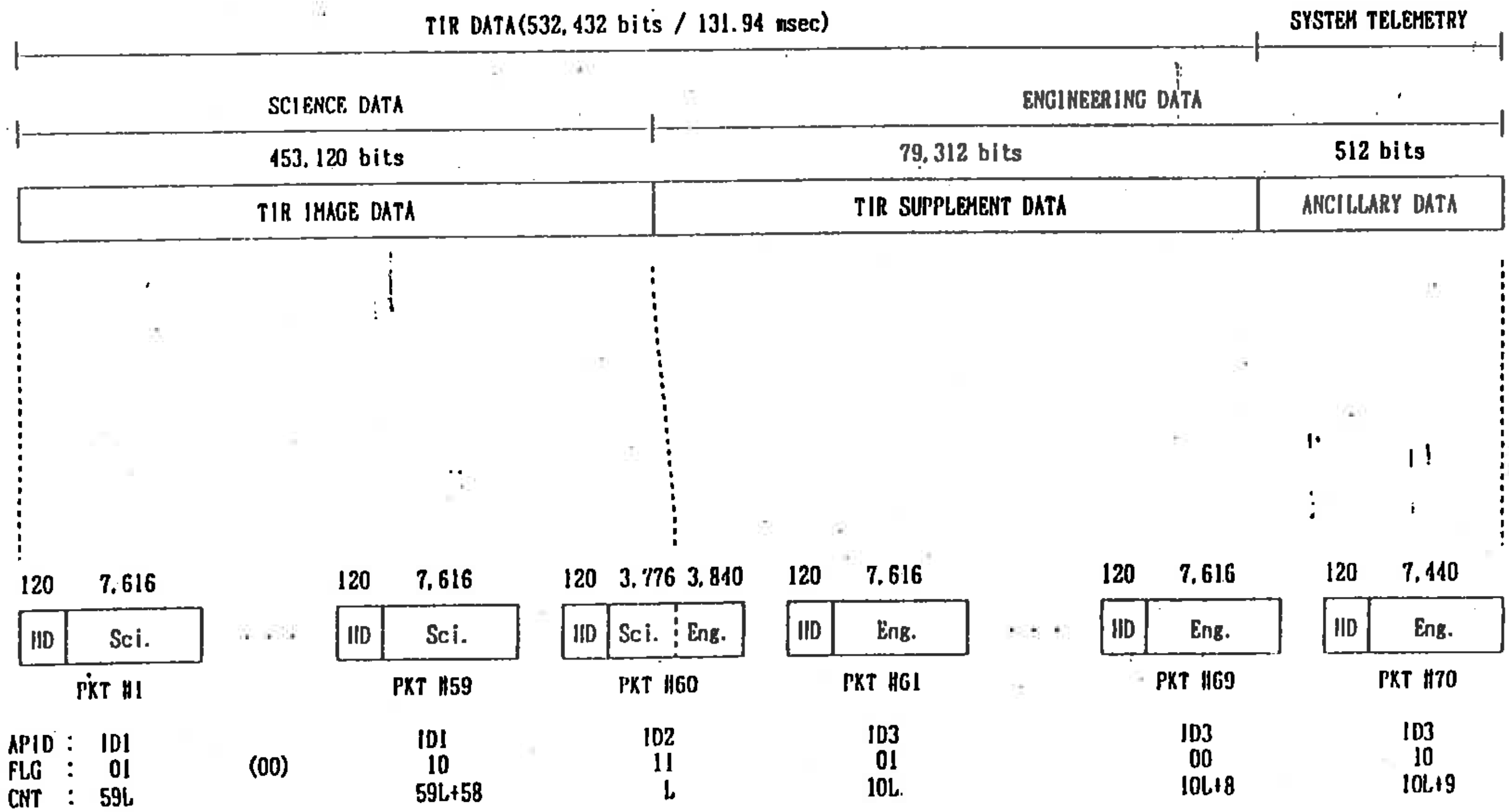
VNIR DATA STRUCTURE (CSP OUTPUT)



SWIR DATA STRUCTURE (CSP OUTPUT)



TIR DATA STRUCTURE
(CSP OUTPUT)



ASTER

APID ALLOCATION

Numbers Hex

	Item	Obs Mode	Cal Mode	Test Mode
VNIR(1)	Sci.	1 0 1	1 0 5	1 0 9
	Sci.+Eng.	1 0 3	1 0 7	1 0 11
	Eng.	— — —	— — —	— — —
VNIR(2)	Sci.	1 1 1	1 1 5	1 1 9
	Sci.+Eng.	1 1 3	1 1 7	1 1 11
	Eng.	— — —	— — —	— — —
SWIR	Sci.	1 2 1	1 2 5	1 2 9
	Sci.+Eng.	1 2 3	1 2 7	1 2 11
	Eng.	— — —	— — —	— — —
TIR	Sci.	1 3 1	1 3 5	1 3 9
	Sci.+Eng.	1 3 3	1 3 7	1 3 11
	Eng.	1 3 2	1 3 6	1 3 10

INPUT SIGNAL TO ASTER

1. Command
   1. 1 Relay Drive Command (Direct from S/C thru BDU)
      MPS ON/OFF, CSP ON/OFF, Launch lock OFF
   1. 2 C&T Bus Command (1553B I/F)
      Receive at CSP and generate intra ASTER command
      ① Pulse command (ex. ASTER S/S ON/OFF)
      ② Serial magnitude command (ex. mode switch, gain, HCE)
      16 bit configuration
   1. 3 Safe Mode Command

2. Signal
   2. 1 IMOK message·····CSP controls Safe mode transfer at timeout.
   2. 2 Ancillary data···CSP adds S/C data to S/S science data.

3. Time Code data and Standard frequency clock
   3. 1 S/C time from C&T bus given at every 1.024 second as a time code.
   3. 2 CSP generates standerd clock (1 μsec nominal) time by using 1MHz clock sent from T&M Frequency and the time code.

OUPUT SIGNAL (TELEMETRY) FROM ASTER

1. Direct Telemetry to S/C (Thru BDU)
   1.1 Passive Bi-level Telemetry
       Status output of relay drive command
   1.2 Passive Analog Telemetry
       Confirmation of operational temperature at turn on.
   1.3 Active Analog Telemetry
       Input/output curret and voltage at MPS

2. C&T bus Telemetry (1553B)
   CSP compiles intra ASTER housekeeping data
   2.1 Active Bi-level monitor
       S/S power supply ON/OFF, SW system ON/OFF
   2.2 passive Analog monitor
   2.3 SERIAL DIGITAL MONITOR

ASTER FOT Training

Overview of ASTER Operations

July 1999

Prepared for NASA

Prepared by NEC

AT NASA/GSFC-EOC

CONTENTS

The AOT consists of six ASTER related organization or projects as follows;

— the ASTER Sensor Committee/Ground System Interface Working Group and ASTER Sensor Committee/ground System Interface Working Group and ASTER Instrument Project conducted JAROS

— the ASTER Science Team/OMP Working Group conducted by both ERSDAC and the US science Team , and the ASTER science Project conducted by ERSDAC.

— the ASTER GDS Committee and the ASTER GDS Project conducted by ERSDAC

— To prepare the detailed Mission Operation Handbook, the ASTER Mission Operation Procedures.

—To conduct the END-to-END Test and Initial, Nomal, and Contingency Operations.

—To perform instrument Analysis.

The chart on the following page shows the organization of ASTER Operations Team.

1.2 ASTER Baseline Operations

ASTER has the following operations.

(1) Initial Check-out Operation

- Initial Check-out Operation begins when S/C is launched and ends when functions of all instruments at the first stage are confirmed.

(2) Normal Operation

- Normal Operation begins when the Initial Check-out Operation is finished and ends when mission life ends.(for 5 years)

(3) Calibration Operation

- Calibration Operation is performed for each instrument during Normal Operation.

(4) Contingency Operation

- Contingency Operation is performed in the case S/C needs contingency actions during Initial Check-out Operation, Normal Operation and Calibration Operation.
- Functional Test and TIR Getter Operation are included in this operation.

1.3 Resources / Constraints

Activity Level Constraints

Type: (Hard/ Soft)	**Activity Level Constraints:**
Hard	The SWIR mirror shall be turned to the calibration position prior to a spacecraft delta-v maneuver in order to avoid contamination. [Note: The SWIR mirror requires 10 minutes to reach the safe position.] ASTER_TO_CONTAMINATION_SAFEMODE activity must occur prior to the spacecraft activity to perform propulsive maneuver(TBD 20).

1.3 Resources / Constraints

Pre-requisite State Checks

	Prerequisite State Checks
1	SWIR Cooldown Mode: Be sure that the Launch Lock is OFF before turning the Cooler Drive Control Circuit ON and making the Cooler ON. The AST_TURN_ON_S_CLR command shall be sent in realtime only if the AST_BR_S_CLR_LOCK telemetry parameter = OFF (1). The AST_ENABLE_S_CLR command shall be sent in realtime only if the AST_BR_S_CLR_LOCK telmetry parameter = OFF (1).
2	After the Launch Lock OFF Commands are transmitted in orbit (i.e., instrument activation), prohibit any transmission of the Launch Lock On Commands. Only if AST_BR_S_CLR_LOCK telemetry indicates SWIR launch lock ON, allow realtime transmission of the AST_FORCE_ON_S_LLK1 and AST_FORCE_ON_S_LLK2 commands. Only if AST_BR_T_CLR_LATCH telemetry = ON, allow realtime transmission of the AST_FORCE_ON_T_CLLR1 and AST_FORCE_ON_T_CLL2 commands.

1.3 Resources / Constraints

ASTER GDS/AOT Constraint Checking (1/4)

PLOT THESE /	Constraint:
1	Limited Life Items (On-Orbit) : VNIR: -Calibration Lamp ON/OFF: 150 times (>114 times = 5 years*365 days/16days) -Calibration Lamp Operation Time: 40 hrs (>19 hours = 114 times*10min / 60min) -Number of Pointings: 20,000 SWIR: -Calibration Lamp ON/OFF: 120 times (>114 times = 5 years * 365 days/ 16 days) -Calibration Lamp Operation Time: 30 hrs (>19 hours = 114 times * 10 min / 60 min) -Number of Pointings: 20,000 -Cooler ON/OFF: 89 times -Cooler Operation Time: 47,500 hrs (>43,800 hrs = 5 years * 365 days * 24 hrs) TIR: -Pointing: 200,000 times -Cooler ON/OFF: 100 times -Cooler Operation Time: 47,500 hrs (>43,800 hrs = 5 years * 365 days * 24 hrs) -Chopper ON/OFF: 79,900 times (>52,560 times = 14.4 rev/day * 2 times * 365 days * 5 years) -Chopper Operation Time: 41,500 hrs (>10,074 hrs = 52,560 times * 11.5 min / 60 min) -Getter Operation Time: 100 min. (> 12 min.)

1.3 Resources / Constraints

ASTER GDS/AOT Constraint Checking (3/4)

17	SWIR mirror must be faced inside prior to spacecraft maneuver in order to avoid contamination (10 minutes required)
18	SWIR: TLM/CMD Circuit is the first component to be turned on, and the last one to be turned off
19	SWIR: Power On Reset Sequence Constraints for Command Timing
20	SWIR Commands must be ≥ 2 secs apart
21	The SWIR Pointing Drive Control Circuit shall be turned on before Pointing Control Commands are sent because these serial magnitude commands are directly decoded by the Pointing Drive Control Circuit
22	SWIR Main shall be turned on before turning on the Pointing Drive Control Circuit
23	SWIR Cooldown Mode: Be sure that the Launch Lock is OFF before turning the Cooler Drive Control Circuit ON and making the Cooler ON.
24	SWIR Standby Mode: After completion of Cooldown Mode, SWIR will go into the Standby Mode without special commands. Standby Mode cannot be entered too early due to detector temperatures.
25	SWIR : Wait 10 minutes for pointing completion before transitioning from calibration position to observation position.
26	SWIR: Wait 1 minute for pointing completion when pointing change is within ±8.55°
27	SWIR Calibration Mode: Pointing Mirror shall be set at the Calibration Position
28	SWIR: Launch Lock On command shall not be sent when the cooler drive circuit power is on.
29	SWIR Launch Lock On command shall be sent before transportation and launch.
30	The SWIR Launch Lock On command shall never be transmitted after the Launch Lock Off command has been successfully executed in orbit. This is because the execution of the launch lock on command during cooler operation will seriously damage or destroy the power amplifiers of the cooler drive control circuit.
31	SWIR Cooler Driver Control Circuit (power) shall be turned on before the Cooler On (start) command is sent
32	SWIR Cooler Off (Cooler stop) command shall be sent before the Cooler Control Circuit power is turned Off.
33	SWIR Calibration Lamp Selection and Lamp On/Off Commands: Calibration Lamp A or B shall be selected before the Lamp is turned On.
34	SWIR Calibration Lamp Selection and Lamp On/Off Commands: The Lamp should be turned off before the other lamp is selected.

2. ASTER Operational Modes

2.1 Definition of ASTER Operational Modes(1/3)

Operational Modes	Definitions
ALL OFF	The mode which makes all ASTER instruments power off and is performed during storage and transportation on the ground.(Contingency Mode)
LAUNCH	The mode which is set during Instrument Activation(L+9 days) after switching EOS-AM1 power supply to internal power supply at L(Lift-Off)-5 minutes and becomes survival mode by launch locking for each radiometer. (Contingency Mode)
LAUNCH –LOCK OFF	The mode which is performed at first during Instrument Activation(L+9days) and cancels launch locks of each instrument. (Contingency Mode)
COOL-DOWN	The mode which is set after finishing launch lock and after survival mode. This mode makes SWIR and TIR coolers start and cools detector temperature to regular temperature of STANDBY 1 mode. (Contingency Mode) This mode needs 40 minutes.
STANDBY	ASTER standby mode that is set in the case long time observation operation does not be required. This mode is the mode which saves electrical consumption by making cooling capacity of SWIR cooler reduce.
PREPAPARION	The mode that is set prior to TIR observation mode or short term calibration mode and has the following operations. (1) To perform stabilization of TIR amplifier, etc. (2) To perform TIR short term calibration and TIR scan mirror pointing for nadir direction. This mode needs approximately 6 minutes.
V/S/T OBS.	The mode which performs observation in all bands of all ASTER radiometers.
VNIR OBS.	The mode which performs observation in all bands of VNIR.
TIR OBS.	The mode which performs observation in all bands of TIR.
S/T OBS.	The mode which performs observation in all bands of SWIR and TIR.
VNIR PRE-CAL.	The mode which is set prior to VNIR OPT CAL. mode and performs stabilization of lamp brightness by the reference lamp. It takes approximately 8 minutes to shift to VNIR OPT CAL. mode.
VNIR OPT CAL.	The mode which obtains calibrated data by VNIR internal reference lamp. This mode is operated at night.
VNIR ELE CAL.	The mode which obtains calibrated data by inputting electrical calibration signal to VNIR detector. This mode is operated at night.

2.1 Definition of ASTER Operational Modes(3/3)

Operational Modes	Definitions
TIR GETTER	The mode which is performed to maintain and recover vacuum level of TIR detector. This mode needs approximately 384 minutes. As this mode is performed under cooler off status, TIR COOL-DOWN MODE is to be performed after finishing this mode. Although this mode is to be performed once two years, if inferior cooling of TIR is found, it is performed as necessity required.
TIR COOL-DOWN	The mode which is set after TIR Getter Mode. It makes TIR cooler start and cools detector temperature to regular temperature. This mode needs approximately 40 minutes.
SAFE	The mode which is shifted from each mode in the case EOS-AM1 control computers or equipment become unusual situation or attitude control accuracy is lost. This mode is the same status as STANDBY 1 MODE. (Contingency Mode) However, it is excepted to shift from the following modes. (1) LAUNCH-LOCK OFF MODE : No shifting to SAFE MODE (2) COOL-DOWN MODE : Instrument status is no change (3) TIR COOL-DOWN MODE : Instrument status is no change (4) TIR GETTER MODE : Same as GETTER OFF status The following is the shifting condition for SAFE MODE. CSP finds shifting status and each susystem performs command to shift SAFE MODE. (1) In the case SAFE MODE command is received (2) In the case IM OK message is paused over 5 major cycles (5.12 seconds) Shifting time for this mode is within 30 seconds after finding shifting conditions.
SURVIVAL	The mode which is shifted from each mode in the case EOS-AM1 falls into electrical critical condition and only survival heaters of ASTER each subsystem work. However, shifting from Launch Lock Off Mode is not permitted. Shifting to this mode is performed by command from the ground.

2.2 ASTER SYSTEM Modes (2/3)

No.	ASTER SYSTEM	VNIR Mode	SWIR Mode	TIR Mode	CSP Mode	MPS Mode
16	TIR POINTING 2	STANDBY	STANDBY	POINTING	TIR DATA PROCESSING	OPERATION
17	TIR OBSERVATION	STANDBY	STANDBY	OBSERVATION	TIR DATA OUTPUT	OPERATION
18	VNIR PREPARATION	OBSERVATION	STANDBY	STANDBY	STANDBY	OPERATION
19	VNIR OBSERVATION	OBSERVATION	STANDBY	STANDBY	VNIR DATA OUTPUT	OPERATION
20	V STEREO OBSERVATION	OBSERVATION	STANDBY	STANDBY	V2 DATA OUTPUT	OPERATION
21	V CH-1 OBSERVATION	OBSERVATION	STANDBY	STANDBY	V1 DATA OUTPUT	OPERATION
22	SWIR PREPARATION	STANDBY	PREPARATION	STANDBY	STANDBY	OPERATION
23	SWIR OBSERVATION	STANDBY	OBSERVATION	STANDBY	SWIR DATA OUTPUT	OPERATION
24	V STEREO & S PREP & T PTG	OBSERVATION	PREPARATION	POINTING	V2 DATA OUT/ TIR DAT PROC	OPERATION
25	S PREP & T OBS	STANDBY	PREPARATION	OBSERVATION	TIR DATA OUTPUT	OPERATION
26	V/S PREP & T OBS	OBSERVATION	PREPARATION	OBSERVATION	TIR DATA OUTPUT	OPERATION
27	V STEREO & T OBS	OBSERVATION	STANDBY	OBSERVATION	V2/T DATA OUTPUT	OPERATION
28	TIR GETTER	STANDBY	STANDBY	GETTER	STANDBY	OPERATION
29	SAFE MODE	SAFE	SAFE	SAFE	Same as previous	OPERATION
30	CONTAMI SAFE MODE	STANDBY	STANDBY	STANDBY	STANDBY	OPERATION

3. ASTER-Related IMT

ASTER Initial Operations consist of the followings.

3．1 **Initial Activation(Launch～L+20days)**

3．2 **Initial Check Out(L+21days～L+53days)**

3．3 **Science-Oriented Check Out**

(L+54days～L+118days;Science Team)

ASTER ALL OFF

LAUNCH MODE —— EOS-AM1 LAUNCH — DAY1

(120V Power from EOS-AM1 is turned ON)
—SELECT MPS A (45 minutes after launch)
—SURVIVAL HEATER ENABLE (45 minutes after launch)
} AST_MPS_ASELSVH_PRC

LAUNCH LOCK OFF MODE — DAY9

—SWIR LAUNCH LOCK OFF1
(Verify SWIR LLOCK OFF)
} AST_SWIR_LLOCK1_OFF_PRC [5 min]

—TIR COOLER LATCH OFF1
(Verify TIR COOLER LATCH OFF)
} AST_TIR_CLL1_OFF_PRC [5 min]

—MPS ON
} AST_MPS_ON_PRC [5 min]

—TIR SCANNER LATCH OFF1
(Verify TIR SCANNER LATCH OFF)
} AST_TIR_SCAN_LLK1_OFF_PRC [10 min]

—CSP A ON
—CSP OPERATE ENABLE
—CSP HCE A ON
—CSP TM&F BUS A SELECT
—CSP SCC TIMEOUT ENABLE
} AST_CSP_A_ON_PRC [8 min]

—VNIR MAIN ON
—VNIR STANDBY
(Verify VNIR mode)
—VNIR MODE SETTING (A SELECT.VHC SET.TABLE CANCEL OFF)
(Verify VNIR is within operational temperatures)
} AST_VNIR_A_ON_PRC [5 min]

—VNIR LAUNCH LOCK A OFF
(Verify SWIR LAUNCH LOCK OFF,TIR COOLER LATCH OFF)
} AST_VNIR_LLOCK_A_OFF_PRC [10 min]

COOLDOWN MODE — DAY9

—SWIR TLM/COM POWER ON
—SWIR TEMP. CONTROL CIRCUIT ON
—SWIR HEATER3 ON
—SWIR HEATER4 ON
—SWIR HEATER5 ON
—SWIR COOLER DRIVE CIRCUIT ON
—SWIR COOLER SETTING
(Verify SWIR detector temperature)
} AST_SWIR_COOL_DOWN_PRC [5 min] (Note:COOL DOWN 40 min)

—SWIR DIGITAL CIRCUIT ON
—SWIR MODE SETTING
(A SELECT.VHC SET.TABLE CANCEL OFFANALOG CIRCUIT ON
—SWIR POINTING POWER ON
—SWIR MODE SETTING (ENCODER ON)
—(Verify SWIR POINTING ANGLE)
} AST_SWIR_OBS_SET_PRC [30 min]

—TIR STANDBY POWER ON
—TIR COOLER POWER ON
(Verify TIR detector temperature)
} AST_TIR_COOL_DOWN_PRC [5 min] (Note:COOL DOWN 40 min) — DAY11

—TIR MIRROR ROTATION
(Verify TIR mirror to calibration position)
} AST_T_MIR_ROT_PRC [10 min] — DAY12

ASTER in STANDBY MODE

Figure 3.1-1 Initial Activation Flow(Use of Realtime Commands)

Table 3.1-3 SWIR LAUNCH LOCK OFF Procedure

NO	Procedure	Command	Telemetry	REF	Note
1	To confirm LAUNCH LOCK ON		BR_S_CLR_LOCK	ON	
2	To send LANCH LOCK OFF command.(After sending command, to watch telemetry approximatelyfor 5 to 10 minutes)	FORCE_OFF_S_LLK 1	BR_S_CLR_LOCK	OFF	Result: In the case OFF, Shift to No.3 Result :In the case ON Shift TO NO.4.
3	Launch LOCK OFF proceduer is finished				
4	To send Launch Lock OFF command (After sending command to watch telemetry	FORCE_OFF_S_LLK 2	BR_S_CLR_LOCK	OFF	Result: In the case OFF Shift to NO.3.

Table 3.1-5 TIR LAUNCH LOCK OFF Procedure

NO.	Procedure	Command	Telemetry	REF	Note
1	To confirm LAUNCH LOCK ON		BR_T_LATCH_ON_OFF	ON	
2	To send SCANNER LATCH OFF A command.	FORCE_OFF_T_SCL1	BR_T_LATCH_ON_OFF	OFF	Result: In the case OFF shift to No.3 Result: in the case ON shift to No.4.
3	LAUNCH LOCK OFF procedure is finished.				
4	To send SCANNER LATCH OFF B command. (After sending command, to watch telemetry approximately for 5 to 10 minutes.)	FORCE_OFF_T_SCL2	BR_T_LATCH_ON_OFF	OFF	Result: In the case OFF shift to No3.

Table 3.1-7 VNIR Launch Lock Off Procedure(1/2)

No.	Procedure	Command	Telemetory	REF.	Note
1	To Confirm LAUNCH LOCK ON		BR_V_LOCK_ON	ON	
	To Confirm Actuator Power		BR_V_ACT_A_ON_OFF	OFF	
			BR_V_ACT_B_ON_OFF	OFF	
	To Confirm LAUNCH LOCK Temperature		TR_V_LOCK	-23~ +47℃	
2	To send LAUNCH LOCK OFF A command and monitor the following items :	FORCE_OFF_V_LLKA			
	To Confirm Actuator Power (Active monitor)		BR_V_ACT_A_ON_OFF	ON	
			BR_V_ACT_B_ON_OFF	OFF	
	To Confirm LAUNCH LOCK Temperature (Active monitor)		TR_V_LOCK	-23~ +47℃	
3	To confirm the following telemetory approximately after 5 minutes from No.2				
	To Confirm LAUNCH LOCK status		BR_V_LOCK_OFF	OFF	Result: In the case ON, shift to No.6
4	To Confirm Actuator Power		BR_V_ACT_A_ON_OFF	OFF	Result: In the case ON, shift to No.7
			BR_V_ACT_B_ON_OFF	OFF	
5	LAUNCH LOCK OFF procedure is finished				

3. 2 Initial Check Out (1/2)

Initial Check Out Activities of ASTER:

Launch+21days ～ Launch+53days

ASTER CHECKOUT SCHEDULE
DAY1-21

ASTER CHECK OUT PROCEDURE

Days: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

No.	EVENT&TEST	ACP No.	NOTE
1	EOS-AM1 EVENTS		
1.1	LAUNCH		
1.2	ORBIT AQUISITION		
1.3	SWIR CPHTS ON		
1.4	TIR CPHTS ON		
1.5	SSR PLAYBACK, HGA,TDRS		
2	ASTER CHECKOUT		
2.1	SURVIVAL POWER ON	AST-101A	
2.2	OUTGAS		
2.3	LAUNCH LOCK OFF	AST-102A	
2.4	MPS A ON	AST-102A	
2.5	CSP A ON	AST-102A	
2.6	VNIR STANDBY	AST-102A	
2.7	SWIR COOLDOWN & OBS SET	AST-103	
2.8	TIR COOLDOWN	AST-103	
2.9	TIR MIRROR TO CAL POS	AST-103	
2.10	VNIR TELESCOPE TEMP.SET	AST-103	
2.11	VNIR POINTING CHECK	AST-403A	
2.12	SWIR POINTING CHECK	AST-502	
3.0	ASTER MODE		
3.1	LAUNCH MODE		
3.2	SURVIVAL MODE		
3.3	LAUNCH LOCK OFF		
3.4	COOLDOWN		
3.5	STANDBY		
3.6	POINTING		

Initial Activation Phase ⟵ | ⟶ Initial Check Out Phase

Note) * : ASTER Check out Procedure

3. 3 Science-oriented Check Out

Initial Check Out Activities of ASTER:

Launch+54days ～ Launch+118days; Science Team

4.1 Observation Operations

ASTER Observations consist of the followings

(1) VNIR Pointing

(2) SWIR Pointing

(3) V/S/T Simultaneous Observation

(4) V/S/T Simultaneous Observation(Stereo)

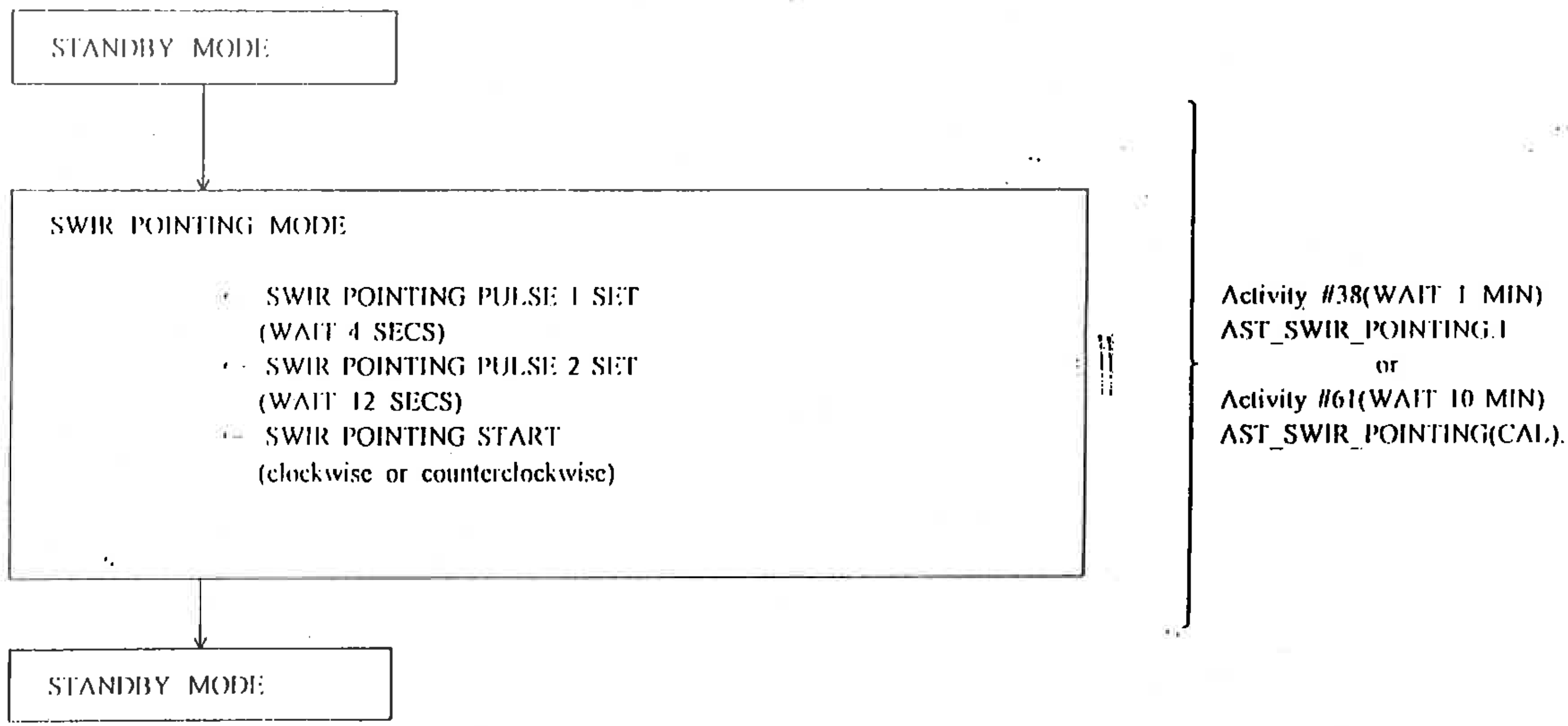
(5) VNIR Observation

(6) VNIR Stereo Observation

(7) TIR Observation

(8) S/T Simultaneous Observation

(2) SWIR Pointing



Note)It takes about 10 minutes to complete the pointing function.

Fig.4.1-2 SWIR Pointing Sequence

V/S/T OBSERVATION MODE

The following are optional command which will be generated when needed.

- TIR DATA Q/L FLAG ON
- SWIR DATA Q/L FLAG ON
- VNIR1 DATA Q/L FLAG ON
- VNIR2 DATA Q/L FLAG ON

} RTCS # 22 } Activity # 35 AST_TURN_ON_QUICK_LOCK FLAGS.1

- VNIR2 DATA Q/L FLAG OFF
- VNIR1 DATA Q/L FLAG OFF
- SWIR DATA Q/L FLAG OFF
- TIR DATA Q/L FLAG OFF

} RTCS # 23 } Activity # 36 AST_TURN_OFF_QUIK_LOCK _FLAG.1

- VNIR1 DATA TAXI A OFF
- SWIR DATA TAXI A OFF
- TIR DATA TAXI A OFF

} TCS = 7

- TIR SCAN STOP

VNIR OBSERVATION MODE
SWIR STANDBY MODE
TIR STANDBY MODE

(WAIT 60 SECS)

- CSP TIR DATA PROCESSING OFF

- TIR SCANNER POWER OFF
  (WAIT 10.240 SECS)
- TIR OPERATION POWER OFF

} RTCS = 4

- VNIR1 DATA TAXI A OFF
- VNIR2 DATA PROCESSING OFF
- VNIR1 DATA PROCESSING OFF
- VNIR STANDBY MODE SET

} RTCS = 13

STANDBY MODE

Fig.4.1-3 V/S/T Simultaneous Observation Sequence (2/2)

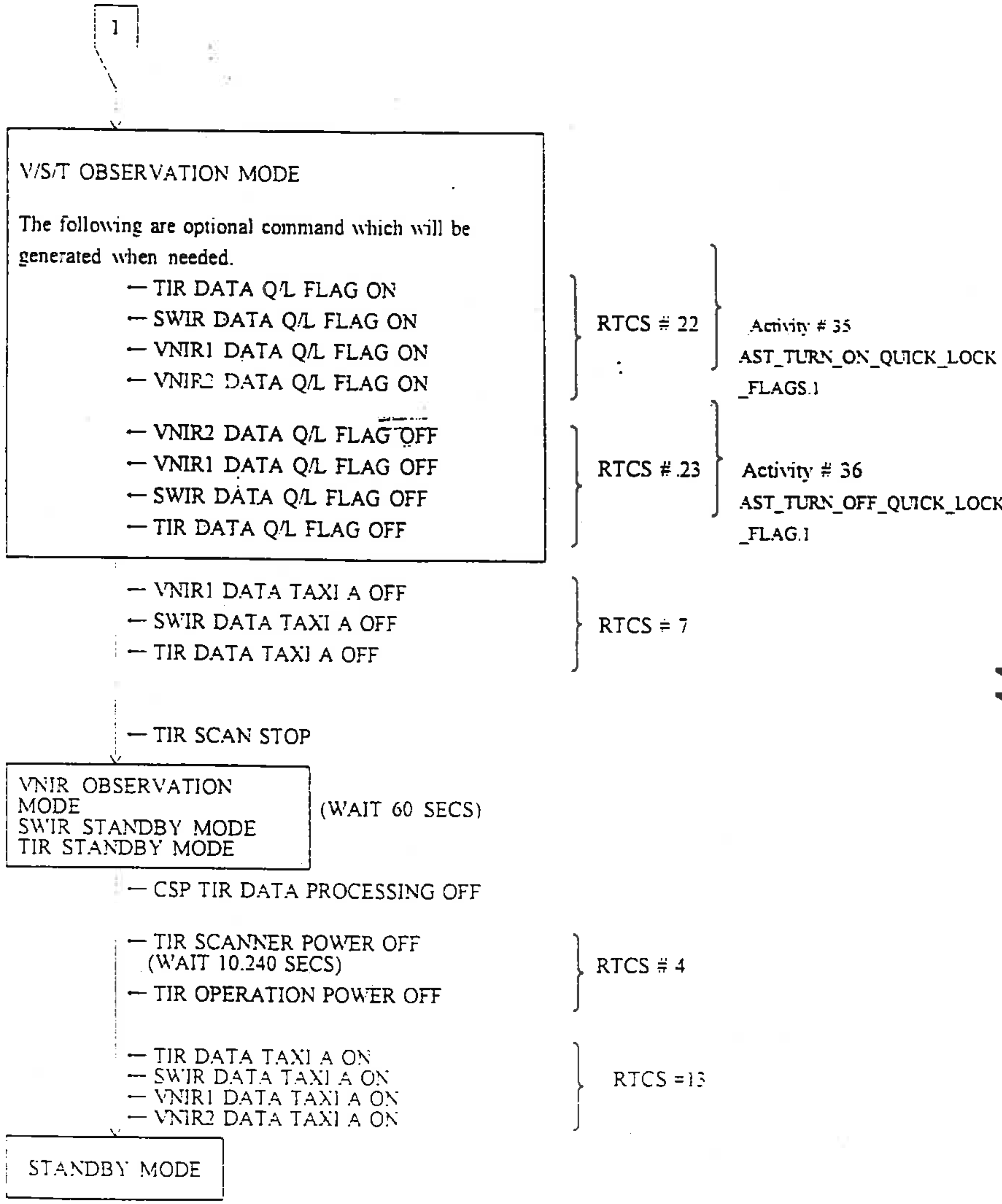


Fig.4.1-4 V/S/T Simultaneous Observation(Stereo) Sequence(2/2)

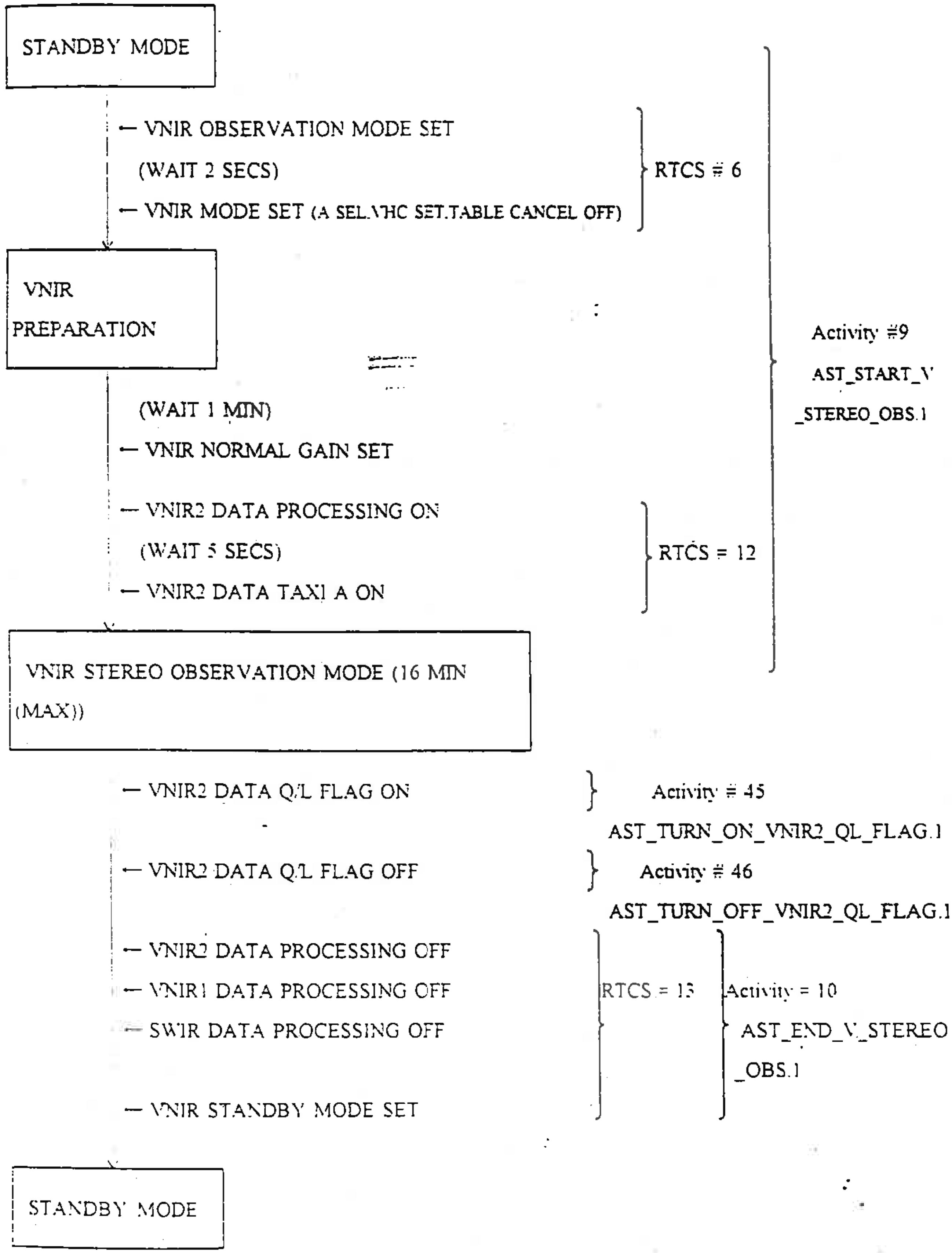


Fig.4.1-6 VNIR Stereo Observation Sequence

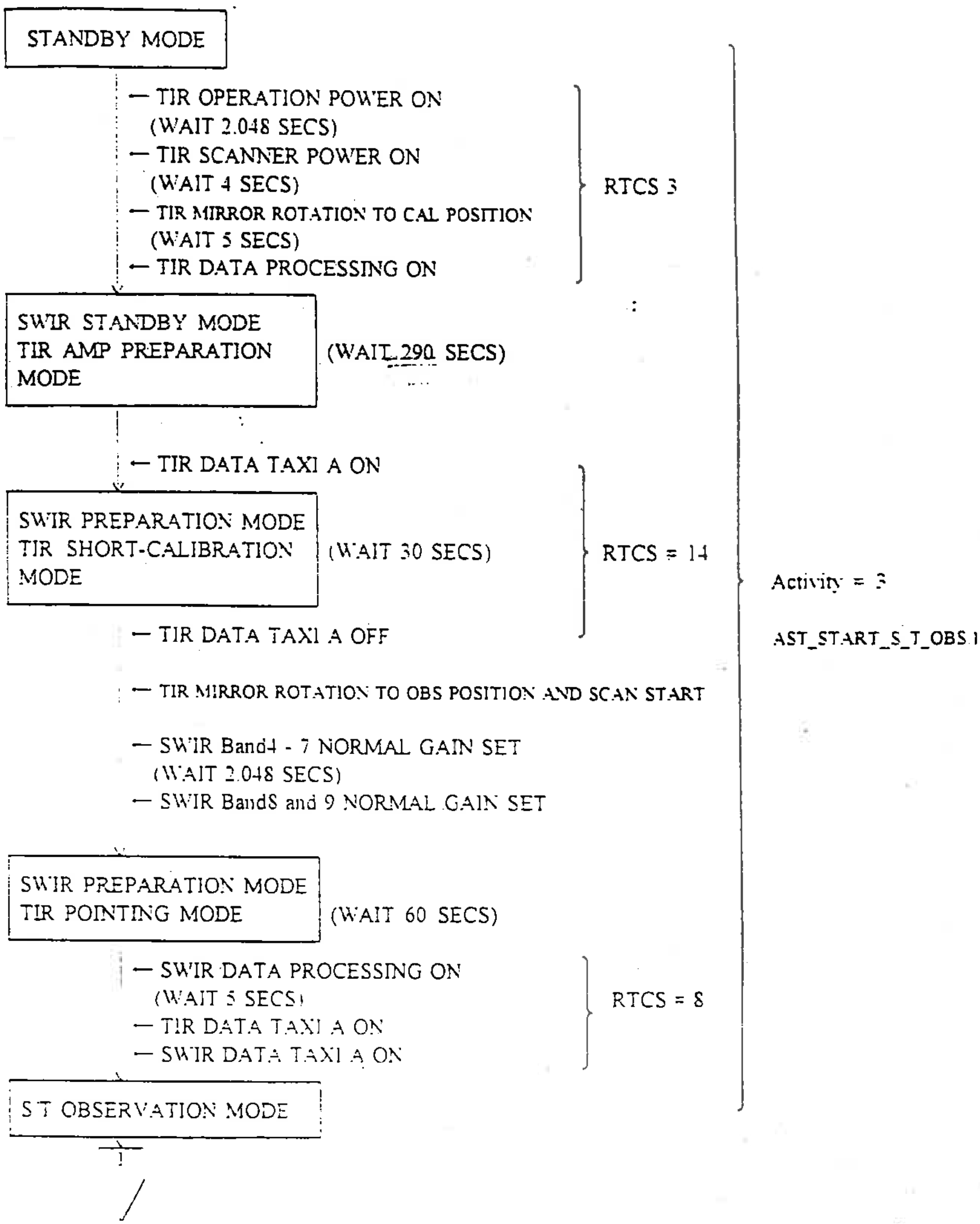


Fig.4.1-8 S T Simultaneous Observation Sequence (1/2)

4.2 Calibration Operations

ASTER Calibration Operations consist of the followings.

(1) VNIR Calibration

- **a. Optical Calibration Mode (Use of Halogen Lamp)**
- **b. Electrical Calibration Mode (Use of Electrical Cal . Signal)**
- **c. Dark Calibration Mode (Use of Dark Area on Earth (Night)**

(2) SWIR Calibration

- **a. Optical Calibration Mode (Use of Halogen Lamp)**
- **b. ~~Electrical~~ DARK Calibration Mode (Use of Electrical Cal . Signal)**

(3) TIR Calibration

- **a. Short -Term Calibration Mode (Use of 270K Blackbody)**
- **b. Long- Term Calibration Mode**
  - **— Optical Calibration Mode (Use of 270K～340K Blackbody,4times)**
  - **— Electrical Calibration Mode (3 times between Opt . Cal)**

Remarks) ASTER Calibration Activity will be taken place every 17 days.

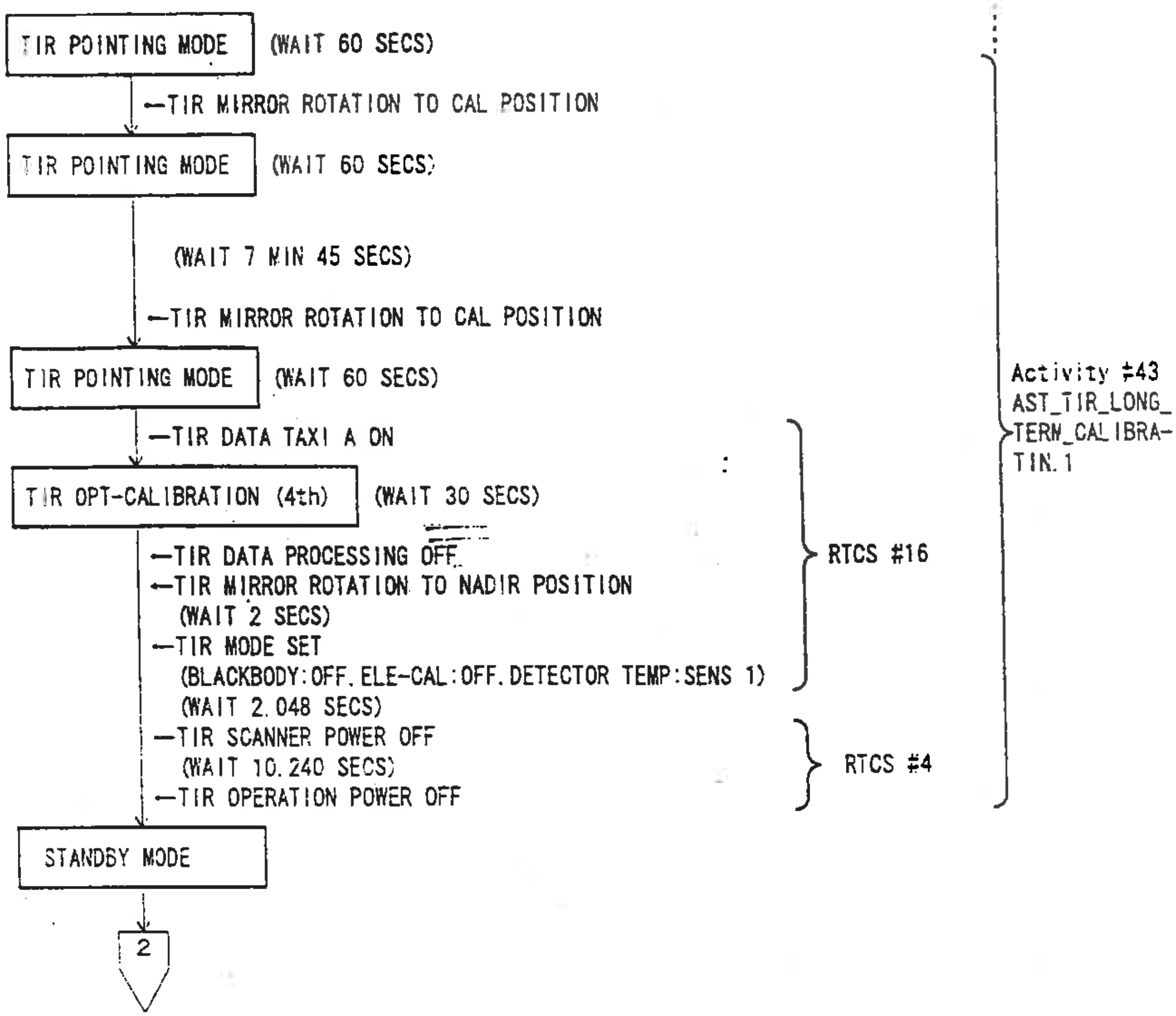


Fig. 4.2-1 ASTER Calibration Sequence (2 /7)

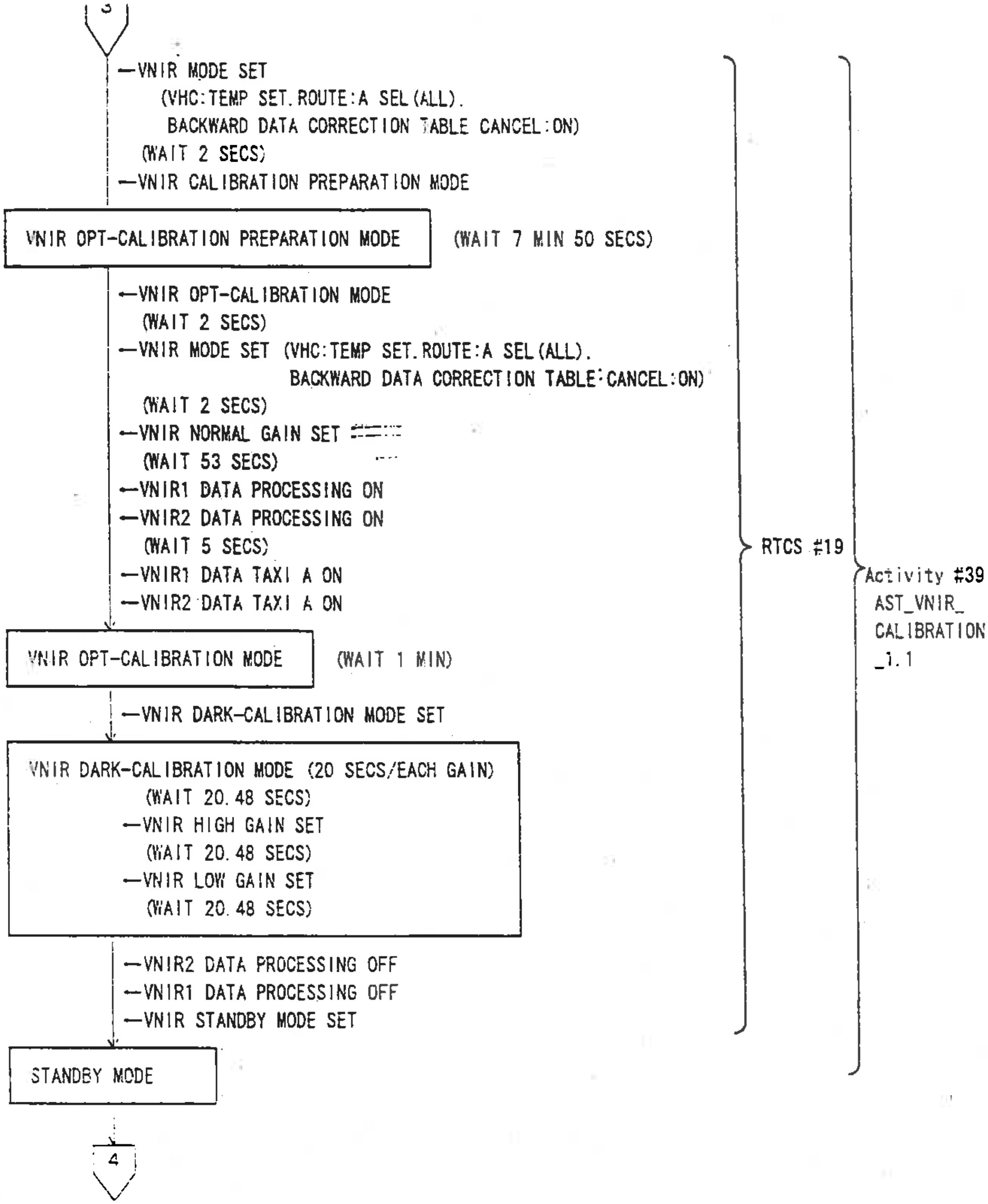


Fig. 4.2-1 ASTER Calibration Sequence (4 /7)

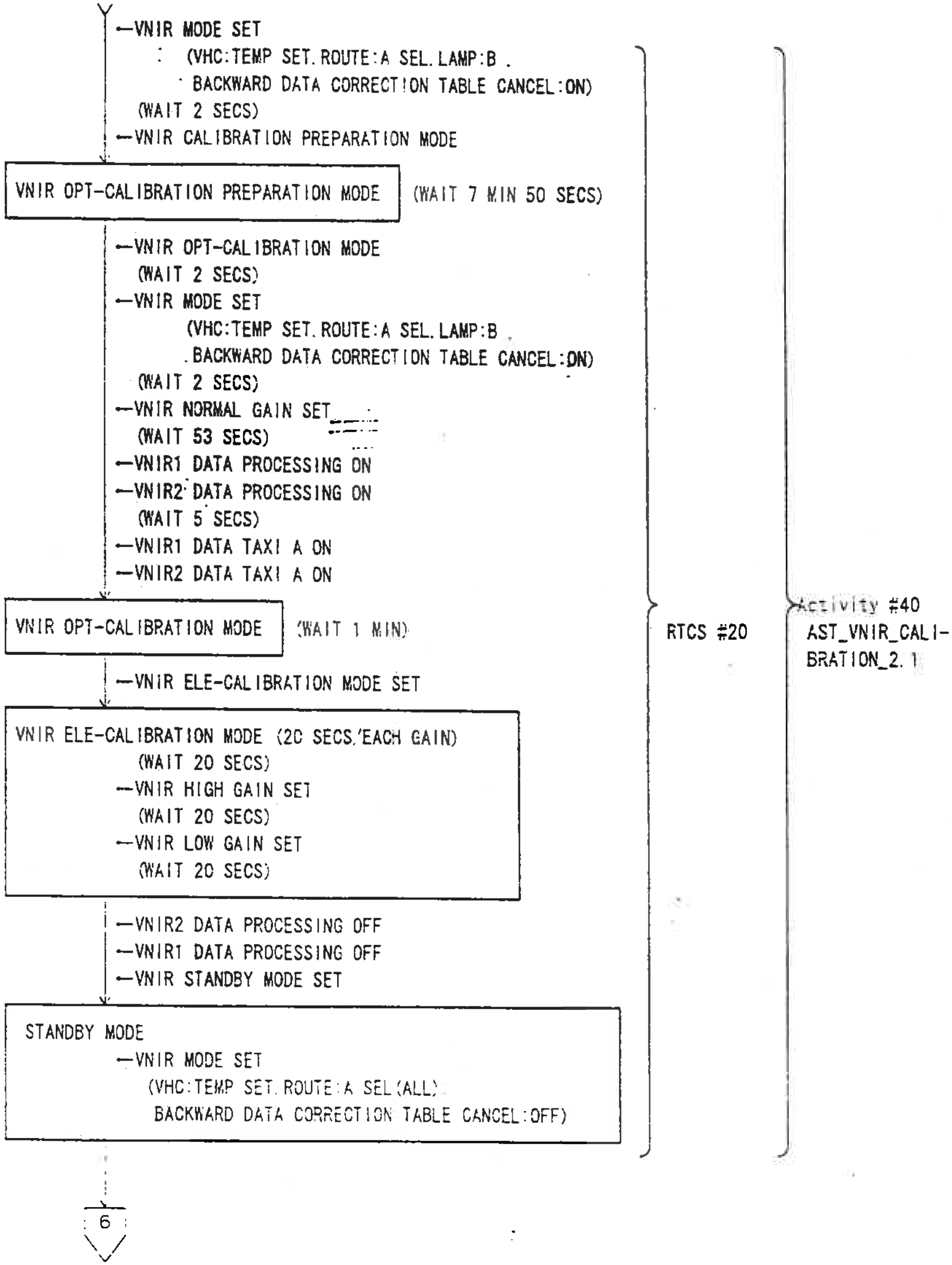


Fig. 4.2-1 ASTER Calibration Sequence (6 /7)

4.3 TIR Getter Operations

TIR Getter Operations will be conducted once/2 years in principle in oder to recover the vacuum quality of the TIR detector assembly

In the case of Contingency, TIR shall go to "Getter Off Mode".

5. Contingency/Emergency Operations

5. 1 ASTER TMONs and Inhibit IDs

5. 2 Emergency Procedures

5. 1 ASTER TMONs

There are five TMONs and four Inhibit IDs approved for the ASTER instrument.

(1) ASTER TMONs

a.TMON41
b.TMON42
c.TMON43
d.TMON44
e.TMON45

(2) ASTER Inhibit Identifiers

a.Inhibit ID#1
b.Inhibit ID#2
c.Inhibit ID#3
d.Inhibit ID#4

d. TMON44 —TIR Baseplate Temperature Monitor TMON

This TMON monitors TIR baseplate temperature telemetry and respond to an under-temperature condition by commanding ~~all of ASTER~~ TIR to Survival Mode.

d. TMON45 —SWIR Calibration On-time Monitor TMON

This TMON monitors the duration that the SWIR Calibration Lamps are powered on and responds to on-times greater than those prescribed by commanding SWIR Calibration Lamps off.

Table 5-2 VNIR Cal Lamp On Time Monitor TMON

VNIR Cal Lamp On Time Monitor TMON Group Options												
				Group Output Controls					Action when OOL1 reaches OOL–Max		Action when OOL2 reach OOL–Max	
TMON Group #	TMON Group Inhibit ID	Execute Freq	Major Cycle offset	Stop After Trigger Ena/Dis	Inhibit bit Setting Ena/Dis	Cmd Output Ena/Dis	Log Reporting Ena/Dis	Max OOL	Inhibit_ ID_Stat bit to be set	Cmd or RTCS to be Sent	Inhibit_ ID_Stat bit to be set	Cmd or RTCS to be Sent
42	2	65.536	0	ENA	ENA	ENA	ENA	12	1	OOL1 Command	0	FS1_NOOP

OOL1 COMMAND =
AST_SET_V_MODE1 to STANDBY

Telemetry Mnemonic	# Bits	Type	BDU (ERT)	Major Cycle	Frequency	Cal Curve
AST_BR_C_A_ON_OFF	1	Passive Bilevel	ASTER BDU		8.192	0=ON/1=OI
AST_BR_C_B_ON_OFF	1	Passive Bilevel	ASTER BDU		8.192	0=ON/1=OI
AST_BR_V_MAIN2	1	Serial	ASTER ERT	0	1.024	0=OFF/1=O
AST_BR_V_PS4	1	Serial	ASTER ERT	0	1.024	0=OFF/1=O

Table 5-4 TIR Baseplate Temperature Monitor TMON

TIR Baseplate Temperature Monitor TMON Group Options												
				Group Output Controls					Action when OOL1 reaches OOL-Max		Action when OOL2 reaches OOL-Max	
TMON Group #	TMON Group Inhibit ID	Execute Freq	Major Cycle offset	Stop After Trigger Ena/Dis	Inhibit bit Setting Ena/Dis	Cmd Output Ena/Dis	Log Report-ing Ena/Dis	Max OOL	Inhibit_ID_Stat bit to be set	Cmd or RTCS to be Sent	Inhibit_ID_Stat bit to be set	Cmd or RTCS to be Sent
44	6	8.192	0	ENA	ENA	ENA	ENA	3	1	RTCS# 1	0	FS1_NOOP

RTCS# 1 => TIR OFF (Any Mode To TIR Survival Mode)
See attachment Page 11

Telemetry Mnemonic	# Bits	Type	BDU (ERT)	Major Cycle	Frequency	Cal Curve #
AST_BR_C_A_ON_OFF	1	Passive Bilevel	ASTER BDU	–	8.192	0=ON/1=OFF
AST_BR_C_B_ON_OFF	1	Passive Bilevel	ASTER BDU	–	8.192	0=ON/1=OFF
AST_BR_T_STBY_PS	1	Serial	ASTER ERT	0	1.024	0=OFF/1=ON
AST_TR_T_BASEPLATE	8 (UI)	Passive Analog	ASTER BDU	–	8.192	79-81

VNIR Cal Lamp Temperature Monitor TMON Test Description					
Subgroup	Tlm Mnemonic	Operator / Engineering Value	Operator / Raw Count	False Path Action	True Path Actic
CSP POWER ON TEST (A ON .OR. B ON)					
0	AST_BR_C_A_ON_OFF	= ON	= 0	PNT	JSG
0	AST_BR_C_B_ON_OFF	= ON	= 0	INL	JSG
VNIR ON TEST (MAIN 2 ON)					
1	AST_BR_V_MAIN2	= ON	= 1	INL	PNT
TEMPERATURE CHECK VSP1 (YELLOW HIGH LIMIT = OOL)					
1	AST_TR_V_VSP1	> 35 °C	< 19	PNT	OOL1
LAMP ON TEST (POWER SUPPLY 4 ON)					
1	AST_BR_V_PS4	= ON	= 1	INL	PNT
LAMP SIDE SELECT CHECK (IF B GO TO SUBGROUP 2)					
1	AST_BR_V_LAMP_AB	= A	= 1	JSG	PNT
LAMP SIDE A TEMPERATURE CHECK (YELLOW HIGH LIMIT = OOL)					
1	AST_TR_V_LAMP_A	> 61 °C	< 16	INL	OOL1
LAMP SIDE B TEMPERATURE CHECKS (YELLOW HIGH LIMIT = OOL)					
2	AST_TR_V_LAMP_B	> 61 °C	< 16	INL	OOL1

Fig 5-1 VNIR Cal Lamp Temperature Monitor TMON

TIR Detector Temperature Monitor TMON Test Description					
Subgroup	Tlm Mnemonic	Operator / Engineering Value	Operator / Raw Count	False Path Action	True Path Ac
CSP POWER ON TEST (A ON .OR. B ON)					
0	AST_BR_C_A_ON_OFF	= ON	= 0	PNT	JSG
0	AST_BR_C_B_ON_OFF	= ON	= 0	INL	JSG
TIR ON TEST (STANDBY POWER SUPPLY ON)					
1	AST_BR_T_STBY_PS	= ON	= 1	INL	PNT
TIR DETECTOR ON TEST (OPERATIONAL POWER SUPPLY ON)					
1	AST_BR_T_OPR_PS	= ON	= 1	INL	PNT
TEST DETECTOR OVER TEMPERATURE (RED HIGH TEST)					
1	AST_TR_T_DETECTOR	> 100 °K	< 226	INL	OOL1

Fig 5-3 TIR Detector Temperature Monitor TMON

SWIR Cal Lamp ON TIME Monitor TMON Test Description					
Subgroup	Tlm Mnemonic	Operator / Engineering Value	Operator / Raw Count	False Path Action	True Path Actic
CSP POWER ON TEST (A ON .OR. B ON)					
0	AST_BR_C_A_ON_OFF	= ON	= 0	PNT	JSG
0	AST_BR_C_B_ON_OFF	= ON	= 0	INL	JSG
SWIR ON TEST (MAIN POWER SUPPLY ON)					
1	AST_BR_S_MAIN_ON_OFF	= ON	= 0	INL	PNT
SWIR LAMP ON TEST (LAMP POWER SUPPLY ON)					
1	AST_BR_S_CAL_LAMP_PS	= ON	= 1	INL	OOL1

Fig 5-5 SWIR On Time Monitor TMON

INHIBIT ID#001:

AST_SET_T_MODE1
AST_SET_S_MODE1
AST_SET_S_MODE2
AST_SET_S_MODE3
AST_SET_V_MODE1
AST_SET_V_MODE3
AST_TURN_ON_S_DTL
AST_TURN_ON_S_PTG
AST_MOVE_T_MIRROR_TO_CAL_POSITION
AST_TURN_ON_C_VDP1
AST_TURN_ON_C_VDP2
AST_TURN_ON_C_SDP
AST_TURN_ON_C_TDP
AST_TURN_ON_C_V1_A
AST_TURN_ON_C_V2_A
AST_TURN_ON_C_S_A
AST_TURN_ON_C_T_A

INHIBIT ID#003:

RTCS #22 V/S/T Quick look Flags ON
RTCS #23 V/S/T Quick look Flags OFF
RTCS #25 VNIR Quick look Flags ON
RTCS #26 VNIR Quick look Flags OFF
RTCS #27 VNIR Launch Lock A Off
RTCS #28 VNIR Launch Lock B Off

INHIBIT ID#004:

RTCS #24 Survival Mode Entry

Table 5.2 Red/Yellow Limits Responses(1/6)

ID	Mnemonic	RedLow	YelLow	YelHi	RedHi	RL resp	RH resp
3747	AST BR V ENCODER LED	-1.0	0.0	2.0	2.0	N/A	N/A
3752	AST BR V MOTOR CONT	-1.0	-1.0	2.0	2.0	N/A	N/A
3757	AST BR V PTG M LIMIT	-1.0	-1.0	1.0	1.0	N/A	ast vnir off
3758	AST BR V PTG P LIMIT	-1.0	-1.0	1.0	1.0	N/A	ast vnir off
3759	AST BR V STEP PULSE	-1.0	-1.0	1.0	2.0	N/A	N/A
2202	AST IR C INPUT	-3.5	-3.5	2.0	3.0	N/A	ast all off
2199	AST IR M CLR OUT	-1.0	-1.0	1.3	1.4	N/A	ast all off
2189	AST IR M MPSA INPUT	-1.0	-1.0	4.95	5.06	N/A	ast all off
2193	AST IR M MPSA OUT	-1.0	-1.0	16.5	16.87	N/A	ast all off
2190	AST IR M MPSB INPUT	-1.0	-1.0	4.95	5.06	N/A	ast all off
2194	AST IR M MPSB OUT	-1.0	-1.0	16.5	16.87	N/A	ast all off
3764	AST IR S CLR1	-1.0	-1.0	0.8	1.0	N/A	ast swir off
3765	AST IR S CLR2	-1.0	-1.0	0.8	1.0	N/A	ast swir off
3766	AST IR S CLR3	-1.0	-1.0	0.8	1.0	N/A	ast swir off
3767	AST IR S CLR4	-1.0	-1.0	0.8	1.0	N/A	ast swir off
3768	AST IR T CLR DRIVE	-1.0	-1.0	0.8	4.0	N/A	N/A
3769	AST IR T SCAN MOTOR1	-1.0	-1.0	0.92	1.0	N/A	ast tir off
3770	AST IR T SCAN MOTOR2	-1.0	-1.0	0.3	0.4	N/A	ast tir off
3841	AST SR S ERROR CMD	-1.0	-1.0	1.0	256	N/A	N/A
3847	AST SR T P ANGLE	-8.8	-8.64	19.9	20.0	ast tir off	ast tir off
3853	AST SR V PTG ANGLE	-999.99	-24.05	24.05	999.99	N/A	N/A
2252	AST TR C HCE	-15.0	-10.0	40.0	50.0	ast all off	ast all off
2249	AST TR C PSU A	-15.0	-10.0	40.0	50.0	ast all off	ast all off
2250	AST TR C PSU B	-15.0	-10.0	40.0	50.0	ast all off	ast all off
2251	AST TR C REF POINT	-15.0	-10.0	40.0	50.0	ast all off	ast all off
2231	AST TR M MPSA	-28.0	-25.0	50.0	55.0	ast all off	ast all off
2232	AST TR M MPSB	-28.0	-25.0	50.0	55.0	ast all off	ast all off
2257	AST TR M MPSC	-28.0	-25.0	50.0	55.0	ast all off	ast all off
3854	AST TR S AMP DEWAR A	-20.0	-10.0	35.0	40.0	ast swir off	ast swir off
3855	AST TR S AMP DEWAR B	-20.0	-10.0	45.0	55.0	ast swir off	ast swir off
3856	AST TR S CAL	-20.0	-10.0	45.0	55.0	ast swir off	ast swir off
3872	AST TR S CAL LAMP	-20.0	-10.0	35.0	40.0	ast swir off	ast swir off
3858	AST TR S COLLECTOR1	8.0	13.0	28.0	33.0	ast swir off	ast swir off
3860	AST TR S COLLECTOR2	8.0	13.0	28.0	33.0	ast swir off	ast swir off

Table 5.2 Red/Yellow Limits Responses(3/6)

ID	Mnemonic	RedLow	YelLow	YelHi	RedHi	RL resp	RH resp
3888	AST_TR_T_AMP5	2.0	10.0	38.0	43.0	ast_tir_off	ast_tir_off
3889	AST_TR_T_AMP6	2.0	10.0	38.0	43.0	ast_tir_off	ast_tir_off
2247	AST_TR_T_BASEPLATE	-28.0	-20.0	50.0	58.0	ast_tir_off	ast_tir_off
6620	AST_TR_T_BBCONT	2.0	10.0	50.0	58.0	ast_tir_off	ast_tir_off
2243	AST_TR_T_BLACKBODY	-20.0	-18.0	78.0	80.0	ast_tir_off	ast_tir_off
3890	AST_TR_T_CHOPPER	2.0	10.0	35.0	48.0	ast_tir_off	ast_tir_off
3891	AST_TR_T_CLR_CONT	-34.0	8.0	40.0	42.0	N/A	ast_tir_off
2248	AST_TR_T_CLR_CONTROL	-28.0	-20.0	40.0	48.0	ast_tir_off	ast_tir_off
3892	AST_TR_T_CLR_OUT1	-34.0	8.0	40.0	42.0	N/A	ast_tir_off
3893	AST_TR_T_CLR_OUT2	-34.0	8.0	40.0	42.0	N/A	ast_tir_off
3894	AST_TR_T_CLR_OUT3	-34.0	8.0	40.0	42.0	N/A	ast_tir_off
3895	AST_TR_T_DETECTOR	60.0	75.0	85.0	100.0	N/A	ast_tir_off
3896	AST_TR_T_LENS_HOLDER	2.0	16.0	21.0	33.0	ast_tir_off	ast_tir_off
3897	AST_TR_T_OPR_PS	2.0	10.0	50.0	58.0	ast_tir_off	ast_tir_off
3898	AST_TR_T_PROCESSOR1	2.0	10.0	50.0	58.0	ast_tir_off	ast_tir_off
3899	AST_TR_T_PROCESSOR2	2.0	10.0	50.0	58.0	ast_tir_off	ast_tir_off
2246	AST_TR_T_RADIATOR	-50.0	-50.0	50.0	58.0	N/A	ast_tir_off
3900	AST_TR_T_RADIATOR1	0.0	0.0	273.0	283.0	N/A	ast_tir_off
3901	AST_TR_T_RADIATOR2	0.0	0.0	273.0	283.0	N/A	ast_tir_off
3902	AST_TR_T_SCAN_CONT1	2.0	10.0	40.0	58.0	ast_tir_off	ast_tir_off
3903	AST_TR_T_SCAN_CONT2	2.0	10.0	40.0	58.0	ast_tir_off	ast_tir_off
3904	AST_TR_T_SCAN_MIRROR	-18.0	-10.0	25.0	38.0	ast_tir_off	ast_tir_off
2245	AST_TR_T_SCAN_MOTOR	-28.0	-20.0	50.0	63.0	ast_tir_off	ast_tir_off
3905	AST_TR_T_SCAN_MTR	-18.0	-10.0	40.0	48.0	ast_tir_off	ast_tir_off
3906	AST_TR_T_STBY_PS	2.0	10.0	50.0	58.0	ast_tir_off	ast_tir_off
3907	AST_TR_T_T_SCOPE	2.0	12.0	22.0	33.0	ast_tir_off	ast_tir_off
2244	AST_TR_T_TELESCOP	-20.0	-18.0	50.0	58.0	ast_tir_off	ast_tir_off
2234	AST_TR_V_BACKWARD	-8.0	-3.0	37.0	42.0	ast_vnir_off	ast_vnir_off
3908	AST_TR_V_BAND1	12.0	17.0	28.0	33.0	ast_vnir_off	ast_vnir_off
3909	AST_TR_V_BAND2	12.0	17.0	28.0	33.0	ast_vnir_off	ast_vnir_off
3910	AST_TR_V_BAND3B	12.0	17.0	30.0	35.0	ast_vnir_off	ast_vnir_off
3911	AST_TR_V_BAND3N	12.0	17.0	28.0	33.0	ast_vnir_off	ast_vnir_off
2237	AST_TR_V_ELECTRO	-20.0	-17.0	39.0	44.0	ast_vnir_off	ast_vnir_off
3912	AST_TR_V_ENCODER	-12.0	-7.0	37.0	42.0	ast_vnir_off	ast_vnir_off

Table 5.2 Red/Yellow Limits Responses(5/6)

ID	Mnemonic	RedLow	YelLow	YelHi	RedHi	RL resp	RH resp
3936	AST VR S AD BAND4	-1.0	4.0	5.0	10.0	N/A	N/A
3937	AST VR S AD BAND5	-1.0	4.0	5.0	10.0	N/A	N/A
3938	AST VR S AD BAND6	-1.0	4.0	5.0	10.0	N/A	N/A
3939	AST VR S AD BAND7	-1.0	4.0	5.0	10.0	N/A	N/A
3940	AST VR S AD BAND8	-1.0	4.0	5.0	10.0	N/A	N/A
3941	AST VR S AD BAND9	-1.0	4.0	5.0	10.0	N/A	N/A
3942	AST VR S CAL LAMP A	0.0	0.0	9.66	10.0	N/A	ast_swir_off
3943	AST VR S CAL LAMP B	0.0	0.0	9.66	10.0	N/A	ast_swir_off
3944	AST VR S MOTOR AMPL	-1.0	-1.0	3.8	4.0	N/A	ast_swir_off
3945	AST VR S OPT MON A	-1.0	-1.0	5.0	10.0	N/A	N/A
3946	AST VR S OPT MON B	-1.0	-1.0	5.0	10.0	N/A	N/A
3947	AST VR S TLM CMD1	0.0	0.93	1.11	5.1	ast_swir_off	ast_swir_off
3948	AST VR S TLM CMD2	0.0	1.95	2.13	5.1	ast_swir_off	ast_swir_off
3949	AST VR S TLM CMD3	0.0	3.99	4.17	5.1	ast_swir_off	ast_swir_off
6621	AST VR T CHOPPER	4.0	4.6	5.4	5.6	ast_tir_off	ast_tir_off
3950	AST VR T OPR PS1	4.4	4.6	5.4	5.6	ast_tir_off	ast_tir_off
3951	AST VR T OPR PS2	9.0	9.2	10.8	11.0	ast_tir_off	ast_tir_off
3952	AST VR T OPR PS3	-11.0	-10.8	-9.2	-9.0	ast_tir_off	ast_tir_off
3953	AST VR T OPR PS4	10.8	11.0	13.0	13.2	ast_tir_off	ast_tir_off
3954	AST VR T OPR PS5	-13.2	-13.0	-11.0	-10.8	ast_tir_off	ast_tir_off
3955	AST VR T STBY PS1	4.4	4.6	5.4	6.5	ast_tir_off	N/A
3956	AST VR T STBY PS2	9.0	9.2	10.8	11.0	ast_tir_off	ast_tir_off
3957	AST VR T STBY PS3	-11.0	-10.8	-9.2	-9.0	ast_tir_off	ast_tir_off
3958	AST VR V BAND1 REF	0.0	3.9	4.1	5.1	ast_vnir_off	ast_vnir_off
3959	AST VR V BAND2 REF	0.0	3.9	4.1	5.1	ast_vnir_off	ast_vnir_off
3960	AST VR V BAND3B REF	0.0	3.9	4.1	5.1	ast_vnir_off	ast_vnir_off
3961	AST VR V BAND3N REF	0.0	3.9	4.1	5.1	ast_vnir_off	ast_vnir_off
3962	AST VR V ECAL1	0.0	2.7	3.4	5.1	ast_vnir_off	ast_vnir_off
3963	AST VR V ECAL2	0.0	2.7	3.4	5.1	ast_vnir_off	ast_vnir_off
3964	AST VR V ECAL3	0.0	2.7	3.4	5.1	ast_vnir_off	ast_vnir_off
3965	AST VR V ECAL4	0.0	2.7	3.4	5.1	ast_vnir_off	ast_vnir_off
3966	AST VR V PHOTO1A	0.0	1.0	5.0	5.1	ast_vnir_off	ast_vnir_off
3967	AST VR V PHOTO1B	0.0	1.0	5.0	5.1	ast_vnir_off	ast_vnir_off
3968	AST VR V PHOTO2A	0.0	1.0	5.0	5.1	ast_vnir_off	ast_vnir_off

ote)

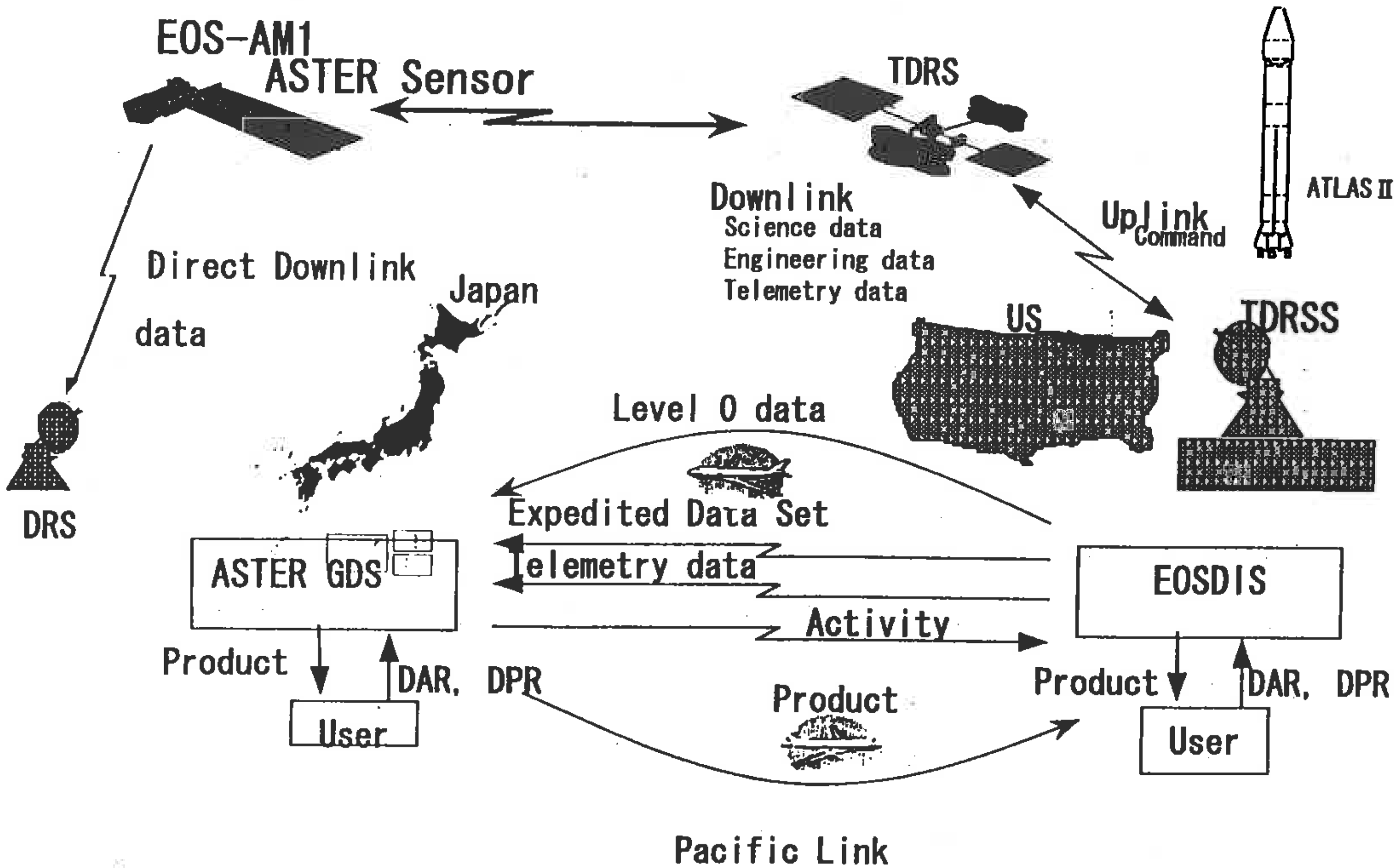
ID	Mnemonic	RedLow	YelLow	YelHi	RedHi	Comments
3863	AST_TR_S_DETECTOR_N	75.0	75.0	85.0	100.0	K. Larson is developing proc to enable limits after Cooldown is complete
3864	AST_TR_S_DETECTOR_W	75.0	75.0	85.0	100.0	K. Larson is developing proc to enable limits after Cooldown is complete
2247	AST_TR_T_BASEPLATE	-28.0	-20.0	50.0	58.0	Limits will be changed to 12,15,35,38 by procedure 6 hours after TIR cooldown is complete
2248	AST_TR_T_CLR_CONTROL	-28.0	-20.0	40.0	48.0	Limits to be changed to 2, 10, 40, 42 by procedure 6 hours after TIR cooldown is complete
2245	AST_TR_T_SCAN_MOTOR	-28.0	-20.0	50.0	63.0	Limits to be changed to -18, -10, 40, 48 by procedure 6 hours after TIR cooldown is complete
2244	AST_TR_T_TELESCOP	-20.0	-18.0	50.0	58.0	Limits will be changed to 2, 10, 25, 33 by procedure 6 hours after TIR cooldown is complete
2237	AST_TR_V_ELECTRO	-20.0	-17.0	39.0	44.0	Limits to be changed to -10, -8, 32, 36 by procedure 6 hours after VNIR is first commanded to Standby n
2233	AST_TR_V_NADIR	-7.0	-2.0	38.0	43.0	Limits will be changed to 15, 18, 24, 27 by procedure 6 hours after VNIR is first commanded to Standby r
2235	AST_TR_V_PREAMP1	-30.0	-26.0	46.0	51.0	Limits will be changed to -11, -7, 40, 45 by procedure 6 hours after VNIR is first commanded to Standby
2238	AST_TR_V_VHC_TEMP	-16.0	-13.0	43.0	48.0	Limits will be changed to -7, -5, 36, 40 by procedure 6 hours after VNIR is first commanded to Standby M

ASTER Ground Data System Flight Operation Training

Hiroshi Watanabe
Akira Miura

July 13.1999

ASTER Data Acquisition and Distribution Scenario



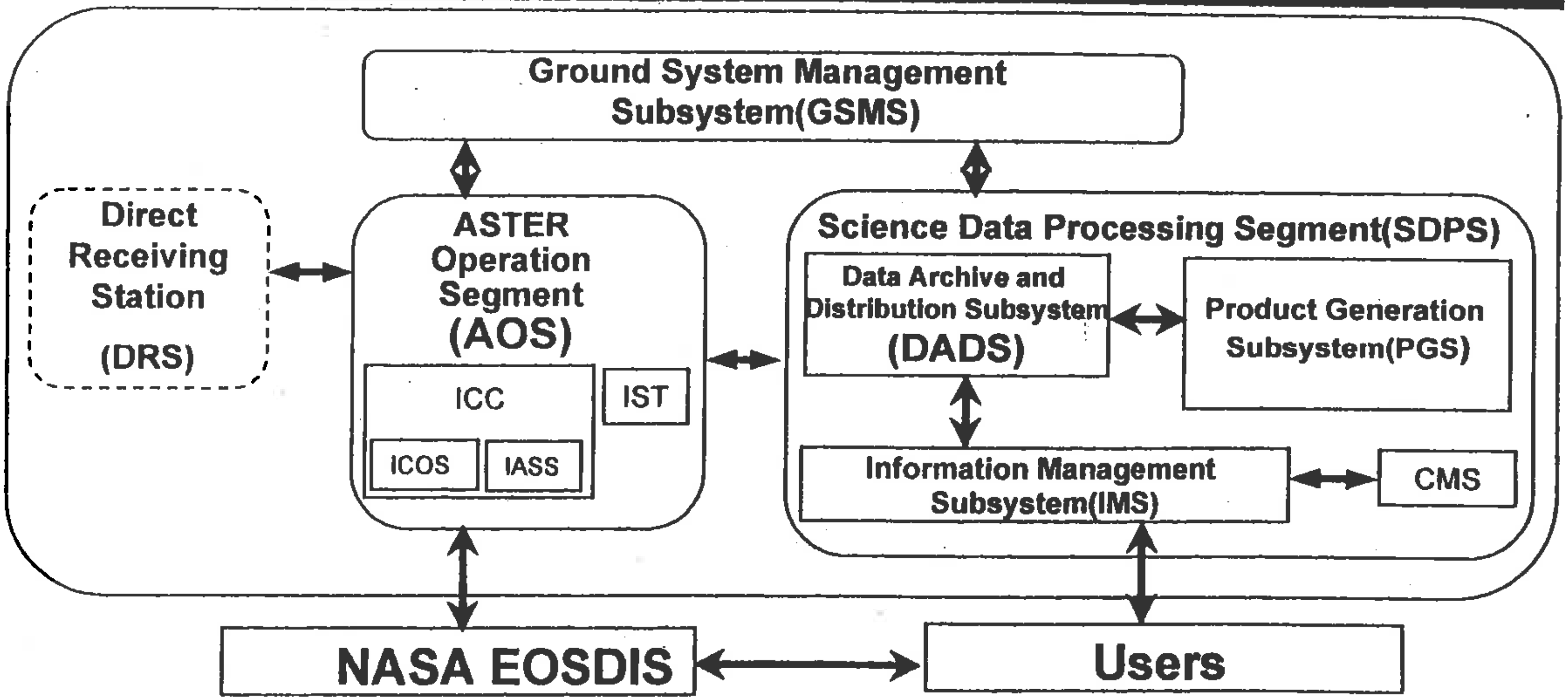
ASTER Data Acquisition and L0/L1 Processing Scenario

ASTER

(1) Capture Users data acquisition request(DAR,STAR,ETR)
(2) Build ODS (ASTER GDS)
(3) Generate ASTER Commands & Uplink to ASTER
(4) Observation
(5) Generate L0 data & transfer to ASTER GDS
  A) PDS - Media(D3 tape)
  B) EDS - Communication Network
(6) Generate L1 Data & transfer to EDC

ASTER GDS System Configuration

ASTER



ICC: Instrument Control Center

ICOS: Instrument Control Operations Subsystem

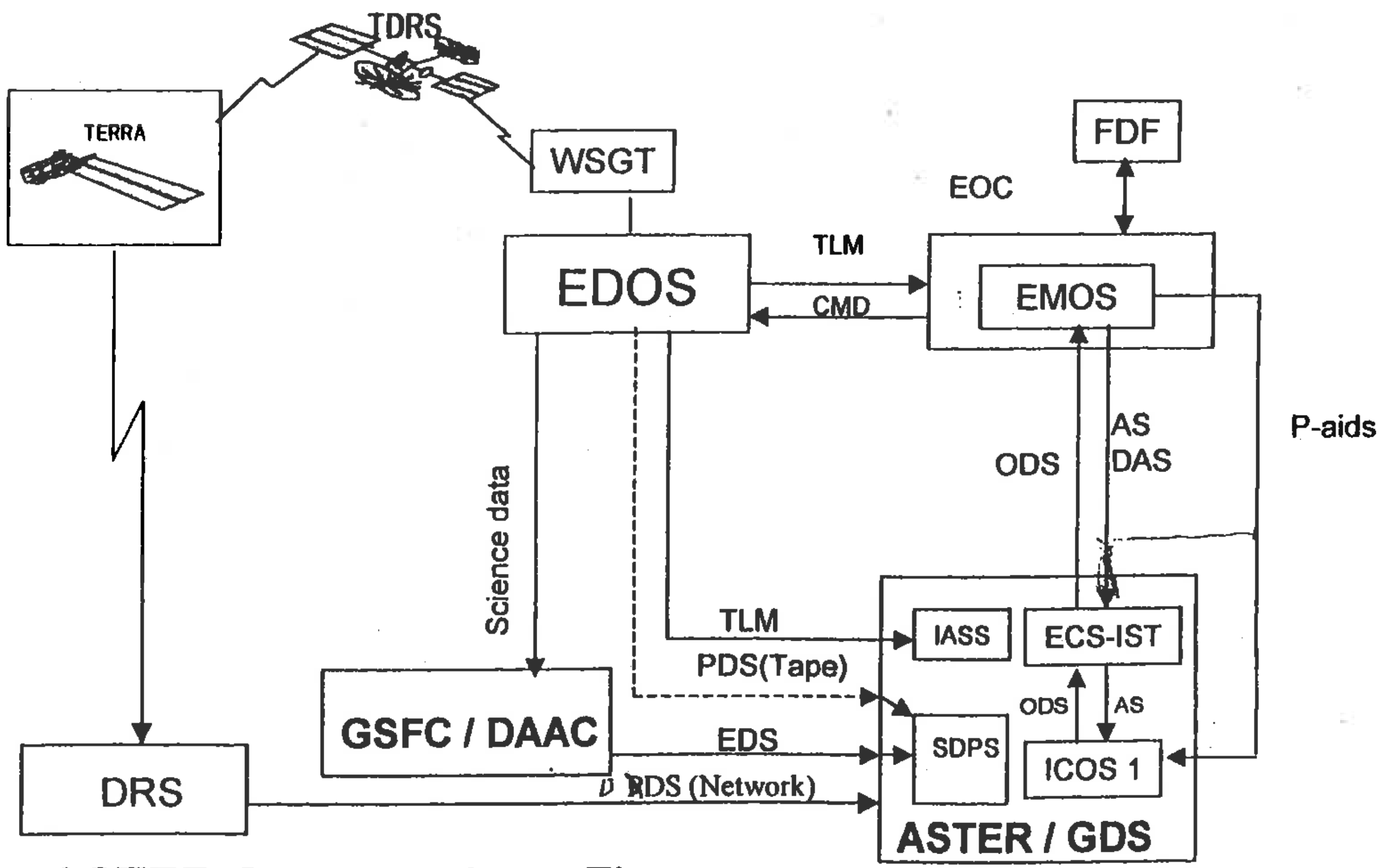
IASS: Instrument Analysis Support Subsystem

IST: Instrument Support Terminal

CMS: Customer Management Subsystem

ADN(ASTER Data Network) and SISS(Software Implementation Subsystem) are also included in ASTER GDS

ASTER Data Flow from Terra to ASTER GDS



ASTER Operation Data Flow

Document List (1) IRD,ICD,etc.

ASTER

1	510-ICD-EDOS/ASTER, ICD Between EDOS and ASTER GDS, 18 Dec 1997, Revision 2	Signed
2	505-41-18, IRD between ECS and MITI ASTER GDS Project, July 1995	Signed
3	505-41-34, ICD Between ECS and Aster GDS, Revision D, Nov 1998	Signed
4	AG-E-E-2060-R00, IRD between ASTER Japan IST and ASTER U.S. IST-US, Mar 1997	Signed
5	540-037, ICD Between EBnet and ASTER GDS, Sep 1997	Signed
6	SSI&T Procedures Document Between the GSFC ESDIS Project and the ASTER GDS for the ASTER Level-1 Software, 25 Mar 1997	Signed
7	ASTER GDS/EGS Overall Test Agreement, Baseline, 3 Feb 1997	Signed
8	Letter of Agreement, 13 Jun 1997, (NASA-MITI cost sharing arrangement for the electronic networks needed for the joint ASTER Ground Data System)	Signed
9	505-10-11, PIP Volume II – Ground Data System, ASTER and ESDIS and EOS-AM Projects, Revision A, September 1997	Signed

Document List (2) Operation Agreements 1/3

ASTER

No	Document Name	Japan Side	US Side	Signer(J)	Signer(US)	POC(J)	POC(US)	Status	Remark
1	OICD	ASTER Instr. GDS	AM1/FOS	M.Kudoh H.Watanabe	M.Kavka C.Scolese D.Perkins T.Anders	A.Miura	D.Ramey	Done	A.Johns
2	OA Between FOT and ASTER GDS	GDS	FOT	H.Watanabe	B.Kofen	A.Miura	D.Ramey	Being reviewed by both parties	M.Rackley
3	OA Between EDOS and ASTER GDS	GDS	EDOS	H.Watanabe	G.Alcott	R.Takamura	T.Rykowsky A.Krimchansky	Being reviewed by both parties	
4	OA between Nascom and ERSDAC for Management and Operation of the IP Network	GDS	EBnet	H.Watanabe	G.Knoble	J.Mashige	J.Smith	Being reviewed by EBnet	

Document List (2) Operation Agreement 2/3

ASTER

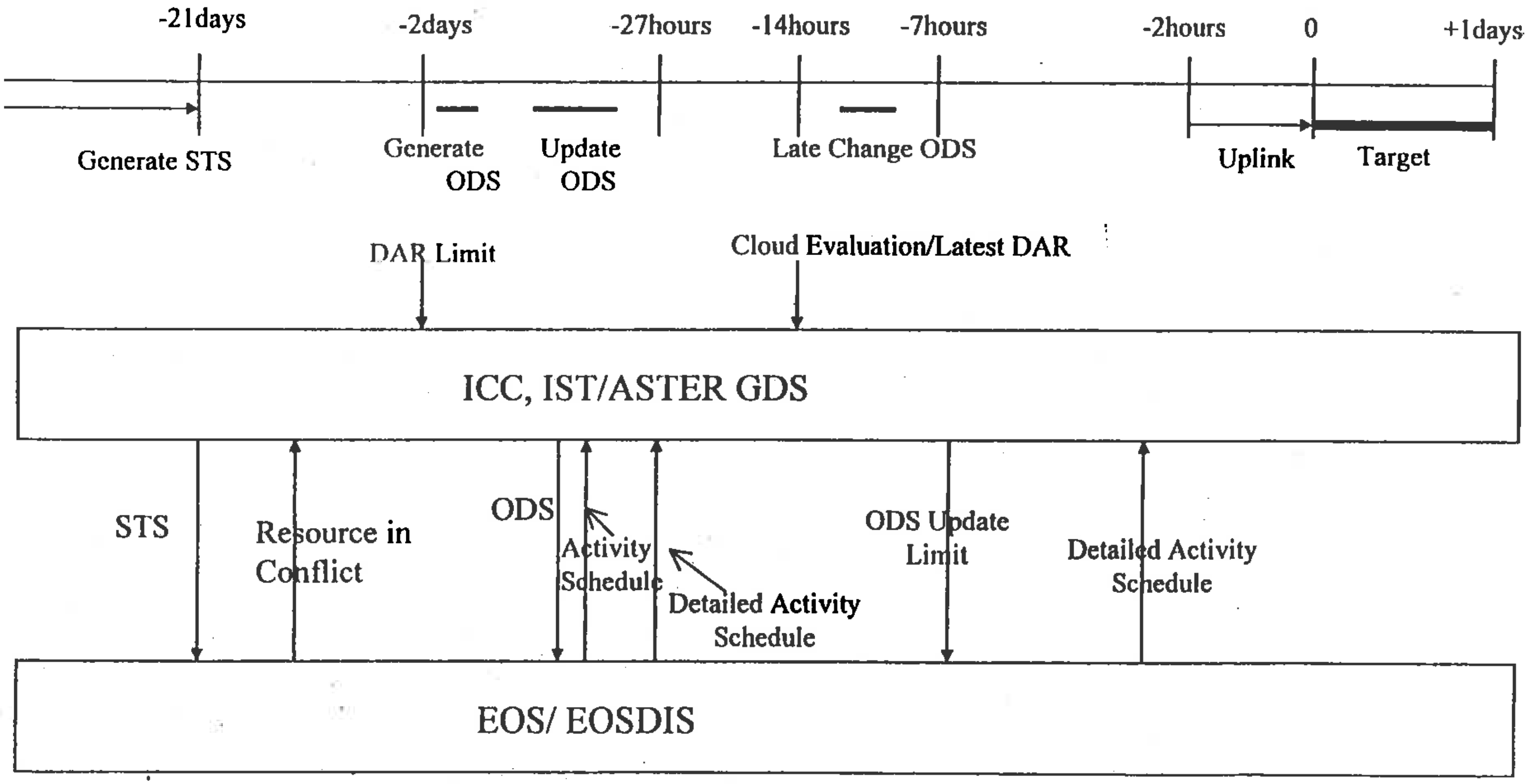
No	Document Name	Japan Side	US Side	Signer(J)	Signer(US)	POC(J)	POC(US)	Status	Remark
5	OA between EDC DAAC and ASTER GDS	GDS	EDC DAAC	H.Watanabe	T.Kalvelage	R.Takamura	M.Benson	Issue1 Issue2 Issue3 Issue4	
6	OA between GSFC DAAC and ASTER GDS	GDS	GSFC DAAC	H.Watanabe	S.Kempler	R.Takamura	C.Harnden	Issue5 Issue6	
7	OA between IST at ASTER GDS and US IST at JPL	GDS	JPL	H.Watanabe	M.Pniel	A.Miura	D.Wenkert	Being reviewed by GDS	
8	Total Cloud Coverage Prediction System OA	GDS	EOSDIS	H.Watanabe	TBD	A.Miura	M.Schwaller	Being reviewed by GDS	R.Sinha
9	OA between ASTER GDS and EOSDIS on B& A(TBR)	GDS	H.Watanabe	D.Perkins	TBD	TBD	TBD	First Cut Draft	

Document List (2) Operation Agreement 3/3

ASTER

1 Describe Procedure for L1 DB update
2 Describe the value for L1 DB update Event Notification Email Account ID
3 Describe EDAAC email address for GDS to send a notification described in paragraph 4.3.4
4 Describe a POC for coordinating DAR User Profile
5 Define and Describe Recovery procedure on EDS transfer failure
6 Define and Describe Procedure to provide OSF associated with US EDS

DITL Time Line



Detailed DITL Operation （1）

ASTER

Following are the Actions during the DITL based on the ASTER GDS point of view.
(*) means EOC related Action.
Below are the Actions, which are mostly in time sequential order.

1.Generation of STS(Short Term Schedule) and Sending it to EOC(*)
 - After sending STS, PRS should be received and confirmed
2.Reception of the Planning Aids, their Processing and Confirmation(ICOS1) (*)
3.Reception of the DAS, their ,Processing and Confirmation (ICOS1) (*)
4.Confirmation of the SCS(S/C Contact Session) (*)
 - Confirmation of the update of SCS time
5.Input of ETR(Engineering Team Request)(ICOS1)
 - GDS plans to input ETR-CAL
6.Generation of ODS(One Day Schedule) (ICOS1)
 - Based on the ETR, the ODS will be generated.

Detailed DITL Operation (2)

ASTER

7.Sending the ODS(ICOS1) to EOC (*)
- The ODS will be sent to EOC.
- The time for sending will be confirmed.

8.Reception of AS (Activity Schedule) and its Processing (ICOS1) from EOC (*)
- Confirmation of the time of the reception
- Check whether there is any constraint
- Decide the actions to be taken when there is constraint
- Modification of ODS and re-sending it to ECS

9.Reception of the Cloud Information, their ,Processing and Confirmation(ICOS1) (*)

10.Generation of Late Change ODS (ICOS1)
- Modification of the ETR-CAL
- Modification of the ODS

Detailed DITL Operation （3）

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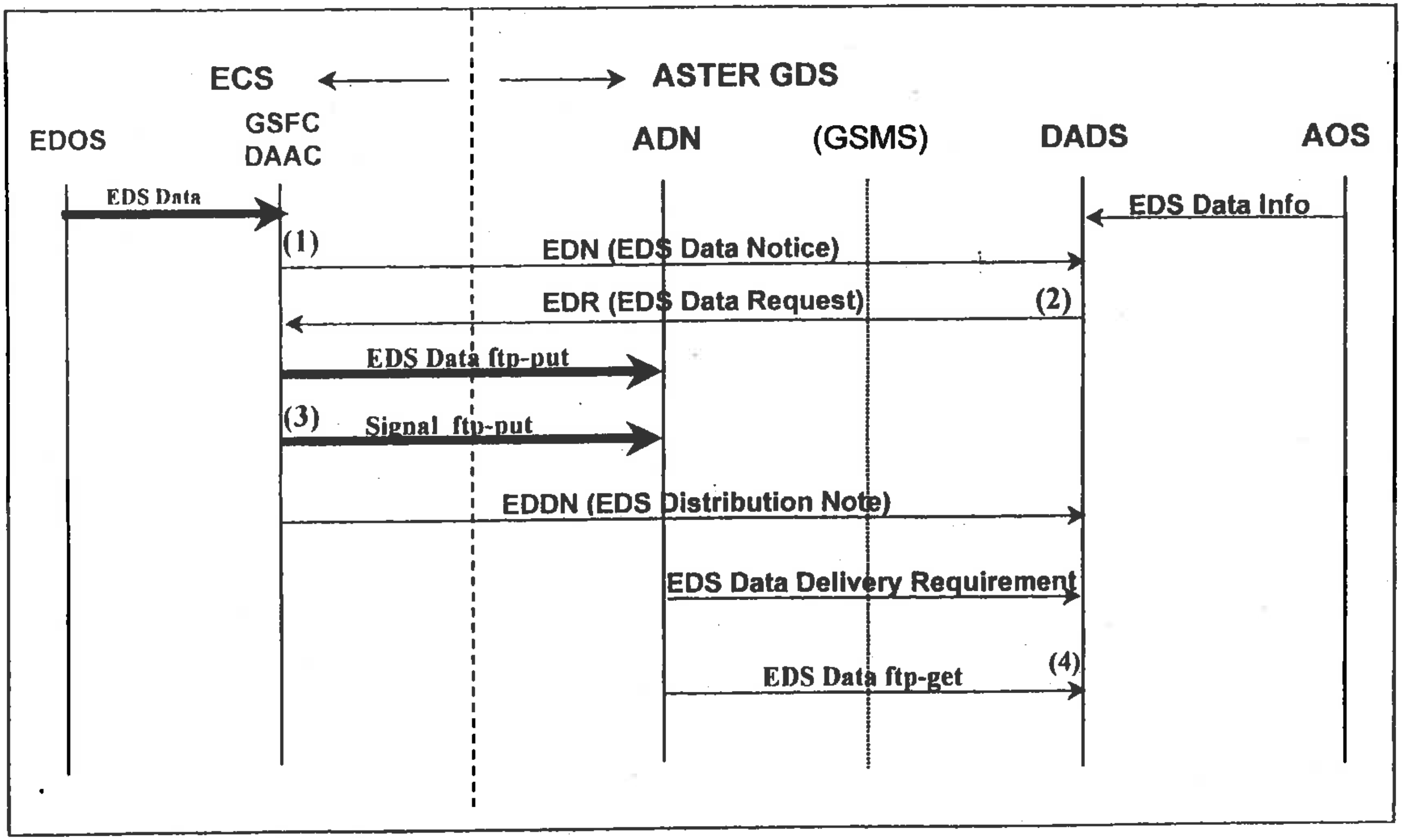
11.Sending the Late Change ODS(ICOS1) to EOC (*)
  - The ODS will be sent to EOC.
  - The time for sending will be confirmed.
  - Reception of AS (Activity Schedule) and its Processing (ICOS1) (*)
  - Confirmation of the time of the reception
  - Check whether there is any constraint
  - Decide the actions to be taken when there is constraint
  - Modification of ODS and re-sending it to EOC

12.Specifying Uplink ODS (ICOS1)
  - After receiving constraint-free AS, specify Uplink ODS

EDS Transmission

ASTER



Preparation at AOS for EDS/PDS processing

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1. AOS gets information on what area on the Earth and when users want to take observation by ASTER Instrument.
2. AOS evaluates user requests coordinating with EOC and determines
   (1) What areas, when and by which ASTER sensor to be observed
      -Build ODS
   (2) What data product scenes(granules) Observed data is to be processed to, when those scene data will have been observed and what area those scenes will have covered
      -Generate Observation Schedule Information

Scenario for selecting EDS/PDS processing

ASTER

How to select EDS or PDS processing:

(1) Information of the Scene that will have been observed is written as an entry in Observation Schedule Information.
(2) Observation Schedule Information is produced by AOS in accordance with ODS.
(3) The information is transferred to DADS from AOS in advance of EDS and PDS arrival. Observation Schedule Information is stored in Observation Schedule File(OSF) at DADS.
(4) DADS produces Product Generation Plan for PGS to generate Products based on Observation Schedule Information.
(5) Each entry in Observation Schedule Information has an EDS flag in it.EDS flag represents whether the scene has been observed as an EDS or not.
(6) On receipt of EDS/PDS, DADS/PGS processes the data as follow:

A) Scene with EDS flag set on is processed in Expedited manner.
B) Scene with EDS flag set off is processed in Non-expedited manner.

Scenario for selecting Japanese requested EDSs

ASTER

Back ground: Since QL flag is one-bit data, GDAAC can not distinguish Japan-requested EDSs from US-requested EDSs. Therefor, following process is needed,

(1) Each EDS Scene that was requested by Japan has an entry in EDS Data Information. Any EDS Scene that was requested by US has no entry in EDS Data Information.
(2) EDS Data Information is produced by AOS in accordance with Observation Schedule Information. EDS Data Information has time of the first and last CCSDS packet of EDS for each EDS.
(3) The information is transferred to DADS from AOS in advance of EDN arrival from GDAAC.
(4) EDN has also time of the first and last CCSDS packet for EDS.
(5) On receipt of EDN, DADS compares time of the first and last CCSDS packet for EDS stored in EDN with those in EDS Data Information. If the former match the latter with some tolerance, DADS sends EDR corresponding to EDS data Information to GDAAC. Otherwise, DADS sends no EDR to GDAAC.

Scheduler Function (1)

ASTER

1.Scheduler's Function

-Based on the area requested by users (xAR Data Base),
Scheduler calculates "score" for each possible data acquisition scenario.

-According to the scores given to each scenario, Scheduler will generate observation schedule which has the highest score value.

-The observation schedule is defined as a series of the "activities". Basic observation schedule is one day long and known as ODS (One Day Schedule). There is another schedule which is 7 week long and known as STS (Short Term Schedule).

-The score will be calculated by the priority function that reflects

- Predicted cloud coverage
- User category
- SWIR Pointing Number
- Data Collection Category
- Urgency
- Area Remaining

Scheduler Function (2)

2.Input to Scheduler

2.1Dynamic Inputs

-Planning Aids (from EOC)
-Total Cloud Cover (from NOAA via Larry Server)
-XAR Data Base
DAR(Data Acquisition Request) from IMS @ AOS @ ASTER GDS
ETR(Engineering Team Request) from IASS @AOS @ASTER GDS
STAR(Science Team Request) from IST@ AOS @ ASTER GDS

2.2Static Inputs

-Instrument Constraints (8min./Orbit, 16 min./ 2 Consecutive Orbits, 5 Operation Modes)
-Priority Function (User category, Cloud Cover, xAR Category, etc)Outputs from Scheduler

Scheduler Function (3)

ASTER

3.Major Outputs

-ODS (One Day Schedule)

24 hour long 20:00z—20:00z of next day + 6 hours

-STS (Short Term Schedule)

1 week long, every week

4.Statistics

-Success of xAR

DAR Budget Control

Success for STAR

-SWIR Pointing Number

Reception of PDS

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Product Data Set (PDS)

- EDOS produces PDS by media
- EDOS sends Physical Media Unit Delivery Record (PMUDR) to GDS
- GDS / PGS ingests PDS, and process Level 1A,1B product
- GDS processes higher level product

AOS Network (1)

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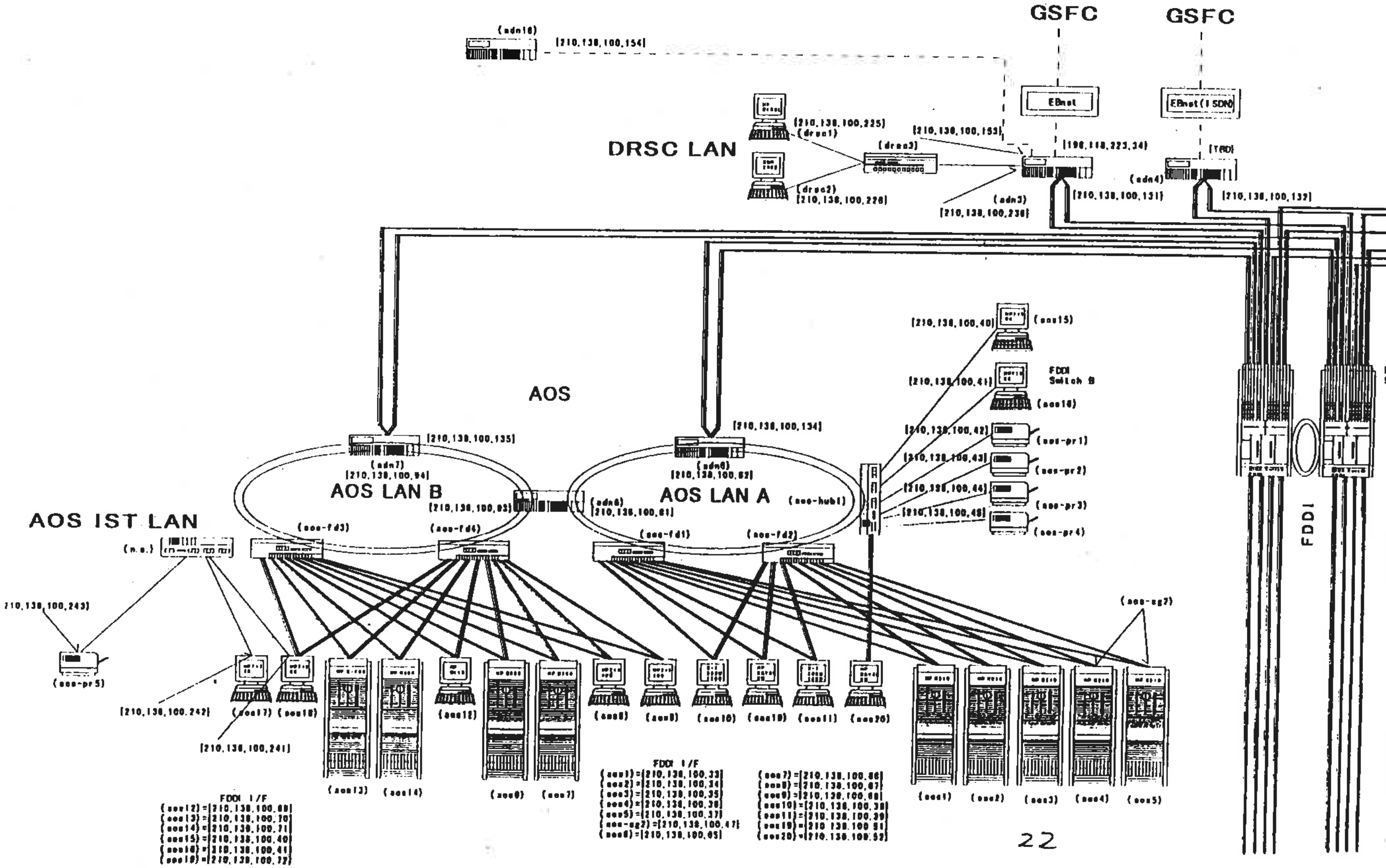

AOS Network (2)

ASTER

aos1	210.138.100.33	Real-time Server
aos2	210.138.100.34	Data Server
aos3	210.138.100.35	Common Backup Server
aos4	210.138.100.36	Disk Array Server 1
aos5	210.138.100.37	Disk Array Server 2
aos6	210.138.100.65	xAR Server 1
aos7	210.138.100.66	xAR Server 2
aos8	210.138.100.67	System Management WS 1
aos9	210.138.100.68	System Management WS 2
aos10	210.138.100.38	ECS IST WS 1
aos11	210.138.100.39	ECS IST WS 2
aos12	210.138.100.69	Non-Real-Time WS 1
aos13	210.138.100.70	Scheduling WS 1
aos14	210.138.100.71	Scheduling WS 2
aos15	210.138.100.40	Real-Time WS 1
aos16	210.138.100.41	Real-Time WS 2
aos-pr1	210.138.100.42	Printer 1
aos-pr2	210.138.100.43	Printer 2
aos-pr3	210.138.100.44	Printer 3
aos-pr4	210.138.100.45	Printer 4
aos17	210.138.100.242	IST WS
aos-pr5	210.138.100.243	Printer 5
aos18	210.138.100.72	IST Server
aos-sg1	210.138.100.46	MC/Service Guard Package 1 :NFS
aos-sg2	210.138.100.47	MC/Service Guard Package 2 :Syabse, Mail
aos-sg3	210.138.100.48	MC/Service Guard Package 3 :N/A
aos-sg4	210.138.100.49	MC/Service Guard Package 4 :N/A

AOS Out line

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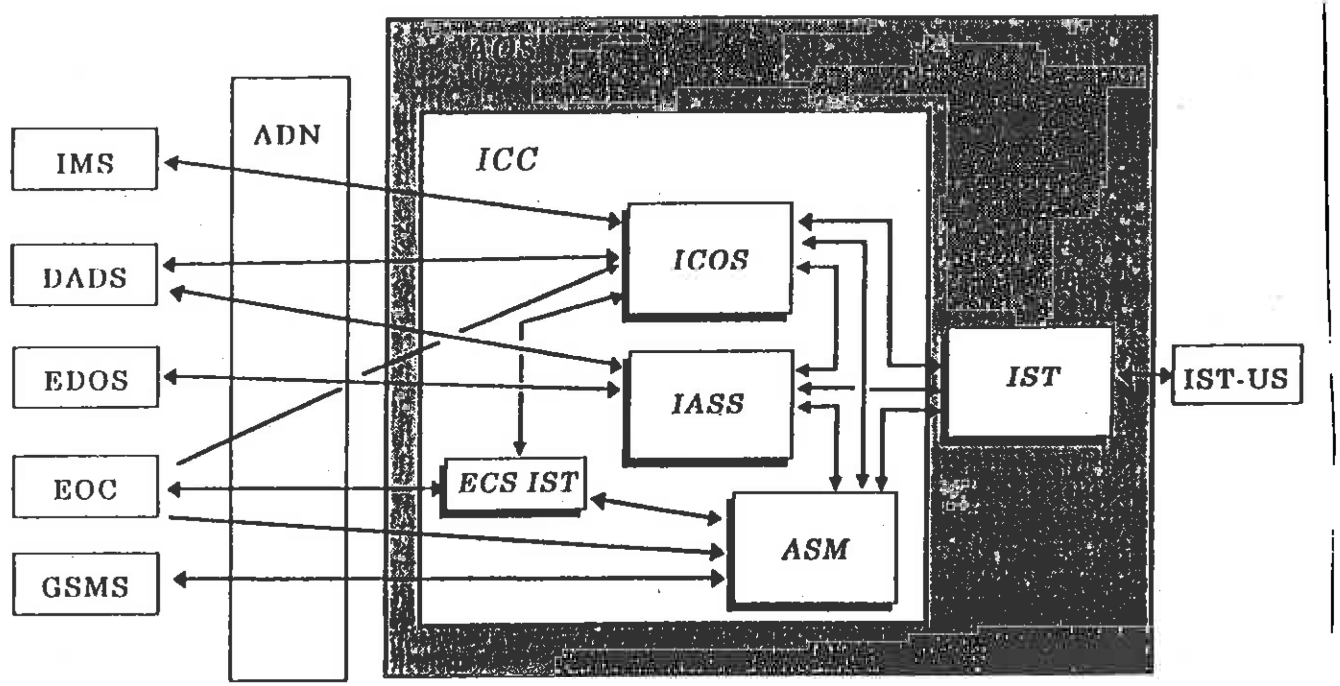

Functions of AOS (1)

ASTER

- ASTER System Management (ASM)
  - Management of AOS hardware , application software, and LAN
  - Security management to AOS user.
  - Time management of AOS

- Instrument Control and Operation Subsystem (ICOS)
  - Reception of observation request (DAR,STAR,ETR)
  - Generation and scheduling of STS and ODS
  - Management of Planning aids and Scheduling information

Functions of AOS (2)

ASTER

- Instrument Analysis Support Subsystem
  - Reception of realtime telemetry data and Rate Buffered Data from EDOS
  - Realtime monitor of telemetry
  - Replay of telemetry data
  - Processing conversion to engineering value
  - Off-line analysis of telemetry
  - Monitor of science data

- ASTER Instrument Support Terminal
  - Input STAR
  - xAR monitor
  - Schedule simulation of STAR

Point of Contact

ASTER

-Mission Operation

Mission Operation Manager

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INTRODUCTION OF ASTER (TRAINING FOR THE FOT)

JULY 13, 1999

Agenda

- ASTER INSTRUMENT OVERVIEW ----- M. KUDOH
- OVERVIEW OF ASTER OPERATIONS ----- F.TAKAHASHI
- ASTER GROUND DATA SYSTEM ----- H.WATANABE
  A. MIURA