Herschel-SPIRE Memorandum of Understanding

Canadian Contribution to the Herschel-SPIRE Instrument Project

SPIRE-UCF-PRJ-001614 Issue 1.0

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David A. Naylor SPIRE Co-Investigator University of Lethbridge, Alberta, Canada David A Naylor	**Matthew J. Griffin** SPIRE Principle Investigator Cardiff University, Wales, UK Matthew Griffin
David J. W. Kendall Canadian Space Agency, Ottawa, Canada David J.W. Kendall	**Kenneth J. King** SPIRE Project Manager Rutherford Appleton Laboratory, Oxfordshire, UK Kenneth King

Document Change Record

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0.2	29 Sept. 2002	Revised following David Naylor *et al.* visit to Cardiff
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0.6	28 May 2003	Additional revisions based on comments from CSA legal dept.
0.7	29 May 2003	Final amendments based on David Kendall's suggestions
1.0	3 June 2003	Issue 1.0 signed at Lethbridge

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1. Scope

This document is a Memorandum of Understanding (MOU) between Cardiff University, acting on its own behalf and on behalf of the SPIRE Consortium, the Rutherford Appleton Laboratory, the Canadian Space Agency, and the University of Lethbridge, acting on its own behalf and on behalf of the Canadian SPIRE team (hereinafter referred to as the "Parties"). The SPIRE Project is led by the Principal Investigator, Professor Matt Griffin of Cardiff University, Wales, UK, and managed by the Rutherford Appleton Laboratory (RAL), Oxfordshire, UK. The Canadian SPIRE team is led by Professor David Naylor the University of Lethbridge, Alberta.

This MOU covers the delivery of test hardware for the SPIRE instrument ground testing facility, and the provision of software and staff effort for instrument testing and operations. It may be updated when necessary to document any official changes between the parties. Only documents signed by all of the parties listed on the title page are official documents.

2. Related Documents

Applicable Documents		
No.	**Document**	**Reference**
AD1	*Spire Management Plan*	Herschel-SPI-PRJ-000011
AD2	*Scientific Constitution for the SPIRE Consortium*	SPIRE-UCF-PRJ-001615

Reference Documents		
No.	**Document**	**Reference**
RD1	*SPIRE: A Bolometer Instrument for FIRST* (Proposal to ESA)	SPIRE-RAL-PRJ-000020
RD2	*SPIRE - Herschel's submillimetre camera and spectrometer*	*M. Griffin, B. Swinyard, L. Vigroux,* In Proc. SPIE-4850, 686, 2003
RD3	*SPIRE Scientific Requirements*	SPIRE-UCF-DOC-000064
RD4	*SPIRE Instrument Requirements Document*	SPIRE-RAL-PRJ-000034
RD5	*FIRST (Herschel) Science Management Plan*	ESA/SPC(97)22

3. The SPIRE Instrument and Project

3.1 The Herschel Mission

The Herschel Space Observatory (formerly known as FIRST) is the fourth cornerstone mission in the European Space Agency (ESA) science programme. Herschel will perform imaging photometry and spectroscopy in the largely unexplored far infrared and submillimetre part of the spectrum, covering approximately the 60 - 670 μm range. The satellite will carry a 3.5-m diameter passively cooled telescope, and a scientific payload complement comprising two cameras/medium resolution spectrometers (PACS and SPIRE) and a high resolution heterodyne spectrometer (HIFI). The instruments will be housed in a superfluid helium cryostat providing a minimum of 3 years operational life. Herschel is scheduled for launch in February 2007 and will operate at the Earth-Sun L2 point.

3.2 Instrument Description

SPIRE, the Spectral and Photometric Imaging Receiver, was selected by ESA in June 1998, as one of three science instruments for Herschel, based on a proposal submitted to ESA by the SPIRE consortium [RD1].

The main scientific goals and design drivers for SPIRE are deep extragalactic and galactic imaging surveys and spectroscopy of star-forming regions in own and nearby galaxies. The instrument comprises a three-band imaging photometer with bands centred at approximately 250, 360 and 520 μm, and an imaging Fourier Transform Spectrometer (FTS) covering 200-670 μm. The detectors are feedhorn-coupled bolometers cooled to 300 mK by a recyclable ^{3}He refrigerator. The photometer field of view is 4 x 8 arcminutes (the largest that can be accommodated) and is observed simultaneously in the three spectral bands. The angular resolution is determined by the telescope diffraction limit, with FWHM beam widths of approximately 17, 24 and 35 arcseconds at 250, 360 and 520 μm, respectively. An internal beam steering mirror allows spatial modulation of the telescope beam, and mapping observations can also be made by drift-scanning the telescope. The FTS has a field of view of 2.6 arcminutes. It uses a dual-beam configuration with novel broad-band intensity beam dividers to provide high efficiency and separated output and input ports. The FTS scanning mirror has a linear travel of up to 3.5 cm, providing adjustable spectral resolution of 0.04-2 cm^{-1} ($\lambda/\Delta\lambda$ = 20 - 1000 at 250 μm). The design and scientific capabilities of SPIRE are described in more detail in RD2. The top-level scientific requirements for SPIRE are given in the *SPIRE Scientific Requirements Document* [RD3], and the detailed requirements on the instrument systems and subsystems are given in the SPIRE *Instrument Requirements Document* [RD4].

3.3 SPIRE Instrument Model Philosophy

Three models of the SPIRE instrument focal plane unit (FPU) are to be delivered to ESA: the Cryogenic Qualification Model (CQM), the Proto-Flight Model (PFM) and the Flight Spare (FS). In addition, the SPIRE consortium will construct and test a Structural Thermal Model (STM) for its own use. The main SPIRE FPU models are described briefly below.

Structural Thermal Model (STM): This is a model of the FPU that will be used to verify (i) the vibration levels that will be experienced by the cold sub-systems during launch, (ii) that the thermal design of the instrument meets the instrument level performance requirements, and (iii) that the optical alignment procedure envisaged for the flight model can be successfully carried out. The STM will also be used to qualify the design of the SPIRE instrument structure and will be vibrated to full qualification levels. This model is not delivered to ESA.

Cryogenic Qualification Model (CQM): This is a model of the instrument that will be used to characterise and verify the instrument scientific performance with functionally representative cold sub-systems and warm electronics units. The purpose of the CQM is to verify that the design of the PFM will be capable of meeting the instrument level performance requirements and that the instrument is compatible of integration into the Herschel satellite.

Proto-Flight Model: This will be the instrument model that is intended for flight. It will be built to full flight quality.

Flight Spare Model: The SPIRE consortium is required to make available to ESA a fully tested and calibrated flight spare FPU which can be installed in place of a faulty PFM FPU during the spacecraft-level integration and test phase. The FS will be built, characterised and calibrated as above. It will be retained at the Rutherford Appleton Laboratory in the UK (unless it is required by ESA) and used for the verification and optimisation of observing modes and software, for the training of personnel, and for troubleshooting any anomalies that may occur during mission operations.

3.4 Alignment, Integration, and Verification (AIV) Facility

Prior to its delivery for integration in the Herschel spacecraft, the SPIRE instrument will be thoroughly tested and calibrated in the Assembly, Integration and Verification (AIV) facility at the Rutherford Appleton Laboratory. The facility is designed to allow all aspects of instrument behaviour, performance, calibration, and optimisation of observing modes to be investigated under flight representative conditions, and includes the following features:

(i) a large test cryostat replicating the in-orbit thermal environment;
(ii) an external telescope simulator and submillimetre sources allowing the instrument to be fed with a beam that accurately simulates the beam from the Herschel telescope;
(iii) internal cold black body for radiometric and flat field calibration;
(iv) cold neutral density filters for control of the radiant background;
(v) a far infrared laser used for spectral calibration of the SPIRE spectrometer channel and to present a source with well understood beam modes to the instrument;
(vi) an external Fourier Transform Spectrometer (FTS) to characterise the spectral response of the instrument in both the camera and spectrometer channel.

The AIV facility FTS is to be provided by Canada, as described in Section 6 below.

4. The SPIRE Project and Consortium

SPIRE is a collaborative project with participation by institutes in Canada, France, Italy, Spain, Sweden, the UK, and the USA. The SPIRE Consortium is constituted by the Co-Investigators, listed in Annex 1. The project is led by the Principal Investigator (PI), Professor Matt Griffin of Cardiff University and managed by the Rutherford Appleton Laboratory, RAL, with Dr. Ken King as Project Manager and Mr. Eric Sawyer as Hardware Development Manager. The PI is the formal point of contact with ESA's Herschel/Planck Project Manager and Herschel Project Scientist on all mission and science related matters. He has full responsibility in the eyes of ESA for the procurement, test and delivery of the instrument and its associated Instrument Control Centre (ICC) and supporting the Herschel Science Centre (HSC) in the operation and scientific exploitation of the instrument. Day-to-day authority for project management and responsibility and for coordination of the instrument design and development is delegated by the PI to the SPIRE Project Manager, the SPIRE Hardware Development Manager, and to the SPIRE Instrument Scientist (Dr. Bruce Swinyard of RAL).

4.1 Project Management and Organisation

The formal arrangements for organisation and management of the SPIRE consortium are described in the *SPIRE Management Plan* [AD1], which has been approved by the SPIRE Co-Investigators and ESA. The following excerpt from Chapter 3 of the *SPIRE Management Plan* is given here for information:

Principal Investigator Responsibilities

The PI is the formal point of contact with the Herschel Project Manager and Herschel 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 Herschel Science Centre (FSC) in the operation and scientific exploitation of the instrument. The overall responsibilities of the PI are given in [the Herschel Science Management Plan (ESA/SPC(97)22)] and are detailed in [the Herschel/PLANCK Instrument Interface Document, Part A] for the provision of instrument hardware and in [the Herschel Science Operations Implementation Requirements Document (PT-03646)] for the implementation and operation of the ICC. In this role he is supported (and, if necessary, deputised) by the Co-PI.

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.

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, 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.

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.

4.2 Herschel Guaranteed Time

ESA's policies on the science management of the Herschel mission are laid down in the (then FIRST) *Science Management Plan* [RD5], approved by the ESA Science Policy Committee in August 1997. Herschel will be a multi-user observatory open to the general astronomical community. The observation time will be divided between Guaranteed Time (GT) and Open Time (OT). The guaranteed time (approximately one third of the total time) will be divided between the contributors to the mission as follows:

- The three instrument teams : 30% each
- The Herschel Science Centre team : 7 %
- The Mission Scientists : 3%

4.3 The SPIRE Consortium's Scientific Constitution

The SPIRE consortium's agreed policies pertaining to the deployment of its GT and to the data rights of consortium members are laid out in the *Scientific Constitution for the SPIRE Consortium* [AD2]. The following excerpts from the document are given here for information.

Article 4:

The SPIRE Science Team shall comprise scientists, from within the SPIRE Consortium or invited from outside it, who contribute to the work of the Consortium and wish to use SPIRE GT or OT data for scientific research. There shall be three categories of member:

SPIRE Co-Investigator: *These are the people who proposed the SPIRE instrument to ESA in response to the Announcement of Opportunity, or who have been appointed as Co-investigators by the SPIRE Steering Group during the course of the project. In accordance with the SPIRE Management Plan, they and their institutes have formal responsibilities to deliver hardware or ICC workpackages for SPIRE.*

SPIRE Associate Scientists: *SPIRE Associate Scientists shall be others who actively and substantially contribute to the work of the SPIRE Consortium by either or both of the following:*

(i) participating in the provision of hardware, software or of other scientific or engineering expertise;
(ii) assisting the Co-Investigators in the preparation and execution of the SPIRE GT programme;

and who intend to publish the results of such scientific or engineering work.

SPIRE Consultants*: SPIRE Consultants shall be experts who are consulted by Co-Investigators about an individual observation, programme or publication.*

Article 7:

Each SPIRE Associate Scientist shall be associated with an individual Co-Investigator, and shall assist that Co-Investigator in carrying out his or her responsibilities or in furthering his or her scientific interests.

Article 20:

All data from the SPIRE GT programme shall be the property of the Co-Investigators until the expiry of the proprietary period.

Article 21:

All Co-Investigators have equal rights of access to any Herschel data resulting from any Science Team observations in SPIRE Guaranteed Time.

Article 22:

Associate Scientists shall be accorded rights to the data by the Co-Investigators in accordance with their contributions to the project as a whole and to the particular areas of science for which the data are to be used. The contributions made by Associate Scientists shall be monitored and reported to the Standing Committee for Science by the relevant Co-Investigators.

5. SPIRE Instrument Control Centre

Each of the Herschel instrument teams is required by ESA to provide an Instrument Control Centre (ICC), responsible for

(i) generating and maintaining all ground software and procedures needed for operating the instrument, and for performing monitoring and trend analysis;
(ii) providing all software and procedures required for error correction, calibration and generally for the scientific processing of the data from the instrument.

The ICC must be fully operational at the time of launch and will function throughout the mission operations phase. ICC software will have been largely tested and verified during instrument ground verification. The ICC concept for SPIRE aims to maximise the use of the expertise spread across the consortium to develop and maintain the software required by the ICC whilst providing a single point of contact with ESA. The SPIRE ICC will 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: ESA's Mission Operations Centre (MOC), the HSC 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 ICC Operations Centre staff will include instrument experts who will have derived much of their expertise through participation in the instrument AIV programme.

6. Canadian Programme and Deliverables

6.1 Fourier Transform Spectrometer for the SPIRE instrument AIV Facility

The University of Lethbridge, with the support of the Canadian Space Agency, will provide an FTS system for the AIV facility, including a computer and appropriate software for its operation. This will be used for the spectral characterisation and calibration of the SPIRE flight and flight spare instruments. The FTS will be accommodated within the facility room-temperature optical system, outside the test cryostat. The system will be returned to Canada at the end of Herschel mission operations (2010), or earlier by mutual agreement.

6.2 AIV Programme Staff Effort

Postdoctoral or engineering staff will be provided by the University of Lethbridge, with the support of the Canadian Space Agency, to participate in the ground testing and calibration of the SPIRE instrument at the Rutherford Appleton Laboratory. Between the period October 2002 and the launch of Herschel, the Canadian-

funded on-site staff effort at RAL will be at least 4 staff years (SY).

6.3 Software for Instrument Testing and Operations

The Canadian contribution to the instrument testing programme, and subsequently the ICC, will encompass the following activities related to FTS processing.

- provision of a library of routines to convert the detector signal data (and associated optical path difference information) in the form of an interferogram, generated from scans of the SPIRE spectrometer, into the equivalent spectrum;
- provision of support to the definition of the processing steps for SPIRE spectrometer operation and associated calibration files;
- support of the testing of both the software and the processing of data from instrument-level testing of the SPIRE instrument in the test facility at RAL;
- maintenance of the delivered software and its evolution both during the development phases and during the Operational and Post-Operational Phases;
- participation in the ICC and instrument teams' understanding of the data received in flight and contributions to the development and validation of revised processing modules to be provided to observers with their data.

The software to be provided will be based on existing routines developed by the Naylor group at Lethbridge, re-coded in Java and conforming to the Herschel Common Science System coding guidelines. It is envisaged that the provision of this software will involve additional staff based at Lethbridge as well as the ICC staff located in the UK. The Canadian software developers will be expected to attend regular ICC development meetings and reviews in Europe. Developers will use the Herschel Configuration Control and documentation systems as provided for the Herschel Ground Segment.

6.4 ICC Staff Effort

Between the period October 2002 and the launch of Herschel (February 2007), Canada will provide at least 6.5 SY postdoctoral or engineering staff effort, based in the UK, to participate in the SPIRE ICC.

It is foreseen that during Herschel operations phase (lasting approximately 4 years from launch), Canada will provide at least 8 SY of UK-based ICC staff effort.

6.5 Institute Management

Depending on the scope and nature of the SPIRE activity at a participating institute, it will be appropriate and acceptable for the roles of SPIRE Project Manager and SPIRE PA manager to be carried out by the same person. It is envisaged that this will done in the case of the SPIRE programme at the University of Lethbridge.

7. Canadian membership of the SPIRE Science Team

The SPIRE Steering Group has approved a contribution to the project equivalent to that described in Section 6, and, taking into account the effort already expended by Canada in studying the Shutter option (now deleted), has deemed the overall contribution of Canada to the work of the SPIRE consortium to be compatible with the following Canadian involvement in the SPIRE Science Team:

- One Co-Investigator (Prof. David Naylor, University of Lethbridge): in keeping with the SPIRE Management Plan, Prof. Naylor will be responsible to the SPIRE Project for delivery of all elements of the Canadian programme, and will be a member of the SPIRE Steering Group.
- Five Associate Scientists from the Canadian astronomical community.

The individuals working on SPIRE either in the UK or in Canada will be eligible for appointment as Associate Scientists in the normal way, to represent their contribution to the project over time. This will be dealt with under the standard procedures as laid down in the *SPIRE Scientific Constitution.*

It is agreed that, should the programme be reduced or enhanced with respect to that outlined in Section 6 above, participation in the SPIRE Science Team by those Associate Scientists not directly involved in the hardware or ICC programmes will be reduced or enhanced in proportion to the actual value of the Canadian participation to SPIRE consortium activities. The SPIRE Steering Group will be the relevant decision-making body.

8. Funding arrangements

Each Party will bear the costs of discharging its respective responsibilities under this MOU, including travel and subsistence of its own personnel and transportation charges for the equipment for which it is responsible.

Each Party's financial obligations under this MOU are subject to its funding procedures and the availability of appropriated funds. Should any Party encounter funding problems, which may affect its ability to fulfil these responsibilities under this MOU, that Party will notify and consult promptly with the other Parties.

9. Exchange of technical data and goods

The Parties are obligated to transfer only those technical data (including software) and goods necessary to fulfil their respective responsibilities under this MOU, in accordance with the following provisions:

1. The transfer of technical data for the purpose of discharging the Parties' responsibilities with regard to interface, integration, and safety will normally be made without restriction, except as required by national laws and regulations relating to export control or the control of classified data, or as required under the general policy direction of a Party. If design, manufacturing, and processing data and associated software, which is proprietary but not export controlled, is necessary for interface, integration, or safety purposes, the transfer will be made and the data and associated software will be appropriately marked. Nothing in this article requires the Parties to transfer goods or technical data contrary to national laws and regulations relating to export control or control of classified data.

2. In the event a Party finds it necessary to transfer goods which are subject to export control or technical data which is proprietary or subject to export controls, and for which protection is to be maintained, such goods will be specifically identified and such technical data will be marked with a notice. Such a notice or identification will indicate any specific conditions regarding how such technical data or goods may be used or re-transferred. The receiving Party agrees to abide by the terms of the notice, and to protect any such identified goods and marked technical data from unauthorized use and disclosure, and also agrees to obtain these same obligations from its related entities prior to the transfer, if such a transfer is authorized by the notice.

3. Subject to national laws and regulations and unless otherwise indicated in the notice or identification referred to in paragraph 2 above, all transfers of technical data and goods are subject to the following provisions:

   (a) All technical data and goods which are transferred under this MOU will be used by the receiving Party exclusively for the purposes of the programs implemented under this MOU. For greater certainty, the receiving Party will not use the transferred technical data and goods for commercialization purposes, unless otherwise agreed between the Parties in writing;

   (b) The receiving Party will carefully protect the marked technical data received from the disclosing Party with the same degree of care used to protect its most confidential proprietary information;

(c) The receiving Party is allowed to make copies of the marked technical data received from the disclosing Party to the extent reasonably required for this MOU. Subject to this right, the receiving Party will not copy, modify, sublicence, assign, pledge, delegate, convey, transfer, reverse-engineer, translate, convert to any programming language, format or decompile or disassemble the marked technical data, in whole or in part; and

(d) The receiving Party will not disclose the marked technical data received from the disclosing Party to any other person or entity and, within its own organization, will disclose the marked technical data only to its own employees who have a need to know same for the purposes of this MOU and who are informed of the confidential nature of the marked technical data.

10. Inventions, patents and other intellectual property rights

1. Nothing in this MOU will be construed as granting or implying any rights to, or interest in, the intellectual property of the Parties or their contractors or subcontractors that has been first created, developed or conceived prior to the beginning of the activities covered by this MOU.

2. All intellectual property created, conceived or developed solely by either Party or either Party's contractors and subcontractors in the performance of activities covered by this MOU will be owned by such Party or by its contractors and subcontractors, in accordance with the arrangements governing the relationship between such Party and its contractors and subcontractors.

3. In the event that intellectual property is created, conceived or developed jointly in the performance of activities covered by this MOU, the Parties will consult in order to determine the steps to be taken in order to protect such intellectual property and to agree on the rights of the respective entities, including the mutual granting of licenses as appropriate. In any event, neither Party will assign or transfer its rights to such intellectual property in any manner, or grant any right to use such intellectual property under license or otherwise, without the prior written approval of the other Party.

11. Resolution of disputes

Should any dispute arise on any matter relating to the interpretation or to the implementation of this MOU, such dispute will be referred to the SPIRE Steering Group which will seek to resolve the dispute by mutual concurrence.

Should the SPIRE Steering Group be unable to agree on a resolution, the dispute will then be referred to an *ad-hoc* group including the PI, the Canadian Co-I and representatives of the Canadian Space Agency and PPARC for final resolution.

12. Amendments

This MOU may be amended upon written concurrence between the Parties.

13. Entry into effect, duration and termination

This MOU will become effective upon signature and will remain in effect until 28 February 2011 or until the end of Herschel mission operations, whichever is later.

Any Party may terminate this MOU at any time by giving a written notice to the other Parties, at least 90 days in advance, of its intent to terminate. Termination by any Party will not affect that Party's continuing undertakings under this MOU with regards to protection of data and goods.

Annex 1: List SPIRE Co-Investigators

Name		Institute
Peter	Ade	Cardiff University, UK
Philippe	Andre	SAp, Saclay, France
Jean-Paul	Baluteau	LAM, Marseille, France
Jamie	Bock	NASA JPL, Pasadena, USA
Peirre	Cox	Institut d'Astrophysique Spatiale, Orsay
Roger	Emery	Rutherford Appleton Laboratory, Oxfordshire, UK
Alberto	Franceschini	University of Padua, Italy
Walter	Gear	Cardiff University, UK
Matt	Griffin	Cardiff University, UK
Emmanuel	Lellouch	Observatoire de Paris, Meudon, France
Harvey	Moseley	NASA GSFC, Maryland, USA
David	Naylor	University of Lethbridge, Canada
Goran	Olofsson	Stockholm Observatory, Sweden
Ismael	Perez-Fournon	IAC, Tenerife, Spain
Michael	Rowan-Robinson	Imperial College, London, UK
Paolo	Saraceno	IFSI, Rome, Italy
Alan	Smith	MSSL, Surrey (acting), UK
Laurent	Vigroux	SAp, Saclay, France
Gillian	Wright	UK ATC, Edinburgh, UK

Annex 2: List of Acronyms

AD	Applicable Document
AIV	Alignment, Integration and Verification
CCLRC	Council for the Central Laboratory of the Research Councils
Co-I	Co-Investigator
CSA	Cannadian Space Agency
CQM	Cryogenic Qualification Model
DAPSAS	Data Processing and Science Analysis Software
ESA	European Space Agency
FIRST	Far Infrared and Submillimetre Telescope
FPU	Focal Plane Unit
FS	Flight Spare
FTS	Fourier Transform Spectrometer
GT	Guaranteed Time
HIFI	Heterodyne Instrument for the Infrared
HSC	Herschel Science Centre
ICC	Instrument Control Centre
ILT	Instrument-Level Testing
MOC	Mission Operations Centre
MOU	Memorandum of Understanding
OT	Open Time
PACS	Photodetector Array Camera and Spectrometer
PFM	Proto-Flight Model
PI	Principal Investigator
PPARC	Particle Physics and Astronomy Research Council
RAL	Rutherford Appleton Laboratory
RD	Reference Document
SPIRE	Spectral and Photometric Imaging Receiver
STM	Structural Thermal Model
SY	Staff Years