SPIRE Systems Team Meeting Caltech May 19 1999

Colin Cunningham and Matt Griffin 7 June 99

Present:

Jean-Louis Auguerres	SAp
Jim Caldwell	GSFC
Bill Gray	JPL
Matt Griffin	QMW
Gerard Lilienthal	JPL
Yannick Le Pennec	SAp
Bruce Swinyard	RAL
George Voellmer	GSFC
Laurent Vigroux	SAp
Rick Shafer	GSFC
Paul Harvey	U Texas
Harvey Moseley	GSFC
Terry Cafferty	JPL
Louis Rodriguez	SAp
Peter Hargrave	QMW
Colin Cunningham	UKATC
Jamie Bock	JPL
Ken King	RAL

Morning session (KJK chair)

1. Aims of the meeting (MJG)

1) Agreement for recommendations for warm electronics system architecture.

This recommendation should be based on technical and programmatic (schedule, qualification, etc.) considerations. Political and funding considerations should be addressed by the Steering Group.

2) Define essential preparation for the PDR Phase 1 in July.

Action 1: Colin to include all relevant people in forthcoming System Team teleconferences to address critical issues for PDR.

3) Discussion of reliability and redundancy philosophy.

2. Warm electronics architecture

JLA: 3 options (as outlined in minutes of Steering Group meeting at Isle de Bendor and WEG meeting on May 6)

(a) DPU, SPU, DRCU baseline
(b) Provision of boards by IFSI to IAC
(c) Include SPU functionality into DRCU by including processor board.

SAp have found company (Matra-Marconi Space) that has developed CPU board for other space experiments

Will need to negotiate with ESA on component quality. But this shouldn't have impact on decision now.

LR: Pointed out that the higher down-link rate and more powerful CPU in DPU means that the amount of memory needed not so great (possibly).

KJK: Yes but sampling requirements also going up . . .
LV: Must take financial budgetary considerations into account

LR presentation on warm electronics:

(1) Electronics block diagram: even with the SPU a sequencer (low-power processor) is still needed in the DRCU. SAp proposal is basically to get rid of SPU and upgrade this to higher power processor in the DRCU.
(2) Warm electronics configuration for the three detector options. Very difficult to find configuration that is OK for all three. Will need to be some final changes after detector selection.
(3) List of questions:
Spectrometer data processing (design driver)
GSFC electronics: 144 of FPGAs – reliability issue, with each having 100 pins – could ASICs be used ? (was discussed at the detector meeting, and dismissed due to lack of time available for ASIC development)
JPL electronics – JJB: Design has evolved and now simpler - to be discussed at detector meeting
(4) Detector readout interfacing-1: Electronics can do co-adding – don't need SPU functionality. KJK: are we doing deglitching on-board? Conclusion: Not for photometer. For spectrometer need to deglitch before decimation to take out oversampling. Interesting issue but not relevant to today's decision.
(5) Detector readout interfacing-2,3:
(6-8) Details of MMS processor board which SAp are considering for the DRCU (ERC32)

HM: If get rid of SPU, don't give up its spacecraft resources – it could be used for the GSFC option warm electronics.
JC: Need to think about what new architecture would mean for GSFC option.

Discussion:
Option B not credible technically and not optimum solution – it is eliminated.

Summary of pros and cons of the other two options:

Options are essentially equivalent in terms of processing power.

See table below for summary.

Conclusion: Option C is preferable on reliability grounds.
JC: For GSFC can live with either option. Reliability important. Useful to get the extra resources.

Action 2: KJK to write document making formal recommendation to Steering Group (by 26 May).

Action 3: MJG to distribute this note to SG and set up meeting/teleconference to make decision. Target date first week in June.

Item	Option A: Baseline	Option C: SAp DRCU	Comments
Interfaces		Fewer electrical/mechanical	Sortware: same
Memory		MMS board has 8 MB RAM (possible upgrade to 12). Additional memory boards can be added (VME bus).	No real difference between memory requiremetns for the two options
S/W development	Fourier processing may be faster/easier	Common tools for SPU/DRCU S/W SAp already familiar with SPARC chip development tools; advantage to have general purpose processor.	
Inetegration/test		Simpler: only two units	
Resources	Possibly faster	DRCU will get a bit bigger but overall mass/power will be lower, freeing up some resources	
Reliability		Fewer interfaces better; MMS processor already being qualified. Redundacny scheme easier as there are fewer boxes; Risk of delays/problems during AIV lower.	
Management		Fewer institutes	
Dev. Risk		Get hardware/dev. tools earlier; Fewer cards	

3. Products and tests vs models and parts grade (J-LA)

BMS: CQM must be flight-like – it qualifies the instrument. Our plan is to make the AVM the CQM electronics the same thing.
Internally, we'll need an EM.

Conclusion: Table on J-LA's viewgraph is fine (except that needs to be revised if Option C is chosen)

BMS: Do we need to have full implementation of all redundancy in CQM?
LV: Yes

3. System risk analysis and redundancy (LR)

Assessment of high risk items and redundancy requirements:

Thermometry: Cooler, FPU 300 mK, Calibration sources (comments: probably not critical),
Cooler: Pump heater and thermal switches
Arrays: Biases and clocks high risk – need redundant wires
BSM: Safe dead position. Two fully redundant drive circuits on same board in DRCU.
FTS: Could live with degraded performance if position sensor lost. Two fully redundant drive circuits on same board in DRCU.
Shutter: Must failsafe open.
MJG: would prefer to have option of operating it in flight.
Have redundant coils
Phot calib source: not critical. Double wiring.
FTS calib source: High risk as essential for compensation of telescope background
BAU/JFET box: Thermometry not so important.
DRCU: Redundant frame sequencer? Cross-redundancy between frame sequencers for photometer and FTS
SPU: Fully redundant boards
DPU: Communication between SPU and OBDH should be redundant.
Cooler redundancy: Should we double the cooler? Put one on Phot and one on Spec. or some other such scheme?
Baseline = no: not enough room and problem with parasitics.
We'll doupble all wires and pump heaters.
JJB: Had a design for FIRE with two operating coolers with one helping with the parasitics of the other one.
BMS: LD looking now at new design of heat switch with lower parasitics – if it works, could contemplate doubling them up.
Current ESA cooler study will be finished next year.

Action 4: Walter + Jean-Paul to provide advice on what elements of arrays need to be preserved in the event of partial failure (squares, strips?)

Action 5: BMS decide on number of calibration sources (in consultation with MJG, J-P B, SHM, et al.)

Action 6: CRC Analyse and document critical cryoharness wires

Action 7: J-LA to consider options for redundancy in warm electronics esp. DPU-DRCU connection.

Action 8: J-LA Update warm electronics model table in the light of possible decision on deletion of SPU.

Afternoon Session (CRC chair)

4. Optomechanical design (BMS)

Revision of optical design:
KD has moved M3 down.
Optical relay sends field to detectors
2-K pupil now much less elliptical
New design gives more space for detectors etc. at the back of the instrument.
Remaining problem: M4 pupil is astigmatic - problem for chopper. KD needs to work on M3 design to take this out.
Pick-off mirror can't be moved away - problem for HIFI requirements.
Question: What are HIFI assuming at the moment?
Alignment of detectors wrt. scan direction - cover under AOCS agenda item
Topographical map of instrument and component naming scheme was shown (& admired!)
MJG: 90 mm dichroic may be problem - what are implications? BMS: makes it awkward - dichroics move towards detectors - difficult to fit in. Can't place a number on this at the moment.

5. Thermal systems design

Action 9: BMS, MJG, CRC to define what level of thermal analysis is needed for the PDR.

6. Gaps in the IID-B (CRC)
Warm electronics power
Action 10: MJG ask Thomas Passvogel about status of warm electronics power availability
Mechanical interface drawings need to be updated
Action 11: BMS Raise Mech. design drawings for IID-B at May 27 Structure meeting
Alignment and stability requirements
Action 12: Kjetil Dohlen raise alignment and stability requirements for IID-B at May 27 Structure meeting
Thermal model
Action 13: MJG, BMS, CRC to define plan for thermal model treatment for PDR by May 27th Structure mtg.
Grounding and bonding
Action 14: All array groups comment on proposed CEA grounding scheme Mid-June
Attitude and orbit control/pointing – see later section in these minutes.

EMC and frequency plan
Action 15: All array groups provide information on frequency plan to CRC by Mid June
EGSE, MGSE, OGSE
Action 16 : Notes by Ken, MSSL, KD by mid June
BAU thermal design and model
Action 17: GSFC to provide BAU design by mid-June

7. AOCS (MJG)
Meeting with ESA on AOCS will take place on June 11, and will be attended by MJG.
Need to compile lists of requirements and questions.
Baseline is in FIRST Scientific Pointing Modes Document (on DMS)

Issues to be addressed at June 11 meeting:
Peak-up mode
Scan rate (max and min): Are
Scan direction/angle
Pointing accuracy during scanning
Turn-around time
Stability and accuracy requirements of scan rate.

Action 18/19: All Systems Team members to review SPRD and provide input (requirements/questions) to MJG prior to the meeting (June 5)

8. Wiring systems CRC deferred to next day splinter

9. Thermal tables (CRC)
CRC showed a what is currently in the IID-B, and agreed to distribute this where necessary, and update the thermal budgets for each subsystem.

10. Mass budget (BMS)

BMS showed the new table summarising budgets and assumptions:
Total H/W + covers to be supported leaves 16-19 kg for structure.
Conclusion: on-target for mass estimate
JJB: JFET box mass may need to be upped a bit
BMS agreed to consider this.

11. Status of IRD (BMS)

- Instrument overview + top-level SRD requirements: written as draft
- Model philosophy + qualification requirements: in draft
- Verification requirements: to be written
- Safety requirements: need work
- Autonomy requirements: not written
- Reliability and redundancy philosophy: needs work
- EMC: not written
- Instrument operations is sketched in: needs detailing
- Global budgets: need to be put in
- Common structure: in draft
- ^{3}He cooler: in draft
- Shutter: not in yet - document exists
- Cold harness within FPU: needs work
- Photometer: all subsystem requirements in draft
- Spectrometer: Detectors needs more information. Calibrator source needs to be put in.
- Warm electronics: J-LA is compiling separate document
- AIV facility: not started. Better to write a stand-alone document

BMS: Major hole is Instrument operations
LV: Need to start with spec and show that it's met so include simulations..
CRC: Sensitivity model and simulations needs higher profile in PDR.
J-LA: Don't need to include Warm Electronics Requirements in IRD
BMS: Agree
Conclusion: Need to have review of IRD + warm electronics + OBS requirements documents in between PDRs 1 and 2. Systems team should have dedicated meeting on this.

Action 20: MJG: Include discussion of how instrument sensitivity and simulations are to be included in PDR Phase 1 in Det. Mtg. Simulations session
Action 21: LV: Draw up draft of autonomy requirements of IRD BMS can then transfer it into IRD form. June 20
Action 22: CRC: Write section on EMC. June 20
Action23 : KJK : Provide input on redundancy to BMS for IRD
Action 24: CRC: Provide input on FPU internal harness requirements
Action 25: KJK: Write draft of Instrument Operations section in consultation with MJK, project scientists etc.
Action 26: MJG, CRC, BMS, KJK Review draft IRD

11. Status of Instrument Development Plan (KJK)

Following complaint from Ken on the few adequate Development Plans he had received, the following action was agreed:
Action 27: Write to Co-Is emphasising the need for Institute Project Managers to provide KJK with essential information and to regard deadlines seriously

The Purpose of the ICP is to show: What is being developed; How will it be verified; When will it be provided; How will it be operated
Need table like J-LA's warm electronics for FPU subsystem
Action 28: Table of deliverables for subsystems and models.
Action 29: All Institute PMs: Subsystem Development Plans by mid June
LV: Will have problem in providing detailed development plan for July PDR. Maybe Sept is possible.

11. Interface Control Documents (CRC)

CRC reported that the ATC has produced a BSM-structure ICD as an example.
The ICDs should cover issues relevant to the two subsystems - not repetition of what appears in IRD etc.
Cal source-chopper is the next example to be addressed
How will evolution of ICDs be monitored? It is important that the systems team keeps strong overall control of interfaces, which is where things most often go wrong.
CRC will include this in the Interface Control Plan - regular meetings of a subset of interface review meetings.
Consortium meetings should also become more technical now we are into the design phase of the instrument and the requirements are more fixed.

12. Actions review (CRC)

KJK: JAL is now looking at minutes of all meetings to track actions. So meeting minutes should include summaries of actions and how they were closed.

52-23	Shutter	Will know this week
52-25	ICD documentation	In hand
52-38	Plan up to CDR	Open
52-4	Structure space envelope	Open
52-10	Strap apertures	It was agreed that the thermal straps should come into the FPU structure through the sides, to enable thermal connection to be made and broken. Size and detailed design TBD, but action closed
52-11	Wiring and connector apertures	It was agreed that all connections would go via the 'JFET box'. Action closed
52-13	Chopper ICD	In draft, but not complete or distributed, so Open

52-5	Venting requirements	Closed – in IRD
52-8	Light-tight aperture design	Open (add RF)
399-2	Updated FTS sensitivity model	Open
399-3	Crosstalk calculations	Closed – as viewgraph to detector meeting
399-10	BACUS test spec	In hand
399-12	Filtering scheme for SPIRE	In hand
	Bias modulation scheme	Open (irrelevant except for JPL)
399-14	Wiring systems & redundancy	Open

13. Summary of Meeting Achievements of Aims

1) Agreement for recommendations for warm electronics system architecture.

We agreed on a recommendation on technical grounds that the DRCU should carry out the functions previously assigned to the SPU, if this can be done from a funding and programmatic viewpoint.

2) Define essential preparation for the PDR Phase 1 in July.

We agreed on work needed for the PDR 1, and agreed to chase progress via the weekly telecons.

3) Discussion of reliability and redundancy philosophy.

A discussion was had, and some conclusions made, but the major issue of how much of an array we could afford to lose was deferred to the science team.

14. Date and place of next meeting

Not decided at the meeting, but subsequently decided that it must be between the 2 PDRs, and either in Paris or at QMW. Suggested dates are 9th/10th September.

Summary of actions			
Number AI-ST-0599-	**Responsible**	**Action**	**Due**
1	**CRC**	**Include all relevant people in forthcoming System Team teleconferences to address critical issues for PDR.**	
2	**KJK**	**Write note to Steering Group making formal recommendation on warm electronics architecture**	**May 26**
3	**MJG**	**Distribute this note to Steering Group and set up meeting/teleconference to make decision.**	**June 7**
4	**WKG + J-PB**	**Provide advice on what elements of arrays need to be preserved in the event of partial failure (e.g. squares, strips?)**	**June 20**
5	**BMS**	**Decide on number of calibration sources (in consultation with MJG, J-P B, SHM, et al.)**	**June 20**
6	**CRC**	**Analyse and document critical cryoharness wires**	**June 30**

7	**J-LA**	**Consider options for redundancy in warm electronics esp. DPU-DRCU connection.**	**Next Systems Mtg.**
8	**J-LA**	**Update warm electronics model table in the light of possible decision on deletion of SPU.**	
9	**BMS, MJG, CRC**	**Define what level of thermal analysis is needed for the July PDR.**	**May 27**
10	**MJG**	**E-mail Thomas Passvogel about status of warm electronics power availability**	**June 1**
11	**BMS**	**Raise Mech. design drawings for IID-B at May 27 Structure meeting**	**May 27**
12	**KD**	**Raise alignment and stability requirements for IID-B at May 27 Structure meeting**	**May 27**
13	**MJG, BMS, CRC**	**Define plan for thermal model treatment at PDR by May 27th Structure meeting**	**May 27**
14	**Array groups: JJB, GV, LR**	**Comment on proposed CEA grounding scheme**	**June 15**
15	**Array groups: JJB, GV, LR**	**Provide information on frequency plan to CRC**	**June 15**
16	**KJK, MSSL, KD**	**Provide notes on EGSE, MGSE and OGSE for IID-B to CRC**	**June 15**
17	**GV**	**Provide BAU design to CRC by mid-June**	**June 15**
18 **19**	**All Systems Team members**	**Review Scientific Pointing Modes Document and provide input (requirements/questions) to MJG prior to the meeting.**	**June 5**
20	**MJG**	**Include discussion of how instrument sensitivity and simulations are to be included in PDR Phase 1 in Det. Mtg. Simulations session**	**May 20**
21	**LV**	**Draw up draft of autonomy requirements for IRD BMS can then transfer it into IRD form**	**June 20**
22	**CRC**	**Write section on EMC for IRD and send to BMS**	**June 20**
23	**KJK**	**Provide input on redundancy to BMS**	**June 20**
24	**CRC**	**Provide input on FPU internal harness and budgets requirements to BMS**	**June 20**
25	**KJK**	**Write draft of Instrument Operations section in consultation with MJG, project scientists etc.**	**June 20**
26	**MJG, CRC, BMS, KJK**	**Review draft IRD**	**June 27**
27	**MJG**	**Write to Co-Is emphasising the need for Institute Project Managers to provide KJK with essential information and to regard deadlines seriously**	**May 26**
28	**All Institute PMS**	**Draw up table of deliverables for subsystems and models**	**June 11**
29	**All Institute PMS**	**Provide Subsystem Development Plans**	**June 11**