SPIRE

SUBJECT: **RAL Project Plan for SPIRE**

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Change Record

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Table of Contents

List of Figures

List of Tables

Glossary

CQM	Cryogenic Qualification Model
ESA	European Space Agency
FIRST	Far Infrared and Submillimetre Telescope
FS	Flight Spare (Model)
FTB	FET Box
HCSS	Herschel Common Science System
Herschel	Herschel Space Observatory (formerly FIRST)
ICC	Instrument Control Centre
PFM	Proto-Flight Model
PI	Principle Investigator
PIMS	Project Information Management System
PPARC	Particle Physics and Astronomy Research Council
RAL	Rutherford Appleton Laboratory
RO	Responsible Organisation
S/C	Spacecraft
SPIRE	Spectral and Photometric Imaging REceiver
SSTD	Space Science and Technology Department (of RAL)
STM	Structural Thermal Model

1. INTRODUCTION

The Herschel Space Observatory, the fourth of ESA's Cornerstone missions, is a space-borne observatory operating in the far infrared and sub-millimetre wavelength ranges. The responsibility for the design, implementation and operation of the scientific instruments on the Herschel spacecraft is given to consortia, made up from members of research institutions and universities, under the leadership of a Principle Investigator (PI). The Rutherford Appleton Laboratory (RAL) is one of the institutes responsible for providing and operating the Spectral and Photometric Imaging REceiver (SPIRE) instrument.

Current PPARC funding covers those activities leading to the delivery and commissioning of the Flight and Flight Spare instruments and to the implementation of the SPIRE Instrument Control Centre (ICC). It does not cover the Operations Phase or Post-Operations activities, which will be a subject of a further bid to PPARC at a later date.

1.1 Scope

This document describes the management and development of those areas of the Herschel SPIRE instrument for which the RAL, and in particular the Space Science and Technology Department (SSTD), has responsibility. It is intended to show how the project will be managed to meet the ISO9000 standard as implemented in the SSTD. It is the Project Management Plan identified in the SSTD Task Allocation and Project Monitoring Procedure (AD01) and contains that information required by the Project Manager's Requirements Procedure (AD02).

As RAL is responsible for the overall management of the SPIRE project, many of the project management activities are covered by the appropriate SPIRE documentation. Where applicable this document refers to material contained these existing SPIRE project documents, or contains extracts from them.

1.2 Documents

1.2.1 Applicable Documents

AD01	ISO9: SPAP/007	Task Allocation and Project Monitoring
AD02	ISO9: SPAP/008	Project Manager's Requirements
AD03	SPIRE-RAL-PRJ-000029	SPIRE Management Plan
AD04	SPIRE-ESA-DOC-000178	FIRST/Planck Instrument Interface Document (IID) Part A, (SCI-PT-IIDA-04624)
AD05	SPIRE-RAL-PRJ-000031	SPIRE Work Breakdown Structure
AD06	SPIRE-RAL-PRJ-000030	SPIRE Product Tree
AD07		SSTD Management Plan (Issue 7.1)
AD08	SPIRE-ESA-DOC-000198	FIRST Science Implementation Requirements Document

1.2.2 Reference Documents

RD01	SPIRE-RAL-DOC-000184	SPIRE Project Office Requirements

RD02	SPIRE-RAL-PRJ-000455	SPIRE Major Milestone List
RD03	SPIRE-RAL-PRJ-000626	SPIRE Configuration Management Plan
RD04	SPIRE-RAL-PRJ-000032	SPIRE Document Management Plan
RD05	SPIRE-RAL-PRJ-000018	SPIRE Science Implementation Plan
RD06	SPIRE-ESA-DOC-000189	Product Assurance Requirements for FIRST/PLANCK Scientific Instruments
RD07	SPIRE-RAL-PRJ-000017	SPIRE Product Assurance Plan
RD08	SPIRE-RAL-PRJ-000033	SPIRE Configurable Documents Tree
RD09	SPIRE-UCF-PRJ-000064	SPIRE Scientific Requirements Document
RD10	SPIRE-RAL-PRJ-000034	SPIRE Instrument Requirements Document

2. PROJECT BREAKDOWN

2.1 Work Allocation

Table 3.1-1 (taken from AD03, but updated in the light of subsequent discussions) identifies the institutes that comprise the SPIRE consortium and the major areas of work for which they are responsible.

Institute		Role
ATC	Astronomy Technology Centre, Edinburgh	Provision of Beam Steering Mechanism (BSMm) Systems Engineering effort ICC Software Design effort Provision of ICC Operations Staff (TBC)
DESPA	Obs. de Meudon, Paris	Provision of FTS expertise and design support
Grenoble	CEA, Grenoble	Provision of ^{3}He cooler
IAC	Instituto de Astrofisica de Canarias, Tenerife	Provision of ICC operations staff
IAS	Institut d'Astrophysique Spatiale, Orsay	Support of ground calibration
ICSTM	Imperial College of Science, Technology and Medicine, London	Provision of ICC UK DAPSAS Centre Provision of ICC operations staff (TBC)
IFSI	Instituto di Fisica dello Spazio Interplanetario, Rome	Provision of Digital Processing Unit (DPU) Provision of DPU On-Board Software (OBS) Provision of ICC operations staff
JPL	JPL/Caltech, Pasadena	Provision of Bolometer Detector Arrays Provision of JFET Modules Provision of RF Filter Modules
LAM	Laboratoire d'Astophysique de Marseille	Provision of Mirrors Provision of FTS mechanism (SMECm) Provision of FTS and BSM control and signal processing electronics
MSSL	Mullard Space Science Laboratory, Surrey	Provision of FPU structure Provision of FTB enclosure Provision of ICC operations staff (TBC)
Padova	Padova Observatory	Provision of ICC operations staff
QMW	Queen Mary and Westfield College, London	Provision of Test Cryostats and support for Detector Arrays testing Provision of Calibrators Provision of Filters, Dichroics, and Beam Dividers Provision of ICC operations staff (TBC)
RAL	**Rutherford Appleton Laboratory, Oxfordshire**	**SPIRE Project Management.** **Provision of SPIRE Project Office.** **Provision of AIV and Ground Calibration Facilities.** **Provision of EGSE** **Provision of ICC Operations Centre.** **Instrument Cold Vibration**

		Systems Engineering
SAp	CEA, Service d'Astrophysique, Saclay	Provision of Detector Readout and Control Unit (DRCU) Provision of ICC DAPSAS Centre (Fr).
USK	University of Saskatchewan, Canada	Provision of Shutter Provision of ICC operations staff.
Stockholm	Stockholm Observatory	Provision of Instrument Simulator(s). Provision of ICC operations staff.

Table 2-1 SPIRE major tasks

2.2 Identification of Models

AD04 identifies the following models of the instrument that are to be delivered by the SPIRE Project to ESA. Each model will be tested and verified at RAL before delivery.

- Avionics Model
- Cryogenic Qualification Model
- Proto-Flight Model
- Flight Spare

2.2.1 Avionics Model (AVM).

This model is required to validate the instrument electronics and software and their interfaces with the S/C. This will include:

- verification of information exchange with the S/C computer, mass memory and attitude control systems
- verification of the instrument autonomy functions
- validation of on-board software updates
- validation of AIV procedures

At the instrument level the AVM will be used for qualification of the warm electronics subsystems. The following tests will be performed:

- EMC tests (Conduction, Emission, Susceptibility)
- Thermal Vacuum Test
- Warm Vibration

In addition the AVM DPU will be used, by ESA, during testing of the CQM (see below) and may temporarily replace the DPU during system level testing of the PFM in the event of a problem with the PFM DPU itself.

The AVM will consist of a DPU plus a DRCU Simulator. The DRCU Simulator will provide sufficient simulation of the operation of the FPU, FTB and DRCU to allow the activities given above to be carried out. The DPU will be built to flight representative standards (using extended range components) but redundancy will not be fully implemented.

2.2.2 Cryogenic Qualification Model (CQM) (including Structural Thermal Model (STM))

Initially, the STM, consisting of the CQM structure and cooler, plus mass and thermally representative models of other subsystems, will be used by the SPIRE consortium:

- To qualify the cold instrument structure design against the proposed environmental test levels and to derive the test levels for other subsystems.
- To verify the thermal design of the instrument
- To verify the optical alignment procedure for the instrument

Subsequently the CQM models of all subsystems will be integrated into the structure and the CQM instrument will be subjected to a series of functional and scientific performance tests. On delivery to ESA it will be used to ensure the compatibility of the Herschel payload and spacecraft by performing a series of functional tests and a set of conductive EMC tests in the ISO Flight Spare Cryostat.

The CQM units will be built to flight standards with full redundancy. The performance capabilities of the instrument may be less than the PFM - i.e. fewer pixels in the focal plane arrays, but it will mimic as exactly as possible the thermal, electrical and mechanical properties of the flight instrument and will be capable of under going the full environmental qualification programme.

This model consists of the FPU, FTB and DRCU only. It is assumed that the AVM DPU may be used for the duration of the CQM tests.

2.2.3 Proto-Flight Model

This is the instrument model that is intended for flight. It consists of all SPIRE Instrument Units. It will be built to full flight standards and will only have minor differences in thermal, electrical and mechanical properties to the CQM. It will have the same mechanical, thermal and electrical interfaces to the satellite as the CQM but, may, however, have minor internal design changes compared to the CQM. For instance the bolometer detector arrays may have many more pixels.

The PFM will undergo environmental test to qualification levels for acceptance times (**TBD)** - this applies to both the warm electronics boxes and the cold FPU.

2.2.4 Flight Spare Model

The Flight Spare Model provides for replacement of failed, or damaged, units during system level testing.

The FS will consist of a full flight standard, calibrated (TBC), FPU and FTB, and tested spare parts (normally at board level) for the DPU and DRCU.

It is possible that the Flight Spare Units may be provided from refurbished AVM and CQM units.

2.3 Work Breakdown Structure

The SPIRE Work Breakdown Structure is provided in AD05. Table 2-2 lists the high-level workpackages assigned to RAL:

FS1	**Project-level Activities**	
FS10	Project Office	
FS11	Management	

FS12	Project Control	
FS13	Product Assurance	
FS1A	Parts Procurement	
FS2	**Instrument Engineering**	
FS20	System engineering	
FS22	Design Documentation	
FS23	System Design	
FS29	Instrument Interfaces	
FS4	**Instrument AIV**	
FS41	General AIV Tasks	
FS42	Instrument Models AIV	
FS4A	Satellite AIV	
FSZ	**Instrument GSE and Facilities**	
FSZW	Special Facilities	
FSZX	OGSE	
FSZY	EGSE	
GFS1	**ICC Development**	
GFS11	Management	
GFS12	Instrument Operations	
GFS12X4	Instrument Observations	
GFS13	Software Development	
GFS2	**ICC Preparation**	
GFS21	Planning	
GFS22	Implementation	
GFS23	Integration and Test	
GFS24	FINDAS Support	
GFS25	Operations Planning	
GFS26	Training	

Table 2-2 RAL Workpackages

2.4 Function Tree

The following table breaks down the activities allocated to RAL into functions to be implemented

Project-level Activities		
	Project management functions	
		Project Breakdown
		Project Organisation
		Project Planning
		Configuration Management
		Information/Documentation Management
		Cost and Schedule Management
		Risk Management
		Interactions with ESA
	Provision of Project Office	

		Documentation Administration	
		Information Administration	
		Project Support	
		Financial Administration (UK only)	
	Product Assurance		
		Documentation	
		Configuration Management	
		Subsystem Acceptance	
	Parts Procurement		
		Coordination of inputs	
Instrument Engineering			
	System engineering		
		Definition of Document Tree	
	Documentation of the design		
		Management of the Design Description Document	
	System Design		
		Definition of Instrument Requirements	
		Definition of Subsystem Requirements	
		Support to Optical Design	
		Support to Thermal Design	
	Instrument Interfaces		
		Management of IID Updates	
Instrument AIV			
	Assembly		
		Test and Measurement of Subsystems Deliveries	
		Assembly into Instrument-Level Units	
	Integration		
		Integration of FPU into cryostat	
		Integration of FTB into cryostat	
		Optical Alignment	
		Bakeout	
		Integration of Warm Electronics with EGSE	
		Integration of Warm Electronics with Cold Instrument	
	Verification		
		Environment Control	
		Thermal Balance Check	
		Functional Testing	
		Performance Testing	
			Beam Profile measurement
			Throughput Test
			Sensitivity Measurement
		Qualification	
			Thermal Vacuum Test
			EMC Test (TBC)
			Warm Electronics Vibration

			Cold Instrument Vibration
	Calibration		
		Photometric Calibration	
			Closed Cryostat Tests
			External Source Tests
		Spectroscopic Calibration	
			Wavelength Calibration
Instrument GSE and Facilities			
	Provision of Test Facility		
	Commissioning of Test Facility		
	Operation of Test Facility		
	Provision of EGSE		
ICC Development			
	ICC Development Management		
	Data Processing Software Development		
	ICC System Testing		
	Ground Segment Testing		
	Instrument Simulator		
ICC Preparation			
	Instrument Database		
	Operations Planning		
	Training		

Table 2-3 Functions to be executed at RAL

2.5 Product Tree

Table 2-4 is a summary of the relevant major elements of the SPIRE Product tree identified in the SPIRE Product Tree (AD06) which have to be provided by RAL.

Product					Number	RO
4.	AIV/Ground Test Items					
	4.1	EMC test facility				RAL
			Radiative emission test facility			
			Radiative susceptibility test facility			
			Conductive emission test facility			
			Conductive susceptibility test facility			
	4.2	AIV facilities				RAL
			Integration Facility			
				Clean Room		
				Clean Bench		
				Measurement Instrumentation		
			Instrument Cryostat			
			Facility electronics			
			Clean Room			
			Infrastructure		1	

				Cryolab		
				Test Control Area		
				Cryogenic facilities		
				Vacuum facilities		
			EGSE			
				CDMU Simulator	5	
				SCOS2000	2	
				TM/TC Interface	3	
				Test Control	3	
				FCSS v 0.1	2	
				OBS Maintenance Facility	2	
				MIB Editor	2	
	4.3	Calibration facility				RAL
			Telescope Simulator			
				Optical Bench		
				Optics		
			Calibration Sources			
				Black Body Source		
				Spectral Line Source		
			Chopper			
			Facility electronics			
	4.4	Thermal Vacuum facility				RAL
	4.6	Warm Vibration facility				RAL
	4.8	Instrument Bakeout facility				RAL

	Product		Number	RO
	Ground Segment Deliverables			
		Instrument Users Manual	3	RAL
		Instrument Database	3	RAL
		Calibration Database	3	RAL
		Instrument Time Estimator		TBD
		Instrument Command Translator (TBC)		TBD

	Product		Number	RO
	Instrument Control Centre			
		DPU OBS Maintenance System	1	IFSI
		DRCU OBS Maintenance System	1	CEA
		RTA/QLA Software		TBD
		Trend Analysis Software		TBD
		Interactive Analysis Software		TBD
		Science Processing Software		TBD
		Science Analysis Software		TBD
		Diagnostic Tools		TBD
		Calibration Analysis Software		TBD
		Instrument Command Translator (TBC)		TBD

		Infrastructure			
			ICC Operations Centre		RAL
			DAPSAS(UK) Centre		ICSTM
			DAPSAS(Fr) Centre		CEA
			FINDAS		TBD

Table 2-4 RAL Product Tree

2.6 Work Package Description

Work Packages are described in Annex A

3. PROJECT ORGANISATION

3.1.1 General Organisation

The organisation of the SPIRE project is given in AD03. Within RAL, the project is organised along the lines described in the SSTD Management Plan (AD07) as shown in Figure 3-1. This structure is based upon a core team of project staff with responsibilities for areas of work within the project with support from teams within other divisions of the Space Science and Technology Department at RAL.

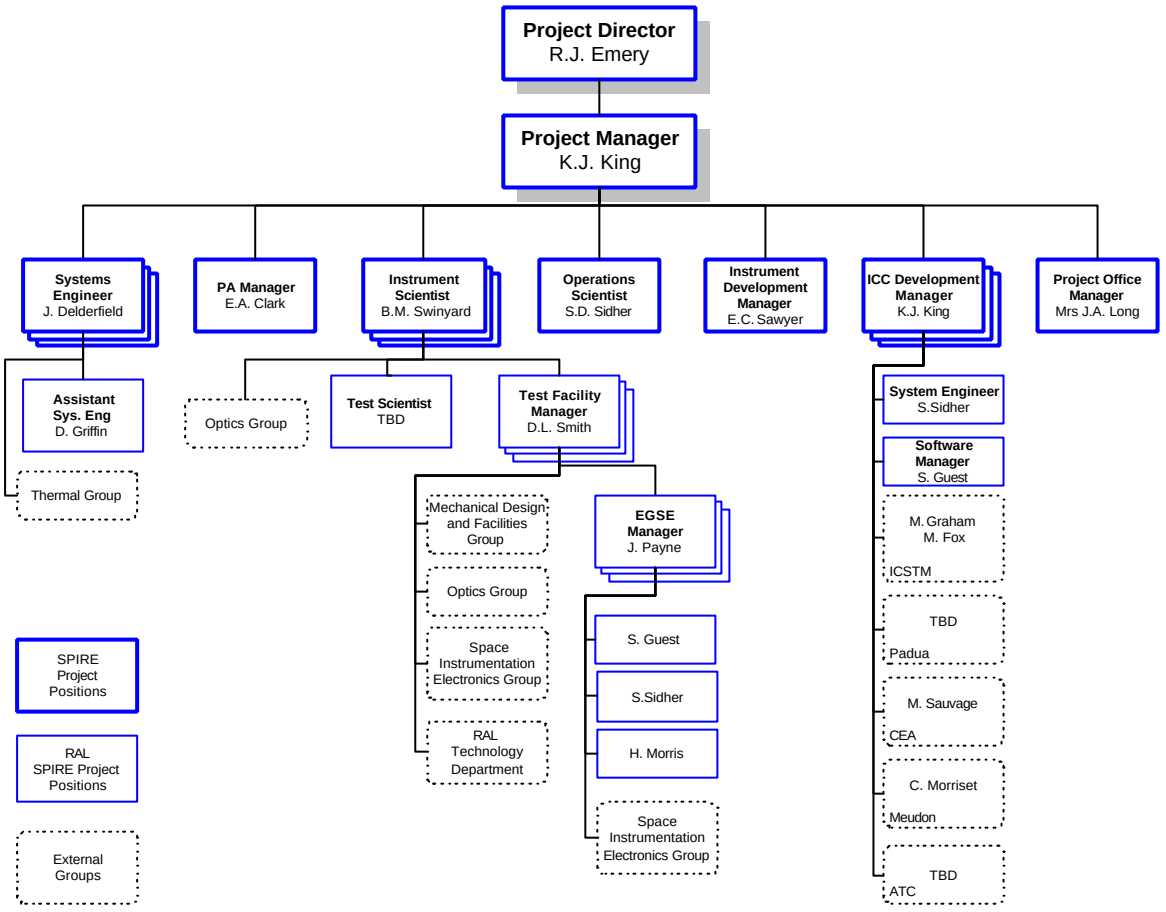

Figure 3-1 RAL Project Organisation

3.2 Management Interfaces

AD03 describes the project interfaces with ESA and with the other members of the SPIRE consortium.

Within RAL, the interfaces to teams within other divisions shall be described in Statements of Work, agreed between the relevant SPIRE manager and the manager of the SSTD facility.

SPIRE Managers report to the Project Manager at regular Project Management Meetings and through monthly reports.

3.3 Roles, Responsibilities and Authority

Some members of the RAL team (Project Manager, Instrument Development Manager, Instrument Scientist, Systems Engineer, Product Assurance Manager, Operations Scientist and ICC Development Manager) have roles and responsibilities within the SPIRE Project as a whole. These are described in the SPIRE Management Plan (AD03).

Others (Project Director and RAL Project Manager) have roles and responsibilities within the SSTD project management structure, which are described in the SSTD Management Plan (AD07).

The remainder of this section lists each of the other key posts and gives the duties and responsibilities associated with that post within RAL.

3.3.1 RAL Project Manager

The management of the activities falling under the responsibility of RAL shall be under the control of the RAL Project Manager, who will:

(i) define the overall schedule necessary to meet the project milestones;
(ii) monitor the project-wide deployment of resources;
(iii) proactively manage technical and schedule risks;
(iv) monitor progress in the development teams;
(v) instigate project reviews, studies and assessments as necessary to resolve issues and ensure a successful project;
(vi) represent the SPIRE project to the SPIRE Project management team.
(vii) represent the RAL project to the PPARC SPIRE Programme Manager and the Herschel/Planck Steering Committee
(viii) represent the RAL Project to the SSTD Management.

3.3.2 EGSE Manager

The EGSE Manager is responsible for the procurement and development of the EGSE system(s) used for testing the instrument models at RAL and at ESA. He/she will:

1. define the requirements on the EGSE, taking into account the need to adhere to agreements with other instruments, and ESA, with respect to common development.
2. define the tasks necessary, and the required resources, to provide the EGSE.
3. identify appropriate staff/facilities for the tasks involved and negotiate their availability.
4. plan the development and implementation schedule to meet the overall project delivery dates.
5. monitor and manage the work, and staff, during the project lifetime.
6. report to the RAL Project Manager on the status of the EGSE development programme.

Note: Operation of the EGSE during AIV falls under the responsibility of the AIV Facility Manager.

3.3.3 Project Office Manager

The Project Office Manager is responsible for the implementation of the facilities required in the SPIRE Project Office (defined in the SPIRE Project Office Requirements Document, RD01) and the operation of the Project Office during the lifetime of the project. He/she will:

1. implement the SPIRE Project Office at RAL to meet the requirements
2. document the procedures required to operate the Project Office efficiently and correctly
3. operate the SPIRE Project Office at RAL
4. report to the RAL Project Manager on the status of the Project Office

Note: The Project Office has an extended role over the normal RAL model and therefore, though it uses the SSTD facilities , exists independently of the SSTD project Resources section.

3.3.4 AIV Facility Manager

1. define the requirements on the SPIRE Test Facility at RAL
2. implement the SPIRE Test Facility at RAL to meet the requirements and schedule
3. report to the RAL Project Manager on the status of the Test Facility
4. manage the execution of the AIV Plan at RAL
5. report to the RAL Project manager and the Instrument Scientist on the progress of the AIV activities

3.3.5 ICC Software Manager

The ICC software Manager is responsible for organising the design and implementation of the ICC software used both in the iCC and in the HCSS. He will:

1. define the ICC software requirements in terms of Use cases and translate these into an object - oriented design for the software
2. support the ICC Development Manager in producing the SPIRE SIP by producing workpackages for the software development activities
3. lead the ICC Software Development Team in implementing the ICC software.

3.4 Generation of Organisation Documents

The project documentation tree is given in RD08.

4. PROJECT PHASING AND PLANNING

4.1 Instrument Hardware

4.1.1 Sequence of Activities

Figure 4-1 shows the SPIRE overall hardware schedule. It is split into 4 phases:

4.1.1.1 Design Phase

During this phase the instrument and subsystem designs are completed. This phase ends with the completion of the Instrument Baseline Design Review.

4.1.1.2 Test and Qualification phase

During this phase the first models of the instrument are manufactured and tested. This phase ends with the Critical Design Review.

4.1.1.3 Flight Model Manufacture Phase

This phase covers the manufacture, test and calibration of the Flight and Flight Spare models of the instrument

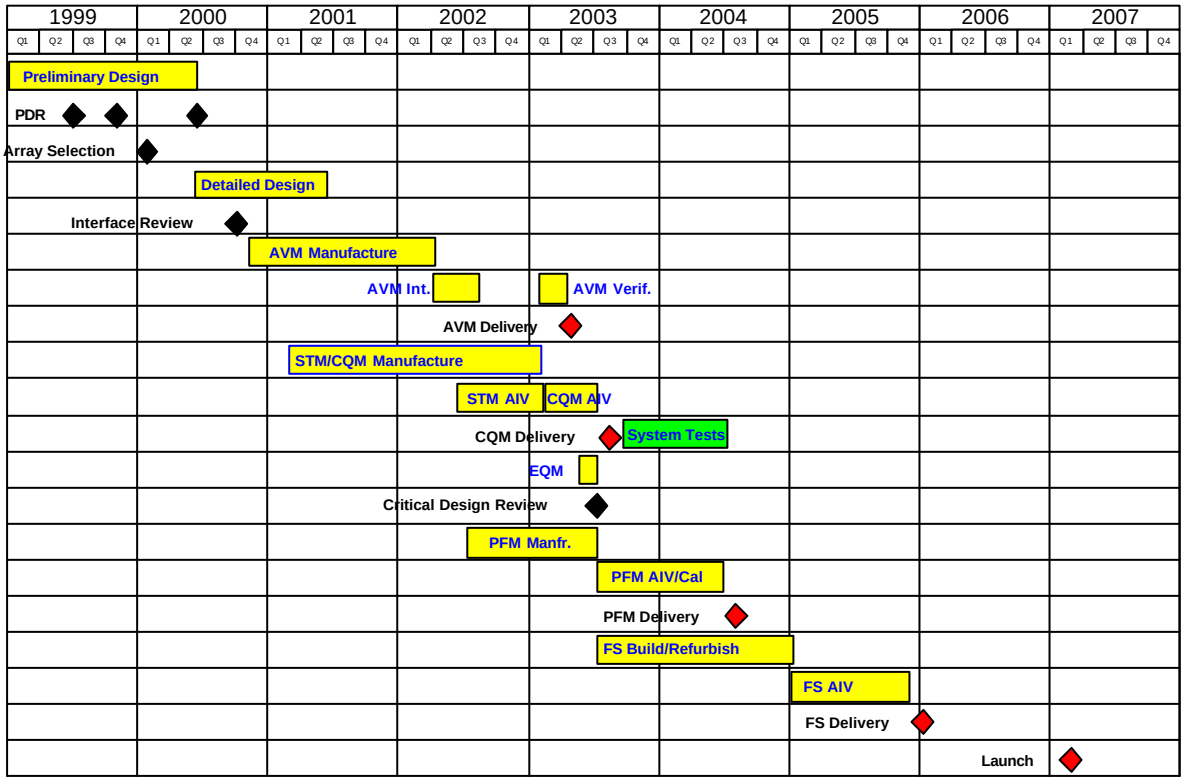

Figure 4-1 SPIRE Overall Schedule

A list of the principal project milestones is given in RD02.

4.1.2 Project Reviews

The project review plan is described in AD03. The dates of the reviews are listed in RD02

4.2 ICC

The planning for the ICC is described in the Science Implementation Plan (RD05).

5. CONFIGURATION MANAGEMENT

5.1 Configuration Management tasks

The plan for configuration management and control is given in RD03.

5.2 Implementation of Configuration Management

The Project will use the SSTD Project Information Management System (PIMS) for configuration control. This system will be set up and operated by the PA Manager.

The project documentation is held on an external site (Livelink at ESA) and so cannot be held in PIMS. Procedures for change control of the project documents are given in RD04.

The classes of document that are required to be under configuration control are defined in RD04.

5.3 Configuration Baseline

See RD03

5.4 Configuration Items

See RD03

5.5 Change Control

See RD03

6. INFORMATION/DOCUMENTATION MANAGEMENT

Documentation management is described in RD04

7. COST AND SCHEDULE MANAGEMENT

7.1 Cost Management

The Project Office maintains a spreadsheet of all project income and spend. At the end of each month this is compared with the FRS output and any discrepancies are resolved with the RAL Admin group.

Reports on project spend are made quarterly to PPARC and the Herschel/Planck Project Director.

7.2 Schedule Management

RD02 contains the project milestones relating to deliveries between SPIRE institutes and between SPIRE and ESA. This document will be maintained under configuration control and changes will be subject to approval.

Institutes shall provide schedules meeting these milestones and report on their status at the weekly project managers teleconference. Any changes in schedule will need approval from the project before being incorporated into the milestone list.

8. TECHNICAL REQUIREMENTS

Requirements on the instrument are generated from the SPIRE scientific requirements (RD09) in the form of a set of instrument requirements (RD10). The interface to the spacecraft is documented in AD04

The ICC requirements are given in AD08

9. PRODUCT ASSURANCE REQUIREMENTS

The requirements put on the SPIRE project are defined in RD06. The SPIRE response to these is specified in the SPIRE PA Plan (RD07).

10. SYSTEMS ENGINEERING

TBW

ANNEX 1
Workpackages

FS1	**Project-level Activities**	
FS10	**Project Office**	
FS100X1000	Provision of SPIRE Project Office	RAL
FS101X1000	Operation of SPIRE Project Office	RAL
FS11	**Management**	
FS110X1000	Support to ESA	RAL
FS111X1000	Organisation of Reviews	RAL
FS12	**Project Control**	
FS120X1000	Project Planning	RAL
FS121X1000	Project Control	RAL
FS13	**Product Assurance**	
FS130X1000	Product Assurance	RAL
FS131X1000	Quality Assurance	RAL
FS1A	**Parts Procurement**	
FS1A0X1000	Parts Procurement Co-ordination	RAL
FS1A1X1000	Parts Procurement for UK groups	RAL

FS2	**Instrument Engineering**	
FS20	**System engineering**	
FS200X1000	System Engineering	RAL
FS22	**Design Documentation**	
FS220X1000	Instrument Requirements Document	RAL
FS23	**System Design**	
FS230X1000	Instrument Requirements	RAL
FS231X1000	Instrument Interfaces	RAL
FS29	**Instrument Interfaces**	
FS290X1000	Instrument Interface Document, Part B	RAL

FS4	**Instrument AIV**	
FS41	**General AIV Tasks**	
FS410X1000	Engineering Test Preparation	RAL
FS411X1000	Calibration Preparation	RAL+
FS412X1000	AIV Team Training	RAL
FS42	**Instrument Models AIV**	
FS420A1000	AVM Integration	RAL+
FS420A2000	AVM Verification	RAL+
FS420C1000	STM Assembly	RAL+
FS420C2000	STM Integration	RAL+
FS420C3000	STM Verification	RAL+
FS420C4000	CQM Assembly	RAL+
FS420C5000	CQM Integration	RAL+

FS420C6000	CQM Verification	RAL+
FS420C7000	CQM Performance Tests	RAL+
FS420P1000	PFM Assembly	RAL+
FS420P2000	PFM Integration	RAL+
FS420P3000	PFM Verification	RAL+
FS420P4000	PFM Performance Tests	RAL+
FS420P5000	PFM Calibration	RAL+
FS420S1000	FS Assembly (TBC)	RAL+
FS420S2000	FS Integration (TBC)	RAL+
FS420S3000	FS Verification (TBC)	RAL+
FS420S4000	FS Performance Tests (TBC)	RAL+
FS420S5000	FS Calibration (TBC)	RAL+
FS4A	**Satellite AIV**	
FS4A0A1000	AVM Integration Support	RAL
FS4A0A2000	AVM Test Support	RAL
FS4A0C1000	CQM Integration Support	RAL
FS4A0C2000	CQM Test Support	RAL
FS4A0P1000	PFM Integration Support	RAL
FS4A0P2000	PFM Test Support	RAL
FS4A1P1000	Launch Campaign	RAL

FSZ	**Instrument GSE and Facilities**	
FSZW	**Special Facilities**	
FSZW0X1000	AIV Facility	RAL
FSZW0X1100	*Infrastructure*	*RAL*
FSZW0X1200	*Test Facility Control System*	*RAL*
FSZW0X2000	Test Facility	RAL
FSZW0X2100	*Test Cryostat*	*RAL*
FSZW0X2200	*Telescope Simulator*	*RAL*
FSZW1X1000	Thermal Vacuum Test Facility	RAL
FSZW2X1000	EMC Test Facility	RAL
FSZW3X1000	Warm Vibration Facility	RAL
FSZW4X1000	Subsystem Cold Vibration Facility	RAL
FSZW5X1000	Instrument Cold Vibration Facility	RAL
FSZX	**OGSE**	
FSZX0X1000	Optical Alignment Jig	RAL
FSZY	**EGSE**	
FSZY0X1000	EGSE Management	RAL
FSZY0X2000	EGSE	RAL
FSZY0X2100	*EGSE-ILT*	*RAL*
FSZY0X2200	*FCSS*	*RAL*
FSZY0X2300	*OBS Maintenance*	*RAL*
FSZY0X2400	*MIB Editor*	*RAL*
FSZY0X2500	*SCOS2000*	*RAL*

FSZY0X2600	*CDMS Interface*	*RAL*

GFS	**Ground Segment Herschel SPIRE**	
GFS1	**ICC Development**	
GFS11	**Management**	
GFS11X1000	Support to ESA	
GFS11x2000	Control and Maintenance of ICC Schedule	
GFS11X3000	Product Assurance	
GFS11X4000	Team Setup and Management	
GFS12	**Instrument Operations**	
GFS12X1000	Instrument Users Manual	
GFS12X2000	Instrument Database	
GFS12X3000	Calibration Database	
GFS12X4	**Instrument Observations**	
GFS12X4100	Instrument Modes	
GFS12X4210	Definition of AOTs	
GFS12X4220	Implementation of AOTs	
GFS12X4300	Operating Procedures	
GFS13	**Software Development**	
GFS13X1000	Instrument Time Estimator	
GFS13X2000	Instrument Command Translator	
GFS13X3000	RTA/QLA	
GFS13X4000	Trend Analysis	
GFS13X5000	Calibration Analysis	
GFS13X6000	Interactive analysis	
GFS13X7000	Science Processing	
GFS13X8000	Science Analysis	
GFS13X9000	Diagnostic Tools	
GFS2	**ICC Preparation**	
GFS21	**Planning**	
GFS21X1000	SIP	
GFS21X2000	PV Phase Testing	
GFS21X3000	Science Validation	
GFS21X4000	ICC Design	
GFS22	**Implementation**	
GFS22X1100	Operations Centre Infrastructure	
GFS22X1200	DAPSAS (UK) Centre Infrastructure	
GFS22X1300	DAPSAS (Fr) Centre Infrastructure	
GFS22X2100	Operations Centre Hardware	
GFS22X2200	DAPSAS (UK) Centre Hardware	
GFS22X2300	DAPSAS (Fr) Centre Hardware	
GFS22X3000	Commissioning Phase Equipment	

GFS22X4000	Instrument Simulator	
GFS22X5000	DPU OBS Maintenance Facility	
GFS22X6000	SPU OBS Maintenance Facility	
GFS23	**Integration and Test**	
GFS23X1100	Operations Centre Integration and Test	
GFS23X1200	DAPSAS (UK) Centre Integration and Test	
GFS23X1300	DAPSAS (Fr) Centre Integration and Test	
GFS23X2000	ICC Internal Interfaces	
GFS23X3000	ICC Operations Test	
GFS23X4000	Herschel Ground Segment Interaction	
GFS24	**FINDAS Support**	
GFS24X1000	FINDAS Prototype	
GFS24X2000	FINDAS Development	
GFS25	**Operations Planning**	
GFS25X1000	ICC Operations Plan	
GFS25X2000	ICC/FSC Operational Interactions	
GFS25X3000	ICC/MOC Operational Interactions	
GFS26	**Training**	
GFS26X1000	ICC Operations Team	
GFS26X2000	FSC & MOC Team	
GFS26X3100	DAPSAS (UK) Team	
GFS26X3200	DAPSAS (Fr) Team	
GFS3	**ICC Operations**	
GFS31	**Management**	
GFS31X1000	Operations Management	
GFS31X2000	Product /Quality Assurance	
GFS32	**Software Maintenance**	
GFS32X1000	DPU OBS Maintenance	
GFS32X2000	SPU OBS Maintenence	
GFS32X3000	ICC Operations Software	
GFS32X4000	Science Processing Software	
GFS32X5000	Science Analysis Software	
GFS33	**Operations**	
GFS33X1000	Health and Status Monitoring	
GFS33X2000	Performance Monitoring	
GFS33X3000	Calibration	
GFS33X4000	Trend Analysis	
GFS33X5000	Science Processing Quality Check	
GFS33X6000	Performance Maintenance	
GFS33X7000	Parallel Mode Analysis	
GFS33X8000	Serendipity Mode Analysis	
GFS33XA000	Ground Segment Interactions	
GFS33XB000	Support to MOC	
GFS33XC000	Support to FSC	
GFS33XD000	Support to the Community	

GFS33XE000	Support from the Consortium	
GFS34	**Facilities Maintenance**	
GFS34X1000	Infrastructure Maintenance	
GFS34X2000	Hardware Maintenance	
GFS34X3000	Computer System Management	

FS11	**Management**	
FS110X1000	Support to ESA	****
FS110X2000	Project Control	RAL
FS110X3000	Product Assurance	RAL
FS110X4000	Reviews	****

FSZY	**EGSE**	
FSZY0X1000	EGSE	UofS
FSZY0X2000	Quick Look Facility	RAL
FSZY0X3000	Digital Instrument Simulator	IFSI
FSZY0X4000	Analogue Instrument Simulator	SAp
FSZY0X5000	Cold Instrument Simulator	SAp
FSZY0X6000	FPU Simulator	SAp
FSZX	**OGSE**	
FSZX0X1000	Optical Alignment Jig	RAL
FSZX0X2000	Throughput Detector Assembly	QMW
FSZW	**Special Facilities**	
FSZW0X1000	AIV Facility	RAL
FSZW0X2000	Calibration Facility	RAL
FSZW0X3000	Thermal Vacuum Test Facility	RAL
FSZW0X4000	EMC Test Facility	SAp
FSZW0X5000	Cold Vibration Facility	
FSZW0X6000	Warm Vibration Facility	RAL

GFS	**Ground Segment Herschel SPIRE**	
GFS1	**ICC Development**	
GFS11	**Management**	
GFS11X1000	Support to ESA	
GFS11x2000	Control and Maintenance of ICC Schedule	
GFS11X3000	Product Assurance	
GFS11X4000	Team Setup and Management	
GFS12	**Instrument Operations**	
GFS12X1000	Instrument Users Manual	
GFS12X2000	Instrument Database	
GFS12X3000	Calibration Database	

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