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# EIS Telemetry

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## 1 - Introduction :

This document outlines the TM packet structure to be used on the EUV Imaging Spectrometer (EIS) to be launched on-board ISAS Solar-B satellite.

## 2 - References :

- 1 - Solar\_B EIS Engineering Meeting at MSSL (27-7-99), Presentation by H.Hara (NAOJ).
- 2 - Private discussion with Matthew Whyndham.

## 3 - TM Structure design guidance :

The following items are used for adopting the tentative TM packet structure:

- 1 - There are two channels for data transfers; the status channel (HK) (exclusive channel) and the image data channel (image and engineering data) [1, page 11]. For example science data (CCD data) and engineering data (eg. EIS time tagged table or observation table dump) can be sent to the MDP via the image data channel.
- 2 - The instruments passes their data to the MDP. The MDP re-packetises the data and produces TM packets [1, page 23]. The structure of the instrument data (in the order of transfer) is as follows (non CCSDS structure [2]) :
  - 1 - EIS packet header.
  - 2 - Time stamp reflecting the exposure start time (c1). No. of bits is TBD.
  - 3 - Time stamp reflecting the start of data transfer to the MDP (c2). No. of bits is TBD.
  - 4 - EIS image parameters.
  - 5 - EIS pixel data.

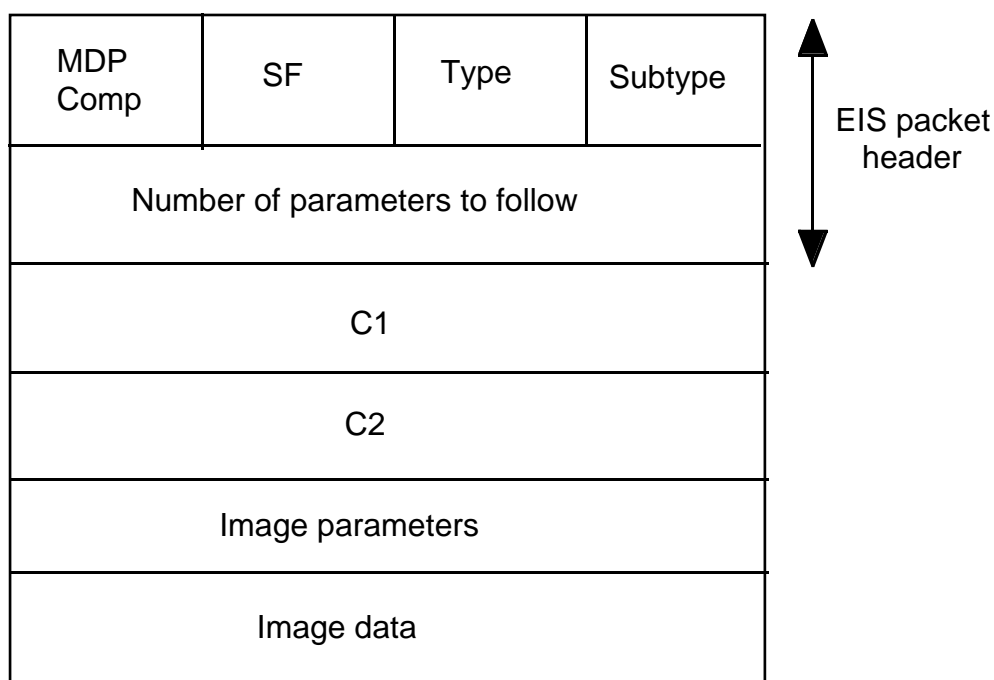
Note that the parameters listed in items 1 to 5 are to be supplied by EIS.

3 - The MDP re-packetises the data as follows (in the order of transmission to the ground) :

- 1 - Add CCSDS packet header (MDP operation).
- 2 - Append EIS packet header as received from EIS
- 3 - Append c1 and c2 as received from EIS.
- 4 - Add PIM time stamp to packet (MDP operation)
- 5 - Add c4 time stamp to packet (PIM time signal reception time) (MDP operation).
- 6 - Append EIS image parameters.
- 7 - Append EIS image data

The details of the tentative EIS TM structure is described below, based on the latest available information [1]. Note that the EIS to MDP TM structure is **subject to an agreement between EIS and Solar-B project.**

#### 4 - EIS to MDP data structure :



**EIS TM Packet Structure**

1 - EIS packet header :

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1 - MDP compression control :

This parameter is a 4 bit and should contain 1 bit for bit compression selection (0 = disabled, 1 = enabled) and 2 bits for image compression selection (00 = disabled, 01 = DPCM selected, 10 = JPEG selected)

2 - SF (segmentation Flag) :

A 4 bit parameter that allows packet grouping. If a single packet contains all the data, the the SF flag = 0. However, if the data is contained in more than one packet (eg. a full CCD dump), then the segmentation flag is a counter that increments from 1 to 15 (Max. 256 kpixel X 15). For example, if dumping the CCD require 3 packets, then SF has the values of 1 (first packet of a group), 2 (second packet of a group and 3 (third packet of a group).

3 - Packet type. This is a 4 bit parameter indicates the category to which the packet relates. The EIS packet types (TBC) are as follows :

Type 1 = Science TM  
 Type 2 = Table dump  
 Type 3 = Anomaly TM report  
 Type 4 = Memory dump.

4 - Packet Subtype. This is a 4 bit parameter, together with the packet type indicates the nature of the telemetry. Following are the packet subtypes for EIS (TBD):

Science TM subtypes :

1 : Raster packet (indicate the start of new raster)  
 2 : Exposure packet(s)

Table dump TM subtypes:

1 : Time tagged table dump  
 2 : Exposure tables dump  
 3 : Line list tables dump  
 5 : Health monitor table dump  
 6 : Internal (EIS) flare detection parameter table dump

Anomaly TM report subtypes:

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- 1 : TC error report (rejected command)
- 2 : Health monitor report (parameter out of limit)

#### Memory dump subtype

- 1 : ICU memory dump

5 - No. of parameters to follow. This is a 32 bit parameter indicating no.of parameters (data) to follow. This is based on the assumption that maximum image size per packet = 256 kpixel [1, page 15].

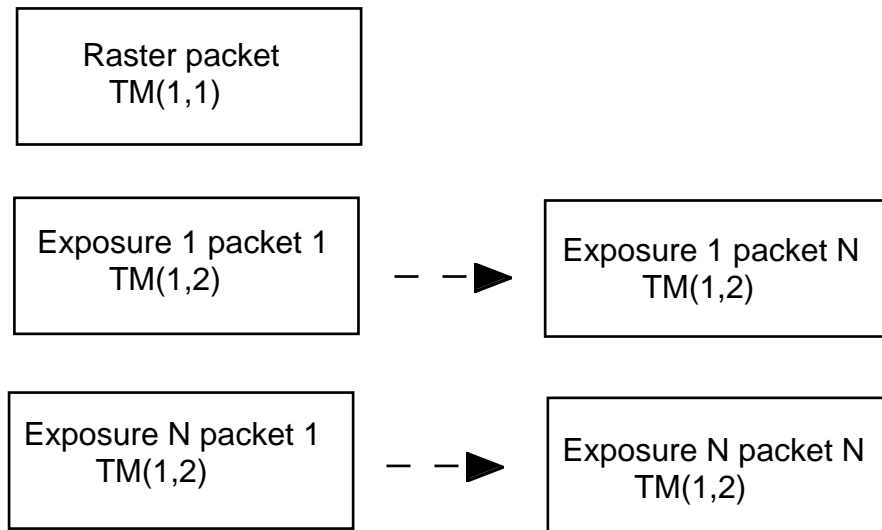
#### **4.1 -TM Types 2 to 4 data structure:**

These packet type contains engineering data, hence the structure is simpler than TM type 1 (science TM). Note that c1 reflects the parameter acquisition time. The dump parameters are appended to the image parameters. For example, if number of parameters to follow is 1000, then the dump data occupies the following space:

dump parameters = number of parameters to follow - c1 - c2

#### **4.2 -TM Type 1 data structure:**

The science stream data flow is shown below (raster packet and exposure packets).



### TM(1,1) and TM(1,2) packet stream

The **raster packet**, TM(1,1), signals the start of a raster. This packet contains the following parameters :

#### Image parameters

Sequence table index

Data compression scheme (EIS software compression, if in use)

Slit number / slot in use

Coarse mirror position

Fine mirror initial position

Number of mirror steps

Mirror step size

Exposure time 1

Exposure time 2 (if more than one exposure is needed per raster)

Line list 1 index

Line list 2 index (if needed)

Line list 1 parameters (10 lines X 4 words per line; X-start, Y-start, X-length, Y-length), i.e 40 words

Line list 2 parameters (10 lines X 4 words per line; X-start, Y-start, X-length, Y-length), i.e 40 words

Note that only 1 Raster packet is generated per observation. The raster packet

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parameters is treated as TM 2 to 4, i.e., the MDP re-packetise and sends (no compression is anticipated).

The data generated by each exposure plus the exposure key parameters are packed in **exposure packet(s)**, TM(1,2). It is anticipated that for most EIS exposures, a single packet (up to 256 kpixel, [1, page 15]), is enough for packing the exposure data. However, there may be a case of needing more than one exposure packet (full CCD) for calibration and test purposes. The exposure packet, TM(1,2), contains the following parameters :

**Image parameters (see un-resolved issues)**

Length of image parameters in words (TBC)

Mirror position

Exposure time

Line list number (1 or 2) if more than one window is needed, otherwise 1

**Pixel data (start of image parameters + length of image parameters)**

**5 - Unresolved issues :**

- 1- It is desired that all TM packets are checksummed by EIS. However, due to MDP re-packetisation or compression, conventional checksum is not possible. However, a pixel data checksum may be introduced, when no MDP data compression is in use.
- 2- Length of image parameters in words for TM(1,2) may be introduced as part of the image parameters to give some flexibility into adding further parameters in the future.
- 3- HK structure.