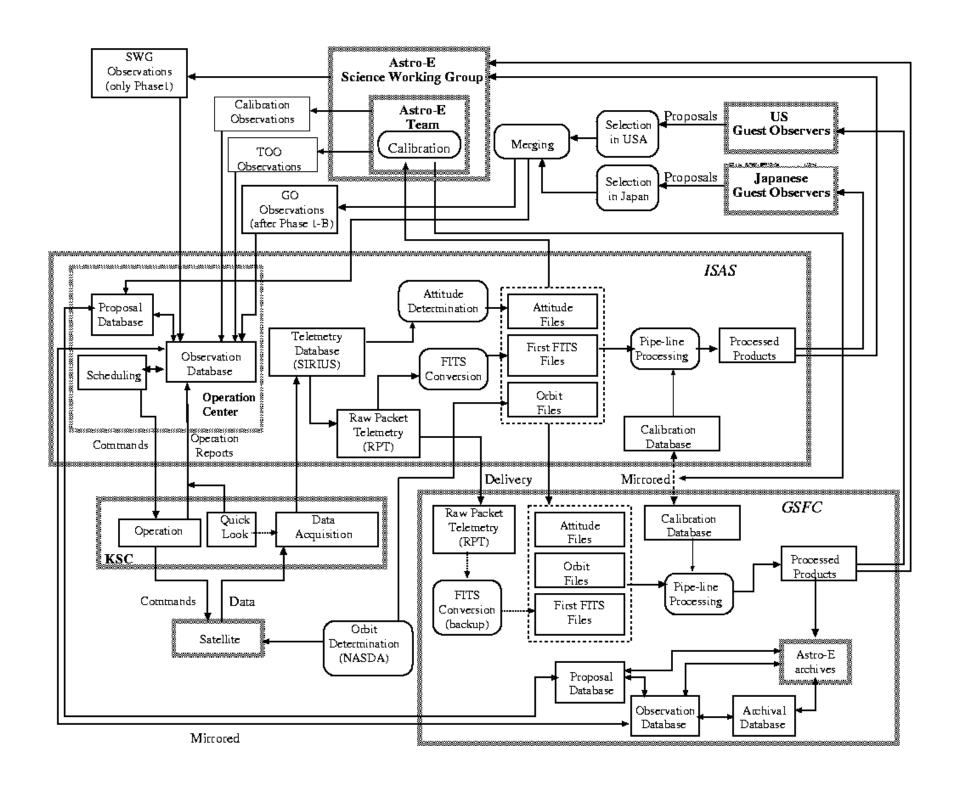# Mission Operations and Data Flow Overview

Koji Mukai

Astro-E2 Guest Observer Facility

Mission Phases

Phase	Months	SWG	Japan (ESA)	US	J/US
0	<1	0	0 (0)	0	0
Ia	1-7	100	0 (0)	0	0
Ib	8-19	25	37.5 (6)	32.5	5
Ic	20-31	15	42.5 (7)	37.5	5
Id	32-??	0	50 (8)	37.5	12.5
II	indefinite	0	60 (10)	30	10

Observing Constraints

- ## Sun angle constraint: 65-115 deg
  - – Many targets visible for 2x~2 month/year
- ## Max slew rate: 12 deg/min, 10min settling time required
  - – Short observations are inefficient
- ## Each observation interrupted by Earth occultations and SAA passages
  - – Familiar pattern for *ASCA* users

Total Available Time

- *ASCA* achieved 37 ksec of on-source data/day
  - *Astro-E2* observing efficiency may well be higher
- *Astro-E2* will be operated ~360 days/year (minus New Year holidays, typhoons)
- Observatory time: 5%, TOO time: 3%
  - The remainder is available for normal (SWG or GO) observations
- Net observing time: 12.3 Msec/year

Division of Labor

- ISAS is responsible for:
  - The ground station (Uchinoura Space Center, USC)
  - Command generation and upload
  - Telemetry downlink and quick-look
  - Processing & data distribution for non-US PIs
- GSFC provides:
  - Scheduling software and personel
  - Processing & data distribution for US Pis
  - Software and English-language documentation support

Observation DataBase (ODB)

- ODB at ISAS is at the focal point of mission operation and contains
  - Details of accepted observations
    - PIs will be contacted for possible updates several weeks before actual observation
  - Scheduling information
  - Operation commands
  - Special notes, at any (e.g., TOO interrupts)
  - Items returned from the processing pipelines
- A subset of these items will be copied to public databases such as HEASARC Browse

Mission Scheduling (Tako)

- *Astro-E2* will use Tako for scheduling
  - Tako was developed for *ASTRO-E* based on *ASCA* experiences using Spike
  - Currently used by *Swift* (on-board); will be used by *RXTE*, *Astro-F*, and *GLAST*
  - Chris Baluta, stationed at ISAS, will run and maintain the *Astro-E2* version of Tako

- Vast majority of observations will be long stares (with inevitable low Earth orbit interruptions) - relatively easy to schedule

Commands and Contacts

- *ASCA* command generation was a very labor intensive process
  - *Astro-E2* process is more automated
- Only one ground station (USC) used
  - Up to 5 contacts a day
  - Shared with other ISAS missions; launch of Astro-F, Solar-B etc. can reduce no. of available contacts
- On-board detector records data at one of several possible rates; up to 1.25 Gbytes raw telemetry downlinked per day.

Quick-look

Quick-look analysis will be performed at USC and at ISAS

- To confirm the intended target is successfully observed

- To monitor satellite and instrument status

- Additionally, to search for gamma-ray bursts in the HXD background data

Attitude file and RPT generation

- Raw telemetry will be concatnated and archived in the ISAS "Sirius" database

- Telemetry will be depacketed and divided into observations and saved as raw packet telemetry (RPT) files

- Satellite attitude will be determined from star tracker and gyro data by ISAS contractors

- *Astro-E2* orbit will be determined by another division of JAXA

Background: *ASCA* experiences

- FTOOLS were in their infancy at the start of the *ASCA* mission

- Instrument teams in Japan developed their own software framework ("animal software") which persisted throughout the ~7 year mission

- ISAS lacked the infrastructure for standard processing of data - each user was on his/her own

- For *Astro-E2*, we need one software system and a uniform starting point for analysis for every user

Parallel Processing

- ISAS will create First FITS Files (fff) from RPTs (GSFC can do the same if necessary)

- FFFs copied over the network to GSFC

- All data are processed at ISAS and at GSFC using identical software

- Produces OGIP-standard FITS files with HEADAS software for analysis

- See Ken Ebisawa's talk for further details of processing

Data Distribution

- When processed, Astro-E2 GOF will inform US PIs of their data's availability
  - ISAS will notify all other PIs
  - For JUS observations, both PIs will be notified
- PGP-encrypted data will be available for download via HEASARC (see Lorella Angelini's presentation)
  - No CD-ROM/tape etc.

Instrument Team Access to Data

- Instrument teams will access data (including proprietary ones) for the purpose of performance monitoring and continued calibration.
    - Similarly, mission operation teams and GOF members may access data for verification and for troubleshooting
- Instrument teams are strongly encouraged to use the same FITS files the GOs will use
- Trend archive will be created and made publicly available