


SERVICES & FACILITIES ANNUAL REPORT - FY April 2001 to March 2002

SERVICE  The NERC MST Radar Facility at Aberystwyth http://mst.nerc.ac.uk	FUNDING Block	AGREEMENT SLA	ESTABLISHED as S&F 1996	TERM 5 years to March 2005
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TYPE OF SERVICE PROVIDED:

The Mission of the NERC Mesosphere-Stratosphere-Troposphere Radar (MSTR) Facility is to provide high quality atmospheric data products in near real-time to the UK scientific community in support of environmental research. It arranges for peer review of projects which require the radar to be operated in a specific mode thereby ensuring that only science of the highest quality is supported. It maintains an awareness of users' requirements so as to ensure that the service is fulfilling actual needs. It provides appropriate scientific and technical support in order to aid in the analysis and interpretation of the data. It achieves these objectives by:

- operating and maintaining the MSTR system and a climate data logger (for measuring surface temperature, pressure, humidity, rain fall and solar radiation) at Capel Dewi, a wind measurement system at Frongoch Farm (3 km to the west of the radar site), and associated computer systems at the Rutherford Appleton Laboratory (RAL)
- monitoring and maintaining the quality of the data
- archiving the data with the NERC British Atmospheric Data Centre (BADC) within 24 hours of acquisition thereby providing access for users through the internet
- investigating new techniques in order to maximise the usefulness of the data products
- promoting the value of the data products, through seminars and presentations at conferences, in order to make them available to the widest possible audience
- maintaining a dedicated website
- holding one-to-one discussions with data-users
- executing commissioned work with the UK Met Office in order to supplement the annual budget

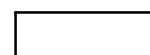
The NERC MST Radar at Capel Dewi, near Aberystwyth in West Wales, is a 46.5 MHz pulsed Doppler radar ideally suited for studies of atmospheric winds, waves and turbulence. It is run predominantly in the ST mode for which such radars are unique in their ability to provide continuous measurements of the three-dimensional wind vector over the altitude range 2 – 20 km at resolutions of a few minutes in time (typically 2-3) and a few hundred metres in altitude (typically 300). Additionally, under certain circumstances the radar returns can give information about the atmospheric static stability (thus allowing monitoring of the altitude and sharpness of the tropopause), humidity fields and turbulence (of at least moderate intensity). The extensive data-set of high-resolution observations from the NERC MST Radar, which covers a period of more than 10 years, offers the potential for studies to be made of atmospheric phenomena ranging from the micro and meso scales through to the synoptic and seasonal scales and beyond. The Radar is the most powerful and versatile wind-profiling system in the UK and the only one operating in the lower-VHF band.

SCORES AT LAST REVIEW (each out of 5)		Date of Last Review: January 1999		
Need 4.5	Uniqueness 5.0	Quality of Service 5.0	Quality of Science & Training 4.5	Average 4.75

CAPACITY of HOST ENTITY FUNDED by S&F 80 %	Staff & Status Project Manager: Dr Stuart White 50% Project Scientist : Dr David Hooper 100% Site Manager : Mr Tony Olewicz 100% (UWA contract)	Next Review (January) 2004	Contract Ends (31 March) 2005
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FINANCIAL DETAILS: CURRENT FY						
Recurrent Allocation £k	Unit Cost £ *			Capital Expend £k	Income £k	Full cash cost £k
	Unit 1	Unit 2	Unit 3			
104.2	11,417	5,709	1,142	8.0	33.0	131.3
FINANCIAL COMMITMENT (by year until end of current agreement)						
2002-03	?	2003-04	?	2004-05	?	2004-06
				2006-07		

- * Unit 1: Specific Project – NERC Funded
 Unit 2: Specific Project
 Unit 3: Pilot Project, Educational, or Teaching Use



STEERING COMMITTEE	Independent Members	Meetings per annum	Other S&F Overseen
NARFSC	5	1-2	Chilbolton Radar Facility

APPLICATIONS: DISTRIBUTION OF GRADES (Current FY — 2001/02)										
	$\alpha 5$	$\alpha 4$			$\alpha 3$	$\alpha 2$	$\alpha 1$	β	Reject	
NERC Grant projects		7: This includes 4 Studentships								
Other academic		1								
Educational/Teaching	There were 7 applications in this category									
Pilot Study	There were 8 applications in this category									
TOTAL		8								

APPLICATIONS: DISTRIBUTION OF GRADES (per annum average previous 3 years — 1998/1999 1999/2000 & 2000/2001)									
Only Specific "Experimental Mode" projects have previously been peer reviewed.									
	$\alpha 5$	$\alpha 4$	$\alpha 3$	$\alpha 2$	$\alpha 1$	β	R*/Pilot	Reject	
NERC Grant projects	2								
Other Academic	1		1						
Students									
Pilot									
TOTAL									

PROJECTS COMPLETED (Current FY)								Not Applicable	
	$\alpha 5$	$\alpha 4$	$\alpha 3$	$\alpha 2$	$\alpha 1$	β	R*/Pilot		
NERC Grant projects									
Other Academic									
Students									
Pilot									

USER PROFILE (current FY)						<i>*Combined non-Thematic and Thematic</i>				
Grand Total	Infrastructure					PAYG				
	Supplement to NERC Grant *	Student Total		NERC C/S	Other	NERC Grant*	Student Total		NERC C/S	Other
28	2	10	3		14					

USER PROFILE (per annum average previous 1 year – no data available pre 2001)						<i>*Combined non-Thematic and Thematic</i>				
Grand Total	Infrastructure					PAYG				
	Supplement to NERC Grant *	Student Total		NERC C/S	Other	NERC Grant*	Student Total		NERC C/S	Other
19.00	1.00	1.00	2.00	1.00	15.00					

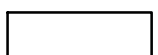
USER PROFILE (current FY)				
Academic	Centre/Survey	NERC Fellows	PhD	Commercial
		1	3	1
USER PROFILE (per annum average previous 1 year – no data available pre 2001)				
Academic	Centre/Survey	NERC Fellows	PhD	Commercial
15		1.00	2.00	1.00

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
			7				7	7		

Distribution of Projects (by science areas)										
SBA	ES	MS	AS	TFS	EO	Polar				
			100%							

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
			7.67				7.67	5.33	2.33	

Distribution of Projects (by science areas)										
SBA	ES	MS	AS	TFS	EO	Polar				
			100%							



OVERVIEW & ACTIVITIES IN FINANCIAL YEAR (2001/02):

The MSTR acquired data for 97.5% of the projected time for the year. Quick-look plots and data files, in a variety of formats, were made available to the academic community through the BADC website within 24 hours of acquisition. Sixteen new users applied for access to the data-set during the course of the year.

Under a commercial contract, MSTR wind-profile data were supplied to the Met Office every three hours in quasi real-time. Surface meteorological data (i.e. temperature, pressure, humidity, rainfall and solar radiation) have been recorded at 10 minute intervals without interruption during the year.

Wind speed and direction data from the tower at Frongoch farm, 3 km to the west of the radar site, were acquired at 1 minute intervals for 98.3% of the projected time until late November 2001. Owing to the fact that the old tower was considered to be unsafe to climb, a new hinged 10 m tower and wind measurement equipment were installed in December 2001; data have been acquired without interruption ever since.

Half-hour data from the Met Office's boundary layer wind profiler, which was located at the Facility between November 1999 and March 2002, were collected for 88.6% of the projected time; these data are also freely available to the academic community through the BADC website.

Efforts made in previous years to increase the protection of the MSTR against damage from lightning strikes appear to have been effective. Three major incidents within a three week period in late June and early July 2001 caused numerous problems with telephone lines and modems in the Aberystwyth area, including at the radar site. However, the only problem suffered by the MSTR itself was a 36 hour loss of power which affected the whole of the Capel Dewi locality.

Following the upgrade in computing facilities at the radar site during 2000, over 25 items of obsolete equipment were disposed of in September 2001. Moreover, in July 2001 a new computer network was installed to replace the existing BNC ethernet; AUI connections to a 24-way hub are now available in all operational rooms in the radar bungalow. The upgrade was motivated, in part, to increase isolation of the equipment from the telephone lines which, as mentioned above, are particularly susceptible to lightning damage. Together with the disposal of old equipment, this action has significantly reduced the amount of clutter and cabling at the site.

The annual Health & Safety inspection of the MST Radar site by a RAL Safety officer established no outstanding issues to be resolved with regard to H&S matters for the radar system and its operation.

A new PC running under Windows 2000 has been installed to take over data collection activities, for the climate data logger at Capel Dewi and the wind tower measurements at Frongoch Farm, from the "back-up" PC. The latter has now been powered-down and taken off-line so as to ensure its protection; it is identical to the master PC controlling the radar and can be substituted for it at short notice in case of a failure.

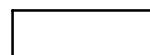
At the beginning of this reporting year, a formal registration process was established at the BADC website for all new applicants for use of MST Radar datasets. Each applicant is requested to provide a summary record including contact information and affiliation, NERC funding details (if appropriate), and a very brief description of the anticipated project. MST Radar staff then assess whether data should be made available based on NERC guidance on support for environmental research. During the year there were a total of 26 registrations for use of MST Radar datasets - these included several applicants already registered from the previous year. Twenty-one registrations were received from the UK HEI community including academics, postgraduates and undergraduates; other registrations were submitted from academics in India, Russia and New Zealand. All registered applications for data were agreed in 2001/02.

There has been a significant increase in promotion of the Facility during the last year. A dedicated website has now been created (<http://mst.nerc.ac.uk>) and this already contains detailed descriptions of the different instruments at the Facility, of radar operating principles and of file formats; it provides links to the quick-look plots and data files available through the BADC website.

Seminars promoting the Facility have been given at the Universities of Leeds, Reading and Aberystwyth and one-to-one discussions held with individual data-users.

A poster promoting the Facility was presented at the Universities Weather Research Network/Royal Meteorological Society conference held in Manchester, September 2001. A science poster covering research work undertaken by the Project Scientist was presented at the "Transport and Chemistry in the Upper-Troposphere Lower-Stratosphere (UTLS) Region Workshop" held in Cambridge, December 2001.

Talks have also been held with the Met Office in order to discuss their present and future requirements for MSTR data products. They are satisfied with the current service and have identified several areas for future development.



SCIENCE SUPPORTED IN FY (2001/02):

No campaigns during the last year have required the radar to be operated in a specific mode. Nevertheless, observations in the standard mode were requested in support of the Vertical Transport of Reactive Organic Carbon, VTROC, campaign conducted in the latter part of February 2002. The aim of the project was to study rapid vertical ventilation of pollutants from the boundary layer into the free troposphere. The primary measurements, of the concentrations of a wide variety of organic compounds, were made from a Falcon aircraft. Although it had been intended that the aircraft might over-fly the MSTR site, the appropriate frontal conditions required for vertical transport did not occur in the mid-Wales region during the period of the campaign.

Analysis of data from the Dynamics of Cold Frontal Zones, DCFZ, campaign conducted during 1999 is on-going. The campaign also involved an instrumented aircraft although in this case the aircraft actually flew over the MSTR site. Particular attention is being paid to a case study of convection in connection with a cold frontal passage. The MSTR Project Scientist's interest in better understanding radar returns is having a synergistic effect for this study since he has independently identified the signature of convection in a variety of MSTR data products. Such a signature is clearly apparent for the case in question and is supported by the fact that simultaneous satellite cloud observations confirm the presence of convective cells in the area.

MSTR radars are particularly well suited for studies of mountain lee waves and there is on-going interest in such waves observed by the NERC MSTR from a number of different data users. Again the MSTR Project Scientist's research interests, in this case into the derivation of atmospheric static stability from radar return signal power, are proving to be complementary to those of others. Attention has been focused on a particular case of mountain lee waves breaking at a critical level in the vicinity of the tropopause. The radar returns indicate not only the presence of turbulence but also the simultaneous reduction of static stability at the tropopause level. Such an effect would be expected in the case of mixing between upper-tropospheric and lower-stratospheric air although it remains to be confirmed whether or not the coincident wave-breaking/turbulence is responsible for this apparent "erosion" of the tropopause. A dedicated lee wave observation campaign, making use of the MSTR amongst other instruments, is scheduled for some time in 2002/2003.

Data from the MSTR have been used for a number of educational purposes, notably by the University of Reading's Department of Meteorology for the Spring Term 2002 Current Weather seminars. Data have also been used for several undergraduate student projects.

A researcher at the University of Canterbury, New Zealand, is analysing raw data from the NERC MSTR in order to develop signal processing routines for the new ST radar system currently under construction in New Zealand. This work is being undertaken with a considerable transfer of knowledge from the NERC MSTR Project Scientist.

FUTURE DEVELOPMENTS/STRATEGIC FORWARD LOOK:

There is set to be considerable development over the forthcoming year. The first stage of radar signal processing has now been almost completely re-written. The existing signal processing routines have remained relatively unchanged for over 10 years and still rely on simplifying assumptions which were necessary owing to the limited computer speed and memory available when they were first written. The new processing routines also make use of more standardly-used product definitions and feature improved data reliability flagging.

The next stage of processing is to create a new type of file which contains all of the principal data products (i.e. the three components of the wind vector, the vertical beam signal strength, the ratio between the vertical beam and 6-degree beam signal strengths and the vertical beam spectral width) in a simplified format. This will make the data much easier to use and to understand for non-radar specialists. Files of this type have already been created using the lower-level data products from the existing signal processing routines. Nevertheless, further development is required in order to ascertain the most appropriate way of combining information from observations made in different beam pointing directions; with observations made in the vertical direction and at 6-degrees off-vertical in four different azimuths, the information can be combined in three different ways in order to derive the three orthogonal components of the wind vector. Data from all instruments at the facility are to be written in the NASA-Ames format, one of the self-descriptive file formats preferred by the BADC. At first the new files will be made available on an on-going basis but eventually all observations will be re-processed and made available in the new format.

The new University Facilities for Atmospheric Measurement, UFAM, mobile boundary layer wind profiler will become available in mid-2002. The instrument is likely to be operated at the MSTR site in-between campaigns and preparations for its installation are already underway. Since the principles of operation are very similar to those of the MSTR, the descriptions on the MSTR web site are due to be generalised, where appropriate, so that they may serve as resources for the UFAM community.

