SPIRE Critical Items List

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Issue	Date	Comments
1	4 February 2002	Issued for SPIRE IBDR
2	6 June 2003	Issued for SPIRE IHDR

Contents

Introduction

This document provides a list of technical and/or programmatic issues which are regarded by the SPIRE Project Team as requiring action in order to maintain the project schedule and the instrument development plan and scientific capabilities. These are receiving on-going attention from the Project Team in consultation with the relevant subsystem groups, ESA, and industry. Progress is regularly tracked in regular Project Team meetings and in *ad hoc* meetings and telecons as appropriate. Each item is the responsibility of one particular individual in the Project Team.

Item	**1. SPIRE Overall Schedule**
Status	Under regular assessment
Last update	6 June 2003
Subsystem	Instrument
Responsible institute	RAL
Nature of criticality	SPIRE schedule compatibility with industry's stated instrument delivery dates
Responsible persons	Eric Sawyer
Failure effect	Late delivery or de-scoped testing
Description	On-time delivery of the CQM is not now feasible without untenably limited and risky programme. An alternative plan has been proposed which involves redefining the STM/CQM programme with delivery of upgraded STM (or down-graded CQM). The alternative STM/CQM/PFM development plan has been presented to ESA and Industry at the last SPIRE Interface meeting in April. The adaptability of the subsystem development plans (especially the DRCU) needs to be assessed. The purpose of this adapted plan is to protect as much as possible the on-time delivery of the PFM. It involves some compromises and added risks to the CQM programme.
Due date of corrective actions	A decision from ESA on whether or not SPIRE should adopt the new approach is expected by the end of June.

Item	**2. STM/CQM Programme**
Status	Currently underway
Last update	6 June 2003
Subsystem	Instrument
Responsible institute	RAL
Nature of criticality	Technical problems; schedule
Responsible persons	Eric Sawyer
Failure effect	Redesign and retest; late delivery or de-scoped testing
Description	The STM/CQM programme includes the first assembly and test of many subsystem and system elements. Various teething troubles and small problems continue to arise and need to be addressed, requiring much attention from the Project Team, at the expense of other areas of work. Schedule is vulnerable at this stage to any AIV facility problems.
Due date of corrective actions	The programme is under continual review and assessment.

Item	3. DRCU Development Plan
Status	Reviewed in April. Currently under discussion with CEA
Last update	June 9
Subsystem	DRCU
Responsible institute	CEA; RAL
Nature of criticality	Compatibility of DRCU schedule with instrument CQM and PFM schedules needs to be established
Responsible persons	CEA: Jean-Louis Augueres RAL: Eric Sawyer
Failure effect	N/A
Description	DRCU development plan favoured by CEA involves waiting until QM design verified by instrument CQM tests before starting PFM programme. This results in late delivery of the QM2 DRCU meaning that when QM1 is delivered to industry withy the CQM, no electronics are available at RAL for instrument testing for approx. 6 months. See DRCU Programme Review Board Report. Discussions are continuing with CEA.
Due date of corrective actions	Status to be reported at IHDR.

Item	4. FDIR
Status	In progress but slowed due to pressure of work
Last update	6 June
Subsystem	System; OBS
Responsible institute	RAL
Nature of criticality	Autonomy modes
Responsible persons	Ken King
Failure effect	Delay in OBS testing
Description	FDIR analysis has been slowed due to lack of resources and late availability of information from subsystems. All information is now available, and additional resources are being deployed.
Due date of corrective actions	Analysis needed by end of June. Update will be given at IHDR meeting.

Item	5. Spacecraft thermal interfaces
Status	ECR09 has not yet been accepted by ESA/industry as a statement of SPIRE's requirement
Last update	6 June 2003
Subsystem	SPIRE FPU: thermal behaviour
Responsible institute	RAL
Nature of criticality	Thermal characteristics of SPIRE and its environment are critical to its scientific performance.
Responsible persons	John Delderfield
Failure effect	Cooler hold time less than 46-hour spec.; loss of sensitivity due to thermal drifts and/or detector temperature running too high.
Description	See ECR09 and minutes of recent interface and dedicated thermal meetings. SPIRE is concerned that optimisation of the overall thermal system is critically important for instrument performance. The iterative approach currently being pursued by ESA/industry is the most constructive way forward in practical terms; SPIRE would like to see this expedited as much as possible.
Due date of corrective actions	SPIRE is in any case planning to implement all necessary measures in order to achieve the best thermal performance of the instrument (see items 7 and 8)

Item	6. EMC: Harness overshielding
Status	Open
Last update	6 June 2003
Subsystem	SPIRE electrical system
Responsible institute	RAL
Nature of criticality	Shielding of the SPIRE detectors from EMI is critical to their scientific performance.
Responsible persons	John Delderfield
Failure effect	Excess bolometer noise or non-functioning bolometers
Description	SPIRE's grounding and RF suppression scheme requires harness overshield inside the Herschel cryostat. SPIRE's request for its implementation has been rejected by ESA. SPIRE has formally requested that the decision be reconsidered. Constructive discussions with industry are taking place and a practical solution is being sought.
Due date of corrective actions	SPIRE assumes that configuration will be clarified for next Industry design review.

Item	7. Change of FPU and detector box supports to carbon fibre
Status	Currently in progress.
Last update	June 9 2003
Subsystem	FPU structure
Responsible institute	MSSL; RAL
Nature of criticality	Schedule criticality for first cold test and technical risk
Responsible persons	MSSL: Berend Winter RAL: Eric Sawyer
Failure effect	The current stainless steel supports will be implemented in the event that the new supports are not ready in time.
Description	Better thermal isolation is needed in order to improve the ^{3}He cooler hold time and the detector operating temperature. New supports will not be implemented for the CQM, but it is planned to install them on the PFM.
Due date of corrective actions	MSSL to formulate implementation plan; to be reviewed in mid June. Report on progress and status at IHDR.

Item	8. Level-0 thermal strap interface
Status	In design for implementation in next STM cool-down
Last update	6 June 2003
Subsystem	FPU structure
Responsible institute	MSSL
Nature of criticality	Lack of time to complete design and implement on STM. Technical risk in implementing electrical isolation with minimal thermal penalty.
Responsible persons	MSSL: Chris Brockley-Blatt RAL: Eric Sawyer
Failure effect	Schedule loss; degraded thermal performance
Description	The thermal performance of the current interface design is inadequate. An alternative design is being developed by MSSL.
Due date of corrective actions	For compatibility with the STM/CQM schedule, the new strap interface must be designed, proven and ready for installation by mid-August, to be incorporated for the cold vibration test

Item	9. FTS mechanism vibration qualification
Status	Open
Last update	6 June 2003
Subsystem	SMECm
Responsible institute	LAM
Nature of criticality	Vibration qualification.
Responsible persons	LAM: Dominique Pouliquen RAL: Bruce Swinyard
Failure effect	Mechanism redesign; possible failure to meet spectral resolution goal
Description	SMECm design was not compatible with vibration levels predicted by FEA model (by a factor of four).Following instrument level vibration tests, levels have been lowered by more than the required factor.
Due date of corrective actions	Qualification tests will take place at unit level before delivery of the PFM SMECm in November 2003.

Item	10. BDA qualification
Status	Under regular review
Last update	6 June 2003
Subsystem	Detectors
Responsible institute	JPL
Nature of criticality	BDA qualification and test programme have been severely delayed due to problems with Kevlar supports for 300-mK stage.
Responsible persons	JPL: Marty Herman Cardiff: Matt Griffin RAL: Bruce Swinyard
Failure effect	Schedule; detector performance; risk of single-point failure
Description	Mechanical qualification not yet achieved; BDA fabrication and test has been delayed; minimal time now available to build, test, deliver JPL hardware. CQM arrays not yet tested FS deliverability may be at risk due to JPL budget constraints.
Due date of corrective actions	Programme is under regular review in weekly telecons with the Project Team.

Item	11. JFET power dissipation
Status	Under regular review
Last update	6 June 2003
Subsystem	Detectors
Responsible institute	JPL
Nature of criticality	JFET Total power dissipation when optimised for low noise operation is to high in photometer mode.
Responsible persons	JPL: Jamie Bock RAL: Bruce Swinyard
Failure effect	Loss of scientific performance due to adverse thermal effects, operation at reduced power/higher noise or switching off of selected channels to reduce overall dissipation.
Description	For best noise performance, the JFETs need to be operated at about 120 K. The overall dissipation needed to achieve this in photometer mode (worst case) is approx. 70 mW (allocation is 42 mW). Power can be reduced at the expense of higher noise, or some FETs can be switched off. The thermal impact will not be fully understood until CQM tests at system level have been carried out.
Due date of corrective actions	CQM tests will clarify power dissipation. JPL are investigating change to JFET support membrane design as alternative design to reduce heating power needed (not a SPIRE-funded programme; best efforts only). RAL are investigating increasing thermal isolation of JFET rack.

Item	12. 300-mK thermal strap supports
Status	Mechanical failure in instrument STM; recovery plan formulated and underway
Last update	6 June 2003
Subsystem	Thermal straps
Responsible institute	Cardiff
Nature of criticality	Potential single-point failure for SPIRE
Responsible persons	Cardiff: Peter Hargrave RAL: Doug Griffin
Failure effect	Loss of SPIRE due to thermal short between 300-mK and 2 K.
Description	A 300-mK thermal strap system light-baffle and thermal strap support unit failed under warm vibration of the instrument STM. The MRB established the cause as a workmanship problem that led to Kevlar breaking due to friction, but concluded that the design should also be improved. The new design provides larger radii at the places where the Kevlar is wrapped around the metal support unit.
Due date of corrective actions	New design will be built, and tested at unit level before installation into the CQM for cooldown (scheduled for mid-August).

Item	13. FPU internal black coating
Status	Open
Last update	6 June 2003
Subsystem	FPU
Responsible institute	Cardiff; MSSL; RAL
Nature of criticality	Black coating is needed in certain places inside the SPIRE FPU to suppress stray light.
Responsible persons	Cardiff: Peter Hargrave MSSL: Chris Brockley-Blatt RAL: Bruce Swinyard
Failure effect	CQM will have limited black coating installed for qualification purposes only.
Description	Qualification of suitable black compound is not yet complete, and the design and manufacture of the black tiles to be installed in the FPU has yet to be carried out. This programme has been slowed down due to the need to solve the problems that have arisen with the thermal strap supports. A work-around will need to be formulated to qualify for use on PFM.
Due date of corrective actions	Samples for CQM testing needed beginning of August. PFM blackening is needed in early October.

Item	14. Correction of mirrors
Status	Open
Last update	6 June 2003
Subsystem	Optics
Responsible institute	LAM
Nature of criticality	STM optics verification revealed misalignments
Responsible persons	LAM: Dominique Pouliquen RAL: Bruce Swinyard
Failure effect	Loss of efficiency due to misalignment
Description	CQM CM3 mirror is misaligned by 0.5^{o} and two others have small misalignments. LAM are having CM3 remade - may be available for retro-fit in the CQM. In the worst case, CQM programme will use existing mirrors with compromised testing capabilities.
Due date of corrective actions	Problems to be corrected for PFM mirrors due in early October.

Item	15. Filter availability
Status	Open
Last update	6 June 2003
Subsystem	Filters
Responsible institute	LAM
Nature of criticality	Schedule; technical (filter delamination)
Responsible persons	Cardiff: Ian Walker RAL: Eric Sawyer
Failure effect	Late delivery of filters - compromised CQM schedule
Description	Production problems with large area filters need to be solved before filters for the CQM instrument and the AIV facility can be delivered. Work continues at Cardiff to solve technical problems.
Due date of corrective actions	In order to avoid the CQM schedule being driven by filter availability, CQM instrument and AIV filters needed by July 1. Status report will be given at the IHDR.

Item	16. Microvibrations
Status	Microphonics test plan has been formulated and issued.
Last update	6 June 2003
Subsystem	Bolometers; SMECm
Responsible institute	RAL
Nature of criticality	Shielding of the SPIRE detectors from EMI is critical to their scientific performance.
Responsible persons	Doug Griffin
Failure effect	Excess bolometer noise or non-functioning bolometers
Description	The SPIRE bolometers and FTS mechanism position sensor are potentially vulnerable to microvibration noise (for instance from the spacecraft gyros). Analysis of susceptibility by SPIRE and of the expected vibration environment by Alcatel indicates that the levels of vibration due to the spacecraft should not pose a significant problem. However, the uncertainties are considered to be large, and continuing analysis, measurement, and review will be important. However, it has been agreed that the system design of the spacecraft need not be driven by this issue. The operating modes of the SPIRE FTS, which is most sensitive to vibration, have been defined such that a step-and-integrate mode of data-taking can be implemented. This may involve some loss of basic sensitivity, but would be far less sensitive to microphonic disturbance.
Due date of corrective actions	Semi-quantitative tests will be carried out during CQM and PFM ILT, as described in the microphonics test plan.