

Solar-B EIS

Report for MSSL Programme Review Meeting

Solar-B EUV Imaging Spectrometer – launch August 2004

<http://www.mssl.ucl.ac.uk/solar-b>

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Issues of Concern

- Need to re-align the spacecraft and instrument development schedules, having had an effective slip of ~3 months due to the Cassegrain/Paraboloid decision process.
- Issues of responsibilities and resources need to be resolved.
- CCD requirements creep will affect performance or cost if MSSL absorbs.

Recent Progress

Basic optical design nearly complete. System design becoming more stable.

There have been two major meetings since the last PRM, an Engineering Meeting at NRL in May and a full Consortium Meeting at Birmingham in June. These meetings were able to ratify the optical design and identify all the necessary components of the system. The consortium meeting also addressed important software and operational issues which have not been prominent hitherto.

The basic design of the components is now taking place at the various hardware institutes.

Science and General Issues

Louise Harra is coordinating the science staff in the consortium institutes. The consortium need to address such issues as operational modes (which affects software development costs and delivery timescales) and data compression methods (affecting data rates and capacities). The science team should also provide inputs to the prioritisation of technical requirements.

There is a need to form a coherent statement of the performance of the present design. At present this is proving difficult due to the rate of evolution.

Solar-B is a three-instrument coordinated observatory. More needs to be done to make contact with the development teams of the other instruments.

Instrument development

System Interfaces

The main interfaces are structural and thermal between the Spectrometer Structure and the spacecraft, and electrical between the ICU and the Solar-B mission data processor.

The structural and thermal mathematical modelling of Solar-B is taking place in Japan, and more inputs are needed from the structure design to add fidelity

to their models. It should be noted that EIS is a significant part of the entire system.

The details of the spacecraft electrical interfaces are being worked out. We are receiving individual details as they become known, but there remains a considerable amount of definition to be done.

Structure - BU

Structure concept being revised to accommodate NRL optical design. Thermal control philosophy needs to be established (impacts ICU design).

Door – BU

No progress.

Optics – NRL

Mirror and grating assembly is being revised to reduce volume and mass. Grating assembly mounting interface undergoing revision. Positioning mechanism need further study to Optical layout will be adjusted to use 4200 l/mm grating, with no impact of structure envelope.

Slit exchange mechanism has been developed considerably. Needs further engineering study to establish disturbance torque and power consumption properties.

Filters – little progress, other than to establish requirement for a CLAMSHELL. The responsibility for this is under negotiation but is expected to be either NRL, BU or both.

A misalignment estimate has been produced which shows that the through-launch motion of the optics may cause the grating foci to move off the baseline CCD face (512 pixel x 13.5 micron). This either requires a larger CCD or another way of controlling the misalignment (stiffer optics or additional motion).

Camera – MSSL

CCD procurement parameters being discussed with EEV. We are working to provide an appropriate number and quality within the original funding. The quality is mainly an issue of the number of acceptable column defects.

Device performance estimates with respect to temperature and radiation are being established. The initial results show a temperature requirement of –80 C approx. MSSL is doing a radiator study to establish the likely range of temperatures available. These show that the average temperature of a simple radiator may be considerably higher. A lot more work needs to be done to converge these two temperatures.

CCD development kit is being planned and procured. Some options revolve around the use of Integral ROE or copies of it as a CCD test-bed. There may be Integral-schedule conflicts?

FPA (Focal plane assembly) design being worked.

ROE (Readout Electronics – for Camera) also beginning.

ICU – MSSL

The Instrument Control Unit broad functional requirements are well-established. This includes instrument thermal control and mechanism control –

which may be devolved to a new unit (MHC). The requirements for the latter are being assembled. It's not clear what control signals each mechanism will need.

A processor has been baselined – the ADSP21020. It's anticipated that if the more capable ADSP21060 can be found in rad-hard form then the design can be updated. The processor load needs to be calculated to establish the viability of the '020.

The Virtuoso RTOS is also baselined. An evaluation kit based on this product is presently in house.

An architecture block diagram is being worked on.

On-board software - MSSL

A draft software requirements list was recently circulated in the team. It's clear that prioritisation of these is necessary, since there is a need to deliver a partly functional PM unit, and that some functionality will be omitted, and that not all functions can be provided with presently available effort. However, a software production schedule, beginning in October 99, has been developed.

EGSE – MSSL

A study of EGSE requirements identifies a number of EGSE or similar equipment and software items. Similar remarks apply as for onboard software. It's hoped that as much as possible can be done to unify the EGSE and unit-level checkout and development systems in order to avoid costs of duplication of functionality.

Other items – Shutter, Clamshell, Purge Harness, Vacuum Harness, QCM

Various institutes. No progress.

Opto-mechanical engineering meeting, NRL

This meeting was successful, having achieved the main objectives of agreeing a basis for the optical design, and having a first cut at subsystem positioning within the structure.

There was discussion of gratings and grating production, particularly about the difficulty of manufacturing a high performance grating of large dimensions. There is an added risk associated with the 4800 lines/mm ruling density. These risks have been addressed by firstly designing a system with a smaller, toroidal, grating. The design will be further developed to use a 4200 lines/mm grating. The optical design assumes the use of two detectors to receive diffracted light from two distinct wavelength ranges.

There was agreement among those present that the design as present could in principle meet the requirements of EIS.

A structure concept based on a recent iteration of the optical layout was presented by BU. A design session took place in which the locations for each subsystem in the proposed structure, and the mounting method, were considered. Many actions arose, with the intention of performing an iteration of both the optical design and the structural design for discussion at the BU consortium meeting.

Consortium meeting, Birmingham

This meeting was an opportunity to present to the whole team the activities of the engineering groups. The entire system design was reviewed, not just the optical and mechanical elements. There was great interest in the CCD performance predictions, the nature of the Instrument Control Electronics (ICU) and the onboard software.

The structural design, modified to accommodate the various mechanisms and the detector, was discussed. This still needs some work before it can be shown to satisfy both the needs of the optical system and the Solar-B spacecraft.

Many of the technical issues which arose will be addressed at a further team meeting in late July.

Future Activities

27-29/7/99 (TBC) Engineering meeting, MSSL
