

SERVICES & FACILITIES ANNUAL REPORT - FY April 2004 to March 2005

SERVICE FSF	FUNDING Block	AGREEMENT Contract	ESTABLISHED as S&F 1988	TERM 3
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TYPE OF SERVICE PROVIDED:

The NERC Field Spectroscopy Facility (formerly NERC EPFS) is a unique world class facility supporting Earth Systems science. It comprises a collection of high quality modern field spectroradiometers and sun photometers, operating over the optical wavelengths, and associated calibration and support equipment. During the period April to June 2004, the Facility transferred from the School of Geography, University of Southampton, to the School of GeoSciences, University of Edinburgh where it currently employs two personnel (an operations manager at 0.75 and an equipment manager at 1.0 (1.5 RA FTE in total in the longer term). During a period of major upheaval for the Facility, disruption to users was minimised; all scheduled loans were supported, new loan application rounds were carried out and a number of emergency applications were supported. Significant progress has been made in a very short space of time. FSF has continued to operate to similar standards to those set by Southampton.

FSF distinctively focuses on techniques to make accurate measurements of the spectral properties of objects in the natural environment, such data being essential to underpin quantitative Earth Observation from aircraft and satellite systems in key scientific issues such as global change, pollution monitoring and biodiversity assessment. The FSF also performs a vital strategic function in underpinning the use of data from airborne sensors, especially those flown by the NERC Airborne Research and Survey Facility. The Facility provides training for postgraduate students and other researchers new to quantitative remote sensing. Training is usually performed on a one to one basis, although we have plans to develop a specific two to three day training course. On average >10 projects each year are associated with postgraduate PhD research including a significant number of NERC research studentships, frequently extending over two summer seasons.

Access to FSF resources is available free of charge to the UK research community, subject to expert peer review by the FSF Steering Committee. 20-30 applications are received each year and the total requested loan time typically exceeds available capacity by ~10–20%. The science supported by the Facility is diverse and of high quality; this year papers were published in the *Journal of Geophysical Research*, *Remote Sensing of Environment* and *Coral Reefs*. Support is provided across NERC Thematic and Non-thematic programmes, with NERC grants and studentships accounting for ~75% of loans in terms of annual cost allocation (average for April 1999 – March 2004 period).

ANNUAL TARGETS (detailed further below)

- Transfer of the Facility to Edinburgh
- Maintenance of user support during the transfer period
- Establishment of the service at Edinburgh
- Awareness raising of the move to the user base
- Purchase of a new ASD Field Spec Pro spectroradiometer
- Major programme of refurbishment, instrument upgrades improvements to QA and calibration procedures
- Increase user community

SCORES AT LAST REVIEW (each out of 5)			Date of Last Review:	
Need 5	Uniqueness 5	Quality of Service 5	Quality of Science & Training 4.5	Average 4.88

CAPACITY of HOST ENTITY FUNDED by S&F 100%	Staff & Status (* funding) 1 x Director (100% UoEdinburgh) 1 x Pool Manager (100% NERC, April – Sept) 1 x PGRA (60% NERC, Sept – March) 1 x Equipment Manager (100% NERC, Oct – March) 1 x Operations Manager (75% NERC, March – April)	Next Review (January) 2006	Contract Ends (31 March) 2007
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FINANCIAL DETAILS: CURRENT FY									
Recurrent Allocation £k	Unit Cost £k						Capital Expend £k	Income £k	Full cash cost £k
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6			
£57.07	£283	£202	£256	£127	-	£32	£16.83	-	£250.23

FINANCIAL COMMITMENT (by year until end of current agreement)									
2004-05	£57.07	2005-06	£102.26	2006-07	£90.90	2007-08	n/a	2008-09	n/a

STEERING COMMITTEE	Independent Members	Meetings per annum	Other S&F Overseen
FSFSC	4	1	None

APPLICATIONS: DISTRIBUTION OF GRADES (Current FY — 2004/05)								
	$\alpha 5$	$\alpha 4$	$\alpha 3$	$\alpha 2$	$\alpha 1$	β	R*/Pilot	Reject
NERC Grant projects	3	1	1					
Other academic	2	12	5	1				
Students (NERC)	2(1)	6(3)						
Pilot								
TOTAL	8	22	6					

APPLICATIONS: DISTRIBUTION OF GRADES (per annum average previous 3 years —2001/2002, 2002/2003 & 2003/2004)								
	$\alpha 5$	$\alpha 4$	$\alpha 3$	$\alpha 2$	$\alpha 1$	β	R*/Pilot	Reject
NERC Grant projects	1.6	5	0.6					
Other Academic	0.6	5.3	6.3	1	0.3		0.6	0.3
Students	0.6 (1)	2.6 (1.3)	1					
Pilot				0.3				
TOTAL	3.8	14.2	7.9	1.3			0.6	0.3

PROJECTS COMPLETED (Current FY)								
	$\alpha 5$	$\alpha 4$	$\alpha 3$	$\alpha 2$	$\alpha 1$	β	R*/Pilot	
NERC Grant projects	3	1						
Other Academic	2	12	1					
Students	2(1)	6(3)						
Pilot	8	22	1					

USER PROFILE (current FY)						<i>*Combined non-Directed and Directed</i>				
Grand Total	Infrastructure					PAYG				
	Supplement to NERC Grant *	Student		NERC C/S	Other	NERC Grant*	Student		NERC C/S	Other
		Total	NERC				Total	NERC		
37	8	11	3	1	14					

USER PROFILE (per annum average previous 3 years)						<i>*Combined non-Directed and Directed</i>				
Grand Total	Infrastructure					PAYG				
	Supplement to NERC Grant *	Student		NERC C/S	Other	NERC Grant*	Student		NERC C/S	Other
		Total	NERC				Total	NERC		
29	7	11	5	4	7					

USER PROFILE (current FY)				
Academic	Centre/Survey	NERC Fellows	PhD	Commercial
19	2		11	

USER PROFILE (per annum average previous 3 years)				
Academic	Centre/Survey	NERC Fellows	PhD	Commercial
10	3	1	13	

OUTPUT & PERFORMANCE MEASURES (current FY)										
Publications (by science area & type)										
SBA	ES	MS	AS	TFS	EO	Polar	Grand Total	Refereed	Non-Ref/ Conf Proc	PhD Theses
0	4	2	4	7	6	0	31	7	21	3

Distribution of Projects (by science areas)						
SBA	ES	MS	AS	TFS	EO	Polar
1	4	2	6	7	1	1

OUTPUT & PERFORMANCE MEASURES (per annum average previous 3 years)										
Publications (by science area & type)										
SBA	ES	MS	AS	TFS	EO	Polar	Grand Total	Refereed	Non-Ref/ Conf Proc	PhD Theses
0	2	3	2	25	22	1	54	14	37	3

Distribution of Projects (by science areas)						
SBA	ES	MS	AS	TFS	EO	Polar
1	2	3	3	18	5	1

Distribution of Projects (by NERC strategic priority)				
Earth's life support systems	Climate Change	Sustainable Economies	Underpinning Science	Specific Research
10	4	5	0	2

OVERVIEW & ACTIVITIES IN FINANCIAL YEAR (2004/05):

Transfer from Southampton to Edinburgh (April – June 04)

- Relocation of the facility from the University of Southampton to the University of Edinburgh, as part of a three month phased transfer from April to June 2004. A new Edinburgh-hosted website went live on April 1st, replacing Southampton's website which was withdrawn at the end of March. The website is the Facility's principal publicity tool, generates a large number of enquiries directed to the Facility, averaging about 2 per day over the last 12 months.
- Transfer of expertise and knowledge. Training of Edinburgh staff by Southampton staff in use of and processing of data from the Facility's instruments, quality assurance and calibration, user training and of planning training sessions, administration procedures including loan management.
- Phased transfer of items of equipment to Edinburgh through the transportation of important equipment items in specific visits by either Southampton or Edinburgh staff, and the return of loaned instruments from Southampton to Edinburgh after the completion of user's loans. All remaining items were shipped at the end of July.

Construction and equipping of new Facility

- Conversion of an existing laboratory within the Grant Institute, University of Edinburgh to construct a calibration facility (temperature regulated dark room), equipment store and office to house the new Facility. Advice on set up and accreditation from the National Physical Laboratories (NPL). Equipping calibration facility with optical bench and accessories.

Loans, user training and support

- 21 loans of equipment supported, despite the disruption brought about by the transfer to Edinburgh. During the summer months the schedule was close to full with most instruments on loan throughout. All existing loans scheduled by Southampton were supported, each receiving the required instrument(s) on time and for the agreed loan period.
- Six emergency loans successfully managed, despite an initial decision not to support emergency loans during the transfer period.
- Training of new users for a variety of instrumentation and configurations has proceeded at Edinburgh with few problems. Responses to the training received have been highly favourable. Telephone support has quickly resolved problems encountered in the field.
- Overall, the process of dealing with existing loans, the processing of both a new round of loan applications (the June application deadline remained unchanged) and emergency loans, and user training and support went smoothly.

Publicity

- Poster presentations made at NERC Earth Observation conference in Plymouth (June) and at RSPSoc Conference in Aberdeen (September), to publicise relocation of the Facility, business as usual and new planned developments.

Quality Assurance and calibration

- Quality assurance responsibilities taken over by Edinburgh from May 7th.
- Repairs and upgrades to calibration equipment, including irradiance and radiance sources, and power supplies. Recalibration of standards by NPL. Refurbishment and replacement of Spectralon reference panels.
- Design and development of independent method to verify outputs of irradiance and radiance calibration sources.
- Development and documentation of rigorous QA and calibration procedures.

Instrumentation

- Upgrades to GER spectroradiometers to allow interface to modern PCs, including upgrades to firmware, on board batteries, software and hardware.
- Expansion of the Facility through the purchase of a new ASD FieldSpec Pro spectroradiometer, now on long-term loan to the Centre of Excellence in Terrestrial Carbon Dynamics.

Other activities

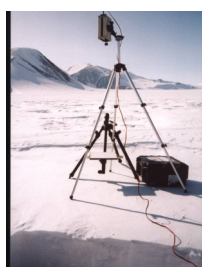
- Canvassing existing and potential user communities on future Facility developments
- Initial planning of activities associated with development of an FTIR instrument
- Development of formal procedures for all Facility activities, including loan applications and review, loan scheduling, training, and data processing
- Full participation in NCAVEO (Network for calibration and validation of Earth Observation data) knowledge transfer activities.

The support received from staff of the Geophysical Equipment Facility at Edinburgh and former EPFS staff at Southampton during the establishment of facilities at Edinburgh is gratefully acknowledged.

SCIENCE SUPPORTED IN FY (2004/05):

World class science supported by FSF in 2004-05:

- MicroTops sun photometers used to provide ground based spectral measurements of the optical and physical properties of anthropogenic aerosol from Eastern and Western pollution sources in the Po Valley, for use in radiative closure studies involving in-situ aircraft data and radiative transfer models, as part of the (Adriatic) Aerosol Direct Radiative Impact EXperiment (ADRIEX), co-funded by NERC and the Met Office. The results feed in to the development of remote sensing methods for aerosol and to the development of aerosol schemes for regional and global climate models. (*Highwood, Reading, NERC Grant Funded*)
- Sun photometers (MicroTops) used to investigate the direct and indirect radiative forcing effects of mineral dust aerosols from the Bodélé depression in northern Chad, the most important key preferential aerosol source on earth. The equipment was used in an international NASA sponsored campaign to measure the column-integrated dust optical properties and atmospheric optical depth in the region to enable characterization of aerosol properties vital to the dust modelling and satellite retrieval effort (e.g. with MODIS and ATSR), specifically, retrieval of dust physical (particle size distribution) and optical properties (single scattering albedo and phase function), and validation of TOMS satellite estimates of optical properties over the Bodélé for the first time. (*Todd, UCL*).



- GER1500 spectroradiometer and MicroTops sunphotometer used to aid the investigation of UV-visible albedo and wavelength dependent extinction both within and above snowpacks in Antarctica, to address feedback mechanisms between the atmosphere and snow interstitial photochemistry through the development of a snowpack-atmosphere model to test how climate change may affect chemical exchange between the two (*King, Royal Holloway*).
- ASD FieldSpec spectroradiometric equipment used to support ARSF supported research into impacts and processes of peat erosion. Understanding is crucial as peatlands play a vital role in long-term carbon storage (~1/4 of world's pool of soil organic C; on-going sequestration of 12% of anthropogenic emissions of CO₂), but also account for about 40 % of global methane emissions. This role, and their high habitat conservation

value, is threatened by climate change, land-use change and nitrogen deposition. Monitoring responses to change is challenging, because of their general remoteness, extensiveness and high degree of heterogeneity at fine spatial scales. Hyperspectral remote sensing offers an unprecedented opportunity to overcome these challenges (*McMorrow, Manchester and Cutler, Dundee*)

Output and performance measures

- 27 applications for equipment were received, all were alpha graded and support given to all >a4 and one at a3. Over 80% of projects were graded >a4 compared to 64% over the preceding three years. 11 projects were in support of PhD students. 6 loans supported campaigns of the NERC Airborne Research and Survey Facility (ARSF).
- A total of 31 user publications were reported for 2004. The spread of projects and outputs across the science areas and strategic priorities reflect the broad range of environmental science supported by the Facility.

FUTURE DEVELOPMENTS/STRATEGIC FORWARD LOOK

New science areas supported

- Atmospheric and solid surface environmental science applications extended through the development of instrumentation covering a wider spectral range to extend from the optical into the thermal range.
- Support to marine and freshwater sciences enhanced through provision of optical instrumentation for the measurement of subsurface spectral radiation and inherent optical properties
- Atmospheric and earth observation communities supported through dedication of the CIMEL sunphotometer instrument to establish a UK AERONET monitoring site.

Planned hardware developments to support science areas

- Two year phased development of a field portable FTIR spectrometer suitable for both atmospheric and solid surface environmental science applications covering the spectral region 2 – 20µm.
- Purchase of a Wetlabs A AC-S-25 instrument for the measurement of underwater absorption and beam attenuation
- Versatility enhancements to existing equipment, including purchase of underwater housing for GER 1500 spectroradiometer and
- upgrade of CIMEL sunphotometer to AERONET standards
- Relocation of CIMEL sunphotometer to Chilbolton to become UK's first AERONET monitoring site.

Other developments planned to meet mission objectives

- Raise profile of the Facility through presentations at five national and international conferences and meetings.
- Grow the user base through supporting wider areas of NERC science outlined above and through development demonstrations
- Enhance training through specific 2-3 day course on field spectroscopy aimed at new users
- Support to wider community through provision of calibration services for non-NERC owned spectroradiometric equipment
- Continued development of rigorous procedures documenting all Facility activities
- Further developments in calibration procedures aimed ultimately at NPL accreditation.
- Development of QA procedures for Spectralon reference panels.
- Further developments to website and databases to improve loan scheduling, equipment inventory, packing notes and user publications.
- Continuing active participation in NCAVEO knowledge transfer activities.