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SOLAR-B EIS EGSE REQUIREMENTS

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1 INTRODUCTION

Solar-B will study the connections between fine magnetic field elements in the photosphere and the structure and dynamics of the entire solar atmosphere.
The mission will perform three basic types of observation with high spatial, spectral and temporal resolution:

Determination of the photospheric magnetic vector and velocity fields.
Observation of the properties of the resulting plasma structures in the transition region and corona.
Measurement of the detailed density, temperature and velocity of these structures.

The EUV imaging spectrometer (EIS) will obtain plasma velocities to an accuracy of <= 10 km s^{-1} along with temperatures and densities in the transition region and corona at <2 arc sec resolution.
EIS consists of a multi-layer coated single mirror telescope, and a stigmatic imaging spectrometer incorporating a multilayer coated diffraction grating. The image produced by the primary mirror is imaged onto an entrance slit/slot and the light, which passes through this spectrometer aperture, is dispersed and re-imaged in the focal plane of the CCD camera.

2 SCOPE

It is the purpose of this document to specify the requirements of the EIS EGSE, both for the software and the hardware.

3 DOCUMENTS

3.1 Applicable Documents

AD 1 MSSL/SLB-EIS/SP003 Solar B EIS ICD document

4 GLOSSARY

DHU	Data Handling Unit
EGSE	Electrical Ground Support Equipment
EIS	Extreme Ultraviolet Imaging Spectrometer
HCE	Heater Control Electronics
HKU	HouseKeeping Unit
ICU	Instrument Control Unit
MDP	Mission Data Processor
MHC	Mechanisms & Heater Control
TBD	To Be Decided
XRT	X-Ray Telescope

5 SYSTEM DESCRIPTION

The purpose of the EGSE is to provide all the software and hardware components to be able to develop and test the EIS instrument prior to delivery. The functionality of the EGSE

1. Models the necessary spacecraft functions for the instrument to function as in flight.
2. Models any other hardware components necessary for proper operation of the instrument.
3. Represents the ground system, allowing user interaction with the instrument and archives data sent from the instrument.

5.1 Software

5.1.1 General

1. The main EGSE software shall be written in C. Programs for administration, analysis and maintenance may use perl.
2. The EGSE software shall be written for the Linux operating system with the real-time Linux kernel extension.
3. The EGSE shall consist of the following:
    a. A real-time Linux module modeling the mdp/spacecraft (the MDP simulator).
    b. An EGSE front-end to provide information about the mdp simulator and allow the user to communicate with the instrument.
    c. A status (housekeeping) monitoring program.
    d. A science Quick Look program.
4. The EGSE shall also consist of the following off-line programs:
    a. A packet archive replayer
    b. A packet archive analyzer program.
    c. A log file browser.
5. The EGSE components shall communicate with each other using sockets and the tcp/ip protocol, with the exception of the MDP simulator.
6. The MDP simulator shall communicate with other programs using real-time fifos.
7. There shall be an EGSE user account. Only this account will be able to modify program source files, system configuration files and system maintenance files.
8. Any EIS user shall be able to run the EGSE software.
9. The software will be configurable to cater for different users' requirements.
10. The EGSE shall be easily re-configurable to facilitate different testing environments at MSSL and in Japan.
11. Additional programs, such as an ICU simulator, camera simulator or MHC simulator, shall be written if needed. This software shall be written in any appropriate language.

5.1.2 MDP Simulator

1. The software shall be able to cope with the highest defined telecommand and telemetry rates.
2. It shall comply with the commanding scheme as outlined in AD 1.
3. It shall comply with the telemetry scheme as outlined in AD 1.
4. It shall generate the spacecraft time.

5. It shall model the MDP buffering scheme and provide buffer status information to the ICU.
6. The hardware status lines shall be monitored.
7. The software shall implement the Data Handling Unit functions.
8. Provision shall be made to support the HKU and HCE interfaces.
9. Provision shall be made to support the power supply system interface.
10. It shall provide a mechanism for communicating current state information to the EGSE front-end program.
11. The user shall be able to alter key parameters of the software.

5.1.3 EGSE front-end

1. The EGSE front-end shall have a graphical user interface. This shall display the current state of the MDP simulator.
2. The software shall provide a scripting interface to allow the definition and transmission of telecommands to the instrument.
3. It shall allow commands to be issued interactively or from scripts.
4. All telecommands to the instrument and telemetry from the instrument shall be archived in raw format. Other log information shall be stored on disk in a human readable form and easily correlated with the archived raw packet data.
5. The software will automatically open an archive file and log files when started.
6. The user shall be able to open new archives and log files at any time.
7. It shall be possible for the user to add information to a log file during testing directly from the keyboard. This shall provide a note-taking facility.
8. The EGSE front-end shall be able to cope with the highest defined telecommand and telemetry rates.
9. The EGSE front-end shall be configurable by the user using configuration files. Re-configuration shall be possible without stopping the software.
10. User definable events shall be logged. A default set of parameters shall be provided.
11. A hex dump of the raw telecommand and telemetry packets shall be provided in real-time. Further decoding of these packets is TBD.
12. The execution of the EGSE front-end shall not depend on the status monitor or quick look programs to be running.
13. The user shall be able to change mdp simulator parameters either through a command line or through the gui.
14. A mechanism shall be provided to simulate the occurrence of XRT flare events.

5.1.4 Status Monitor

1. The software shall have a graphical user interface.
2. The software shall be able to display the raw status values and also the corresponding engineering values.
3. There shall be the ability for status values to be monitored. A default set shall be provided. The user shall be able to re-define which values are to be monitored.
4. The monitoring of status values shall have the ability to be turned on and off.
5. Warning and error conditions shall be highlighted appropriately.
6. The user shall have the ability to re-configure the limits and calibration values of the status parameters online while the program is running.

7. Graphical plots shall be available for system defined status parameters, typically voltages, currents and temperatures.
8. Quitting the status monitor program shall not prevent the rest of the EGSE software from working.
9. The status monitor program shall be independent from the rest of the EGSE software in that the user shall be able to connect the status monitor to the EGSE front-end at any time.
10. The user shall have the option of whether significant events will be logged to a log file or not.
11. The software shall provide a time-stamped record of events, such as out of range parameters.

5.2 Hardware

5.2.1 Hardware

1. The EGSE shall be implemented on PC hardware. Two PCs networked together with a dedicated Ethernet link are envisioned for this.
2. Back ups onto tape of program source and archived data shall be possible.
3. The EGSE shall interface to the EIS instrument via PC ISA card(s) designed and built at MSSL; the status and command interfaces shall be implemented using this/these card(s). An additional pci data capture card may be required for the mission data interface.

6 DELIVERABLES

6.1 Prototype Model

A PM version of the EGSE (software and hardware) shall be delivered with the prototype model ICU.

6.2 Flight Model

The flight model version of the EGSE (software and hardware) shall be delivered with the flight model ICU.

6.3 Documentation

Documentation for the EGSE shall include a user manual for the flight model version.