EIS<->Spacecraft Interface
(Spacecraft Operational Concepts)

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From our recent discussions at MSSL following the request from Hara for our strawman (baseline) EIS design, we feel that the following best represents our views at present.

We realise that these views are subject to modifications in the light of further knowledge of the spacecraft subsystems, other Solar-B instrument desires, and selection of the U.S. contribution to the EIS detector system.

Because of these uncertainties we have only concentrated here on the aspects which affect the EIS<->spacecraft interface, and EIS operational aspects.

EIS Baseline/Strawman Design:

(1) EIS will be as independent as possible:

- Contain within itself all its necessary processing.
  (We see no cost savings in having spacecraft performing EIS processing as EIS will have to implement all processing functions anyway in order to test instrument)

- The EIS could contain observation tables which instruct the EIS to operate particular modes, with detailed settings at particular times, for particular durations. Such tables could alternatively, or also be implemented in the spacecraft.

(2) EIS will respond to high level operational commands (such as quiet sun mode with specified detailed control parameters such as ccd window, cadences, etc). It will then autonomously operate such modes (such as setup and perform repeated ccd exposures, whilst autonomously moving the

mirror between exposures etc.)

- This will reduce demand on spacecraft commanding, by preventing need for long streams of repeated detailed commands from spacecraft.

- Such autonomous operation will also allow for much faster real-time control, and much more flexibility in mode design, and operation.

(3) EIS will also allow 'low level' commanding to set up and perform simple 'atomic' steps such as set ccd gain voltage, set mirror position, start/stop/readout ccd exposure.

- This will be valuable in debugging basic instrument capability, and could be used to fully control the EIS from the spacecraft if desired.

(4) EIS will transfer science (CCD) data in blocks to MDP.

- Assuming MDP data compressor, would operate best by having EIS data input in contiguous blocks.

(5) EIS will add associated info with each data block such as type of data compression scheme required, length of data block, type of data (e.g. spectral/image, raw, integrated)

- Best incorporated as header in front of block of data -> then becomes packet of data - i.e. block with descriptive header.

Note: There are 3 critical interfaces here :-

(i) EIS to MDP i/f
(ii) MDP to onboard mass storage
(iii) Onboard mass storage to ground i/f.

The above block/packet transfers only affect EIS to MDP i/f.
Does not necessarily have to affect the other i/f's if decided not to be packet based. (Also not necessarily affect i/f's from other instruments to MDP - though would recommend it for possible simplifying gains).

Information EIS Needs From MDP/Spacecraft:

At present our knowledge of the EIS to MDP interface is rather vague, and refinement in terms of maximum data transfer rates and possible technology's for the interface would be extremely helpful for whatever information is available from the spacecraft side.

The EIS needs this knowledge to help contribute to the selection process between the various Hara plans, and is also valuable in allowing the EIS team refine its maximum processing requirements, and hence choice of processor, as well as for advancing the design of the EIS-MDP interface.

- **EIS<->MDP maximum data transfer rate ?**

  - We are currently assuming that 64 kbits/s is the nominal EIS telemetry allocation, on entry to the Spacecraft onboard mass memory storage (which is after the MDP compression stage.)

  - This implies that the nominal data rate from the EIS to the MDP will be 64 kb/s multiplied by the expected MDP compression factor. E.g. assuming a maximum MDP compression factor of 10 (for image compression), this means that to get an output rate of 64 kb/s from the MDP, the input data rate from the EIS must be 10x64 = 640 kb/s.

  - Now we also believe that the EIS may be allowed to exceed it's nominal 64 kbps telemetry allocation at certain times. Assuming, that the maximum EIS telemetry allocation is 2x the nominal, this leads to a combined maximum data transfer rate from the EIS to the MDP of **~1.3 Mbits/sec.**

- **What are the spacecraft/MDP limitations on the maximum data rate for this EIS<->MDP interface ?**
  What technology is spacecraft considering for this interface ?
  What is the maximum data transfer rate associated with this technology ?

  - Is the spacecraft side consideing e.g. twisted pair or ethernet connections, which can commonly cope with even higher data rates on ground systems ?