SPIRE

SUBJECT: **SPIRE Management Plan**

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Glossary

AIV	Assembly, Integration and Verification
ATC	Astronomy Technology Centre, Edinburgh
AVM	AVionics Model
BAU	Buffer Amplifier Unit
CDR	Critical Design Review
CEA	
Co-I	Co-Investigator
CQM	Cryogenic Qualification Model
DAPSAS	DAta Processing and Science Analysis Software
DESPA	
DPU	Digital Processing Unit
DRCU	Detector Readout and Control Unit
ESA	European Space Agency
GSFC	Goddard Space Flight Center
FIRST	Far Infra-Red Space Telescope
FPU	Focal Plane Unit
FS	Flight Spare model
FSC	FIRST Science Centre
FTS	Fourier Transform Spectrometer
IAC	Instituto de Astrofisica de Canarias, Tenerife
IAS	Institut d'Astrophysique Spatial, Orsay
ICC	Instrument Control Centre
ICSTM	Imperial College of Science, technology and Medicine
IFSI	Instituto di Fisica dello Spazio Iterplanetario, Rome
JPL	Jet Propulsion Laboratory
LAS	Laboratoire d'Astronomie Spatiale, Marseille
MOC	Mission Operations Centre
MRB	Materials Review Board
MSSL	Mullard Space Science Laboratory
NCR	Non-Conformance Report
PA	Product Assurance
PDF	Portable Document Format
PDR	Preliminary Design Review
PFM	Proto-Flight Model
PI	Principal Investigator
PM	Project Manager
PPARC	Particle Physics and Astronomy Research Council
PV	Performance Verification
SAp	Service d'Astrophysique, CEA, Saclay
SPIRE	Spectral and Photometric Imaging REceiver
SPU	Signal Processing Unit
TBC	To Be Confirmed
TBD	To Be Determined
UofS	University of Saskatchewan, Canada
WWW	World Wide Web

1. SCOPE

The Far Infra-Red Space Telescope (FIRST), the fourth of ESA's Cornerstone Missions, is an 'observatory-class' telescope operating in the far infrared and sub-millimetre wavelength ranges. The responsibility for the design, implementation and operation of the scientific instruments is given to consortia, made up from members of research institutions and universities, under the leadership of a Principle Investigator (PI). This document describes the high-level organisation and management of the consortium responsible for providing and operating the Spectral and Photometric Imaging REceiver (SPIRE) instrument.

This plan covers those activities leading to the delivery and commissioning of the flight instrument and to the implementation of the SPIRE Instrument Control Centre. It does not cover the Operations Phase activities -these are dealt with in the SPIRE Operations Management Plan (RD1), nor the Post-Operations activities – these are dealt with elsewhere.

2. DOCUMENTS

2.1 Applicable Documents

AD1 FIRST/PLANCK Instrument Interface Document, Part A (PT-IID-A-04624)
AD2 FIRST Science Management Plan (ESA/SPC(97)22)
AD3 FIRST Science Operations Implementation Requirements Document (PT-03646)

2.2 Reference Documents

RD1 SPIRE Operations Management Plan (TBW)
RD2 SPIRE Instrument Implementation Plan (SPIRE/RAL/D/0035)
RD3 SPIRE Product Assurance Plan (BOL/RAL/D/0017)
RD4 SPIRE Cleanliness and Contamination Control Plan (TBW)
RD5 SPIRE Science Implementation Plan (SPIRE/RAL/D/0018)
RD6 SPIRE Work Breakdown Structure (SPIRE/RAL/D/0031)
RD7 SPIRE Product Tree (SPIRE/RAL/D/0030)
RD8 SPIRE Document Tree (SPIRE/Ral/D/0033)

3. INSTRUMENT TEAM ORGANISATION

3.1 Introduction

The programme for the provision of FIRST/SPIRE, is constrained by a compressed schedule and financial limits. In order to meet the programme requirements whilst minimising development risks, an essential requirement is an efficient, well defined, management structure with clearly identified interfaces and clear-cut divisions of responsibility. A prime objective of the SPIRE management structure will be to ensure that all programme requirements are met on time and cost effectively. Effective reporting will be set in place to ensure visibility of programme activities and provide the means of monitoring the execution of all tasks and enable potential as well as existing problems to be detected so that timely corrective action can be taken.

The teams collaborating in the project are drawn from several countries. Because of the geographical distribution, it is important that effective means of communication are set in place.

3.2 The Consortium

SPIRE will be built by a consortium of institutes from the UK, France, Italy, USA, Spain, Sweden and Canada (TBC). The SPIRE institutes and their main roles in the project are summarised in the table below. A full breakdown of the work package responsibilities is given in the SPIRE Work Breakdown Structure (RD6).

Institute		Role
ATC	Astronomy Technology Centre, Edinburgh	Provision of Chopper. Contributions to, structure and optics design. 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.
GSFC	Goddard Space Flight Center, Maryland	Provision of Bolometers (option). Provision of Internal Calibrators for Photometer and Spectrometer
IAC	Instituto de Astrofisica de Canarias, Tenerife	Provision of Signal Processing Unit (SPU). Provision of ICC Operations Staff.
IAS	Institut d'Astrophysique Spatiale, Orsay	Support to 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 S/W. Provision of ICC Operations Staff.
JPL	JPL/Caltech, Pasadena	Provision of Bolometers (option).
LAS	Laboratoire d'Astonomie Spatiale, Marseille	Provision of Optics. Provision of FTS mechanism. Provision of FTS Control and Signal Processing Electronics.
MSSL	Mullard Space Science Laboratory, Surrey	Provision of Structure. Provision of ICC Operations Staff (TBC).
Padova	Padova Observatory	Provision of ICC Operations Staff.
QMW	Queen Mary and Westfield College, London	Provision of Focal-Plane Arrays. Provision of Filters, dichroics, polarisers. Provision of ICC Operations Staff (TBC).
RAL	Rutherford Appleton Laboratory, Oxfordshire	Project management. Project Office. Provision of AIV and Ground Calibration facilities. Provision of ICC Operations Centre.

SAp	CEA, Service d'Astrophysique, Saclay	Provision of Bolometers (option). Provision of instrument Control and Signal Processing Electronics. Provision of Signal Processing Unit (SPU) On-Board S/W. Provision of ICC DAPSAS Centre (Fr).
UofS	University of Saskatchewan, Canada	Provision of EGSE (TBC). Provision of ICC Operations Staff (TBC).
Stockholm	Stockholm Observatory	Provision of Instrument Simulator. Provision of ICC Operations Staff.
TBD		Instrument Cold Vibration.

Table 3-1 SPIRE Consortium Roles

In addition to their hardware and software provision responsibilities, all SPIRE institutes will support the development and operation of the SPIRE Instrument Control Centre (ICC).

Note: In some cases, in order to simplify the management reporting structure, a single institute will take the responsibility for the work carried out at another site.

3.3 Management

An organisation chart showing the delegation of responsibilities within the SPIRE consortium is shown below

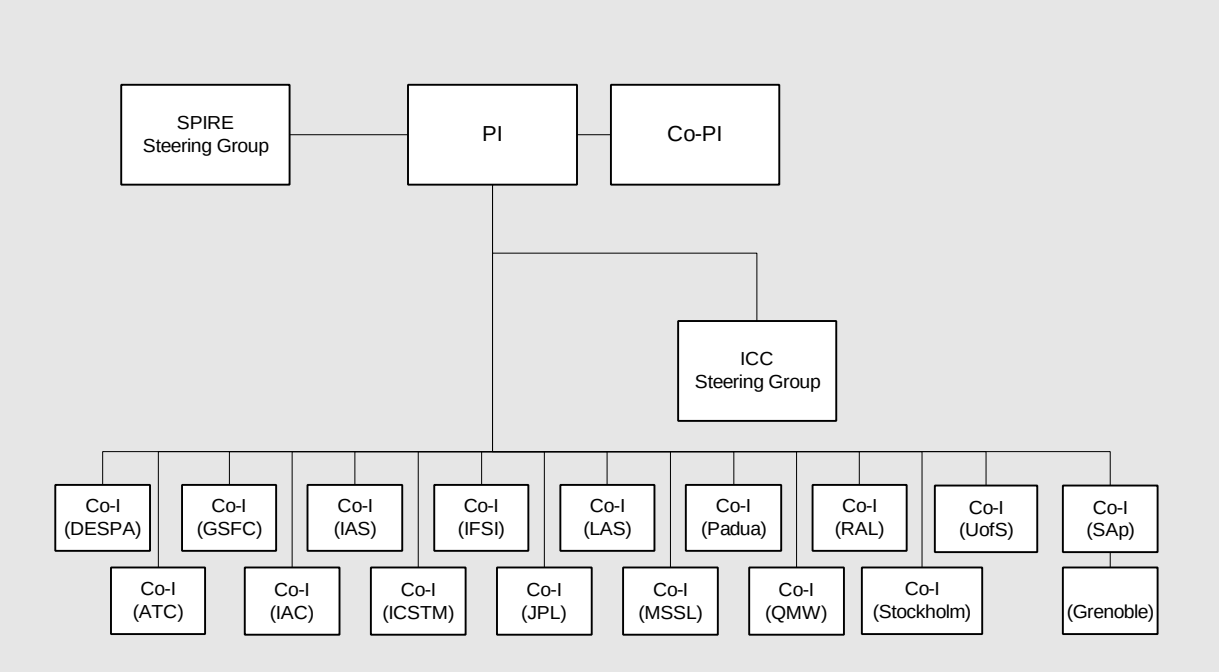

Figure 3-1 Delegated Responsibilities

3.3.1 Responsibilities

3.3.1.1 Principal Investigator Responsibilities

The PI is the formal point of contact with the FIRST Project Manager and FIRST Project Scientist on all mission and science related matters. He has full responsibility for the procurement, test and delivery of the instrument and its associated Instrument Control Centre (ICC) and supporting the FIRST Science Centre (FSC) in the operation and scientific exploitation of the instrument. The overall responsibilities of the PI are given in AD2 and are detailed in AD1 for the provision of instrument hardware and in AD3 for the implementation and operation of the ICC. In this role he is supported (and, if necessary, deputised) by the Co-PI.

3.3.1.2 Co-PI

The position of Co-PI reflects the major contribution to the project from France and is indicative of the fact that all major project decisions shall be arrived at by consensus.

3.3.1.3 The SPIRE Steering Group

The SPIRE Steering Group will be responsible for the overall direction of the project, and shall agree all major policy and strategic decisions concerning the instrument development and the international allocation of tasks. It will also have the power to revise the list of SPIRE Co-Investigators and Associate Scientists. It will comprise the PI, the Co-PI and one member from each of the participating countries (Canada (TBC), France, Italy, Spain, Sweden, UK, USA). The members shall be senior figures representing the project within their own countries and before their national space agencies, and shall work to ensure that the project has the necessary support from those agencies. In particular, they shall assist the PI in solving problems associated with funding and manpower resources within their countries.

At the commencement of the project each contributing nation will commit to delivering an agreed package of work. This package can only be changed by agreement with the PI and the SPIRE Steering Group. Within each country, attribution of resources between contributing groups will be dealt with on a national level (e.g., within the UK, PPARC will set up a steering group to advise them of such issues and to act as an independent monitor of the UK elements of the project). The PI and the Steering Group will be given visibility of such attributions. In the case of problems that cannot be solved by the Steering Group, the matter will be decided through the intervention of an *ad-hoc* group representing the appropriate national funding bodies.

The SPIRE Steering Group shall have the PI as chairman and the Co-PI as Co-chairman.

The Group's membership is given in Appendix A.

3.3.1.4 Co-Investigator Responsibilities

Each institute having hardware and/or ICC responsibilities shall designate one Co-Investigator. These shall be senior scientists or engineers with the authority to represent the SPIRE instrument within their organisations and their organisation to the SPIRE consortium, with the responsibility to deliver the work packages which have been assigned to their institute. They shall:

(i) support the definition and development of the work packages assigned to their institutes.
(ii) obtain the resources necessary to carry out the assigned work packages.
(iii) appoint a local Project Manager to handle the day-to-day management of their work packages.
(iv) appoint a local Product Assurance Manager to handle the PA responsibilities of their institute (this will involve enforcing the SPIRE project PA plan).
(v) assist the PI in solving any technical/programmatic problems associated with work allocated to their institutes.
(vi) participate in the definition and co-ordination of the Guaranteed Time programme.

They shall have an automatic right of access to Guaranteed Time data in recognition of these duties.
Co-Is will be assisted by Associate Scientists, who have no formal responsibilities within the project, but may assist in the technical development and scientific optimisation of the instrument.

Participation by Canada in the SPIRE consortium is being considered by the Canadian Space Agency. At this time a design study is under way to investigate possible participation, by Canada, in FIRST . In the event of an acceptable proposal being made from Canada to make a substantial contribution to the project, a Canadian Co-I will be appointed.

The Co-Is are listed in Appendix A.

3.3.1.5 The Instrument Control Centre (ICC)

The ICC shall have three parts:

(i) an Operations Centre located at the Rutherford Appleton Laboratory in the UK. This will be the sole point of contact for communication with the rest of the ground segment (MOC, FSC and other ICCs). Operations Centre staff will include people seconded from the various SPIRE institutes.

(ii) two Data Processing and Science Analysis Software (DAPSAS) Centres, one at Imperial College (ICSTM) in London and one at SAp, Saclay.

This structure has been devised to maximise the efficiency of the ICC from the point of view of instrument operations and quality of the data processing software. The Operations Centre, and its manager, will be the single interface with ESA. The DAPSASCs will allow the widely distributed expertise within the consortium to be brought to bear in an organised way on the task of producing and refining data processing software.

Core staff at the ICC Operations Centre, provided by RAL, will be supplemented by additional staff provided by the SPIRE consortium member institutes to form the operational team. It is expected that these additional staff will have taken part in the instrument and/or ICC design and development tasks and will therefore bring experience and expertise in the instrument operation to the ICC. The following effort will be supplied by each country (at least in the early years of operations):

Canada (TBC)	1
France	2 (TBC)
Italy	2
Spain	1
Sweden	1
USA	1 (+2 fte , located in US)
UK	2

Table 3-2 Contributions to the ICC

In addition, appropriate staff from SPIRE hardware institutes, including the DAPSAS Centres, will spend extended periods at the Operations Centre during critical periods such as the commissioning and PV phases.

The ICC tasks are defined in the FIRST Science Operations Implementation Requirements Document (AD3).

Specific DAPSAS Centre tasks are:

(i) production, and delivery to the ICC Operations Centre, of instrument data-processing software;
(ii) revision, enhancement and updating of data processing software, especially during flight operations;
(iii) quality control and calibration of SPIRE data;
(iv) preparation and planning of PV and routine phase observations;
(v) reduction of data taken in special observing modes (e.g., serendipity).

The DAPSAS Centres shall be connected to the Operations Centre via high-speed data links. In carrying out their functions, they shall rely on the expertise and efforts of the various SPIRE hardware-providing groups, and shall organise and channel this expertise for the maximum benefit of instrument operation. During routine operations, DAPSAS Centre staff shall participate actively in ICC Operations activities, both through secondment of staff and through defined activities at the two DAPSAS centres.

3.3.1.5.1 The ICC Steering Group

An ICC Steering Group shall be set up to direct the scientific development of the ICC. It shall be chaired by the ICC Scientist and comprise the PI, the Co-PI, the Instrument Scientist, the ICC Development Manager, the Managers of the DAPSAS Centres, and representatives (at Co-I level) of the two DAPSAS Centres. It has the responsibility to define the scientific policies for ICC development, to allocate the ICC work packages between the ICC Centres and to monitor the effectiveness of the ICC implementation. The implementation shall be the responsibility of the ICC Development Manager and the DPASAS Centres' managers, and, subsequently, the ICC Operations Manager.

To feed the scientific expertise and experience of the consortium into the ICC development, an ICC Definition Team will be established, under the chairmanship of an ICC Scientist. This team will bring together the scientific, technical and managerial expertise required to establish the ICC work packages and to keep them aligned with scientific and technical priorities.

3.3.2 Management Structure

The Management Structure is shown in the organisation chart given in figure 3-1. The following sections define the formal links between the various parts of the project. However, this does not exclude day-to-day contact at a working level, as long as the formal point of contact is kept informed.

3.3.2.1 Project Manager

The management of the instrument development shall be under the control of the Project Manager, who will:

(i) define the overall schedule necessary to meet the project milestones;
(ii) monitor the project-wide deployment of resources;
(iii) define deadlines and requirements for institute project managers and advise them on project-wide priorities;
(iv) proactively manage technical and schedule risks;
(v) monitor progress in participating laboratories;
(vi) instigate project reviews, studies and assessments as necessary to resolve issues and ensure a successful project;
(vii) represent the SPIRE project to the ESA management team.

The Project Manager will be assisted in these tasks by a project management team consisting of four Unit Managers, who will take responsible for the development of the following areas of work:

- The Warm Electronics and On Board Software.
- The Focal Plane Unit.
- Instrument AIV facilities and operation.
- The Instrument Control Centre.

The Unit Managers will manage the work of the institutes contributing to their area of responsibility and report directly to the Project Manager.

The Project Manager shall rely on the PI/Co-PI and the SPIRE and ICC Steering Groups for policy definition, and the Project Scientists, Instrument Scientist, Systems Engineers and PA Manager for detailed advice.

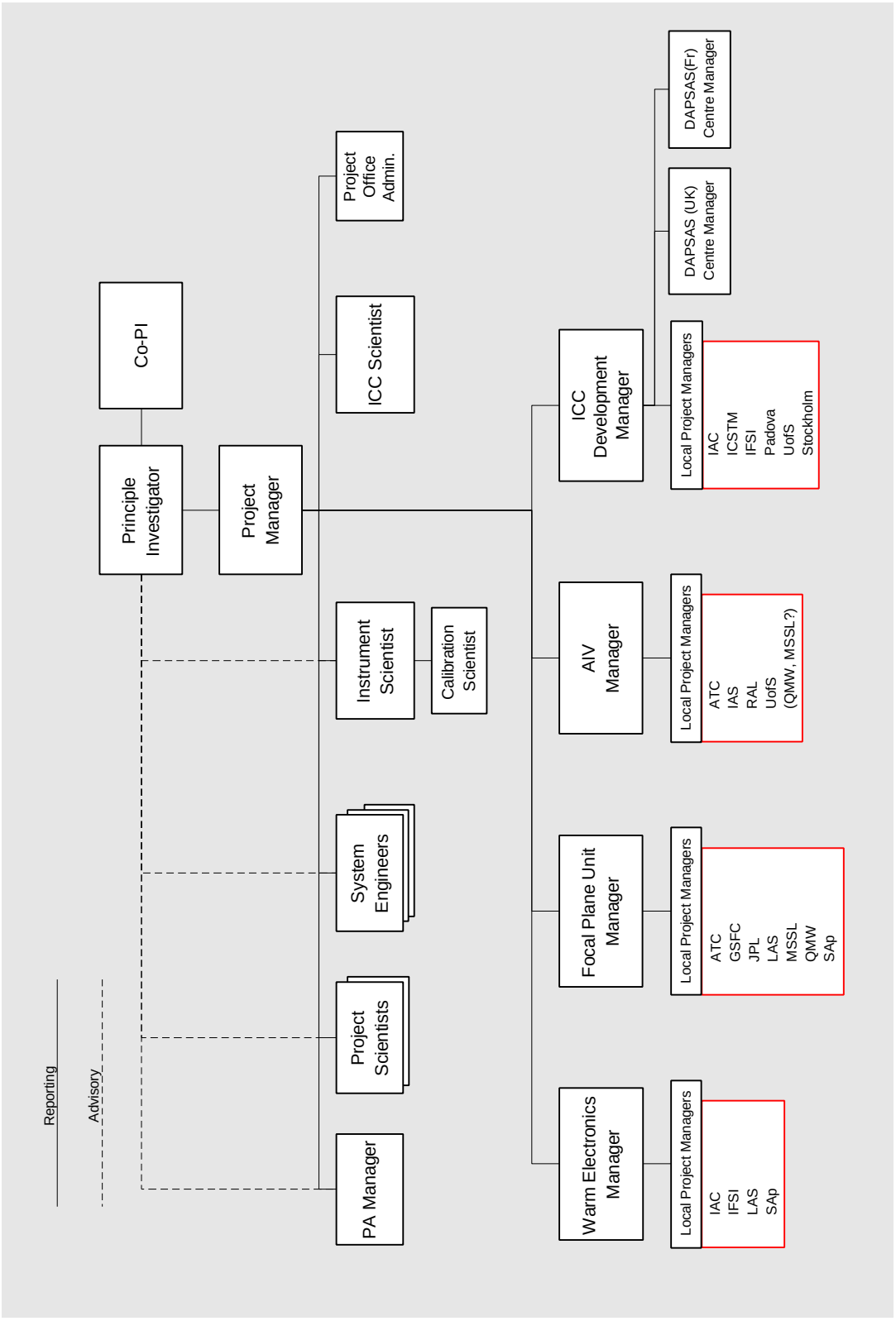

Figure 3-2 Management Structure

3.3.2.2 Product Assurance Manager

The PA Manager is responsible for the following:

- To implement the Product Assurance Plan (RD3)
- To advise the PI on PA matters.
- To liaise with, and advise local PA Managers at collaborating institutes.
- Carry out PA surveillance and control of collaborating institutes, to include Audits and Acceptance of equipment.
- Set in place a project non-conformance and waiver system including sub-contractor and supplier N.C.R's.
- Carry out a planned system of audits internally on the project.
- Attend all major design test and delivery reviews, providing necessary PA inputs such as safety, defects and failure data
- Agree and provide the necessary documentation in the form of Log Books and End Item Data Packs.
- Convene and chair MRB's, and attend the Test Readiness/Qualification Status Reviews for all Qualification and Verification tests
- Provide management and cost control for the complete P.A. work package
- Implement Parts, Materials and Processes control activities
- Ensure the software configuration status list is prepared and maintained
- Ensure the Cleanliness and Contamination Control Plan (RD4) is prepared and implemented
- Ensure the Safety Plan (RD5) is prepared and implemented
- Ensure the reliability asssurance activities are carried out
- Advise on mechanical and electrical parts

The PA manager has an independent role within the Project Management team and can therefore act independently of the Project Manager in PA matters when necessary.

3.3.2.3 Project Scientists

There shall be two Project Scientists who will have experience in astronomical observations in the sub-millimetre and the development of instrumentation for use in the sub-millimetre wavelength range. They shall:

(i) specify and update the scientific goals for the instrument;
(ii) oversee the instrument design and capabilities with respect to these goals;
(iii) maintain a performance model of the instrument;
(iv) assist the Instrument Scientist in defining the detailed specification of the observing modes, ground and in-orbit calibration strategy, and data-reduction requirements;
(v) together with the ICC Scientist, take responsibility for the specification of the requirements for the data reduction and science analysis software;
(vi) be members of the ICC Steering Group;
(vii) advise the PI on all of these issues.

3.3.2.4 Instrument Scientist

The Instrument Scientist is responsible for

(i) definition and maintenance of the detailed system and subsystem requirements;
(ii) definition of the AIV plan;
(iii) definition of the ground and in-flight calibration plans and the Commissioning and Performance Verification Plans;
(iv) leading the design the of the AIV and ground calibration facilities and oversee their commissioning and operation;
(v) assistance to the Project manager in organisation of instrument design reviews;
(vi) advising the PI and Project Manager on all of these issues.

3.3.2.5 Systems Engineers and Systems Team

A Systems Team will be set up to oversee the systems design and specification of the instrument. It shall include the Project Manager, the Project Scientists, the Instrument Scientist, the ICC Development Manager, specialist engineers, AIV and PA experts and others as appropriate. Whilst being constituted and operated as a single team, it shall have three sub-groups, with particular responsibility for

- the Focal Plane Unit;
- the instrument Warm Electronics and On Board Software;
- the Ground Segment;

with named Systems Engineers responsible for each. The Systems Team shall:

(i) oversee the specification and control of all internal and external interfaces;
(ii) establish necessary procedures and teams for monitoring system aspects of instrument design, construction, calibration, operation;
(iii) identify and take action on actual or potential problems at system level;
(iv) advise the PI and the Project Manager on all of these issues.

3.3.2.6 Calibration Scientist

The Calibration Scientist shall establish and operate the Ground Calibration Facility at the Rutherford Appleton Laboratory, under the guidance of the Instrument Scientist, and shall be instrumental in transferring the expertise so acquired to the ICC Operations Centre.

3.3.2.7 ICC Scientist

The ICC Scientist will be responsible for ensuring that the scientific goals of the instrument will be met by the design and implementation of the ICC. This will be carried out by

(i) leading the work of ICC Definition Team;
(ii) chairing the ICC Steering Group;

3.3.2.8 The ICC Development Manager

The ICC Development Manager is responsible for the implementation of the ICC according to the SPIRE Science Implementation Plan (RD6) and the recommendations of the ICC Steering Group. He shall:

(i) manage the provision of the ICC Operations Centre
(ii) ensure the implementation of the DAPSAS Centres
(iii) represent the whole of the ICC to ESA during the development phase
(iv) report to the Project Manager

After ICC readiness, this post will no longer be necessary; the ICC Manager from ESA's point of view will then be the ICC Operations Centre Manager.

3.3.2.9 Local managers and institute responsibilities

Each SPIRE institute with hardware and/or ICC responsibilities will have a single local Project Manager who will report to the SPIRE Project Manager (via the Unit Managers) on all aspects of the planning and progress of work in that institute. The local Project Managers (some of whom are in an acting capacity, pending availability of major project funding) are given in Appendix A.

3.4 Formal Communication

3.4.1 Communication with ESA

The PI will be the formal point of contact with ESA for science and mission matters.

The Project Manager will be the formal point of contact on programmatic and technical matters.

Day to day contact between the consortium and ESA will be only through those members of the SPIRE System Team with the responsibility for the particular area of work and the appropriate ESA Project Personnel.

Copies of all correspondence shall be sent to the SPIRE Project Office at RAL.

3.4.2 Communication between Institutes

The local Project Managers will be the formal points of contact in each collaborating institute. All formal communications and provision of documents from the Project Office at RAL shall be distributed through them. They shall be responsible for ensuring that the material is passed on locally to the appropriate colleagues within their institute.

Transmission of communications and documents may be via e-mail, file transfer, WWW, fax, courier or mail, as appropriate.

Electronic documents shall, preferably, be provided in Adobe PDF format, for non-editable documents and Microsoft WORD for editable documents.

To reduce travelling time, and costs, short meetings or discussions shall be carried out by teleconference or videoconference. The following institutes have these facilities ***(NB this list is still under construction***) :

ATC	teleconference	videoconference
DESPA		
GSFC		
IAC		
IAS		
ICSTM	teleconference	
IFSI		
JPL		
LAS		
MSSL		
Padova		
QMW		
RAL	teleconference	videoconference
SAp		videoconference
Saskatchewan	teleconference	videoconference
Stockholm		

Table 3-3 Communication Facilities of the Institutes

3.5 Financing

The members of the SPIRE Steering Group are committed to securing adequate funding and resources for the work packages that have been agreed for each country. The Co-Is will ensure that the resources allocated to their institutes are properly deployed.

4. PROJECT CONTROL

On order to manage the SPIRE programme, the Project Manager will implement project control systems and procedures focussing on the definition, maintenance and reporting of schedule, costs and configuration information.

4.1 Project Breakdown Structures

To clearly identify the instrument, scope of work and responsibilities involved, the following structures will be created and maintained.

Each participating institute shall provide information, as required, to allow these structures to defined.

4.1.1 Product Tree

This will break down the instrument, its associated test equipment, and the ICC into its components, both hardware and software.

It is defined in the SPIRE Product Tree (RD8).

4.1.2 Documentation Tree

This will provide a break down of the project documentation to be written.

It is defined in the SPIRE Documentation Tree (RD9).

4.1.3 Work Breakdown Structure

This will be used to define the scope of the work and the responsibilities involved.

It is defined the SPIRE Work Breakdown Structure (RD7).

5. SCHEDULE CONTROL

5.1 Baseline Master Schedule

The Baseline SPIRE Master Schedule is given below. Product schedules and Gantt charts for them will be provided in the SPIRE Instrument Implementation Plan (RD2) and the SPIRE Science Implementation Plan (RD6). These will cover:

(i) Overall Instrument Programme
(ii) Design
(iii) AVM
(iv) CQM
(v) PFM
(vi) FS
(vii) Critical Activities
(viii) ICC development

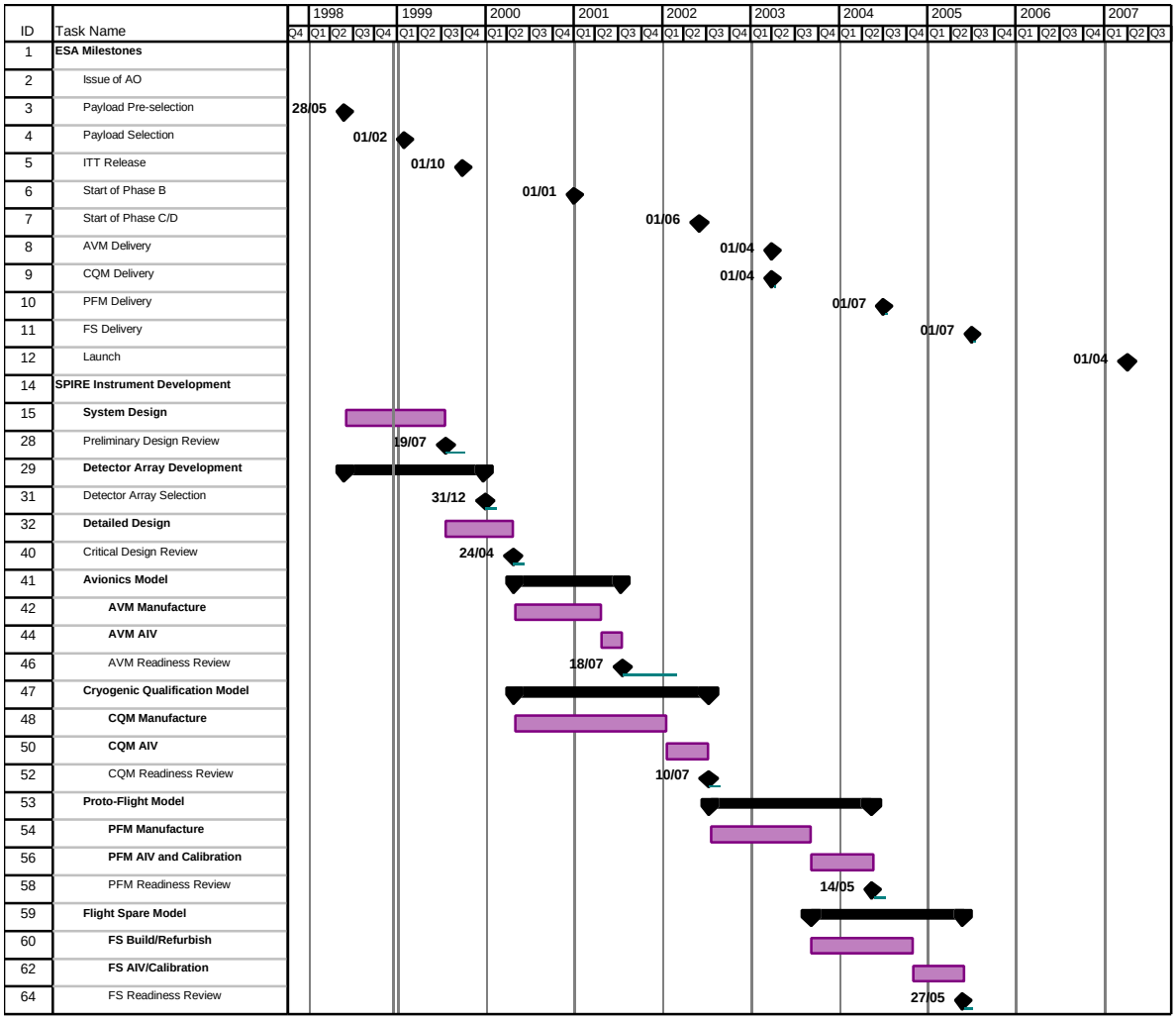

Figure 5-1 SPIRE Baseline Schedule

5.2 Schedule Monitoring

The Project Manager shall monitor the progress of each work package. He shall:

(i) Record the progress achieved.
(ii) Maintain forecasts.
(iii) Compare the progress achieved with respect to the Baseline Master Schedule and the lower-level schedules given above.
(iv) Develop and implement corrective action where deviations to the baseline occur or are predicted to occur.

5.3 Schedule Reporting

5.3.1 Reporting to ESA

The Project Manager shall provide schedule reports to ESA, as part of the regular reporting procedure (see section 8.1).

These reports will contain:

Monthly:
(i) A list of the current tasks with:
- Percentage complete
- Planned completion date
- Estimated completion date
- Status

(ii) A list of milestones passed in the reporting period with
- Planned date
- Actual date
- Status

(iii) Actions to be taken in the case of estimated delay or problems

Quarterly:
Progressed bar charts showing:
- A summary of the instrument as a whole
- A summary of each major instrument Unit
- Details of the next 6 months

5.3.2 Reporting within the Consortium

In order to enable the Project Manager to provide schedule reports to ESA, the local project Managers shall provide, as part of the regular reporting procedure (see section 8.1) the following:

Monthly:
(i) A list of the current tasks with:
- Percentage complete
- Planned completion date
- Estimated completion date
- Status

(ii) A list of milestones passed in the reporting period with
- Planned date
- Actual date
- Status

(iii) Actions to be taken in the case of estimated delay or problems

Quarterly:
Progressed bar charts showing:
- A summary of each major work package
- A summary for the institute
- Details of the next 6 months

6. CONFIGURATION MANAGEMENT

This is covered in the SPIRE Product Assurance Plan (RD3). The PA Manager and the local PA Managers are responsible for implementing the plan and providing the required control and accounting.

7. REVIEWS AND MEETINGS

7.1 ESA Reviews and Meetings

7.2 ESA Reviews

AD1 identifies a series of reviews held at ESA before an ESA appointed review board with the objectives of ensuring:

(i) the instrument will achieve the anticipated science objectives
(ii) the instrument complies with the technical and programmatic interface requirements of the IID

These reviews are:

Instrument Science Verification Review (ISVR)
Instrument Baseline Design Review (IBDR)
Instrument Hardware Design Review(IHDR)
Instrument Critical Design Review (ICDR)
Instrument Flight Acceptance Review (IFAR)

The content of these reviews will be fully covered by the SPIRE consortium within their series of SPIRE Instrument Reviews (see section 7.4).

7.3 ESA Progress Meetings

Regular (quarterly, TBC) Instrument Progress Meetings will be held during the development and verification phases of the programme.

The SPIRE team shall be represented at these meetings by an appropriate combination of the PI, Co-PI, PM, Instrument Scientist, Systems Engineers and others, as needed.

The SPIRE project will also participate fully in the meetings of the FIRST Science Team.

7.4 Internal Reviews and Meetings

7.4.1 Technology Selection Meetings

Those parts of the instrument that are subject to technology development programmes during the early phases of the project (e.g. detector arrays) will be subject to a review at a Technology Selection Meeting at which time an unambiguous choice of the technology to be used, will be made. ESA will be invited to observe these meetings.

These Technology Selection Meetings shall be held at such a time that the Baseline Master Schedule is not compromised.

7.4.2 Internal Reviews

The following instrument reviews have been defined to achieve the aims of the reviews identified in AD1, taking into account the current model philosophy including provision of an Avionics Model and a Cryogenic Qualification Model, with no Engineering Model.

An independent Review Board will be appointed (in consultation with ESA) to take part in each Instrument Review. The SPIRE consortium will take action based on the recommendations of this board.

7.4.2.1 Preliminary Design Review

Held at the end of the instrument system design phase

Purpose:
- To verify that the instrument system design fulfils the instrument scientific requirements.
- To assess whether the instrument design will meet the instrument engineering requirements.
- To approve the instrument system interfaces and budgets.
- To approve the Interface Control Plan
- To approve the on-board software User's Requirements Documents.

Tasks:
- To review the instrument scientific requirements.
- To review the instrument system design.
- To review the instrument system requirements.
- To review the instrument system interfaces and budgets.
- To review the instrument subsystems requirements.
- To review the Interface Control Plan.
- To review User's Requirements Documents for the Digital Processing Unit and the Signal Processing Unit software.

7.4.2.2 Critical Design Review

Held at the end of the instrument detailed design phase

Purpose:
- To verify the instrument design fulfils the instrument engineering requirements and release it for manufacture of the Avionics Model and Cryogenic Qualification Model.
- To approve the on-board software Software Specification Documents.

Tasks:
- To review the instrument design.
- To review the instrument subsystems designs.
- To review the Software Specification Documents for the Digital Processing Unit and the Signal Processing Unit software.

7.4.2.3 Avionics Model Delivery Review

Held at the end of the instrument Avionics Model AIV phase

Purpose:
- To accept the instrument Avionics Model for delivery to ESA for integration into the spacecraft Avionics Model
- To approve the Instrument Users' Manual (Draft)

Tasks:
- To review the results of the Avionics Model instrument-level tests.
- To review the Avionics Model delivery documentation.
- To review the Instrument Users' Manual (Draft).

7.4.2.4 Cryogenic Qualification Model Delivery Review

Held at the end of the instrument Qualification Model AIV phase.

Purpose:

- To accept the Qualification Model for delivery to ESA for system-level testing.
- To verify the instrument design as qualified and to approve the release for manufacture of the Proto-Flight Model.
- To approve the Instrument Users' Manual (Issue 1)

Tasks:
- To review the results of the instrument Electrical Model system-level tests.
- To review the results of the Qualification Model instrument-level tests..
- To review the Qualification Model delivery documentation.
- To review the results of the Qualification Model instrument-level qualification testing.
- To review the Instrument Users' Manual (Issue 1)

7.4.2.5 Proto-Flight Model Delivery Review

Held at the end of the Flight Model instrument-level AIV phase.

Purpose:
- To accept the instrument Flight Model for delivery to ESA for integration on the spacecraft.
- To accept the Instrument Users' Manual for delivery to ESA.

Tasks:
- To review the results of the Qualification Model system-level tests.
- To review the results of the Flight Model instrument-level tests .
- To review the results of the Flight Model calibration.
- To review the Flight Model delivery documentation.
- To review the Instrument Users' Manual (Issue 2).

7.4.2.6 FS Delivery Review

Held at the end of the Flight Spare Model instrument-level AIV phase.

Purpose:
- To accept the instrument Flight Spare Model for delivery to ESA.

Tasks:
- To review the results of the Flight Spare Model instrument-level tests .
- To review the results of the Flight Spare Model calibration.
- To review the Flight Spare Model delivery documentation.

7.4.2.7 ICC Reviews

TBW

7.4.3 Progress Meetings

Regular (quarterly, TBC) consortium meetings will be held at which the progress of the instrument and ICC programmes will be assessed.

The objective of the meetings will be to:
- ensure that the instrument design, development, assembly and test is proceeding to schedule, within the cost constraints and within specification
- ensure that the interface technical design integrity of the experiment, its compatibility with the spacecraft system and the instrument programme, are proceeding in a manner which is in line with the overall programme.

These meetings will be held at one of the consortium institutes premises, on a rotating basis (TBC). ESA will have a standing invitation to attend these meetings.

7.4.4 Sub-System Review Boards

The following Reviews Boards will be convened as necessary:

Material Review Boards: The Material Review Boards are responsible for the disposition of non-conforming parts and materials and for determining future corrective and preventative measures. In reaching their conclusions the boards shall analyse the available data and initiate such actions as may be necessary to determine, as far as possible, the cause of the non-conformance.

Test Review Board: Following qualification or acceptance testing of each sub-system the sub-system engineer will hold a Sub-system Test Review at which it must be demonstrated that the objectives of the test have been met. The conclusions of the meeting must be approved by the Instrument Scientist.

Integration Readiness Review Board: Before each sub-system is accepted for integration on the SPIRE instrument, the Instrument Scientist will convene an Integration Readiness Review Board, at which it shall be demonstrated that the item is suitable for integration. This review may be combined with the Sub-System Test Review.

8. REPORTING

The technical and programmatic aspects of the SPIRE programme will be assessed between the ESA Project Office and the instrument team through:

(i) Regular progress reporting.
(ii) Instrument progress meetings,
(iii) A cycle of formal Instrument Reviews,
(iv) All technical information in copy,
(v) Schedule visibility,
(vi) Management/organisational reporting

8.1 Reporting to ESA

The PI shall deliver to ESA, 5 days after the end of the month, a Monthly Progress Report in which the current status of each activity is described and problem areas or potential problem areas are highlighted together with identification of the proposed remedial action.

The Monthly Progress Report shall include:
(i) Overall Summary
(ii) Design, development and Verification Status
(iii) PA Status
(iv) Programmatic status, including schedule reports
(v) Science Performance status
(vi) Problem areas and corrective actions

8.2 Internal Reporting

Each local Project Manager shall deliver to the Unit Managers and Project Manager, at the end of the month, a Monthly Progress Report in which the current status of each activity at their institute is described and problem areas or potential problem areas are highlighted together with identification of the proposed remedial action.

The Monthly Progress Report shall include:
(vii) Overall Summary
(viii) Design, development and Verification Status
(ix) PA Status
(x) Programmatic status, including schedule reports
(xi) Science Performance status

(xii) Problem areas and corrective actions

The Project Scientists, Systems Engineers, Instrument Scientist and PA Manager shall deliver to the Project Manager Monthly, at the end of the month, Monthly Progress Reports.

9. DELIVERABLE ITEMS

9.1 Instrument Models

The SPIRE consortium shall deliver the following hardware instrument models:

(i) Avionics Model (AVM)
(ii) Cryogenic Qualification Model FPU (CQM)
(iii) Proto-Flight Model FPU and Electronics (PFM)
(iv) Flight Spare FPU (FS) (TBC)
(v) Spare subassemblies for Warm Electronics and BAU

These, along with other deliverable items are identified in the SPIRE Product Tree (RD7).

9.2 Documentation

The project documentation is identified in the SPIRE Documentation Tree (RD9). A subset of this (to be agreed with ESA) will be delivered, as required.

9.3 Mathematical Models

The SPIRE consortium shall also deliver mathematical Structural and Thermal models of the instrument

9.4 Ground Support Equipment

The SPIRE consortium shall deliver the following ground support equipment

(i) A Quick Look Facility for payload and satellite level integration and testing
(ii) A Quick Look Facility for location at the MOC for use during the Commissioning Phase
(iii) Others (TBD)

9.5 Ground Segment Software

The SPIRE consortium will deliver the following Ground Segment Software

(i) An Instrument Simulator
(ii) An Observation Time Estimator (TBC)
(iii) Data Processing Software (TBD)

9.6 Instrument Data

The SPIRE consortium will deliver the following Instrument Data

(i) Instrument telemetry/telecommand databases
(ii) Instrument parameter monitoring database
(iii) Instrument calibration files
(iv) Others (TBD)

APPENDIX A

A.1 SPIRE Project Posts

PI	Matt Griffin, QMW, London
Co-PI	Laurent Vigroux, SAp, Saclay
Project Manager	Ken King, RAL, Oxfordshire
ICC Scientist	Seb Oliver, ICSTM, London
P.A. Manager	Geoff Douglas, RAL, Oxforshire
Project Scientist	Walter Gear, MSSL, Surrey
Project Scientist	Jean-Paul Baluteau, LAS, Marseille
Instrument Scientist	Bruce Swinyard, RAL, Oxfordshire
Calibration Scientist	TBD
System Engineer (Electronics)	Louis Rodriguez, SAp, Saclay
System Engineer (FPU)	Colin Cunningham, ATC, Edinburgh
System Scientist (Ground Segment)	Sarah Unger, QMW, London
Warm Electronics Manager	Jean-Louis Augueres, SAp, Saclay (TBC)
Focal Plane Unit Manager	Ken King, RAL, Oxfordshire (TBC)
AIV Manager	TBD
ICC Development Manager	Trevor Dimbylow, RAL, Oxfordshire (TBC)
DAPSAS Centre (UK) Manager	Tim Sumner, ICSTM, London (Acting)
DAPSAS Centre (Fr) Manager	Rene Gastaud, SAp, Saclay
Project Office Administrator	Judy Long, RAL, Oxfordshire

A.2 SPIRE Steering Group

Canada (TBC)	G. Davis, UofS, Canada.
France	Jean-Paul Baluteau, LAS, Marseille.
Italy	Gianni Tofani, Osservatorio di Arcetri, Firenze.
Spain	Ismael Perez-Fournon, IAC, Tenerife.
Sweden	Göran Olofsson, Stockholm Observatory.
UK	Michael Rowan-Robinson, Imperial College, London.
USA	Andrew Lange, Caltech, Pasadena.

A.3 SPIRE Co-Investigators

ATC	Gillian Wright
DESPA	Emmanuel Lellouch
GSFC	Harvey Moseley
IAC	Ismael Perez-Fournon
IAS	Pierre Cox
ICSTM	Michael Rowan-Robinson
IFSI	Paolo Saraceno
JPL	Jamie Bock
LAS	Jean-Paul Baluteau
MSSL	Walter Gear
Padova	Alberto Franceschini
QMW	Peter Ade
RAL	Roger Emery
SAp	Philippe André
Stockholm	Goran Olofsson
UofS (TBC)	Gary Davis

A.4 ICC Steering Group

ICC Scientist	Seb Oliver, ICSTM, London
ICC Development Manager	Trevor Dimbylow, RAL, Oxfordshire
PI	Matt Griffin, QMW, London
DAPSAS (Fr) Representative	Laurent Vigroux, SAp, Saclay
DAPSAS (UK) representative	Michael Rowan-Robinson, ICSTM, London
DAPSAS (Fr) Manager	Rene Gastaud, SAp, Saclay
DAPSAS (UK) Manager	Tim Sumner, ICSTM, London

A.5 SPIRE Local Project Managers

ATC	Fraser Morrison
GSFC	Juan Roman
IAC	Jose-Miguel Herreros
IAS	Francois Pajot
ICSTM	Tim Sumner
IFSI	Riccardo Cerulli
JPL	Bill Gray
LAS	Dominique Pouliquen
MSSL	Wilf Oliver
Padova	Paola Andreanni
QMW	Peter Hargrave
RAL	Ken King
SAp	Jean-Louis Augueres
Stockholm	Hans-Gustav Floren
UofS (TBC)	TBD

A.6 SPIRE Local PA Managers

ATC	Fraser Morrison (Acting)
GSFC	TBD
IAC	TBD
IAS	TBD
ICSTM	Tim Sumner
IFSI	Renato Orfei
JPL	TBD
LAS	TBD
MSSL	TBD
Padova	TBD
QMW	Peter Hargrave (Acting)
RAL	G. Douglas
SAp	Francoise Loubere
Stockholm	Hans-Gustav Floren
UofS (TBC)	TBD