

Herschel / Planck

Instruments to CDMS Interfaces Working Group

(Data Management WG)

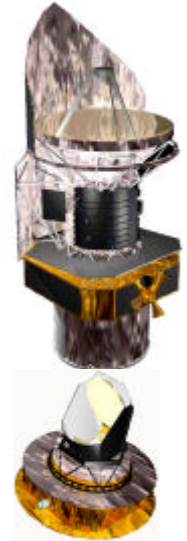
Meeting 8, 9-10-2001, ESTEC

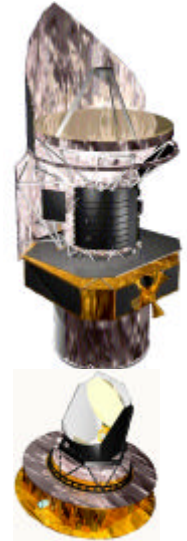
Stefan Thürey, SCI-PT



Data Management WG, Meeting 8

- **Agenda:**
- 1) Introduction, Action Item Status
- 2) PS-ICD: Clarifications on Packet Structures
- 3) On-board Time Synchronisation
- 4) Utilisation of the SDB Protocol
 - 4.1 General remarks to data bus I/F testing
 - 4.2 CDMS Sim. acceptance test: open points, future activities
 - 4.3 Asynchronous message handling
 - 4.4 Other implementation issues
- 5) Data traffic scenarios and throughput on the data bus
- 6) Status of Instruments, A.O.B.



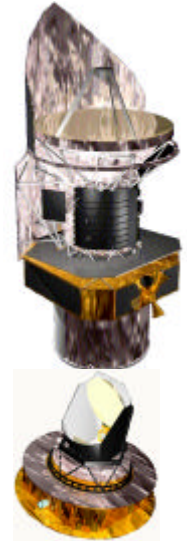


1) Introduction, Action Items

- The last meeting of the Data Management WG took place on 30-1-2001 in Garching.

Thereafter various issues were dealt with in the framework of the Instrument-EGSE WG, like the CDMU Simulator, or in conjunction with the Prime kick-off clarification meetings, System Requirements Review, etc.

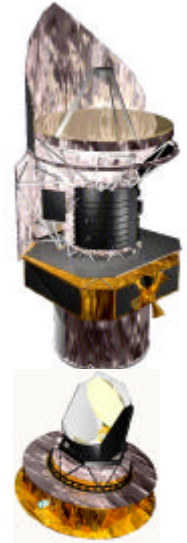
- The meeting of today should serve for presenting the status of the data management I/F as established after the SRR, and should give an overview of the development status of the instruments.
- Open issues related to this I/F should be addressed, and action items in order to resolve them, should be defined.
- After this meeting the Data Management WG will be organised and chaired by the Alcatel.
- Als from last meeting:
IFSI was asked to provide a proposal how the 16 plus 16 bits of the Memory ID and Address Field of the Memory Management Service should be used with a TCS 21020 DSP (still pending).



2) Packet Structure ICD: Review and Clarifications

- **Comments on selected subjects:**

- **1) Introduction of capability to modify, or define, HK/ Diagnostic-Packets:**
 - Instruments have indicated that they do not see a necessity for that service, and would rely instead of a code patch, if HK-packets need to be modified.
- **It should be pointed out that any SW modification in-orbit has a cycle time from definition to activation of new code on-board in the order of 3 to 6 months, among others depending on the quality of the delivered SW maintenance facility.**
- **2) Modification of HK / Diagnostic packets:**
 - Currently only TM-packets up to the length of about 242 octets can be (re-)defined. Considering this capability as 'additional' service, this might be acceptable. However, the subservice TC(3,1), (3,2), and (3,9), (3,11) are under review.



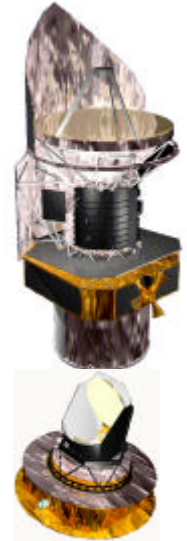
2) Packet Structure ICD: Review and Clarifications, 2

- **3) Start Function, TC(8,1):**

The parameter N will be replaced by a **Spare-field, set to zero**. A Start Function TC should always be carried out with parameters, defined by a SID. (The SID=0 can define an empty parameter field). The same applies for TC(8,4).

- **4) Variable-length Parameter-fields in Telecommands (8,1) or (8,4):**

If only a few out of a larger group of parameters need to be changed, either a specific SID is used for only those parameters, or a larger parameter field is sent, with only a few changes.

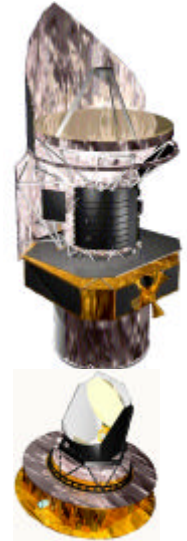


2) Packet Structure ICD: Review and Clarifications, 3

- 5) A Technical Note '1553 Bus Protocols', SPIRE-RAL-PRJ-issue 1, has been circulated last week.
- The purpose of this note is **only, to summarise several thoughts and suggestions of a single party (RAL)**, after first experiences with the SDB Protocol. This was done on request by ESA.
- The suggestions for modifications will be analysed and commented.

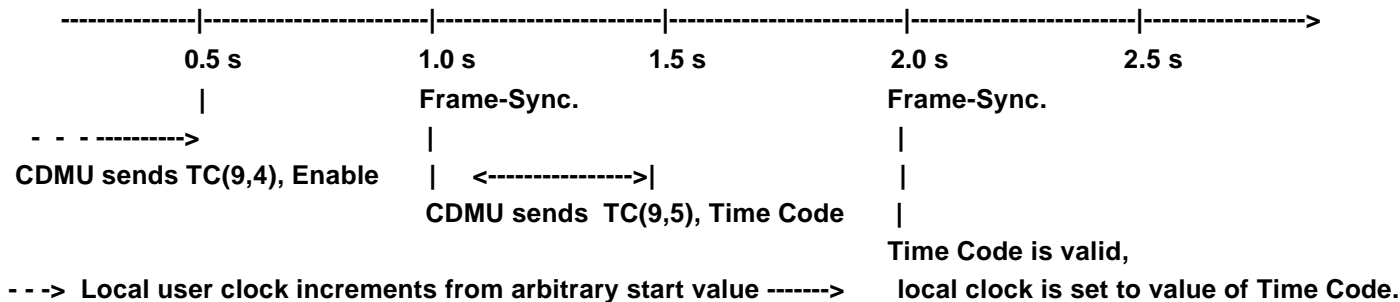
But only if evidence of a **definite and severe flaw of the protocol** can be provided, a **proposal** for a modification will be worked out by Prime / ESA, and then circulated to all parties affected, in order to assess the impact of a change. **Only after agreement by all parties the SDB Protocol will be modified.**

- **Currently, no update is foreseen. The only need for updating the protocol may be in the area of more detailed definitions of error-handling.**

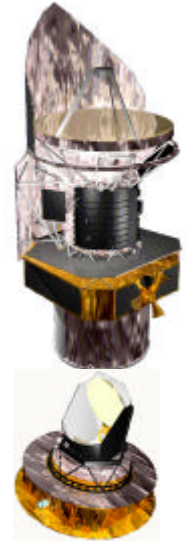


3) On-board Time Synchronisation

- On-board time synchronisation is used to allow central and remote units to utilise a common time, which is identical for all users, with high accuracy. Currently, the detailed timing requirements related to the TM-Packet Service 9 are missing or TBD.
- These requirements need to be defined in order to enable all on-board users (ACC, instruments, etc.) to carry out the on-board time synchronisation properly.
- The following timing is under consideration (currently TBD / TBC by industry):



- Time Verification may be carried out **independently** from Time Sync. (before / after).

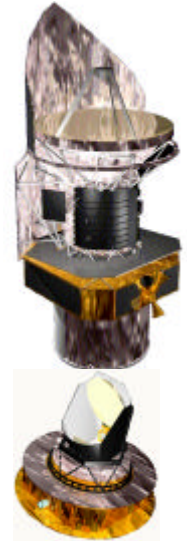


4) Utilisation of the SDB Protocol (1)

• 4.1 General remarks to data bus I/F testing

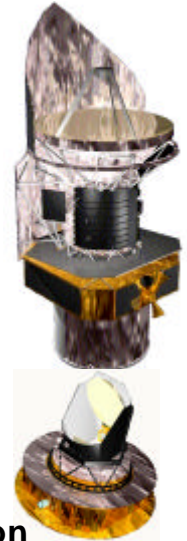
The success of a on-board data bus infrastructure based on the Mil 1553 B standard depends on several factors:

- Selection of a subset of Mil 1553 B options, agreed by all parties
 - * specified as part of SDB Protocol
- A consistent data exchange protocol for all communication layers
 - * specified in overall PS-ICD
- **A detailed and comprehensive test and verification approach / plan**
 - * For the Physical Layer and basic characteristics of the Data Link layer the plan shall be based on Section 100 of the MIL-HDBK-1553A (AD 2 of Appendix 9, PS-ICD). For requirements up to the Transfer Layer the test plan/procedure should be based directly on App. 9, PS-ICD
- Proper testing according to these plans on various levels of integration (I/F-unit-level, instrument-level, ... to overall S/C-level)



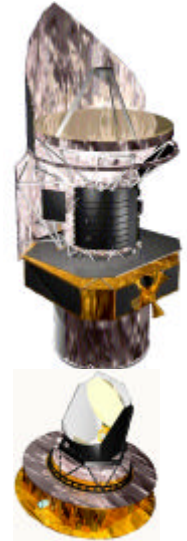
4) Utilisation of the SDB Protocol (1, cont'd)

- For the 3 Herschel Instruments the following test specifications for the data bus I/F have been generated:
 - CDMS-interface test-requirements spec., SRON-U/HIFI-SP-2000-5 (mainly applicable for RT, i.e. instrument)
 - CDMS Simulator Acceptance Test Plan, SPIRE-RAL-PRJ-000733 (adapted for BC, like CDMS Sim.)
 - Filled-in CDMS-Sim. Acceptance Test Plan = Test Report (final issue pending)
- They represent an **adequate test approach** for this interface.
- However, the draft of the DPU / ICU Spacecraft I/F Acceptance Test Plan, CNR.IFSI.2001TR04, seems to be too superficial, as it skips many detailed test steps.
- **If this test plan is not improved significantly, and followed during ICU/DPU-tests, the Acceptance Data Package at instrument-delivery will be considered incomplete, and ESA will have reservations against connecting instruments with undocumented I/F characteristics to the S/C.**



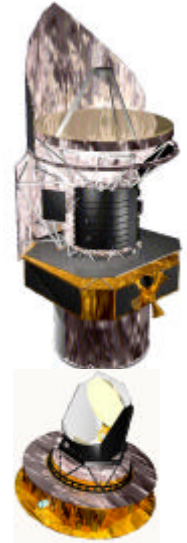
4) Utilisation of the SDB Protocol (2)

- 4.2 CDMS Simulator acceptance test: open points, future activities
 - The first extensive acceptance test of the data bus I/F simulator for three Herschel instrument EGSEs (called CDMS Simulator) has been successfully carried out at RAL on 26, 27-9-2001.
 - However, certain deficiencies have been registered:
 - Missing capability to link the protocol to a master/external clock, i.e. to make it synchronous to the on-board timing based at a 1.0-sec-cycle.
 - Setting of instrument time
 - Dynamic/ instantaneous switching between different bus profile lists (without data gaps)
 - **Burst mode, or any capability to transfer data in more than about 21 Subframes per second.**
 - Fast asynchronous message handling
 - Any error handling (error reporting to higher layers, and reaction to anomalies)
 - More extensive performance testing



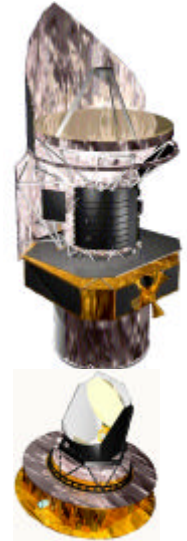
4) Utilisation of the SDB Protocol (2, cont'd)

- **CDMS Simulator acceptance test: Future activities on open points**
 - Synchronisation of the protocol to a master/external clock: RAL has taken an action to investigate several options and implement one out of them.
 - Setting of instrument time with the CDMS-Sim.: under investigation by RAL
 - Dynamic/ instantaneous switching between different bus profile lists (without data gaps): under development by RAL.
 - Burst mode, or any capability to transfer data in more than about 21 Subframes per second: currently acceptable as starting point, under development. Firm goal: full compatibility with spec.
 - Fast asynchronous message handling: desired by instruments, under consideration by RAL.
 - **Any error handling: to be implemented. It should be noted that details on this subject are TBD. S/C-level system engineering should generate the detailed requirements for the CDMS, which then can be simulated in instrument EGSEs.**
 - More extensive performance testing will be done by RAL to cover the operational envelopes of the instruments.



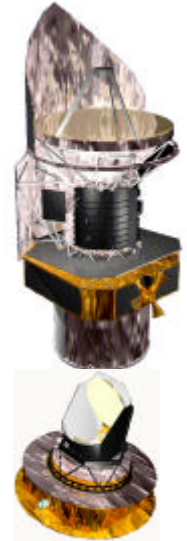
4) Utilisation of the SDB Protocol (3)

- **4.3 Asynchronous Message Handling**
(Utilisation of Subaddresses 5T, 6T for short TM-messages, and SA 3R, 4R for short TC-messages):
 - It should be recalled, as introduction to the subject, that
 - the PS-ICD is a specification of data structures and generic protocol rules. It does normally not specify the operational use and their limitations.
However, some operational requirements are put into the introductions of several paragraphs, others may still be missing.
 - The PS-ICD covers the total envelope of all definitions needed on-board the two spacecraft. Some of these data structures and capabilities are for overall S/C-control (only), or for high priority functions (in contrast to instrument communication). **Several features are not (fully) available to instruments.**
 - Several details related to the use of certain packet structures were TBD (on purpose) in order to give the freedom to the Prime to design an optimised S/C.



4) Utilisation of the SDB Protocol (4)

- The open issue:
 - It is requested by several instrument parties to use SA 5T and 6T for short TM-packets, like all TC-Verification and Event-Packets on a regular basis, in order to have a capability to route two TM-packets per Subframe, instead of just one long or short one.
 - However the concept for the use of Subaddresses 5T, 6T is, that the S/C has the capability to retrieve short high priority messages much faster than normal. The CDMU would need to poll one or a small group of RTs each Subframe to check, if new messages are waiting, also in 'Instrument-Subframes'.
 - This service will not be available to instruments but used in support of e.g. FDIR functions of the S/C or ACMS. Only in exceptional cases, where a fast system reaction is needed (< 500 ms), this service can be used. Approval of ESA / Prime is needed for each individual case / packet.

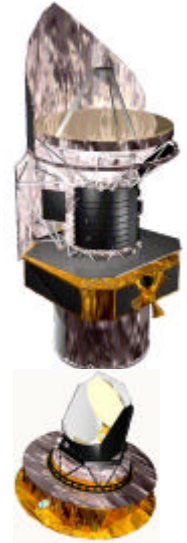


5) Data Traffic Scenarios, Data Bus Use

- A TN has been distributed by Alcatel, in which certain boundary conditions, which have impact on the data rates on the data bus, are discussed.

The TN does not define data rates which are actually available to instruments - the binding values are laid down in the IID-A.

- This TN was a first attempt to analyse the effects of the various parameters. As several points could not be taken into consideration at the time the TN was generated, the figures provided in that issue of the TN are all under review and will be updated.
- Now, as the System Requirements Review comes to a conclusion, resulting in consolidated and updated specifications on all levels, the TN will be updated in line with the actual status of ESA and industrial specifications, and re-issued.
- Certain aspects will be addressed in a separate presentation:



6) Any other Business, Action Items

- **Short overview on development status and future activities of Instruments:**
- **Summary of Action Items: see MoM**
- **Next Meeting: as agreed during the meeting of 9-10-2001**

Tentative date: Thur., 29-11-2001

Location: Cannes