

Solar B - EIS

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EIS ICU Design 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:

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

The EUV imaging spectrometer (EIS) will obtain plasma velocities to an accuracy of $\leq 10 \text{ km s}^{-1}$ along with temperatures and densities in the transition region and corona at < 2 arc sec resolution.

The Solar-B EUV Imaging Spectrometer (EIS) instrument consists of a multi-layer coated single mirror telescope, and a stigmatic imaging spectrometer incorporating a multi-layer 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 for the design of the ICU in order to meet the science and system requirements.

The requirements for the PSU, which physically resides in the same enclosure as the ICU, are described in AD5.

3 APPLICABLE DOCUMENTS

AD1:	MSSL/SLB-EIS/SP007	EIS Science Requirements
AD2:	MSSL/SLB-EIS/SP011	EIS System Definition
AD3:	MSSL/SLB-EIS/SP003	SOLAR B - EIS ICD Document
AD4:	SLB-120	Solar-B Electrical Designs Standard
AD5:	MSSL/SLB-EIS/SP014	Specification for Power System

4 ICU SCIENCE/SYSTEM REQUIREMENTS

1. The ICU shall be designed to meet science requirement 2.4 in document AD1:

“To perform both the imaging and spectroscopy mode with high temporal resolution. In spectroscopy mode, EIS is required to obtain accurate measurements of strong line intensities and line widths in < 1 s in highly dynamic events such as flares, and every 10 s in less dynamic phenomena such as active region loops. In imaging mode, EIS is required to obtain monochromatic images of an active region ($\sim 4 \times 4$ arcmins) in ~ 3 s for dynamic events and 10 s for active region loops.”

The ICU hardware shall also be designed to meet the following requirements:

2. AD1 section 3.2(a) – “To expose and readout the maximum image area of both CCDs (2048"x512") simultaneously.”
3. AD1 section 3.2(e) – “To expose and process 1" X 512" (e.g. readout time, compression) data in the order of fractions of a second.”
4. AD1 section 3.2(f) – “To perform exposure times in the range 100 ms - few hundred s with an accuracy of 5 %. The ability to make shorter exposures down to 10 ms is desirable. *(CMB is investigating this).*”
5. AD1 section 3.2(h) – “To perform data compression. The data compression is currently JPEG in the MDP, but the facility to include a different compression scheme in the ICU should remain open. *It is required that the compression can be varied in different studies.*”
6. AD1 section 3.5(b) – “Monitor the health of the instrument and enter a safe mode if an anomaly is detected.”
7. AD1 section 3.5(c) – “The instrument must respond in an appropriate manner to spacecraft emergency.”
8. The EIS-ICU spacecraft interfaces shall be designed to the specifications in the EIS ICD (AD3).
9. AD4 section 4.1.4 – “The design of wire harness and connectors should be made considering maximum currents that are tabulated in Figures 4.1.1-2 and 4.1.1-3. Each subsystem group shall design the instrument within the maximum currents.”
10. AD4 section 4.1.6 – “(2) 28 V regulated bus: In case that turning on/off of primary power is required, the function is realized by switch that is located in the instrument.” (This is TBC, as the switch is believed to be on the spacecraft).
11. AD4 section 6.1 figure 6.1-1/line 16 – which states the cable requirements for a “Low-speed digital” signal type.
12. AD4 section 6.1 figure 6.1-1/line 17 – “which states the cable requirements for a “High-speed digital” signal type.
13. AD4 section 6.2 – “Standard of wire harness used in Solar-B satellite is shown below. When the other type of wire harness is required, instrument-side shall negotiate with the system-side and provide the required wire harness with the system side.
 - (1) Power line / Signal line
 - High tensile strength wire (AWG20~26)
 - High tensile strength twisted pair wire (AWG20~26)
 - High tensile strength shielded twisted pair wire (AWG20~26)
 - (2) Co-axial cable
 - Flexible co-axial cable (RG-316-U)
 - Semi-rigid co-axial cable (TBD)”
14. AD4 section 6.3.2 – “Recommended Connectors”
15. AD4 section 6.3.3 – “Ground pin of electrical box”
16. AD4 section 6.3.4 – “Identifier of connectors”
17. AD4 section 6.3.5 – “Other Regulations”
18. AD4 section 7 – “Electro-magnetic conditions”
19. AD4 section 8(8) – “Interface circuit for low-speed digital signal (<100kbps)”
20. AD4 section 8(9) – “Interface circuit for high-speed digital signal (>100kbps, <10Mbps(TBD))”

5 COMPONENT QUALITY

All parts procured to build the ICU shall meet the following requirements:

1. 30 krad total radiation dose.
2. ESA SCC level C or Mil level B, except at interfaces to the spacecraft, where the specification shall be ESA SCC level B or Mil level S.
3. SEU rates TBD.