SPIRE-RAL-MOM-000798

OBS Meeting at RAL
Tuesday 31st July
Conference Room 3, Building R61

Attendees: C. Cara, R. Cerulli, D. Ferrand, H-G. Floren, K.J.King, T.L. Lim, G. Olofsson, S.D. Sidher, B.M. Swinyard

1 Development Schedule

After discussion the teams agreed critical dates for their work:
30/09/01: SO receive H/W for the simulator from their contractor
30/11/01: DPU-CDMS Interface test at IFSI
15/01/02: DRCU Simulator#1 to IFSI to start OBS testing

2 Documents Required

The following documents were identified as being required for the work:

DRCU Simulator URD
This should cover the different phases: DPU interface and OBS testing at IFSI, EGSE Testing at RAL, AVM testing at RAL and Alcatel
Action OBS#1-01 King/Swinyard to write DRCU Simulator URD, Issue 1.0, covering at least IFSI testing phase. Due 15th September.

DPU ICD
This needs to be placed under control by 15 September to allow SO to use it for the design of DRCU simulator and for RAL to generate the SPIRE MIB (used for testing the OBS at IFSI and the AIV facility at RAL).
Action OBS#1-02 Cara and Ferrand to send updates to the DPU ICD to Cerulli. Due 15th September.
Action OBS#1-03 Cerulli to update the DPU ICD. Due 20th September.

SO felt it was important to fix the response timing as much as the content of data as this has impact on their hardware and real-time software design.

Details of time evolution of data within a subsystem should be described in design description documents.

DRCU ICD
This will cover FPU interfaces, internal PSU interfaces, power interface to S/C and launch-lock interface.
Action OBS#1-04 Cara to update the DRCU ICD. Due 15th September.

Status of Other Documents
- MCU Design Description - Issue 2 available - now needs updating following this meeting
- DCU Design Description - needs updating

Action OBS#1-05 Cara to update the MCU Design Description. Due 30th September.
- SCU Design Description - not yet available

Action OBS#1-06 Cara to issue the first draft of the SCU Design Description. Due 30th September.
- PSU Design Description - this is to be delivered by contractor, but does not concern the DPU-DRCU interface
- DPU Design Description - A version is available
- Operating the SPIRE Instrument - draft 1 issued for this meeting

Action OBS#1-07 Sidher to update the 'Operating the SPIRE Instrument' document to draft 2. Due 31st August.

- Data ICD - a version is in preparation

Action OBS#1-08 King to issue draft1 of the Data ICD. Due 30th September.

- Test Plans - TBD at a future meeting
- Integration plan for Warm Electronics

King already has an action to provide this, due 30th September

3 OBS Architecture (Cerulli)

Riccardo described the OBS and DPU-DRCU interface

High Speed Data Lines:
Because the high speed science data FIFO is only read when the 'FIFO half full' interrupt is received it was recognised that a specific command to the instrument to read the FIFO would be necessary at the end of an observation (or building block) to make sure that all data associated with a measurement was telemetred to the ground in good time. A consequence of this would be that science telemetry packets may not always be of the same length.

If synchronisation of high speed data is lost - we have to clear the FIFO and restart data taking. Presumably the DPU will take care of this action.

Low-speed line:
Only one output latch and one input latch is provided for all three channels, so the DPU has to read the response to a command before sending the next command. This takes as a minimum 200us plus the response time of the DRCU (which should be less than 500us). In general the DPU will be configured to wait 1 ms from sending a command to reading the response.

If an error occurs in executing the command the response will contain an error code (flagged by a bit in the response word). The DPU must check this for each command and take the appropriate action.
Cara will put this information in the DPU ICD (see Action OBS#1-02)

MCU Trace Mode:
Ferrand described how the trace mode works in the MCU. We are now able to store any set of MCU parameters at timing intervals greater than or equal to the MCU control loop time (100us, TBC), subject to the limits on the memory space available (TBD) and the time required to read the data out on the high speed telemetry line.
Ferrand to add MCU trace mode to the DPU ICD (see Action OBS#1-02)

Measurements:
Cerulli described how it was possible to command the DRCU without interfering with the periodic housekeeping data collection and yet retain the timing accuracy required. This method uses a high-priority interrupt, and requires the setting of a mutex in advance of the command being sent to the DRCU in order to stop housekeeping data collection while the commanding takes place. A consequence is that the DPU needs to read and store the return value from the last housekeeping request during the interrupt routine so that it can be read later by the housekeeping task when it resumes.

Cerulli proposed to implement the measurement operations in the form of a Command List, which would be interpreted by the OBS. This list would contain both commands to the DRCU and commands to the OBS (to allow functions such as setting the interrupt timer, looping, branching, calling subroutines etc)

It was not clear during the discussion whether this method of controlling measurements would be acceptable.

Action OBS#1-09 King/Sidher/Swinyard to evaluate the Command List concept and if acceptable send a list of commands required in the OBS Command List. Due 30th September.

4 Operations

Chopping
King described a possible implementation of the CHOP command

Cara pointed out that detector sampling is synchronised to the detector bias clock. This means that there is a possible jitter on the detector sampling with respect to the BSM position of up to one bias period (this could be as much as 30ms for a 30hz bias frequency).
Action OBS#1-10 Swinyard to write a TN confirming that if we record the sample time and can calculate the position of the BMS at that time (by interpolation of the BSM position data) then there is no significant increase in the noise on the determined signal. Due 15th September

Action OBS#1-11 King/Sidher to identify the high-level commands required to operate the MCU subsystems, including whether they are to be acted upon immediately. Due 15th August.

Calibration
The DPU is responsible for driving the calibrator waveform (up to 5 Hz, sine, TBC) as well as sending commands for sampling data etc.

Temperature Control
This will be handled by the DPU as part of the housekeeping data collection task, but this requires the temperature sensor data to be available as housekeeping parameters.

Cara agreed that the DCU would continuously sample detector data and copy the TC parameters into memory. These would then be able to be requested by the DPU as a HSK channel for thermal Control.
Cara will put this information in the DPU ICD (see Action OBS#1-02)

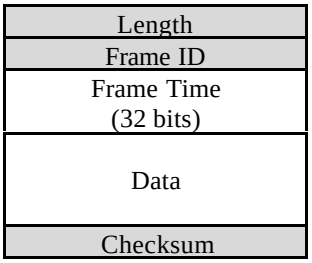
CC, DF to update DPU ICD according to KK's proposed tables

5 High Speed Data Frames from the DRCU

The following DRCU frame structures from DRCU to DPU were agreed:
Notes:

- *All words are 16 bits unless indicated otherwise*
- *shaded words are removed by the DPU before packing into a science telemetry packet*

General frame format :



Where:

Length: Total number of (16 bit) words in the frame, including Length
Frame ID: Frame type identifier:
Note: Each Frame type is allocated to a different Science Telemetry Packet Subtype and SID for transmission to the ground

Unit	TM Packet Subtype, SID (hex)	Frame Type	Frame ID (hex)
DCU	1,00	Full Array	00
DCU	1,01	PSW	01
DCU	1,02	PMW	02
DCU	1,03	PLW	03
DCU	1,04	SSW	04
DCU	1,05	SLW	05
DCU	3,06	Test Pattern	06
DCU	4,07	Phot Offets	07
DCU	4,08	Spec Offsets	08
MCU	2,10	SMEC Scan	10
MCU	2,11	SMEC Step	11
MCU	2,12	Chop	12
MCU	2,13	Jiggle	13
MCU	3,14	Trace	14
MCU	3,15	Test Pattern	15
SCU	4,20	Hsk	20
SCU	3,21	Test Pattern	21

Frame Time: Time that the frame was generated by the DRCU Unit
Checksum: Exclusive OR of all words (TBC). This value is checked by the DPU and a flag set in the DPU telemetry if there is an error.
Data: Determined by Frame ID

SMEC Scan Frame (10)

Zero Crossing Delta Time (32 bits)
Crossing Count
Mean Velocity
DC LVDT

SMEC Step Frame (11)

SMEC Position
Position Error
AC LVDT
DC LVDT

CHOP Frame(12)

Time (32 bits)
Chop Position
Chop Error Signal

Jiggle Frame (13)

Time (32 bits)

Jiggle Position
Jiggle Error Signal

Trace Frame (14)

Sample Time (32 bits)
Parameter#1
Parameter#2
Parameter#3
Parameter#4
Parameter#5
Parameter#6

Cara will put this information in the DPU ICD (see Action OBS#1-02)

6 MCU Command Sequences

Chopping can be commanded in the MCU in the following ways:
CHOP(y0,y1)

1. Automatic:

Set_chop_position0(y0)
Set_chop_position1(y1)
Set_chop_period(p)
Set_sample_interval(i)
Set_chop_samples(n) - number of samples per chop position
Set_chop_cycles(n) - 0 = indefinite chopping
Update()
:
:
Stop_chop() - if necessary

2. Command Driven

Set_chop_position0(y0)
Set_chop_position1(y1)
Set_sample_interval(i)
Set_chop_samples(n)
Move_chop() - move to y0 and take n samples
Move_chop() - move to y1 and take n samples
Move_chop() - move to y0 and take n samples
Move_chop() - move to y1 and take n samples
:
:

Jiggle is commanded in the following way:
Input: z, y0,y1 for each jiggle position
JIGGLEANDCHOP(z,y0,y1,……)

Move_jiggle(z) - move to z
Chop(y0,y1)
Move_jiggle(z') - move to z']
Chop(y0',y1')

Move_jiggle(z") - move to z"
Chop(y0",y1")
:
:

FTS is commanded in the following way:
Note: the encoder position count is incremented for each zero-crossing
Power on FTS - sequence is TBD but is followed by:
Initialise() - scans to find the zero point of the LVDT and sets the encoder position counter
Define_home(n) - moves the FTS n encoder positions to home position and resets the encoder position counter to zero
We are now ready to scan

SCAN(s, e, n)

Set_scan_speed(v)
Set_scan_mode(m) - sawtooth, triangular
Set_scan_number(n) - number of scans
Set_scan_start(s) - number of counts from home at which to start scientific part of scan
Set_scan_end(e) - number of counts from home position of end of scientific part of scan
Set_sample_interval(i) - generate a SMEC data sample at every i counts
Update()
:
:
This operation should be followed by a flush_fifo command to the DPU

Note: Scan quality information should be put in memory for reading as housekeeping data (it will need to be associated with a scan number)

7 'Command List' language

Assumptions:
- VM has a set of 32 (TBC) general purpose registers
- The response from each command sent is placed in a fixed VM register (TBD). It is overwritten when the next command is sent and the response to the previous command is read.

Language commands
Set(reg, value)
Incr(reg)
Decr(reg)
Add(reg,const)
Dec(reg, const)
Send(subsystem, code, value)
Send(subsystem, code, reg)
SetTimer(delay)
Mutex(flag)
JumpNZ(reg, displacement)
And(reg,value)
Jump(address)
Return()
Write(reg) - writes register to DPU Science Frame

Possible scenario for chop measurement:

Assume Command List Interrupt Routine is entered a fixed time (1ms, TBC) after command is received.

Delta Time	Commands	Comments
1ms	Set(r0,y0) Set(r1,y1) Set(r2,n) Mutex(set) SetTimer(1ms)	Copy arguments to registers Get command line
1ms	Send(MCU, Set_chop_position0, r0)	Initialise chop parameter
1ms	Send(MCU, Set_chop_position1, r1) SetTimer(249ms)	Initialise chop parameter
1ms	Send(MCU, Move_chop) Mutex(release) SetTimer(1ms)	Move to y0 Release command line
249ms	Mutex(set) SetTimer(249ms)	Get command line
1ms	Send(MCU, Move_chop) Mutex(release) SetTimer(1ms)	Move to y1 Release command line
249ms	Mutex(set) SetTimer(249ms) Decr(r2,1) JumpNZ(r2, -3) SetTimer(1ms)	Get command line Repeat for n chop cycles
1ms	End()	

8 Date of next Meeting

TBD

Summary of Actions

Action Number	Actionee(s)	Action	Due Date
OBS#1-01	King or Swinyard	to write DRCU Simulator URD, Issue 1.0, covering at least IFSI testing phase	15th September
OBS#1-02	Cara and Ferrand	to send updates to the DPU ICD to Cerulli	15th September
OBS#1-03	Cerulli	to update the DPU ICD	20th September
OBS#1-04	Cara	to update the DRCU ICD	15th September
OBS#1-05	Cara	to update the MCU Design Description.	30th September
OBS#1-06	Cara	to issue the first draft of the SCU Design Description	30th September
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