# SPIRE

**SUBJECT:** **Critical Items List**

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# Distribution

All SPIRE Subsystem Managers
SPIRE Project Team

# Change Record

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## 1. 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, industry and national agencies. 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

## 2. CRITICAL ITEMS LIST

| | Item and Responsible Individual | Description |
|---|---|---|
| 1 | Spacecraft interfaces (IID-A and IID-B)<br>*John Delderfield* | SPIRE has submitted a set of ECRs in connection with the current exercise to formalise the IIDs. While further iteration may be needed based on technical work and analyses which are ongoing, early formalisation of the IIDs is seen as essential to provide a working baseline. |
| 2 | Bolometer Arrays<br>*Matt Griffin* | US funding constraints at JPL are having a significant impact on the JPL deliverables and/or the level of unit-level testing and calibration that will be done before delivery to SPIRE.<br><br>The JPL management team is working in consultation with the SPIRE Project Team to devise a plan to accommodate the funding constraints while protecting key deliverables and maintaining the delivery schedule. It is likely that in order to do this, the testing programme will have to be significantly curtailed, introducing additional risk and requiring a higher level of testing at instrument level. Every effort is being made to minimise the overall impact on the programme. |

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|---|---|---|
| 3 | 300-mK Thermal Straps<br>*Doug Griffin* | The architecture and implementation of the thermal straps from the 300-mK cooler to the five detector arrays presents a set of challenging problems. These have been further complicated by the measures taken to produce a compact and light weight FPU. Now that the design of the 2-K detector enclosures is sufficiently mature, we are looking at the detailed implementation of the straps. The thermal strap programme is now schedule-critical. A technical Tiger Team has been established, led by Doug Griffin (Assistant Systems Engineer), to carry out a design study and experimental evaluation of three design concepts. At the time of writing, all three are deemed feasible from the point of view of basic thermal/mechanical performance and reliability. Further study will concentrate on the results of vibration tests and analysis of the accommodation and integration. A selection of one concept for detailed design and implementation is planned for early March. |
| 4 | FPU Structure<br>*Berend Winter* | The schedule for production of the FPU structure by MSSL is on the critical path for the STM. The MSSL development plan has been regularly reviewed in detail by the SPIRE Project Team in consultation with the UK Herschel/Planck Programme Director, and also by ESA. Measures are being adopted to speed up production through hiring additional engineering staff and outsourcing manufacture to a number of external companies. |
| 5 | Microvibration<br>*Colin Cunningham* | 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 is 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. |

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|---|---|---|
| 6 | Warm Electronics: DRCU Development Plan and schedule<br>*Eric Sawyer* | The development plan and model philosophy for the DRCU are unavoidably complex, and must work within constraints imposed by French working practices and industrial procurement policies. The SAp schedule has been reviewed in detail by the SPIRE Project Team to ensure the earliest possible deliveries and avoid significant impact on the overall schedule. The current plan is non-optimal from a technical point of view, having been dictated by programmatic priorities. The DRCU is now on the critical path (or sufficiently close to be so regarded). The schedule is receiving continuing attention and iteration by SAp in consultation with the Project Team, and a review by ESA in the near future is also foreseen. |
| 7 | Warm Electronics: DRCU Mass<br>*Eric Sawyer* | The current mass estimate for the DRCU is 36 kg, compared with the SPIRE allocation of 23 kg. A detailed justification for the increased estimate has been requested of SAp by the SPIRE Project. Pending the outcome of this and a possible mass-reduction exercise, a waiver request may be issued with respect to the total SPIRE mass budget as defined in the IID-A. It must be noted that any work to effect a mass reduction of the DRCU could have a negative impact on the DRCU schedule. |
| 8 | EMC<br>*Doug Griffin* | EMC is recognised as an important and difficult system-level issue for SPIRE and Herschel. The SPIRE EMC Control Plan summarises our approach to design, modelling and verification. We are continuing to devote significant attention to EMC. |
| 9 | Beam Steering Mechanism<br>*Matt Griffin* | The budget in the UK for the BSM is strictly limited, having already increased significantly above the original allocation. There is currently a problem with the procurement and testing cost for the flex pivots which is pressurising the budget. A cost limitation exercise may result in a de-scope either of the testing programme or of the capabilities of the mechanism. |

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|---|---|---|
| 10 | UK Project Team costs<br>*Matt Griffin* | The UK budget for the Project Team (PI support, Project Management, Systems Engineering, Thermal and Stray light modelling, PA, Project Office) is strictly limited. The current rate of spend is unsustainably high and must be reduced. This is partly due to the re-work and iteration that has been and continues to be needed on system and IID-B issues.<br><br>There is no prospect of any additional UK funding over the next two years (if ever). Regrettably, it will therefore be necessary to curtail Project Team effort from now on, resulting in an inevitable slow-down in some activities. The Project Team will consult with ESA and Industry in deciding which areas should be given priority. |
| 11 | Staff effort for OBS at IFSI<br>*Ken King* | Progress on the SPIRE OBS has been slower than desired up to now due to staff effort limitations at IFSI. Latest indications are that these problems are now solved. The Project Tem will continue to monitor progress closely to make up for the lost time and then maintain the Schedule. |
| 12 | Shutter programme<br>*Matt Griffin* | The Shutter programme is currently proceeding at a very slow rate because of delays in appointing the industrial contractor. This is due to the slow progress of in setting up programmatic agreements between ESA and the CSA. If these issues are not resolved quickly, the Shutter delivery schedule will become critical.<br><br>The utility of the shutter in the Herschel cryostat on the ground relies on the SPIRE instrument being operable even outside the TV chamber. It has not yet been confirmed by Industry that the temperature of the optical bench will be low enough to allow this. |
| 13 | AIV and Ground Calibration Facility<br>*Bruce Swinyard* | There are concerns over the delivery dates for the cryostat and the cryoharness (both being procured from industry). The Project Team is monitoring the progress of the relevant contracts. |
| 14 | FMECA/FDIR<br>*Bruce Swinyard* | The subsystem FMECAs have been carried out and are available as the input to a system-level FMECA and to the FDIR. This activity is now just starting, and work in progress will be reported at the IBDR. However, it has not progressed as far as is desired at this time, due to the limited effort available. The option of contracting out this work to industry has been explored and rejected on grounds of excessive cost. |