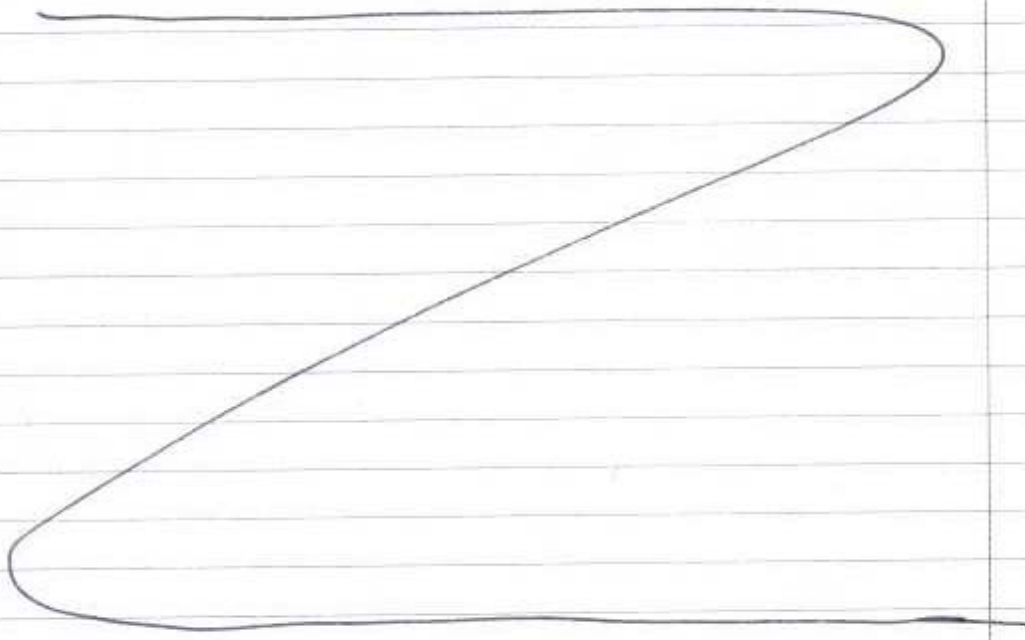


**LABEN****MINUTE OF MEETING**Reference N° LA-GE-DQ-MN-0006-02 Date 18/04/2002 Page 1 of 5Programme HERSCHEL / PLANCKAt LABEN Place VIMODRONE (MILANO)Subject: 2nd PA Qrtly MeetingMeeting Type:  KO  PDR  CDR  SRR  ADR  TRR  TRB  DRB  Other

Participants	Company	Agreement signature	Additional distribution
A. DRAGONI (LFIPA)	LABEN		
A. HEURTEL (HFIPA)	ONRS		
M.M. Jacobs	SRON		
E.A. CLARK	RAL		
T.W. LARSON	JPL		
P. OLIVIER	ESA		
J. Rautakoski	ESA		
C. MASSE	ALCATEL		
B. Jyl	MPE		

Agreements	Actions
<u>Agenda as per ANNEX 1</u>	
	

Reference N°

Date 18/04/2002 Page 5 of 5

Agreements

Actions

SRON provide the impact of the air which can enter to CVV through seating (ref. to ASTRIUM TN: HP-2-ASED-TN-0034)

AI 6 SRON/MPE/RAL  
2nd half of May 2002

All the actions coming from the 1st Qthly PA meeting are closed.

Next Qthly PA meeting foreseen the 11th of July 2002 at MPE (to be confirmed)

AI 7 MPE  
asep

Reference N° \_\_\_\_\_

Date 18/04/2002 Page 4 of 5

### Agreements

### Actions

HERSCHEL HIFI (SRON)

Presentation as per ANNEX 6.

HIFI requests 6 samples for evaluation of clean-room molecular contamination measurements.

AI 3 ESA  
Mid May 2002

ESA to provide Alcatel with the safety <sup>statement</sup> submissions from HIFI delivered to ESA by K. Waterbakker before the IBDR

AI 4 ESA  
26.4.2002

SRON request to ESA a radiation sector analysis with service module.

AI 5 ESA  
date to be provided

HERSCHEL / PLANCK JPL S/S status

See ANNEX 7 presentation.

It is pointed out that Materials and Processes shall be <sup>included in</sup> ~~one~~ document to be issued for each instrument S/S (HIFI, SPIRE, HFI, ~~Solar~~ Cooler). Same approach for EEE parts lists.

Reference N° \_\_\_\_\_

Date 18/04/2002 Page 3 of 5

**Agreements**

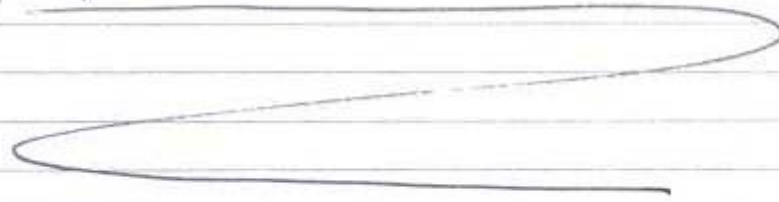
**Actions**

PLANCK HFI (IAS)

Presentation as per ANNEX H.

Derating requirements as per PSS-01.301 shall be applied to all EEE parts of design and not only for I/F.

Change request are in service and managed directly by J. CHARRA PM.



PLANCK LFI (LABEN PST)

Presentation according to ANNEX S

Safety submissions shall be available at Alcatel latest by the end of May. (draft documentation to be available from JPL)

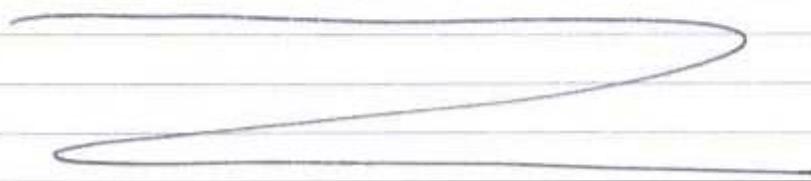
AI 1, end of May (SCS / MTU → JPL)

It is proposed by LFI to verify that the derating rules have been taken into account at reviews with the sub-systems.

The SW suppliers follow the ESA BSSC(96)2 for SW QA, even if the ECSS-Q-20 is applicable.

The SW QA plan from ISN to be delivered to ESA and it shall be clarified if it is applicable to LFI as well as to HFI.

AI 2, 26.4.2002 (HFI / SCE → IAS)



Reference N° \_\_\_\_\_

Date 18/04/2002 Page 2 of 5

**Agreements**

**Actions**

HERSCHEL PACS status (NPE)

See ANNEX 2 for presentation  
 Difficulties are pointed out with  
 institutes to make analyses (FITECA,  
 XCA, Derating, ...) due to pretty  
 unexperienced persons -

HERSCHEL SPIRE status (RAL)

Presentation attached as ANNEX 3

ESA highlight that the cleanliness  
 values shall be included in  
 each IIDB as IF requirements

Gentlemen,

During our Quarterly PA meeting on December 14th 2001, we reserved April 18th 2002 at Laben as a preliminary date and place for our next meeting. Can you please confirm if this is still okay, starting at 9:00. Please also provide attendance list.

The draft agenda is:

Instrument PA status and outlook including problems/solutions and help needed

CIL

NCR

Safety submissions

System FMECA and effect on S/C (propagation of failures)/HSIA

Cleanliness (materials)

Results on derating

Status on VCD

Configuration status

MIP planning

AIT procedure preparation

AOB

Can you please send me your comments on the agenda and confirm your agreement for the date and place, thanks.

Best regards,

Jan Rautakoski

ESA - ESTEC

Keplerlaan 1

NL 2201 AZ Noordwijk ZH

Phone : Int + 31 71 565 6089

Fax : Int + 31 71 565 5751

e-mail : [jan.rautakoski@esa.int](mailto:jan.rautakoski@esa.int)

## PACS Status PA/QA at MPE

- Results from IBDR (Board Report)

Open: Derating, Worst Case, FMECA, FDIR, HSIA  
(System analyses)

Comments: 1) There is no final agreement between institutes, and industry as a level where PA/QA has to be done in accordance with ESA requirements.

There is a difference between engineering tasks (system analyses see above) and PA tasks.

2) Direct contacts from PA MPE to industry must be developed in accordance with institutes.

3) It is not seen that system analyses have to be performed completely before producing hardware. ( depend on the contracts between industry and institutes.)

4) Even if AVM must not be checked completely with FM level MPE recommend to see it as test for further PA activities.

5) Final comment:

Only industry (or skilled people of the bigger institutes) are able to perform system analyses.

ESA requirements have to be met at least at delivery of QM.

The requested issues has to be done on the own responsibility of institutes with industry.



## Status of PA/QA of DPU / SPU / DECMEC

- Manufacturing flow charts with MIP/KIP
- Incoming inspection
- Storage, handling, transportation, preservation
- ADP / EIDP
- Test procedures
- Specification of hardware and subsystems

are proceeding and will be formed out during handling the real parts. It seems to be easier to develop understanding for PA/QA by handling with real processes.

23.04.02  
Georg Igl

# Product Assurance

**Eric Clark**

**RAL**

# Spire PA Status and Outlook

## ➤ From the IBDR

- PA Plan
- Declared Lists
- Change Control
- CIDL
- Cleanliness
- MIP

## ➤ Added from Agenda

- Safety
- CIL
- VCD
- System FMECA- HSIA
- Planning
- AIT

# PA PLAN

## ➤ SPIRE Product Assurance Plan

**SPIRE-RAL-PRJ-000017**

**Issue 1**

## ➤ Changes To the Plan Now at Issue 1.1

- **Most of the comments from Pierre have been incorporated.**

# Declared Lists

Combined list have been generated for

- **Declared Material List** **DML**  
**SPIRE-RAL-PRJ-001092**
- **Declared Processes List** **DPL**  
**SPIRE-RAL-PRJ-001093**
- **Declared Mechanical Parts** **DMPL**  
**SPIRE RAL PRJ 0001094**
- **Electronic, Electrical and  
Electromechanical Parts** **EEE, Parts**  
**SPIRE-RAL-PRJ-001095**

## Declared Lists

- Each of the subsystem Declared Lists have been combined into these documents with each list kept separate in a section of its own.
- Not all the required information has been recorded on the lists as required, and some lists are still outstanding.
- There is still a lot to do, to bring most of them into line with **ESA: PSS-01-700 Issue 2.**

# Change Control

- **Non-Conformance Report** **NCR**  
Status Report/List- **SPIRE-RAL-PRJ-0001079**
- **Engineering / Document Change Request** **ECR**  
Status Report/List- **SPIRE-RAL-PRJ-0001080**
- **Request For Waiver / Deviation** **RFW**  
Status Report/List- **SPIRE-RAL-PRJ-0001081**
- **Review Item Discrepancy** **RID**  
Status Report/List **Number not allocated**

# Change Control Status

- **Non-Conformance Reports**  
6 of 7 still open re EGSE none Major.
- **Engineering / Document Change Request**  
17 of 35 open
- **Request For Waiver / Deviation**  
both still open
- **Review Item Discrepancy**  
None of the current 19 outstanding have been closed



# CIDL

- **CONFIGURATION ITEM DATA LIST** **CIDL**  
**SPIRE-RAL-PRJ-001134.** Now at draft issue 2.
  
- **Most of the subsystems CIDL's added.**  
Some will require updating and putting into document format.
  
- **Technical notes have been removed.**
  - **As it is not intended to configuration control them at instrument level.**  
**Instead changes to the Specification and Design documents will be made under DCR's.**

# SAFETY Submissions

- **Basically there are no safety issues once SPIRE is cold**
- **However it does have Cryogenics and Sorption Cooler (Pressure 80 Bar at room temp), these are identified on the Hazard Source Check sheet.**
- **Report on Pressure test etc on the Sorption Cooler and Hazard Check Sheet have been sent to ALCATEL.**
- **NCR (safety) Any NCR concerning safety to the instrument or personnel would be treated as a Major NCR. Therefore it would be forwarded to ALCATEL and ESA immediately.**
- **SPIRE do not have a separate Safety NCR database.**

# CIL. WCA & Derating

- **CIL List presented at IBDR (not Formally Maintained)**
  - SPIRE does not have a formal CIL.  
It has weekly, (more frequently if required), Tele-con's that track critical items.
  
- **Worst case analysis and Derating analysis**
  - Have been requested from the Subsystems, although as this primarily concerns electrical / electronic components they are not required from Some of the subsystems.  
Those that are, are being pressed to supply them.

# FMECA - HSIA

- **System FMECA and effect on short circuit (propagation of failures).**  
**The System FMECA will cover all system including interfaces for Launch and Flight**
- **Hardware/Software Interaction Analysis (HSIA).**
- **RAL have promised this by the end of April (Re Meeting we had with Jan on the 21 March)**

# Configuration Status. & VCD.

## ➤ Configuration status

- **SPIRE still has far to many documents still in Draft.**
- **Aim to get all the documents listed on the CIDL into the configured state before our next meeting.**

## ➤ Verification Control Document. (VCD)

- **Database is up and running currently being updated against the CQM & STM Test Plans**

# AIT, MIP's & KIP's

## ➤ AIT Procedure Preparation.

- AIT Plan for STM in Draft, is almost completed, with all the Test plans, issue, date, etc included.
- AIT Plan for CQM is in hand.

## ➤ Mandatory & Inspection Points (MIP's)

## ➤ Key Inspection Points (KIP's)

- **Are detailed in the AIT plan above**

ESA will be informed of the place, time and date of a MIP Typically Four weeks before, by fax or Email, and reminded two days before, by Email or Telephone.

# Cleanliness

- **The SPIRE PA Plan and the PACS Cleanliness Plan are very similar and when used In conjunction with the Cleanliness document produced by Bruce Swinyard will meet the requirements**
- **Except Spire will only bakeout Materials (TML) at 80°C for 48Hrs, not at the higher temperatures specified in the PACS plan**

***“ If it’s clean enough for PACS its clean enough for SPIRE”***

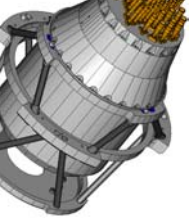
# Planning

- ✓ **Declared List's to be to ESA: PSS-01-700 Issue 2.**  
By Next Quarterly PA meeting.
- ✓ **All documents listed on the CIDL to be "Configured"**  
By Next Quarterly PA meeting.
- ✓ **NCR's, ECR's, RFW's, and RID's**  
**to be closed or have agreed actions to close them,**  
By Next Quarterly PA meeting.
- ✓ **WCA & Derating Analysis**  
To be passed to ESA By end of May.
- ✓ *With testing and delivery from subsystems coming closer there will be considerable work to do and currently very little resource to do it with.*



## PROBLEMS

- **The problem areas are resource, Money and person power. (*politically correct statement*)**  
There is not enough of either available to meet the requirements for Hardware, Software or Documentation.
  
- **Spire Have too options:-**
  1. To obtain more money from somewhere. This is being actively pursued.
  2. To Prioritise what SPIRE can deliver and what it can not. *Decisions whether we want Hardware or documentation will have to be made if option 1 is unsuccessful.*



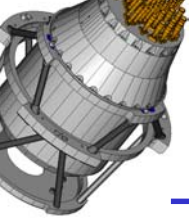
Product Assurance  
Status and outlook since the IBDR  
*(February 19-20 2002 at IAS)*

Alain Heurtel

HFI PAM

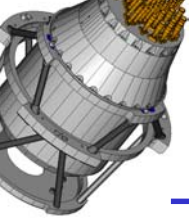
CNRS/IN2P3/LAL and IAS (France)

heurtel@lal.in2p3.fr



## Plan

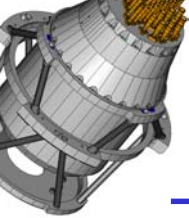
- PA situation after the IBDR
- PAP status
- Management of Air Liquide PA
- Cleanliness Control Plan
- Safety Plan
- Base-line changes : Consequences for PA
- Other PA documents



## Situation after the IBDR

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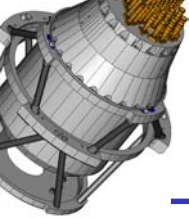
- **Priority** : Following the IBDR and the issue of the Compendium of comments (received March 8<sup>th</sup>), priority is obviously to review and to up-grade documents presented for the review.
- **PA support** : PA support asked to reinforce the PA at system level in IAS is not arrived yet. This affects now :
  - the writing of the PA manufacture procedures and MIP planning organisation (with the SE).
  - the preparation of the verification of the AIT procedures (with the AIT Manager).
- **Strategy adopted** :
  - To correct system level documents when information is available,
  - S/S :
    - to distribute duties,
    - to spread information, templates and examples to fulfil due documents.



## The PAP situation

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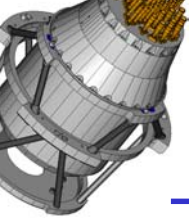
- Numerous errors or imprecision have been detected by ESA in the Plan,
- Corrections require help of ESA for clarifications (NCR, management of configuration, etc...) ,
- Retained idea is to take advantage of the arrival of the new PA specialist at IAS to correct the PAP. This constitutes an excellent occasion to introduce him into the heart of the project.



## Air Liquide PA management

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- Air Liquide is officially joining the project, but is in phase B. It is charged of design, manufacture and assembly of the dilution cooler, the 1.6/0.1K exchanger (that constitutes the HFI cryostat). It is also charged of the He DDCU (Dilution Cooler Control Unit) manufacture.
- These activities are on the critical path.
- I presented to AL status of general PA activities at system level and specific duties for this S/S, at Grenoble, on March 7<sup>th</sup>,
- AL PAM produces progressively PA documents : PAP and compliance matrix are available.

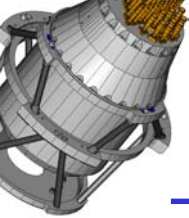


## Cleanliness Control Plan (Rev.01, Issue 02)

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### Principal improvement : (March 29<sup>th</sup>, 2002)

- *List of plans modified : Only plans already submitted listed,*
- *Permanent venting until launch? Submitted to the Project by e-mail,*
- *Precisions brought to remove all TBC,*
- *Molecular absorption and multiple reflections on mirrors : Considered by the Project as weak. No other calculations made,*
- **Cleanliness procedures for manufacture, test and integration of sensitive parts (pipes, isotopes) will be written by AL,**
- *A detailed particulate budget based on the HFI Master Schedule document written. It will constitute the "HFI Particulate Contamination Evaluation" document (AN-PH192-200167-IAS). Under evaluation by now.*



## Safety Plan (*Issue 02, rev.0*)

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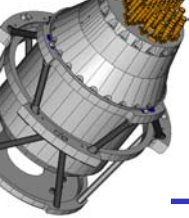
### Principal modifications : (*March 27<sup>th</sup>*)

- *The Plan includes now corrections after ESA comments and the CNES CGS Safety Regulations,*
- *List of S/S plans : Only Air Liquide Plan maintained, because AL manages high pressure,*
- *Safety procedures include now :*
  - *Principles of safety regulation,*
  - *Accident situation : Minor and major with procedures to apply.*
- *Removal of facilities test programme chapter.*

*Remark: CGS Safety Regulations should be completed because they do not treat technical safety instructions for material building : General design criteria and rules for pressure relief are not given inside.*

**Detailed safety procedures will be written by the AL PAM.**

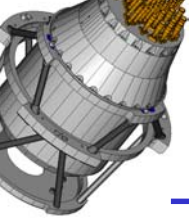




## Base-line modifications : consequences for PA

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- **DPU :**
  - New design interface between REU, DPU (PDP board) and the satellite has been defined, then frozen, during the last *Power Interface Meeting* held at Cannes, April 8<sup>th</sup>. (TN-PHB-250901-LAL issue 3, rev.0. April 11)
  - Consequences for existing PA documents :
    - Minor changes are foreseen into the **DPU and REU FMECA** made at system level.
    - **FDIR** should be entirely reconsidered (week 17 ? ).
- **FPU :**
  - A PA meeting was held in IAS with Air Liquide on April 12<sup>th</sup> to prepare the up-grade of the **cryo-chain FMECA** after AL design modifications. (MM-PH192-200166-IAS).  
*(Note that He circuitry and ISN electronics are not frozen).*
  - Specific **Air Liquide DPL and DML** are under preparation.



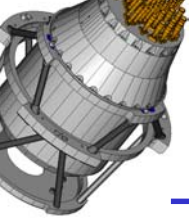
## Other documents (1/2)

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- **HSIA :**
  - New person is arrived in LAL on April 1<sup>st</sup> to write on-board software and to participate to the HSIA analysis.
  - No information nor model found on ESA site,
  - The purchase of 2 ESA recommended books has been ordered in the USA : waiting for delivery.
- **CIL, DML, DPL:**

No inputs received since the IBDR.
- **Derating :**
  - Is underway in LAL for DPU parts interfaced with the satellite.
  - For other S/S (CESR, ISN), parts choices have been approved by the CPPA.
- **VCD :**

A template of Design Verification Matrix has been sent to each group on March 19<sup>th</sup>, with separated clear explanations and examples.



## Other documents (2/2)

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- **Configuration status :**
  - Management made by the IAS Project Controller (B. Cougrand).
  - Baghera DMS (documentation) is connected to AGILE (configuration) linked to the Product Tree. They are fully operational at IAS.
  - All documents sent to IAS are under control.
- **MIP planning :**

Will be managed when sub-contractors will have been chosen after design freezing. Pre-orders are on-going for S/S, including the electronics of the CQM, FM and spare.
- **NCR system :**

Not in service yet.

## **Product Assurance Topics**

- *Status on PA documentation***
- *Reliability and Safety***
- *EEE Parts, Materials and Processes***
- *Cleanliness and Contamination***
- *Software QA***
- *Configuration Management***
- *Critical issues***

## Status on PA documentation

Suppliers	LFI →							SCS →	
	JBO	SAN	MiliLab	Laben (TRM)	Laben	IAC	PST	JPL (TMJ)	ISN (SCE)
PA Documents									
Comp. Matrix to LFI PA Plan	February 2002	February 2002	-	-	July 2001	-	July 2001	-	-
Dedared Components List	March 2002	February 2002	February 2001	July 2001	March 2002	February 2002	March 2002	-	February 2002
Dedared Materials List	Dec. 2001	February 2002	-	July 2001	October 2001	July 2001	February 2002	May 2001	February 2002
Dedared Processes List	Dec. 2001	February 2002	-	-	October 2001	July 2001	February 2002	May 2001	February 2002
FMECA	February 2002	February 2002	-	-	January 2001	July 2001	January 2001	Nov. 2000	February 2002
Critical Items List	February 2002	February 2002	-	-	Dec. 2001	July 2001	Dec. 2001	Nov. 2000	-
Manufacturing Flow Chart	February 2002	March 2002	-	-	February 2001	November 2001	-	-	-

## ***Reliability and Safety***

- **The LFI System FMECA issue 1 shall be completely reviewed at the light of the new configuration approach under finalisation.**

**In particular the next issue of the document will take into account: the new redundancy approach, the reduction on the DC/DC converters numbers and the relevant power switching philosophy.**

**As soon as the design and in particular the DAE subsystem shall be consolidated the analysis shall be produced.**

- **Up to know the FMECAs at supplier level have not pointed out any single point failure (No input from MilliLab, JPL foreseen an updating?).**
- **JPL Safety Data Package is under way: foreseen delivery in June 2002 (Cooler element CDR). Hazard Analyses have been prepared for the current design baseline.**

## ***EEE Parts, Materials and Processes***

- **An internal review on the available data about the LFI EEE, Materials and Processes was held at PST level during January and February.**
- **Following the above and after clarifications provided by the LFI Suppliers (Laben, SAN/MIER, JBO, IAC/CRISA) it is decided to update the LFI:**
  - **Declared Component List**
  - **Materials and Mechanical Parts List**
  - **Processes List**
- **More details with respect to the first issue are provided inside the lists following the design status of art and ESA comments.**
- **MilliLab have not yet provided any input for the Materials/Mechanical Parts, and Processes. This aspect is considered critical by PST.**

## ***Cleanliness and Contamination***

- **Requirements settled during the Cleanliness and Contamination Working Group and inserted in the last issue of the LFI PA Plan**
- **Molecular contamination parameters not yet frozen at LFI level**
- **Molecular contamination effects on LFI is on the way; status provided just after the “LFI Design Status & I/F consolidation Meeting” at Bologna (end of March 2002)**



## **Software QA**

- **The SWs belong to the SCE and REBA subsystems**
- **The Suppliers' declared approach follow the ESA BSSC (96)2**
- **Difficulties to obtain visibility on SW QA activities from IAC (REBA) and ISN (SCE) up to now**
- **An HW/SW interaction analysis at Supplier level is requested for the IBDR**

## ***Configuration Management***

- **LFI CADM Plan, issue 3 emitted in final version after ESA Review**
- **LFI System CIDL to be finalised**
- **Configuration items data storing in real time from Suppliers**
- **LFI Product Tree, already aware by the Suppliers, updated taking into account definition of LFI part numbers down to subsystems and per model philosophy.**

## Critical issues

1/2

LFI SUPPLIER	CRITICAL CATEGORY	ITEM IDENTIFICATION	RISK	ACTIVITY FORESEEN OR IMPLEMENTED
IASF	A (= Safety & Reliability)	4K Reference Load, see (1)	No data on the behaviour of the 4K Ref. Load materials at 4 Kelvin	Evaluation/Qualification Program to be finalised. Collaboration IASF-ESA for a test campaign started.
JBO	A	30 & 44 GHz FEMs	No data on the behaviour of the FEMs at 20 Kelvin.	Evaluation/Qualification Program to be finalised, see (5). Review as per Annex 12 of (8). Updated (6).
JBO	A	30 & 44 GHz FEMs: • InP LNA HEMTs, see (2)	<ul style="list-style-type: none"> <li>No data available on the space qualification of the InP LNAs and their behaviour at 20 Kelvin.</li> <li>ESD.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluation/Qualification Program to be finalised, see (5). Review as per Annex 12 of (8). Updated (6).</li> <li>Handling procedure to be finalised.</li> </ul>
YLI	A	70 GHz FEMs	No data on the behaviour of the FEMs at 20 Kelvin.	Evaluation/Qualification Program to be finalised, see (5) and (9).
YLI	A	70 GHz FEMs: • InP LNA HEMTs, see (2)	<ul style="list-style-type: none"> <li>No data available on the space qualification of the InP LNAs and their behaviour at 20 Kelvin.</li> <li>ESD.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluation/Qualification Program to be finalised, see (5).</li> <li>Handling procedure to be proposed.</li> </ul>
LAB (TRW)	A	100 GHz FEMs	No data on the behaviour of the FEMs at 20 Kelvin.	Evaluation/Qualification Program to be proposed, see (5).
LAB (TRW)	A	100 GHz FEMs: • InP LNA HEMTs, see Instrument Science Verification Review (10-11/11/1999)	<ul style="list-style-type: none"> <li>Not sufficient but partial data exist on the space qualification of the InP LNAs and their behaviour at 20 Kelvin (data distribution restricted).</li> <li>ESD.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluation/Qualification Program to be finalised, see (5).</li> <li>Handling procedure to be finalised.</li> </ul>

## Critical issues

2/2

LAB	A	DAE unit: • Multichip Modules (MCM)	Manufacturing processes.	Qualification program in progress, completion foreseen within 2002.
LAB	A	DAE unit: • RT54SX32S, FPGA, 208/256 pins	Extension of the mounting process on PCBs of the parts with more than 196 pins.	Qualification program in progress, completion foreseen within first half of 2002.
JPL	B (= Fracture Critical Items)	Sorption Cooler System: Mechanical Thermal Unit (MTU)	<ul style="list-style-type: none"> <li>• Pressurised vessels and cryogenic subsystems</li> <li>• Internal surface of the unit are very susceptible to both molecular and particulate contamination.</li> </ul>	Safety and Hazard Analyses under way following current design baseline. Safety Data Packages as per (10). Contamination Control Plan: see (11).

- |  |                                    |
|--|------------------------------------|
| (1): Planck LFI Declared Materials & Mechanical Parts List     | PL-LFI-PST-LI-011, issue 2.0       |
| (2): Planck LFI Declared Components List                       | PL-LFI-PST-LI-012, issue 2.0       |
| (3): Planck LFI Declared Processes List                        | PL-LFI-PST-LI-013, issue 2.0       |
| (4): Planck LFI FMECA  | PL-LFI-PST-AN-001, issue 1.0       |
| (5): InP LNA Evaluation Proposal                               | PL-LFI-PST-TN-008, issue draft 0.1 |
| (6): 30 & 44 GHz LNA Qualification Plan                        | PL-LFI-JOD-PL-002, issue draft 0.3 |
| (7): A proposal for mechanical test on adhesive for 4KRL       | PL-LFI-TES-TN-006, issue draft 0.1 |
| (8): LFI System Interface Meeting                              | PL-LFI-PST-MM/01-016               |
| (9): MilliLab / Ylinen Response to InP LNA Evaluation Proposal | PLA-lfi-YLIN-PR-0278-01            |
| (10): JPL FIRST / Planck Project Safety Plan                   | D-16875, Revision A                |
| (11): JPL Herschel / Planck Contamination Control Plan         | JPL D-19156 (April 13, 2001)       |



Space Research Organization  
Netherlands  
Stichting Ruimteonderzoek  
Nederland

*HIFI*

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## Product Assurance

**HIFI**

**18<sup>th</sup> April 2002**

[H.M.Jacobs@SRON.nl](mailto:H.M.Jacobs@SRON.nl)

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## Programmatic:

### HIFI system PA:

**Point of contact towards the Sub-systems for all PA issues including cleanliness:**

**Hans Goulooze:**     -LO sub-system.  
                          -WBS sub-system.  
                          -HF sub-system.

**Herman Jacobs:**    -FP sub-system.  
                          -HRS sub-system.  
                          -ICU sub-system.

**David Griffiths:**    Parts procurement interface to the mixer groups for all CPPA matters.

Origin:            Overload in PMP segment, Communication issues Mixer Groups versus CPPA.

**Sub-system PA:**

A PA baseline is agreed between HIFI system and all users.

All sub-systems have allocated manpower to PA.



Currently, for the **LO** and the HRS, both sub-systems are in a phase of implementation.

**Training:**

**Product Assurance workshop:**  
(mid 2001)

-WBS (KOSMA + MPAE)

-LO (MPIfR).

**ESD training/audit:**  
(Jan. 2002)

-FP (SRON; Mixer groups; Yebes)

-LO (MPIfR; RPG)

## Parts, Materials and Processes:

### General:

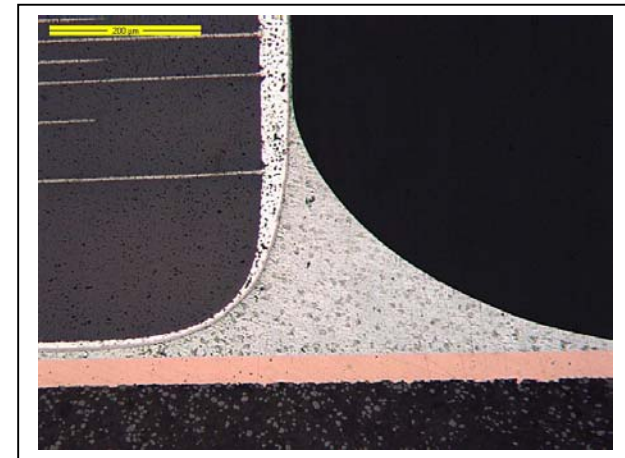
As support to the users, the most critical electrical interconnection techniques versus the planned components are evaluated for their application.

*Attention is focused on mixers applications.*

### Materials and processes:

Materials list is updated to issue 2.

Processes list is updated to issue 2.



**Concerns: Status of both lists are out of phase with the hardware planning.**



**EEE parts:****HIFI component list**

is updated to issue 11;  
(included in the IBDR data package).

**Main concerns:**

- Lack of component definition for Cryo-passives (Design)
  - Lack of component definition HRS; -DC/DC converter (Sub-contract)
  - IF (Miteq Sub-contract)
- Proposal evaluated due (29-04-2002)

**Parts approval status:**

Currently, processing of PAD sheets (self procured) to the Part-board is an ongoing activity.

(Users / HIFI system / Parts-board)

**The status is visible on the CSL (see also HIFI web-site).**

## Quality Assurance:

All procedures for KIP/MIP; NCR's; TRRB; DRB and QSR are set.

## KIP/MIP:

**The identification of KIP's is started since the planning is available (since 2 weeks) and planned to be completed end of April.**

*Thanks Renato*

-WBS and HRS is under definition



## TRRB; DRB and QSR:

Are included in the planning.

## NCR's:

On flight model EEE components are category 1 and will be processed via ESA

**Concern: Implementation of Configuration Control at S/S and unit level.**

## Cleanliness:

The impact of a change in particle/size distribution is absorbed in the molecular contamination budget.



### HIFI cleanliness control approach:

FPU & LOU:	Budget allocation and facility validation for particulate- ; molecular cleanliness and hardware exposure time. (class 1000 or better)
Units on SVM:	Good workmanship practices and periodically monitoring of facilities. (class 100,000 or better)

### HIFI cleanliness versus space craft:

- LOU purging is agreed between HIFI and ESA but need to be formalised (CR on IID-B)
- LOU protection against particles generated during launch is under discussion. (The issue is related to EMC protection).

**ESA to supply Molecular contamination samples so validation of LO/FP cleanroom may start.**

## **Activities planned on short term:**

### **Support LO &HRS for PA implementation:**

**In the perspective of the current status of the PMP program, one FTE for each S/S is minimum required.**

### **Critical Items /PAD:**

**Continuos activity until the CDR  
Dedicated meeting/ progress meetings.**

### **Configuration Control:**

**A draft Data base is available for S/S and unit suppliers (HIFI web).  
Final will be available after check and S/S comments (April 2002).**

### **Cleanliness control:**

**Budget breakdown and clean room validation (Finish Oct.2002).  
Measurement of cleanroom facilities LO/FP**

### **Materials/Processes:**

**Push users for realistic listings (Finish Oct.2002).**

## Outline towards the CDR:

### PA activity:

- Completing flight worthiness assessment of technology components
- Completing Part approval cycles.
- Completing Materials / Processes approval.
- Implement cleanliness control plan
- Finish KIP/MIP in planning.

### Engineering activity:

- HIFI system; Finalise
  - WCA and FMECA
  - Hardware – Software interaction analysis
  - FDIR summary  
(Failure Detection Isolation and Recovery)
- HIFI Units:
  - Part Stress analysis.

**The engineering planning towards the CDR is currently under construction**

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**HIFI Critical Items**

**Status and Approach of Critical Items**

**March 14, 2002**

Issue 2

SRON-U/HIFI/PR/1999-008; Listing and control of Critical Items. <http://www.sron.nl/hifi/>

**Generic:**

There are many items open, or items partly visible but with not sufficient visible or documented information that allows implementation in a Critical Items List.

**Reference or base line for observations:**

PDR presentation on critical items on April 27, 2001

All EEE components procured through the CPPA are for the purpose of the critical items control not considered as critical items.

**FMECA**

**FMECA status:** SRON-U/HIFI/RP/2000-001 iss.1.1 (30-03-2001)

**FMECA related items:**

- Chopper: Containes pivots,
- Calibration source: PID for assembly is beeing developed.
- Diplexer mechanism: Containes pivots.
- Local Oscilator Source Unit: The LSU has been redesigned, impact on the FMECA is unknown.

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**Reliability or Qualification Status Items, self manufactured or self procured**

**Focal Plane Unit:**

**Mixers:**

A review has been performed recently to assess the PID status and the PID qualification status of the mixer designs, with the exception of mixer band 6L that will be reviewed later.

For all the mixer units prequalification items concerning parts, materials and processes has been identified. For some mixer groups controls has to be implemented as required by the PA plan.

The PID status varied largely from group to group.

Some items such as the evaluation and application of components and interconnection technology versus substrate and clamping approach will be coordinated by the Focal plane S.S.

**Pivots:** See also above. No procurement spec., procurement source and evaluation program visible, but alternative sources are being reviewed.



**Calibration source:** See also above.

- PID under development, semiconductor temperature sensor will be evaluated also for radiation and PAD for temp. sensor to be issued.

**Isolator/circulator PAMTECH:** PAD/PID under development.

**Intermediate Frequency Amplifier 1:**

- InP HEMT transistors from TRW: No formal status available concerning evaluation and qualification. Verbal information (JPL) has been provided that TRW has performed qualification on a wafer lot for a user outside HIFI, but no procurement spec. and qualification base line visible.
- The combination substrate/components/interconnection technology to be defined and evaluated/qualified, also versus the substrate clamping technology.
- PAD for passive components to be applied outside their qual. temperature range has been issued, see further the interconnection technology evaluation.

**Intermediate Frequency Amplifier 2:**

- Design status is open.
- PAD for GaAs transistor has been rejected (power consumption).

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**Local Oscillator unit:**

- Varactor dice: Applied in frequency multipliers assembled, either by JPL or RPG. JPL PID under final development and qualification approach is visible.
- Varactor, discrete: Applied by MILLITECH for a frequency multiplier. Screening and qualification approach is visible. PAD to be issued.
- Frequency Multipliers: Assembled by JPL, PID under development and qualification approach is visible.
- Frequency Multipliers: Assembled by RPG, no visible PID and qualification approach.
- Frequency Multiplier: Assembled by MILLITECH. PID under development and qualification approach is visible
- High Frequency Amplifiers: Manufactured by TRW. Procurement specification, including qualification approach and PID base line from JPL, is visible.
- Isolators, designed by JPL/MILLITECH and manufactured by MILLITECH, presently under development.
- Isolator designed and manufactured by MILLITECH, presently under development, awaiting PDR documentation confirming also PID status.

**Local Oscillator Source Unit:**

- The unit contains mainly electronic components and some of them are not available from qualified sources but have a successful application history. Some components require further development. Further development of the component list will be undertaken. At present a preliminary list is available. A number of components will be procured through the project CPPA, the remainder will be self procured by COMDEV. PAD have been requested

### Wide Band Spectrometer:

- Bragg cell: Procurement specification and qualification approach is visible.
- CCD: PAD covering procurement evaluation, assembly PID and qualification is visible. Sensitivity to radiation is high, 2 KRad Si, and requires further confirmation and requires evaluation of shielding.
- Solid State Laser: PAD covering screening and qualification is visible.
- ASIC, digital, CMOS: PAD is under development. Open items concerning qualification to be closed and implemented.
- Intermediate Frequency Modules: The PAD summarising the acceptance approach for the components is under development. The PID for the module assembly is being developed.
- Power supply modules (hybrids): The WBE procurement approach is at present open but procurement through the CPPA is being considered. PAD has been requested by HIFI to cover the procurement approach.

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**High Resolution Spectrometer:**

- Recent redesign or descoping, impact on components list.
- Intermediate frequency Modules: No formal, confirmed approach visible.
- ACS: PAD sheets of a GaAs ASI and a CMOS ASIC has been made available and are being processed.
- There is no visibility on the procurement approach of the power supplies.

## Definition of Critical Items

**On HIFI consortium level, a start has been made with the identification and tracing or follow-up of critical items.**

**In order to control the identification of critical items and in order to enable prioritising the related initial efforts, a more formal definition has been established.**

**All this is in support of the effort, to have components and subassembly designs evaluated and qualified prior to application in qualification and flight equipment.**

**Table 1: Summary of critical items and documentation approach**

Ref.	Critical item definition	Summary of proposed control documentation
1	New or unique technology items and electrical or mechanical components designed and manufactured in the HIFI consortium	<ul style="list-style-type: none"> <li>- Design specification</li> <li>- Development and qualification plan</li> <li>- Process Identification Document</li> <li>- Facility review</li> </ul>
2	EEE components from non qualified sources	<ul style="list-style-type: none"> <li>- Request for approval (PAD sheet), component and manufacturer evaluation plan</li> <li>- Procurement specification dedicated to actual procurement approach and actual manufacturer, including Lot Acceptance Test plan</li> <li>- Process Identification Document to be established at the manufacturer.</li> </ul>
3	EEE components and mechanical components used outside their qualification limits	Request for approval (PAD sheet), component evaluation plan, Lot Acceptance Test plan for the specific application
4	Materials and processes applied outside qualification limits	Request for Approval, evaluation and qualification plan
5	Items/components identified through FMECA as single point failures	Development plan(for new or unique technology item), qualification plan; system, subsystem or assembly design description and evaluation of alternatives
6	Long lead items with a lead time in excess of 12 month or items that will have to be ordered prior to the Preliminary Design Review	All activities as applicable (see critical item definition references 1-5) shall be started and results and documentation shall be accepted prior to ordering or starting flight hardware. Relevant dates or milestones shall be identified in the subsystem, supplier or subcontractors planning.

(SRON-U/HIFI/PR/1999-008; Listing and control of Critical Items.)

**Criticality classification:**

**A: Reliability**

**B. Performance**

**C: Single point failure**

**D: Manufacturing, reproducibility**

**E: Procurement, availability**

**F: Handling and storage and/or ESD sensitive**

**G: Organizational/programmatic critical/availability**

(SRON-U/HIFI/PR/1999-008; Listing and control of Critical Items.)



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## Indication of critical items

**Formally, critical items are considered to be identified from:**

- **Block and circuit diagrams: Detection of Single point failures and evaluating redundancy considerations\***
- **Components, materials and processes lists: Evaluation of reliability and qualification status**

**However, real life is different.**

**Most of the critical items are already visible from the very beginning of the project and a lot of work has already been done to define and document design approach, hardware approach and the qualification or evaluation approach. In addition, a lot of information has emerged as a result of the recently held Sub System Preliminary Design Reviews.**

\*In support of this, a FMECA has been performed and is maintained on HIFI System level reference: Failure Mode, Effect and Criticality Analysis at system level, SRON-U/HIFI/RP/2000-001

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## Critical Items list

**An effort has to be made to provide an overview of the status of already known critical items and to provide a baseline for indicating other critical items that are less obvious or may not be recognised as such at a local level.**

**In order to trace the status of the definition and the status of acceptance of design or selection, a list will be established and maintained by HIFI System. The list will show the documented approach for the critical items, subsequently it will show the status of the design, hardware control and evaluation or qualification results.**

**The Critical Item approach will be subject of discussion between the sub systems and the HIFI System, also based on quality requirements as established for the project and taking established redundancy considerations into account.**

**Based on the acceptance or positive outcome of the respective steps, the criticality may be closed.**

### Balanced approach

**As identified earlier, most of the critical items do require additional effort early in the program to insure that programmatic, performance and quality requirements are met at a later stage in the program.**

**In the end, a balanced approach with respect to reliability has to emerge, with respect to items considered critical and items considered non-critical.**

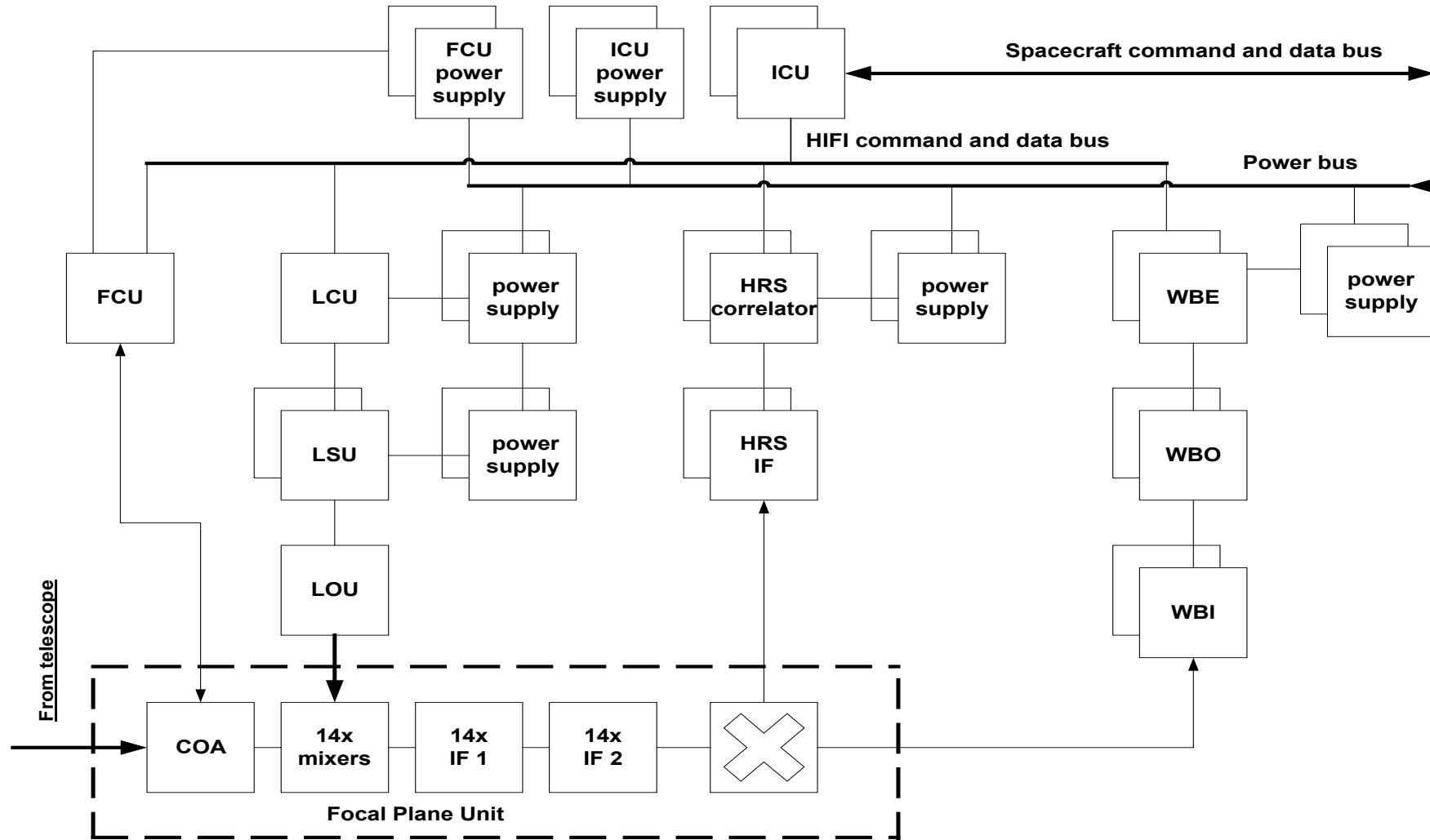
**EEE components processed through the co-ordinated procurement.**

**For obvious reasons EEE components, based on the presented criticality definition, might be defined as critical items, will not be considered as such when they are processed through the co-ordinated procurement. (FPCB and ESA controlled procurement Agent)**

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**Where are the critical items located within HIFI**

## Simplified block diagram of HIFI



### FMECA related items

The Focal Plane Unit is the only unit that does contain realistic “Criticality Index 1 and 2 Failure mode” items.

- Chopper, mainly because of the pivots (FMECA cat.2 failure)
- Calibration source, (FMECA cat. 2 failure)
- Diplexer mechanisms, mainly because of the pivots.(FMECA cat. 2 failure)
- Thermal straps.(FMECA cat. 1 and 2 failure)

The Local Oscillator Source Unit has a Criticality Index 2 Failure Mode\* in the coupler/splitter at the end connection of the 2 redundant synthesisers

\* Failure Mode, Effect and Criticality Analysis at system level, SRON-U/HIFI/RP/2000-001

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## Criticality Index of the assumed failure mode

(Failure Mode, Effect and Criticality Analysis at system level, SRON-U/HIFI/RP/2000-001)

**1= Failure propagation towards on board equipment outside the HIFI instrument**

**2= Full loss of HIFI functions**

**3= Sensible degradation of HIFI functions**

**4= No degradation of HIFI functions**

### With Criticality Index Suffix:

**SP= no redundant function available**

**R = redundant function available**



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## Reliability or Qualifications Status related Items

The Focal Plane Unit does contain mainly new or unique technology items both mechanical and electronic. In addition, EEE components (standard passive components) are applied that are used outside their qualification limits. Depending on the application location (organisational) also materials and processes have to be considered critical that do require a further qualification effort, in particular with respect to the extreme low temperature application and associated cycling.

Main new or unique technology items:

- Mixers from several sources.
- IF amplifiers (4-8 GHz) from YEBES and ETH, containing InP HEMT.
- InP HEMT discrete transistors from YEBES and TRW.
- Isolators/circulators (4-8 GHz) by PAMTECH.
- Chopper; (FMECA cat.2 failure), also containing pivots.
- Calibration source; (FMECA cat. 2 failure).
- Duplexers; (FMECA cat. 2 failure), containing pivots.

---

**Reliability or Qualifications Status related Items, continued:**

**The Local Oscillator unit contains also mainly special designed, special manufactured, new technology items that are considered as critical items:**

- **Multipliers, based on varactor diodes manufactured by JPL and assembled/ tested by JPL or RPG: design, manufacturing and reliability critical.**
- **Multiplier, manufactured, tested and qualified by MILLITECH.**
- **Isolators, manufactured, tested and qualified by MILLITECH.**
- **EHF power amplifiers also containing GaAs MMIC, designed by JPL/TRW and manufactured, tested, and qualified by TRW: design, manufacturing and reliability critical.**

**In addition a number of process and materials items as applied in the LOU do need further attention.**

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**Reliability or Qualifications Status related Items, continued:**

**It is expected that the Local Oscillator Source Unit is mainly made-up of EEE components, available on the market.**

**However, formal qualified high frequency EEE components are rare, but components with a successful application history are certainly available from several sources. This makes the LSU EEE components reliability/procurement critical.**

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Reliability or Qualifications Status related Items, continued:

**From a management point of view, the Control Units (ICU, FCU, LCU) should not contain critical hardware items. This is confirmed at review of the EEE components lists and is largely due to the co-ordinated component selection and procurement effort on Spacecraft level.**

**The Wide Band Spectrometer contains the following items considered critical:**

- **The Bragg cell: procurement critical, special production and single source.**
- **The 4 lines CCD: special new design, evaluation required, reliability and procurement critical.**
- **The Solid state Laser: only available as commercial product from a single source, in-house up screening, reliability critical also because of the intrinsic limited life time under power (2 lasers are foreseen in cold redundancy).**
- **The 14 bit ADC, 800 KSPS: reliability and procurement critical, not available through the co-ordinated procurement at this moment.**
- **ASIC, Digital, CMOS, reliability and procurement critical.**

**Further EEE components as required may be available through the CPPA.**

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**Reliability or Qualifications Status related Items, continued:**

**The Intermediate Frequency unit (IF) and the correlator (ACS) of the High Resolution Spectrometer are solely made up of EEE components.**

**A number of components for the IF and ACS is available through the CPPA. In the ACS, 3 ASIC designs are being applied:**

- **ASIC, Digital, CMOS, reliability and procurement critical**
- **ASIC, Digital, GaAs, reliability and procurement critical**
- **ASIC, Analogue, GaAs, non complex, reliability and procurement critical**
- **ASIC of respective designs, assembled in multi chip modules, also critical because of power consumption and critical heat flow/thermal design. Manufacturing/reliability critical.**

**The IF unit contains high frequency components that are not available through the co-ordinated procurement, among them custom VCO designs, multi chip modules and special packaging: procurement and reliability critical.**

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Reliability or Qualifications Status related Items, continued:

**Power supplies**

**As will be observed from the HIFI hardware block diagram, power supplies are being applied in all HIFI sub systems. They require special attention, in particular when hybrid modules are being applied.**

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**Page for notes and remarks:**



# **Herschel/Planck Project**

## **JPL PA Status**

**Tim Larson**

**JPL H/P Mission Assurance Manager**

**2<sup>nd</sup> Quarterly PA Managers Meeting**

**18 April 2002**

**Milan, Italy**

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- **JPL contributions:**

- **Herschel**

- SPIRE: Bolometer Detector Assemblies, JFET Modules, RF Filter Modules, cryo harnesses
- HIFI: High power amps, high and low frequency diodes, Band 5 and 6 mixers and LO chains

- **Planck**

- HFI: Bolometer modules (100GHz to 853GHz)
- LFI: Sorption cryo cooler subsystem (cold end interfaces with LFI and HFI instruments, mechanical and thermal attachment to the S/C structure and radiators)

- **PA Approach**

- **JPL Mission Assurance process applied to all project elements**
- **One Mission Assurance Manager and support team for consistent application across the project**
  - Contact info: [timothy.larson@jpl.nasa.gov](mailto:timothy.larson@jpl.nasa.gov)
  - Phone: (818) 354-0100

- **Disciplines managed by MAM**
  - **Project Risk Management**
  - **Reliability**
    - Reliability analyses
    - Environmental requirements and testing
  - **Quality Assurance**
  - **Safety Assurance**
  - **Contamination Control**
  - **Materials and Processes**
  - **Electronic Parts Assurance**
    - Parts selection, evaluation, procurement
  - **Configuration Management**

- **Scope**

- **MAM is part of project staff with independent reporting path through the Office of Safety and Mission Success**
- **Mission assurance program is peer reviewed by MA organization**
- **MAM reports at:**
  - Project Monthly Management Reviews
  - Monthly OSMS reviews
  - Presents MA Fever Chart at quarterly program office reviews

- **SPIRE**
  - RAL comments incorporated, approval pending
- **HIFI**
  - Approved by SRON
- **LFI (Cooler)**
  - Draft submitted to Laben
- **HFI**
  - No formal requirement flowed down from Cardiff
  - Business Agreement references JPL Herschel Planck Project Mission Assurance Requirements document
  - Same MA processes/requirements are applied to HFI element

- **Materials and processes specialist reviews materials usage lists concurrently with design progress**
- **Non-standard materials and processes are identified and qualified prior to use**
- **Status –**
  - **SPIRE – all materials have been reviewed and approved. Will finalize materials list and forward to RAL.**
  - **HIFI – materials are being reviewed, design in progress. Final list by CDR.**
  - **Cooler – materials review is up to date with current design status. One material to be qualified. Final list by CDR.**
  - **Hfl – all materials have been reviewed and approved.**

- **Project Interface Engineer coordinates all support from the parts assurance organization**
  - Parts selection, parts specialists, procurement, stores, kitting, FA lab
- **All electronic parts are used outside of standard temperature ranges (from 100mK to 120K)**
  - Custom made parts (HIFI diodes) are qualified at the part level (some are used in JPL HIFI hw, some are shipped to other HIFI consortium members)
  - Procured parts – DPAs and component evaluation performed where necessary
  - Parts will undergo rigorous assembly level qualification and acceptance test program

- **Contamination Control Plan is in place**
- **Contamination control engineer participated in earlier ESA contamination control working group meetings**
- **All facilities handling flight hardware are evaluated and certified to appropriate levels (most labs and assembly areas must meet class 100.000 level)**
- **When environmental tests are performed in areas not meeting the class 100.000 requirement, hardware is placed inside special fixtures for protection**

- **Reliability analyses**
  - FMECAs, WCAs, and PSAs performed as appropriate
- **Environmental requirements**
  - Thermal, vibration, EMC, radiation
- **Single Point Failures**
  - **SPIRE**
    - Will discuss potentially serious SPF issue at upcoming Detector Summit on April 24, 25
  - **HIFI**
    - Failures lead to loss of bandwidth
  - **COOLER**
    - Two identical, fully redundant coolers
  - **HFI**
    - Failures lead to gradual loss of bandwidth



- **Problem/Failure Reporting System**

- **P/FR system used to track all problems, anomalies, and failures on the flight hardware**
- **Includes description of problem, analysis of root cause, corrective action, and verification**
- **Requires review by CogE, project element management, reliability, safety, MAM**
- **Problems with serious impact and/or uncertain corrective action result in a 'red flag P/FR' requiring project manager approval for closure**

- **Safety engineer reviews all facilities, tests and processes that could threaten the hardware**
  - **Operational Safety Reviews**
  - **Pre-test Reviews**
  - **Facility Safety Reviews**
- **Safety Data Package will be prepared for the Sorption Cooler**

- **Quality Assurance reviews and approves all AIDS (Assembly and Inspection Data Sheets) that control all assembly, handling, test and other activities on the flight hardware**
  - These AIDS define the inspection points
  - AIDS are maintained under configuration control
- **PA/QA personnel review all qualification and acceptance test plans and procedures**
- **QA personnel witness all tests**
- **Vendors are surveyed and approved by QA**
- **PA requirements are passed on to all subcontracts**

- No deliverable software

- **All controlling documents are listed in the Business Agreements and Specification Documents**
- **Drawing Trees list all drawings that define the hardware**
- **All test and engineering procedures, plans, AIDS, other documents, and drawings are placed in JPL PDMS (Project Data Management System) database**
- **This system is used to store and track release status of drawings and documents**
- **ECRs are part of this system, and are used to track changes to controlled documents and drawings**
- **All IRs (Inspection Reports) are also tracked in this database for CogEngineer disposition and QAE concurrence**

- **All EIDPs will include:**
  - **ADP**
  - **List of open IRs**
  - **List of open P/FRs**
  - **Handling Documents**
  - **Any other documentation defined in the Business Agreement**



# PA Documentation Status



Document	JPL-D	Status
Mission Assurance Requirements for the Herschel/Planck Mission	D-16642	Released 1/01
Herschel/Planck Risk Management Plan	D-16857	Released 11/00
Herschel/Planck Configuration Management Plan	D-16873	Released 1/01
Herschel/Planck Mission Assurance Plan (includes Parts/Materials/ Processes, Quality Assurance, Reliability)	D-16874	Released 2/01
Herschel/Planck Safety Plan	D-16875	Released 12/00
Herschel/Planck Problem/Failure Reporting Plan	D-19151	Released 10/00
Herschel/Planck Environmental Requirements Document	D-19155	Released 2/01
Herschel/Planck Contamination Control Plan	D-19156	Released 4/01
Herschel/Planck Quality Assurance Plan	D-19173	Released 9/01