

Provision of cryogenic motors for the FIRST- SPIRE Instrument Beam Steering Mirror

**4th
DRAF**

PROJECT	FIRST-SPIRE
Work-Package Title	BSM Cryogenic motors
Work-Package Manager; SPIRE BSM PACS	I.Pain, UK ATC TBD
Start Date	15 October 2000
End Date	31 December 2003

1 WORK-PACKAGE DESCRIPTION

PACS will provide design data and advice on a best efforts basis to the UK ATC to assist in their provision of the Beam Steering Mechanism for the SPIRE instrument. Subject to agreement, supply of hardware will also be included for the Beam Steering models as listed and specified in Annex A (*SPIRE BSM Cryogenic Motor Specifications*) and Annex B (*Schedule*).

1.1 Tasks

1. Advice and design data to develop a cryogenic motor for BSM based on the PACS concept.
2. Similar advice and design data for position sensors based on the PACS concept to allow evaluation of the viability of adopting common sensor types.
3. Detailed design, modelling and optimisation of the cryogenic motors
4. Manufacture of the Prototype and Development model cryogenic motors (TBC)
5. Manufacture of the CQM, PFM, FSM flight hardware and test components (TBC)
6. Delivery of space qualified components with appropriate documentation (TBC)

Note that all of the hardware provision parts are to be confirmed.

1.2 Deliverables

1. Documented design data in accordance with the *SPIRE BSM Cryogenic Motor Specifications* document and any changes to it which may be agreed in the future by UK ATC and PACS.
2. Equivalent documentation for position sensors if agreed as a viable option by UK ATC and PACS.
3. Prototype and Development model cryogenic motors and sensors (TBC).
4. CQM, PFM, FSM flight hardware cryogenic motors and sensors (TBC).
5. Full space qualification and QA documentation for all CQM, PFM and FSM delivered components (TBC).

1.3 Conditions

1. SPIRE would be charged for any hardware delivery at a value to be agreed following detailed design and costing.
2. Subject to agreement, manufacture of some elements of the hardware may be performed by the UK ATC or subcontractors using design data supplied in 1.2.
3. This agreement is being taken on as part of a scientific collaboration between SPIRE and PACS to share technology and reduce costs through pooling of expertise and resources. The contract is thus undertaken on a best efforts basis (equivalent to the conditions under which QMW is providing design effort and instrument hardware for PACS).

2 Costs

- 2.1 A provisional estimate of the costs (for information only) is £38k for hardware supply costs. This figure will need to be refined following design discussions and information from the PACS team, should it be decided to proceed with the hardware provision element of this agreement.
- 2.2 The details of component manufacture and costing are to be determined following detailed designed discussions.
- 2.3 The following effort is not costed:
 - (i) Advice and design data to develop a cryogenic motor for BSM based on the PACS concept.
 - (ii) Similar advice and design data to develops a position sensor for BSM based on the PACS concept.
 - (iii) Detailed design, modelling and optimisation of the cryogenic motors

3. SPIRE-PACS instrument collaboration

This agreement is associated with an complementary agreement between the PACS and SPIRE instrument consortia under which design expertise and information are to be freely exchanged between the teams: PACS (MPIA, Heidelberg) will provide design information and consultancy on the design and optimisation of the SPIRE Beam Steering Mechanism, as outlined in Sections 1& 2 above. In return, QMW are proving design effort, expertise, and advice on filter and dichroic implemenation for PACS. A separate agreement has been drawn up between the QMW and PACS to cover this part of the collaboration.

Annex A: *Draft SPIRE BSM Cryogenic Motor Specifications*
Annex B: *Schedule (to be drawn up)*

Annex A: Draft SPIRE BSM Cryogenic Motor Specifications

Beam Steering Mirror: MPIA-ATC collaboration.

The baseline design of the drive mechanisms for the Beam Steering Mirror (BSM) for SPIRE is based very much on the MPIA design for the ISOPHOT chopper. Therefore, advice from MPIA is essential in replicating this space-qualified and flight proven design.

The available documentation and design data on the ISPHOT design is limited, and insufficient to replicate a space qualified design without significant additional work. The improved motors for PACS represent a significant improvement over ISPOHOT motors, and the supporting design data and expertise is fully current, Therefore this will now form the basis for the BSM Cryogenic motor design.

The required support would include:

1. Assistance in the design of cryogenic motors to allow motion in two axes in a fashion similar to the ISOPHOT motor design.
2. Sufficient design and manufacturing information to enable motor sets to be built for laboratory tests of the BSM prototype, the BSM Development models (two each), the CQM,PFM and FSM.
3. Assistance in geometric adaptation, magnetic circuit modelling and optimization of the PACS motors to suit the BSM space envelope and torque requirements. Scaling or re-packaging of the PACS motor to fit the BSM is envisaged.
4. Drive electronics, control parameters and shielding requirements to allow ATC to incorporate the motors into the BSM design.
5. Collaboration on purchase and qualification of components and material as would be mutually advantageous.
6. The full BSM subsystem specification and design description are referenced (SPIRE-ATC-PRJ-001, SPIRE-ATC-PRJ-002).

Annex B: Draft Delivery Schedule

Assume hardware purchase results from the development programme, the following time-scales are required:

Delivery of Prototype Motors:	Dec.00
Delivery of Development Model Motors:	Apr.01
Delivery of CQM Motors:	Oct.01
Delivery of PFM Motors:	May.03

An appropriate design document will accompany each stage of delivery