

Compte rendu de réunion / Minute of meeting

Objet / Subject: SPIRE SMEC FM Delivery Review Board

Participants / Attendees	Organisme / Institute	Diffusion / Distribution	Organisme / Institute
Baluteau J.-P.	LAM	All the Attendees	
Griffin M.	RAL	Sawyer E.	RAL
Mercier K.	CNES	Clark E.	RAL
Pouliquen D.	LAM	Blanc J.C.	LAM
Rousset G.	LAM	Blanchard P.	LAM
Swinyard B.	RAL	Garcia J.	LAM
Turzo G.	CNES	Repetti B.	LAM
Van der Laan T.	ESA		
Auteur / Author: Griffin M./ Pouliquen D.			

Date de mise à jour de la liste :

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Minutes

Actions

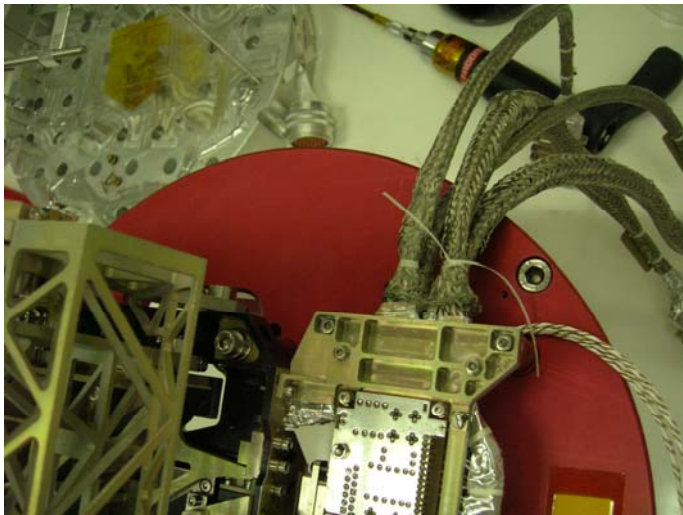
Present: Thijs van der Laan, Karine Mercier, Dominique Pouliquen, Bruce Swinyard, Matt Griffin, Jean-Paul Baluteau, Gerard Rousset, Guy Turzo

Participating by telecon: (for discussion of interface grinding procedure): Doug Griffin, Alan Pearce

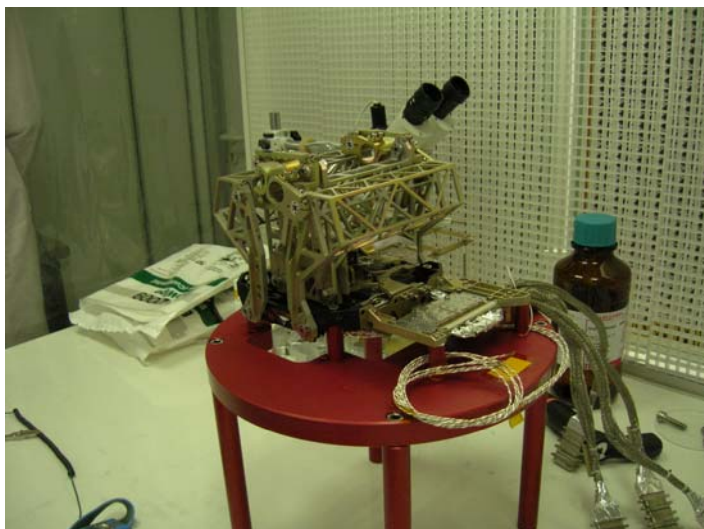
1. REVIEW OF DOCUMENTATION

- Summary of comments by Bruce (see summary document).

2. HARWARE INSPECTION



Harness to be shielded



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3. OVERVIEW OF SMEC MODIFICATIONS, TESTS AND PERFORMANCE (DP)

- See DP viewgraphs

3.1 Summary of modification and test sequence

- Summary of removal of material to eliminate friction at mechanical stops
- Preamp board fault and replacement and subsequent acceptance vibration
- Cleaning procedure (cleaning twice per day) recommended by CNES expert is being followed.
- Card will be sent to CNES for detailed inspection and confirmation that corrosion is indeed the cause of the failure

3.2 Performance tests

- See DP viewgraphs
- No problem closing the loop for SMEC control
- Speed stability and position error requirements are met
- Optical encoder performance:
 - Loss of amplitude as travel increased. Seen on all LEDs, so it's due to the photodiode.
 - No impact on performance as long as amplitude is > 300 ADU

3.3 List of user manual contents

- Will be available on draft form on June 24th
- Comments:
 - Needs a description of the software, in a separate document
 - Priority elements for Asier and Sunil will be the correspondence between HK and physical measurement.

3.4 Qualification status (vibration and thermal)

- Summary of hours of operation and number of latching events
- Life test will be done at 300 K on DM, taking about 110 days
- Likely to be carried out later this year (in parallel with the FS programme)
- Qualification status
 - No contiguous sequence of test-cold vibration-test
 - Levels that will be seen in acceptance test at FPU-level are known
 - Cold vibration in the FPU followed by verification in SPIRE PFM-4 cooldown will complete the qualification.
 - Levels for the FPU acceptance will need to be the same as for the previous test with the SPIRE FPU (Berend - and possibly Thijs - will be present).
- Conclusion:
 - All elements of qualification are regarded as satisfactorily completed except that the FM SMEC as-built has still to be cold vibrated and subsequently tested. This will be done in the course of the SPIRE FPU acceptance level cold vibration at CSL, and the following instrument-level cold test campaign.

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3.5 Delivery activities

- Various items of work on the hardware
- Removal of accelerometers
- Final functional check
- Overall cleaning
- Ship to RAL next week and arrive on Friday
- LAM (inc. DP) will be at RAL for a week from July 24
- Unpacking and inspection will await DP arrival on 24th
- Functional tests with LAM electronics (1/2 QM2)
- Grinding procedure
 - Procedure document is available – additions will be made by RAL to include cleaning and other steps
 - To be carried out by LAM specialist (Gabriel Moreaux) under SPIRE project supervision
 - Flatness spec is < 10 μm (will be added as a comment on both interface drawings)
 - Local slope on the pads also has to be assured, so grinding will be needed in any event
 - Bruce will bring the grinding block and abrasive to RAL (Alan Pearce) for practice operations on the spare bench
 - RAL QA will need to approve the procedure and plan for its implementation
 - RAL propose LAM expert comes to RAL to do the grinding on the 20th
 - Alodining deemed unnecessary
- Integration in FPU and functional test
- Finish 28 July

3.6 Support for PFM-4 cold testing

- FPU due to return rom CSL in week of Sept.11
- FPU due to be cold again Oct. 10, with about 6 weeks of testing
- Dominique will support key events as needed #Didier may also be available for tests of BSM operation

3.7 NCRs

- List as in Section 23
- LAM approach has been to concentrate on NCRs that affect interfaces, handling or performance. Internal non-conformances not included.
- Bruce:
 - List contains both major and minor NCRs
 - Project needs a list of all NCRs – demonstrating that they are available for inspection should the need arise in the future.
 - Conclusion:
 - Three new NCRs will be raised:
 - NCR detailing condensation
 - Replacement of preamp board, flux cleaning etc. should be included.

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- Sticking of mechanism.
- RFW will be raised on the mirror scratch

3.8 Open work

- Qualification completion – see above
- Life test – see above.
- Various activities to be carried out on the SMEC before packing (as in DP's presentation)
- Installation of temperature sensor at RAL
- CoG: done on DM (can't do on FM as harness gets in the way)
- Various elements of the documentation to be completed
- Some handling procedures to be added (use of shorting plugs, wrist straps etc.)
- Latch EGSE : RAL to provide the I/F connector type. LAM to provide a simple mean to know the latch's status, for example a box with 2 battery powered LED's.

Conclusion : RAL accepts the SMECm FM with caveats. The caveats are the completion of the open works.

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Preliminary DRB checklist (to be reviewed again at RAL on July 24th)

SPIRE SMEC DRB Checklist			
No.	Record applicable answers and provide explanations in comment column	Yes/No/NA	Comments
1	Are all documents, drawings, etc. complete, approved, and under configuration control?	Not in all respects.	See above minutes. By 24 th , all except the following should be addressed: User Manual and Software Description.
2	Do the released items above reflect all approved changes?	Yes	A couple of drawings need to be added (electrical layout drawings)
3	Is the hardware identical to other hardware delivered. If not provide difference list?	No	Previous deliveries were CQM and DM.
4	Does the hardware fulfil its functional requirements, specifications, RFWs, ICDs etc.?	Yes	Relevant RW will be added to the documentation.
5	Does the As-built Configured Items List reflect hardware as delivered?	Yes	
6	Have all required environmental tests and analyses been completed?	Yes for the purpose of delivery.	See minutes for current qualification status. Outstanding are life testing and final cold vibration at FPU level.
7	Are all the required test and qualification procedures and reports completed and available to review.	No	Test reports are outstanding (to be in place by July 24 th meeting)
8	Have all the Declared Lists, i.e. DML, DMPL, DPL and components (EEE Parts) list been released? (Need not necessarily be included in EIDP, but must be available)	Yes	
9	Have PADS been raised and approved where required?	Yes	On photodiodes and LEDs.
10	Are relevant Test Readiness Review (TRR) minutes and the Post Test Reviews (PTR) complete and available?	N/A	
11	EIDP check: Are all agreed sections of the EIDP complete? Record any anomalies or open work.	No	See minutes. To be reviewed on July 24 th

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Documentation summary remarks

Section	Document	Comment
00	LAM.SSP.SPI.ADP.060630_01_10_ ADP SMEC FM.doc	This is most of the EIDP in one document. See individual comments below
01		Pro forma invoice OK Deliverable list OK, is there any EGSE for bench test?
02	LAM.MEC.SPI.NOT.040330_01_11 LAM.MEC.SPI.PRC.040714_01_12 LAM.MEC.SPI.PRC.040902_01_10 LAM.MEC.SPI.PRC.040901_01_10	ok ok ok, in French ok We need a copy of this procedure – supplied - we need the Word version Procedure for the grinding LAM.SSP.SPI.PRC.063006_01_10 of the four SMEC pads on the SOB Add an electrical handling procedure (Short-circuits, ESD protection, wrist wrap...)
03	C of C	ok
04	Reference: LAM.PJT.SPI.NOT.050630_01 Issue 1 Rev 0 Matrix	Should be in section 25, test reports? To be provided against specification document requirements as part of the performance test report.
05	Drawings	Excellent, a full set
06	Interface drawings	ok – flatness requirement not called out on drawing – needs to be amended with comment on both sides (MSSL to update)
07	Functional diagram	na
08	Circuit diagrams	NOK – provide for optical encoder; pre-amp and LVDT
09	ABCIDL	This should be a list of all documents used in the construction of the PFM, hence defines the build standard. Ok from PA
10	Serialised components	Ok
11 and 12	List of RFWs	None? Disposition of open NCRs may raise RFWs
13	User manual	We will need this document
14	Historical record	Ok
15	Log book	None supplied – to be supplied with unit in French

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Section	Document	Comment
16	Operating time/cycles	Blank form, but not filled in Do we need this? Yes – we need to check how many we are allowed from specification document. LAM will provide this and RAL will continue the log.
17	Connector mating record	Ok
18	Age sensitive items	Na
19	Pressure vessel	Na
20	Calibration data	RAL has the temperature sensor calibrations, but what about the encoder etc? To be provided as part of the user manual LVDT; current versus commanded value; control loop parameters Comment these may change slightly as unit tested with red. QM2 but not flight electronics
21	Temporary installation	Yes record required: Log book contains record of electronics card replacement – accelerometers and connector savers were temporarily installed need record of this.
22	Open work	List to be provided at DRB – list is part of section 0
23	List of ncrs	NCRs for the sticking problem and the corrosion to be listed as Major as there could have been significant impact on the instrument performance
24	Copies of ncrs	NOK – provide copies of sticking problem and corrosion NCRs
25	Test reports	We will need the vibration, thermal and performance test reports when available. CoG of the SMECm DM to be added. CoG of the SMECm FM not measured, due to the harness.
26	Proof load certs	Na
27	Low level EIDPs	Na
28	Mass record	ok – typo in document “CQM” instead of “PFM”
29	Cleanliness	Ok
30		

SMECm FM Pre Delivery Review

Agenda

- Quick review of documentation
- Review of the final test campaign and user manual status
- Qualification status
- Major and Open NCRs, RFWs
- Inspection of hardware
- Pre delivery and delivery activities
- Launch latch EGSE
- Support for PFM cold testing
- AOB : review of the grinding procedure

Quick review of documentation

- Documentation put on LAM server
- Remains to be written:
- => reports on the tests
- => user manual

Review of the final test campaign

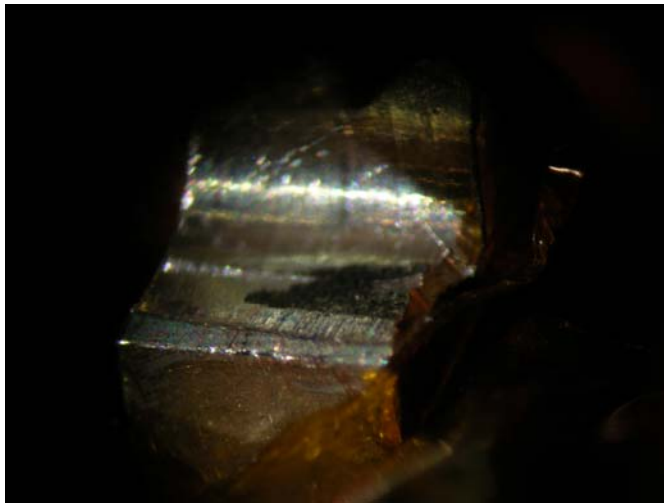
Tests overview

Following the 26 April 2006 meeting at ESTEC,

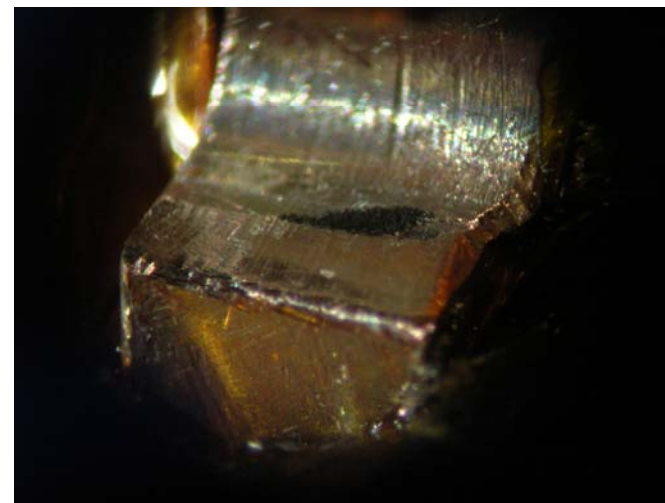
- Modification of the thermal interface plate with the cryostat for better I/F stiffness
- 11/05 to 15/05/2006 : 300K – cryo – 300K cycle to identify the origin of the friction => friction on the Z mechanical stops and on the rear end Y mechanical stop due to contact of the pins with extruded material
- 19/05 to 06/06/2006 : Removal of the extruded material
- 06/06 to 09/06/2006 : 300K – cryo – 300K cycle to verify the modification => no friction
- 12/06/2006 : Z acceptance vibration to verify the latch => no problem with the latch
- 13/06 to 16/06/2006 : 300K – cryo – 300K cycle to confirm the 1st thermal test => no friction but no optical encoder
- 19/06 to 27/06/2006 : Preamplifier board and encoder board replacement
- 29/06/2006 : X acceptance vibration => nothing to be noted
- 29/06 to 10/07/2006 : Two 300K – cryo – 300K cycles to check the repeatability => no friction. Optical encoder operational.

Removal of the extruded material

- The friction was due to the material extruded by shocks during vibrations that blocked the movement of the mechanism
- The friction has been eliminated by removing the extruded material and increasing the gaps up to the middle of the shock surface (19 May to 6 June 2006)
- Was done on all the Z and on the Y backend mechanical stops



Before removal



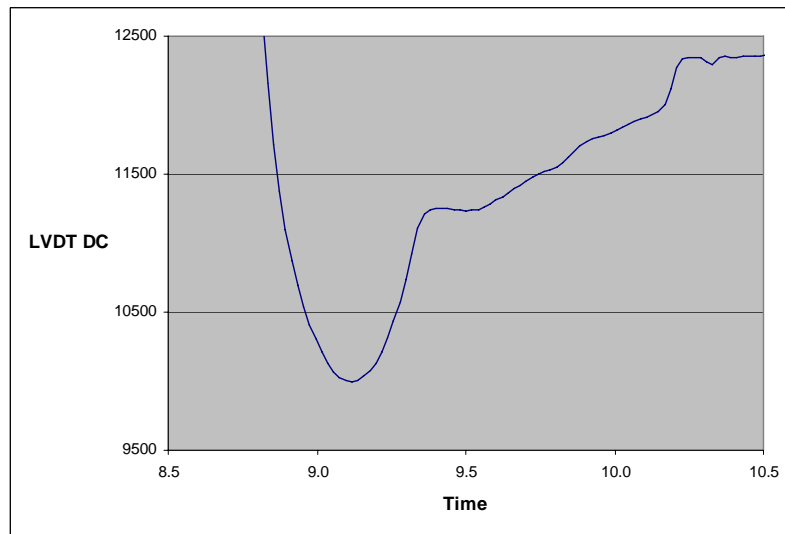
After removal

Friction and no friction

With friction

Cryo 13/05/2006

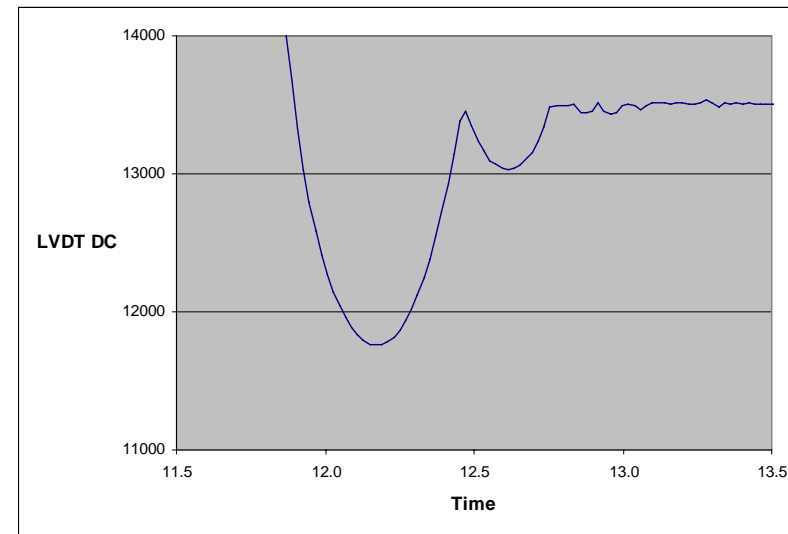
Before extruded material
removal



Without friction

Cryo 07/06/2006

After extruded material
removal



Preamplifier board

- Problem when unpacking at CSL : SMECm FM very cold (about 10°C)
- Not being aware of the temperature
- => unpacking => condensation
- Consequence : corrosion of the preamplifier board junctions with the harness due to residual soldering flux
- Long term corrosion : the encoder went out 6 weeks later
- Solution : replace the preamplifier board, the harness and the optical encoder board and flex (precaution)
- Followed by an X axis acceptance vibration test for verification
- Done : from 19 to 27 June 2006

Control parameters

Same as those of the CQM:

- Integral limit = 2000 (904E07D0)
 - Slew rate limiter = 300 (9051012C)
 - $K_d = 700$ (904B02BC)
 - $K_p = 2000$ (904A07D0)
 - $K_i = 1000$ (904D03E8)
-
- No problem for closing the loop when the encoder is initialized.

Speed

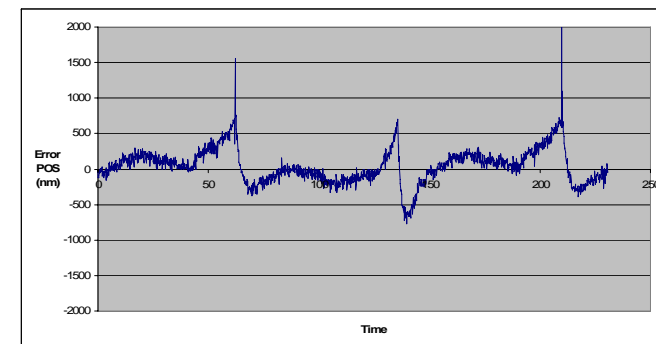
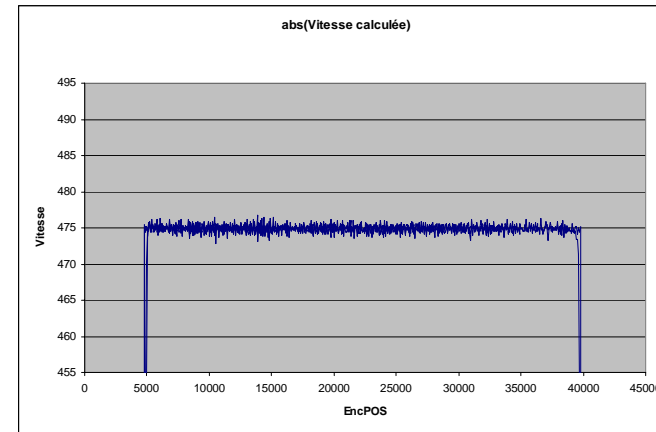
Speed = 475 μ /s when 500 μ /s
commanded

- Due to scheduler timing and software:
- The speed is calculated by the software as a function of elementary task.
- The elementary task is 21 μ s instead of 20 μ s at the beginning.

Speed stability : within 10 μ /s
R.M.S. except when changing
the direction

Position error within 0.1 μ R.M.S.

No loss of encoder count



Optical encoder behaviour

Loss of amplitude along the travel:

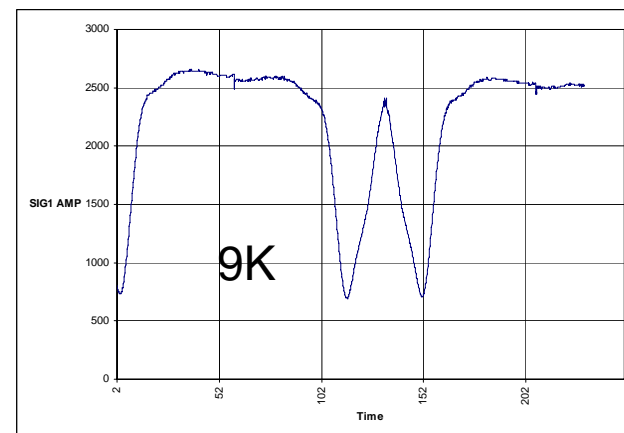
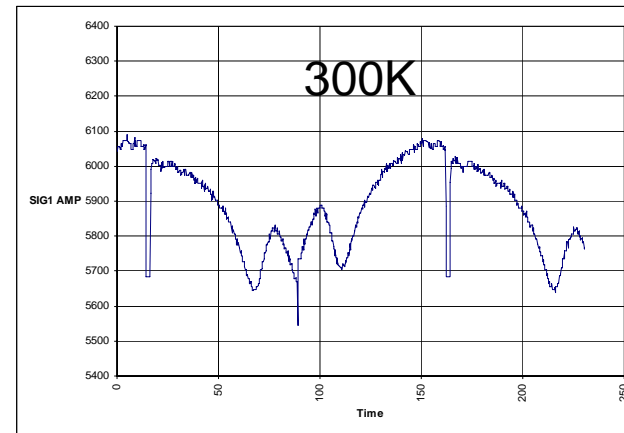
- 6% at 300K
- 70% at cryo temperature

Due to the rule

- Does not come from a particle
- Might be due to a scratch on the rule

Difference between 300K and cryo temperature due to a lateral relative displacement of the rule w.r.t. then head

The software copes with it.



User manual

The user manual is to be written:

Contents:

- Functional test procedure
- Procedure to initialize the encoder
- Control parameters
- Procedure to close the loop
- Procedure to open the loop
- Procedure to choose a correct LED level
- Correspondence HK \leftrightarrow physical measures
- Latch measurement vs position
- Procedure to verify that the latch is latched and unlatched

The software description document will be in a separated document, TBW.

Qualification status

Vibrations & thermal test

300K qualification vibrations performed at LAM on the SMECm DM (June 2005)

4K acceptance vibrations performed at CSL, SMECm DM integrated in SPIRE PFM (Dec 2005 – Jan 2006) : all 3 axis

300K acceptance vibrations performed at LAM
(March 2006) : all 3 axis

4K acceptance vibrations performed at CSL
(April 2006) : X and Z axis

300K acceptance vibrations performed at LAM
(June 2006) : X and Z axis

Thermal tests at cryogenic temperature (9K).

The cumulative time at 9K has been about 40 hours.

The launch latch has been operated about 100 times (cold and warm) with success.

Life test

- Will be done on the SMECm DM.
- Configuration : SMECm DM with an actuator.
- Done at 300K
- On the ground, 6100 cycles at R=1000, 33,750 at R=100 and 337,500 at R=10, for a total of 30 days.
- In flight, 50,000 cycles at R=1000, 260,000 at R=100 and 2,600,000 at R=10, for a total of 255 days
- Taking into account the safety factors (4 for ground operations and 1.25 for flight operations), the number of cycles to be performed is 87,000 R=1000 cycles plus 4,600,000 R=10 cycles
- Square inputs of current, 1 per second
- On the basis of 2s per cycle, the test will last about 110 days.

Delivery activities

Pre delivery activities at LAM

- Shielding finalization of the replaced harness
 - Mounting the screw locks of then interface connectors
 - Dismounting of the accelerometers
 - Final functional test
 - Overall cleaning
 - Packing
 - Documentation completion
-
- The SMECm FM departs from LAM on the 19th of July 2006 and arrives at RAL on the 21st of July 2006

Delivery activities at RAL

The lapping of optics bench will be done during the 17th of July week. => LAM + RAL

- Unpacking => LAM
- Incoming inspection => LAM + RAL
- Functional test with MCU ½ QM2 => LAM
- Fit temperature sensor => RAL + LAM
- Integration => LAM + RAL
- Functional test with MCU ½ QM2 => LAM + RAL

- Dates : from 25/07 to the 28/07 (morning) July 2006

Delta DRB for the PFM SMEC.

25 July 2006

Pouliquen P, Rousset G, Sawyer E, King K, Sider S, Araburu A.

Activities performed after the DRB.

- Local grinding of the interface on the FPU was successfully carried out during the week 17 to 21 July.
- A flatness measurement was performed on 25th July and flatness measured at 5 microns.
- Unpacking and incoming inspection carried out on 25th July
- Functional test successfully completed on 25th July.

Review of open items.

- Qualification completion –
 - Life test to be done.
 - Vibration within the FPU.
- Activities before packing.
 - Shielding finalization of the replaced harness - Done
 - Mounting the screw locks of then interface connectors - Done
 - Dismounting of the accelerometers - Done
 - Final functional test - Done
 - Overall cleaning – Done
 - Packing - Done
 - Documentation – Not complete
 - Installation of temperature sensor at RAL – completed on 26/7/06
 - C of G measurement - Not required.
 - Documentation
 - Dominique will complete the user manual with all requested inputs this week before he leaves RAL.
 - End stop and limit positions will be included in the user manual.
 - Calibration data will be supplied in a separate document not the user manual.
 - A software design document was delivered to RAL some time ago as was the code. RAL will include this in the EIDP.
 - LAM will supply extra photographs taken during the build phase, to include in the EIDP.
 - The MCU/DCU command list will be updated and sent to CEA. The DCU document of CEA is the external interface to SPIRE.
 - Handling procedure to include ESD precautions – done.
 - Latch EGSE. Supplied by LAM. A harness is required, RAL to confirm type and quality of connector that mates with the S/C.

Support for cold testing.

Two visits planned.

A calibration check of the LVDT will be required at 4K at instrument level.

Review of check list open items.

2 Electrical circuit diagrams added.

- 4 Copies of RFWs added.
- 7 Test reports will be available soon.