

**NERC EARTH OBSERVATION DATA ACQUISITION
AND ANALYSIS SERVICE**

ANNUAL REPORT APRIL 2006 – MARCH 2007

ANNEXES

The annexes are provided in two sections as follows:

- Combined and common annexes provided for both the NEODAAS-Plymouth and Dundee nodes.
- Supplementary annexes provided for the NEODAAS Dundee node only.

COMBINED AND COMMON ANNEXES FOR NEODAAS-PLYMOUTH AND DUNDEE

ANNEX

1. Mission statements
2. Steering Committee Membership & Terms of Reference
3. Equipment inventories
4. Summary of performance information
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6. Finance
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ANNEX 1: MISSION STATEMENTS

NEODAAS-PLYMOUTH MISSION STATEMENT

MISSION STATEMENT

of the

NERC Earth Observation Data Acquisition and Analysis Service - Plymouth

The mission of NEODAAS-Plymouth is to research & develop, implement, and operate systems for cost effective processing and analysis of remote sensing data in collaboration with, or on behalf of, the NERC and UK academic communities.

* NEODAAS-Plymouth will supply data products to customers in a timely fashion appropriate to customer's reasonable requirements.

* NEODAAS-Plymouth will provide services *complementary* to those reliably available through NASA or ESA.

* NEODAAS-Plymouth will ensure data products meet international standards for formats or quality where defined.

* NEODAAS-Plymouth will provide advice on processing satellite data to ensure efficient use of resources throughout the community.

In order to achieve its mission the NEODAAS-Plymouth will:

- maintain awareness of developments in the remote sensing/image analysis fields, and act as a point of contact with NASA-GSFC, NASA-JPL, NOAA, NMC, to ensure changes or updates to processing systems, or new methodologies, are implemented in a timely manner, and to ensure advice is up-to-date;
- maintain awareness of its customers' needs through regular contact;
- actively seek funding opportunities for its customers and itself;
- maintain close contact with NEODAAS-Dundee staff and the NERC Earth Observation Data Centre;
- provide services to customers through peer-reviewed application and will itself apply for funding through peer-review;
- undertake small exploratory research and development projects to investigate the feasibility and scope of new services or research areas, and to justify CR funding.

User Communities

The NERC Earth Observation Data Acquisition and Analysis Service - Plymouth will provide specialist services to the Environmental Sciences community supporting Council's remit to promote and support high quality research thereby meeting the needs of the User Communities identified in the NERC Mission.

PML/SPD May 2000

NEODAAS-DUNDEE MISSION STATEMENT

MISSION STATEMENT

of the

NERC Earth Observation Data Acquisition and Analysis Service - Dundee

- * to receive direct broadcast data from a number of polar orbiting Earth Observation satellites – specifically AVHRR data from the United States NOAA series, MODIS data from the NASA Terra and Aqua satellites and *SeaWiFS ocean colour data from Orbview-2.
- * to maintain an archive of all received polar orbiting satellite data which are of increasing value and relevance to the environmental research community as the archive lengthens.
- * to receive data from the operational European Meteosat geostationary satellite and data relayed via Meteosat from other geostationary meteorological satellites such as the United States GOES and Japanese GMS satellites.
- * to provide AVHRR, MODIS, SeaWiFS and geostationary satellite data, via network or on appropriate media, to environmental scientists in support of their research, thereby enhancing the UK's industrial competitiveness and quality of life.
- * to provide advice and promote good practice in the use of the data to the user community.
- * to provide the required support to the user community.
- * to operate appropriate procedures to enable access to the Facility to ensure that the best science is supported e.g. via peer review of the quality and relevance of applications.
- * to support NERC Science and Society activities.

In order to achieve its objectives NEODAAS-Dundee will:

- maintain and operate a satellite receiving station and the associated systems to receive, archive and disseminate AVHRR, MODIS, SeaWiFS and geostationary meteorological satellite data;
- routinely receive approximately 12 AVHRR, 12 MODIS and 3 SeaWiFS recordings per day plus extra passes as requested by users;
- deliver a copy of all received AVHRR, MODIS and SeaWiFS data to the Plymouth Marine Laboratory based partner node of NEODAAS (NEODAAS-Plymouth) for value added processing to support marine science projects in particular – data delivery to be via network in near-real time;
- maintain an archive of all received AVHRR, MODIS and SeaWiFS data and produce a backup copy for routine transfer and secure storage at the NERC Earth Observation Data Centre;

(contd.)

- routinely receive all unencrypted Meteosat geostationary satellite data and data relayed via Meteosat from other geostationary meteorological satellites;
- maintain a rolling archive of recently received geostationary satellite data for access by all users;
- produce local and online catalogues and image browse facilities etc. as required by users;
- maintain a Web site providing access to service and product information, browse imagery and data ordering interface;
- provide free public access to information and non-scientific image products through the Web site;
- maintain a watching brief on future EO satellites with a view to receiving their data - particularly satellites with direct broadcast capability and carrying follow-on or similar sensors to those received at Dundee;
- maintain awareness of national and international infrastructure in terms of comparable facilities;
- maintain awareness of the user community's requirements;
- monitor user satisfaction with the service provided;
- seek commissioned work to supplement income to provide the required service.

* **NOTE:** Activities associated with SeaWiFS are subject to data decryption information being available from the satellite operator. Following a change in SeaWiFS licencing terms, data received since 24th December 2004 are archived in encrypted form which cannot be processed or distributed at present. NEODAAS continues to acquire encrypted SeaWiFS data as advised by the user community with a view to obtaining more favourable terms for retrospective decryption of the data at some point to extend the archive.

User Community:

NEODAAS provides support to many physical and biological oceanographers. The user community also includes atmospheric, earth, terrestrial and polar scientists. The core user group comprises researchers in NERC institutes and UK HEI's. Other users include UK/overseas government and commercial organisations, overseas researchers and a huge number of individuals who use free website facilities for personal interest.

NERC Scientific Services & Facilities Management
May 2007

ANNEX 2: STEERING COMMITTEE MEMBERSHIP & TERMS OF REFERENCE

MEMBERSHIP AS AT JUNE 2007

Dr Gay Mitchelson-Jacob (Chair) 6/05	Centre for Applied Marine Sciences Marine Science Laboratories Menai Bridge Anglesey LL59 5AB	egm@bangor.ac.uk Tel: +44 1248 713808 Fax: +44 1248 716729
Dr John Turner 10/01	British Antarctic Survey High Cross Madingley Road Cambridge CB3 0ET	j.turner@bas.ac.uk Tel: 01223 221485 Fax: 01223 362616
Dr Gill Malin 6/05	School of Environmental Sciences University of East Anglia Norwich NR4 7TJ	g.malin@uea.ac.uk Tel: 01603 592531 Fax: 01603 507714
Mr Ross Reynolds 6/05	Department of Meteorology School of Mathematics, Meteorology & Physics The University of Reading POB 243 Earley Gate Reading RG6 6BB	r.reynolds@reading.ac.uk Tel: 0118 378 8956 Fax: 0118 378 8905
Mr Andrew Wilson 06/07	Earth Observation CEH Monks Wood Abbots Ripton Huntingdon Cambridgeshire PE28 2LS	akw@ceh.ac.uk Tel: 01487 772400 Fax: 01487 773277

Ex Officio

Prof Ian Robinson (NERC EODAB Representative)	School of Ocean and Earth Science University of Southampton National Oceanography Centre European Way Southampton SO14 3ZH	Ian.S.Robinson@noc.soton.ac.uk Tel: 02380 593438 Fax: 02380 593059
Mrs Claudia Hawke	NERC Earth Observation Programme Polaris House North Star Avenue Swindon SN2 1EU	clste@nerc.ac.uk Tel: 01793 411781 Fax: 01793 411545
Dr Steve Parkes	Satellite Receiving Station School of Computing University of Dundee Dundee DD1 4HN	sparkes@computing.dundee.ac.uk Tel: +44 01382 385194 Fax: +44 01382 388838
Mr Steve Groom	Plymouth Marine Laboratory Prospect Place West Hoe Plymouth PL1 3DH	sbg@pml.ac.uk Tel: 01752 633150 Fax: 01752 633101
Dr Peter Miller	Plymouth Marine Laboratory Prospect Place West Hoe Plymouth PL1 3DH	pim@pml.ac.uk Tel: 01752 633485 Fax: 01752 633101

Dr Lin Kay	NERC Scientific Facilities and Technology Group Polaris House North Star Avenue Swindon SN2 1EU	rlfk@nerc.ac.uk Tel: 01793 411600 Fax: 01793 411610
Miss Michelle Manning	NERC Scientific Facilities and Technology Group Polaris House North Star Avenue Swindon SN2 1EU	mcman@nerc.ac.uk Tel: 01793 442635
Mr Neil Lonie (Secretary)	Satellite Receiving Station School of Computing University of Dundee Dundee DD1 4HN	ntl@sat.dundee.ac.uk Tel: 01382 384409 Fax: 01382 202575

REMIT AND TERMS OF REFERENCE FOR THE NEODAAS STEERING COMMITTEE

Remit

The NEODAAS Steering Committee exists to:

- review applications for use of data from NEODAAS
- monitor outputs from NEODAAS
- provide advice to Director of Science and Innovation on aspects of the operations of NEODAAS

Director of Science and Innovation, in turn, provides advice to the Science & Innovation Strategy Board on Services and Facilities.

Terms of Reference

1. To review applications and establish priorities, for the Heads of NEODAAS, for the allocation of those of the service's resources funded from NERC Services & Facilities budget, taking into account recommendations made through the NERC peer review mechanisms.
2. To review the science quality of work undertaken by users utilising data from NEODAAS based on reports and publications.
3. To monitor the level of user satisfaction with the service and to analyse the user base.
4. To give guidance to the Service Heads on improvement of equipment and its service function.
5. To advise Director of Science and Innovation on:
 - a. the level and direction of the internal R&D programme for the service.
 - b. anticipated changes in requirements from the service and the anticipated levels of future demand for data.
6. To receive annually a report from the Service Heads and to comment thereon as appropriate prior to submission of the report to the Director of Science and Innovation.
7. To provide advice to the Director of Science and Innovation at other times as appropriate.

Membership Constraints

Membership of the Committee will be decided by the Director of Science and Innovation with advice from the Science & Innovation Strategy Board and suggestions from the Committee itself. It will include the Service Heads and a representative from Science and Innovation.

Members, other than ex-officio members, will be invited to serve for a term of up to four years with a maximum extension of a further two years. The Chair will serve a maximum of four years.

ANNEX 3: EQUIPMENT INVENTORIES

NEODAAS-PLYMOUTH EQUIPMENT INVENTORY

This section removed.

NEODAAS-DUNDEE EQUIPMENT INVENTORY

1. Tracking, Data Reception, Ingest and Test Equipment etc.

This section removed.

2. Data Archiving, Processing and Server Systems etc.

This section removed.

ANNEX 4: SUMMARY OF PERFORMANCE INFORMATION

4.1 APPLICATION GRADES

NEODAAS supports UK scientists who have submitted an application form either to NEODAAS-Plymouth or Dundee, though most applications are submitted to Plymouth as supplier of the higher level products. Applications expected to 'cost' greater than £500 are peer-reviewed by the NEODAAS-SC on an ongoing basis, so that the grading is known before undertaking the work. Applications are also accepted on-line for access to pre-processed imagery available via the NEODAAS-Plymouth web site, which logs the images accessed by authorised users in a database.

During this year, NEODAAS supported 56 applications in total, 23 of which were new applications which were reviewed. All reviewed applications were successful, occasionally following clarification of queries raised by reviewers. A few additional new applications were received at Dundee and supported, but not reviewed due to the low levels of support requested. The new applications requiring review were graded as follows:

APPLICATIONS: DISTRIBUTION OF GRADES (Current FY — 2006/07)								
	$\alpha 5$	$\alpha 4$	$\alpha 3$	$\alpha 2$	$\alpha 1$	β	R*/Pilot	Reject
NERC Grant projects	1	4						
Other academic	1	6						
Students	1	9	2					
Pilot								
TOTAL: 23	3	19	1					

4.2 DISTRIBUTION OF PROJECTS

NEODAAS-PLYMOUTH

Applications supported by Plymouth can be mapped onto NERC's Science Areas and Science Priority Areas, as a percentage of the Full Cash Cost:

Science Area	Number of Projects	Allocated Cost (%)
Atmospheric	0	0
Earth	1	1
Marine	42	92
Terrestrial and Freshwater	0	0
Earth Observation	(7)	4
Science-based Archaeology	(-)	0
Polar	(3)	3
TOTAL	43	100

Science Priority Areas	Number of Projects	Allocated Cost (%)
Earth's Life Support Systems	23	44
Climate Change	19	28
Sustainable Economies	14	19
Underpinning Science	0	0
Specific Research	12	9
Other	0	0
TOTAL	-	100

NEODAAS-DUNDEE

All applications supported by Dundee were distributed across NERC's Science Areas and Science Priority Areas as follows:

Science Area	Number of Projects
Atmospheric	5
Earth	1
Marine	35
Terrestrial and Freshwater	3
Earth Observation	8
Science-based Archaeology	0
Polar	1

Science Priority Areas	Number of Projects
Earth's Life Support Systems	17
Climate Change	18
Sustainable Economies	14
Underpinning Science	1
Specific Research	14
Other	0

4.3 APPLICATIONS SUPPORTED DURING FY 2006/7: NEODAAS-PLYMOUTH

HEI Name (as per HESA list)	PI Surname	App. No.	Application Title	Grade	Fellow	PhD	Dundee data	Complete	NERC Ref No	Funding Mode	Funding Type
University of Plymouth	Lavender	00/7	Development of algorithms for processing ocean color imagery from European coastal waters	a5			1			NN	O
Open University	Harris	00/19	Emplacement of lava flow fields and tube systems at Etna volcano: satellite insights	a4			1			NN	O
Plymouth Mar. Lab.	Groom	-	In-house research	-			1			INF	O
NOCS	Hydes	01/20	FerryBox (BICEP)	a4			1			CS	O
Proudman Oc. Lab.	Proctor	01/18	POLCOMS development	a4			1			CS	O
NOCS	Lampitt	02/13	ANIMATE: Atlantic Network of Interdisciplinary Moorings and Time-series for Europe (BICEP)	a4			1			CS	O
University of Plymouth	Lavender	02/17	AMT: Atlantic Meridional Transect Programme	a4			1		NER/O/S/2001/00680	Consortium	R
NOCS	Pollard	03/11	CROZEX: CROZet natural iron bloom EXPORT experiment (BICEP)	a4				1		CS	O
University of Southampton	Holligan	03/15	Physical-biological control of new production within the seasonal thermocline	a3			1	1	NER/S/J/200211128	NT	S
University of Wales Swansea	Hays	04/7	Habitat use by marine vertebrates: synergistic use of geolocation with satellite remote sensing	a4			1		NER/B/S/2002/00504	NT	R
NOCS	Quarty	04/12	MadEx: Propagating features in the Madagascar Retroreflection region	a4						CS	O
Cornwall College	Speedie	04/16	The Wildlife Trust Basking Shark Project	a4			1			NN	O
University of Wales, Bangor	Bowers	05/01	Remote sensing of chlorophyll-a in a turbid shelf sea	a3		1	1	1	NER/S/D/2004/12688	CofE	S
University of Newcastle	Polunin	05/02	Stable isotope data to elucidate food web structures	a4		1		1	S-A/2003/1185	NT	S
NOCS	Achterberg	05/04	Trace metal speciation during coccolithophore bloom	a4		1	1	1		CS	S
NOCS	Martin	05/11	Hydrographic controls on seabird distributions in the eastern North Atlantic	a4	1			1	FNER/J/S/2001/00708	CS	O
BAS	Fleming	05/12	Mean chlorophyll-a around the Antarctic Peninsula	a4				1		CS	O

University of Liverpool	Williams	05/13	Does nutrient transport control phytoplankton blooms	a4		1	1	1		CS	S
University of London	Culloch	05/17	Conservation of Pakistan's marine cetacean biodiversity and pelagic environment	a3						NN	O
NOCS	Achterberg	SOLAS	Impact of atmospheric dust on tropical N Atlantic near-surface plankton microbiota, Cape Verde	a4					SOLAS	T	R
University of Wales, Bangor	Mitchelson-Jacob	06/01	The spatial and temporal distribution of cetaceans within Skjálfandi Bay, North Iceland (Cecchetti)	a4			1	1		NN	S
University of Wales, Bangor	Mitchelson-Jacob	06/02	Spatial use of common dolphins in relation to habitat features (Bush)	a4			1	1		NN	S
University of St Andrews	Hammond	06/03	Monitoring cetacean abundance with the help of passive acoustic techniques & modelling distributions using topographic & oceanographic variables	a4		1	1	1	NER/S/A/2003/1188 9	NN	S
Plymouth Mar. Lab.	Mountford	06/04	Remote sensing as a tool for quantifying oceanic CO2 sinks in the Southern Ocean	a5				1	CASIX	CofE	R
University of Wales, Bangor	Simpson	06/05	Structure of Turbulence in Shelf Seas	a4	1		1	1	NER/D/S/2002/0096 5	NT	R
University of St Andrews	Luke Rendell	06/06	Modelling cetacean habitat in the western Mediterranean	a4	1		1	1	NER/I/S/2002/00632	NT	R
Marine Biological Assoc	Kirby	06/07	A comparison of in situ estimates of phytoplankton abundance in the northeast Atlantic	a3			1	1		NN	S
University of Wales, Bangor	Bowers	06/08	Remote Sensing of Chlorophyll Concentrations in a Turbid Shelf Sea	a5		1	1	1	NER/S/D/2004/1268 8	CofE	S
NOCS	Dix	06/09	Modelling exclusion zones for marine aggregate dredging	a4			1	1		NN	R
Natural History Museum	Young	06/11	Micropalaeontological fingerprinting of ice-rafted detritus sources and nannoplankton response to Heinrich events	a4		1	1	1	NER/S/J/2003/1201 2	NT	S
SAHFOS	Reid	06/12	Spatio-temporal fluctuations of Phytoplankton species in the North Atlantic Basin	a3		1	1			NN	S
Plymouth Mar. Lab.	Torres	06/13	Residual circulation of the Ria de Vigo: dynamics and hydrography	a5			1			CS	O
University of Dundee	Cutler	06/14	Remote sensing of European lake ecosystem parameters	a4		1	1			NN	S
University of Leeds	Krom	06/15	Environmental effects of the turn-off of the River Nile on the adjacent coastal region of the E. Mediterranean	a4				1		NN	R

University of Durham	Hoelzel	06/16	Foraging ecology and population genetics of the Minke Whale in the North Atlantic	a4		1	1			NN	S
University of Southampton	Iglesias-Rodriguez	06/17	Calcifying phytoplankton in a changing ocean; Export production - new approach using proteomic signatures	a4		1	1		NER/S/A2006/1421 1	NT	S
NOCS	Martin	06/18	Biophysical interactions in the Iceland Basin (BIB) cruise, Oceans 2025 Theme 2	a4			1			CS	R
CEH Banchory	Daunt	06/19	Seasonal patterns of guillemot activity: where and when to release oiled guillemots	a4			1			CS	R
University of Glasgow	Gore	06/20	Ecology of Whale Shark around Mahe, Seychelles	a4		1				NN	S
Plymouth Mar. Lab.	Oubelkheir	06/21	Ultra-violet impact on phytoplankton and coloured dissolved organic matter in the Southern Ocean	a4				1		NN	R
University of Wales, Bangor	Mitchelson-Jacob	06/22	Minke Whale habitat ecology (Tetley)	a4		1	1		NER/S/A/2006/1408 4	NT	S
University of Newcastle	Upstill-Goddard	SOLAS	Deep Ocean Gas Exchange Experiment (DOGEE)	a4			1	1	SOLAS	T	R
University of Leeds	Brooks	SOLAS	Field Observations of Sea Spray, Gas Fluxes and Whitecaps (SEASAW)	a4			1	1	SOLAS	T	R
NOCS	Holligan	BAS	Drake Passage: Falklands to Rothera	a4				1	BAS	CS	R

4.3 (CONTD.) APPLICATIONS SUPPORTED DURING FY 2006/7:

NEODAAS-DUNDEE

Funding Mode: T Thematic
 NT Non-Thematic
 CS Core Strategic
 INF Infrastructure
 NN Non NERC

Funding Type: S Studentship
 R Research Grant
 O Other

NOTE: - No review (i.e. limited data requirements).

User Name	Affiliation	Project Title	Funding Mode	Funding Type	Grade	Science Areas										Science Priority Areas						
						Atmospheric	Earth	Marine	Terrestrial & Freshwater	Earth Observation	Science Based Archaeology	Polar	Earth's Life Support Systems	Climate Change	Sustainable Economics	Underpinning Science	Specific Research	Other				
Blyth Dr A	Univ. Leeds	Convective Storms Initiation Project	NT	S & R	a4	1												1	1			
Gray Dr S	Univ. Reading	Intensification of Polar Lows	NT	S	a4	1												1	1			
Freegarde Dr T	Univ. Southampton	Where to find the English thermal	NN	S	-	1															1	
Mitchelson-Jacob Dr EG	UW-Bangor	No specific project – browse image products for use by local researchers	NN	O	-			1								1	1					
Pingree Prof R	Marine Biological Assoc	No specific project – weekly supply of enhanced photo prints as browse images for use by local researchers	NN	O	-			1								1	1					
Ramsay Dr G	Scottish Crop Research Inst.	Investigating long distance pollen dispersal	NN	O	-				1	1											1	
Renfrew Dr I	Univ. East Anglia	Greenland Flow Distortion Experiment	CS	O	a4	1						1					1					
Simpson Mrs P	NOCS	No specific project – browse image products for use by local researchers	CS	O	-			1												1		
Slater Dr MT	Univ. Dundee	Sample data sets for MSc Image Processing taught sessions	NN	O	-				1	1											1	

User Name	Affiliation	Project Title	Funding Mode	Funding Type	Grade	Science Areas							Science Priority Areas						
						Atmospheric	Earth	Marine	Terrestrial & Freshwater	Earth Observation	Science Based Archaeology	Polar	Earth's Life Support Systems	Climate Change	Sustainable Economies	Underpinning Science	Specific Research	Other	
Vaughan Prof G	Univ. Manchester	Exchange of ozone and aerosols between the boundary layer and the free troposphere	NT	S	-	1												1	
Wilson Dr Andrew	CEH Monks Wood	UK Vegetation Phenology Observatory	CS	O	pilot study				1	1				1	1				
Slater Dr MT	Univ. Dundee	Comparison of sea-surface temperature information derived from AVHRR, MODIS data and static sea buoy data.	NN	S	-			1										1	
Lavender Dr S	Univ. Plymouth	Development of algorithms for processing ocean colour imagery from European coastal waters	NN	O	a5			1		1				1	1	1			
Harris Dr A	Open University	Emplacement of lava flow fields and tube systems at Etna volcano: satellite insights	NN	O	a4		1									1			
Groom Mr S	Plymouth Mar. Lab.	In-house research	INF	O	-			1						1	1	1			
Hydes Dr D	NOCS	Biophysical interactions and controls on export production (BICEP): FerryBox	CS	O	a4			1							1	1			
Proctor Dr R	Proudman Oc. Lab.	POLCOMS development	CS	O	a4			1						1	1	1			
Lampitt Dr Richard	NOCS	Biophysical interactions and controls on export production (BICEP): ANIMATE	CS	O	a4			1							1				
Lavender Dr S	Univ. Plymouth	Atlantic Meridional Transect (AMT) Programme	Consortium	R	a4			1		1				1	1				
Holligan Prof P	Univ. Southampton	Physical-biological control of new production within the seasonal thermocline	NT	S	a3			1								1			
Hays Dr G	Univ. Wales Swansea	Habitat use by marine vertebrates: synergistic use of geolocation with satellite remote sensing	NT	R	a4			1										1	
Speedie Mr C	Cornwall College	The Wildlife Trust Basking Shark Project	NN	O	a4			1							1			1	

User Name	Affiliation	Project Title	Funding Mode	Funding Type	Grade	Science Areas							Science Priority Areas					
						Atmospheric	Earth	Marine	Terrestrial & Freshwater	Earth Observation	Science Based Archaeology	Polar	Earth's Life Support Systems	Climate Change	Sustainable Economics	Underpinning Science	Specific Research	Other
Bowers Dr D	Univ. Wales Bangor	Remote sensing of chlorophyll-a in a turbid shelf sea	CofE	S	a3			1		1			1		1			
Achterberg Dr E	NOCS	Trace metal speciation during coccolithophore bloom	CS	S	a4			1					1					
Williams Prof R	Univ. Liverpool	Does nutrient transport control phytoplankton blooms	CS	S	a4			1					1					
Mitchelson-Jacob Dr G	Univ. Wales Bangor	The spatial and temporal distribution of cetaceans within Skjálfandi Bay, North Iceland (Cecchetti)	NN	S	a4			1									1	
Mitchelson-Jacob Dr g	Univ. Wales Bangor	Spatial use of common dolphins in relation to habitat features (Bush)	NN	S	a4			1									1	
Hammond Prof P	Univ St Andrews	Monitoring cetacean abundance with the help of passive acoustic techniques & modelling distributions using topographic & oceanographic variables	NN	S	a4			1									1	
Simpson Prof J	Univ. Wales Bangor	Structure of Turbulence in Shelf Seas	NT	R	a4			1						1				
Luke Rendell Dr L	Univ. St Andrews	Modelling cetacean habitat in the western Mediterranean	NT	R	a4			1									1	
Kirby Dr R	MBA	A comparison of in situ estimates of phytoplankton abundance in the northeast Atlantic	NN	S	a3			1					1	1				
Bowers Dr D	Univ. Wales Bangor	Remote Sensing of Chlorophyll Concentrations in a Turbid Shelf Sea	CofE	S	a5			1		1			1		1			
Dix Dr J	NOCS	Modelling exclusion zones for marine aggregate dredging	NN	R	a4			1							1			
Young Dr J	Natural History Museum	Micropalaeontological fingerprinting of ice-rafted detritus sources and nannoplankton response to Heinrich events	NT	S	a4			1					1	1				
Reid Prof C	SAHFOS	Spatio-temporal fluctuations of Phytoplankton species in the North Atlantic Basin	NN	S	a3			1										

						Science Areas							Science Priority Areas						
User Name	Affiliation	Project Title	Funding Mode	Funding Type	Grade	Atmospheric	Earth	Marine	Terrestrial & Freshwater	Earth Observation	Science Based Archaeology	Polar		Earth's Life Support Systems	Climate Change	Sustainable Economies	Underpinning Science	Specific Research	Other
Torres Dr R	PML	Residual circulation of the Ria de Vigo: dynamics and hydrography	CS	O	a5			1								1			
Cutler Dr M	Univ. Dundee	Remote sensing of European lake ecosystem parameters	NN	S	a4			1		1					1	1			
Hoelzel Dr R	Univ. Durham	Foraging ecology and population genetics of the Minke Whale in the North Atlantic	NN	S	a4			1										1	
Iglesias-Rodriguez Dr D	Univ. Southampton	Calcifying phytoplankton in a changing ocean; Export production - new approach using proteomic signatures	NT	S	a4			1						1	1				
Martin Dr A	NOCS	Biophysical interactions in the Iceland Basin (BIB) cruise, Oceans 2025 Theme 2	CS	R	a4			1						1					
Daunt Dr F	CEH Banchory	Seasonal patterns of guillemot activity: where and when to release oiled guillemots	CS	R	a4			1								1		1	
Mitchelson-Jacob Dr G	Univ. Wales Bangor	Minke Whale habitat ecology (Tetley)	NT	S	a4			1										1	
Upstill-Goddard Prof R	Univ. Newcastle	Deep Ocean Gas Exchange Experiment (DOGEE)	T	R	a4			1						1					
Brooks Dr I	Univ. Leeds	Field Observations of Sea Spray, Gas Fluxes and Whitecaps (SEASAW)	T	R	a4			1						1					

4.4 (CONTD.) COST ALLOCATIONS FY 2006/7: NEODAAS-DUNDEE

Service Capacity

The unit cost for NEODAAS-Dundee is based on staff effort. For the purpose of Cost Allocations, capacity is measured in terms of operational staff (Shift Technicians) with other staff undertaking support activities, e.g. station management, software/systems maintenance, development and administration, general administration and clerical duties.

Annual capacity assumes 213 working days per staff member each year as per NERC guidelines.

$$\begin{aligned} \text{Total Capacity} &= * \text{No. of Operational Staff} \times \text{Working Days} \times \text{Shift} \\ \text{Duration} & \\ &= 2 \times 213 \times 7.5 \\ &= 3195 \text{ hours (or units)} \end{aligned}$$

Unit Pricing

For Cost Allocation returns, the operational staff effort involved in producing each product has been estimated to give the number of units for each product (see Table). Consequently, there is only a single unit of pricing. The unit price is calculated as follows:

$$\begin{aligned} \text{Full Cash Cost of DSRS} \div \text{Total Capacity} &= \text{Unit cost} \\ 390080/3195 &= \text{£ } 122.09 \end{aligned}$$

(Note: Full Cash Cost for NEODAAS-Dundee 2006/07 is £ 390,080 – provided by NERC.)

Free Web Based Browse Image Service

Browse images are available free through the website to users who register. They are used extensively by thousands of users at all levels, with several million image downloads annually. However, these facilities are not cost allocated because of the huge number of users involved and the difficulty in assessing the service in terms of unit cost per image delivered.

NEODAAS-Dundee products and units to produce each

Product Category	Product Description	Units
Hard Copy	Browse File Sheet	0.125
	Photo X1 Quicklook	0.083
	Photo Sector Enlargement	0.417
	Laser Print X1 Quicklook	0.017
	X1 Quicklook Xerox Copy	0.017
Archive Data Recovery	0 - 400 Line Scene	0.219
	401 - 800 Line Scene	0.238
	801 - 1200 Line Scene	0.257
	1201 - 1600 Line Scene	0.276
	1601 - 2000 Line Scene	0.295
	2001 - 2400 Line Scene	0.314
	2401 - 3600 Line Scene	0.371
	Full Pass Scene	0.447
Data Processing & Delivery	0 - 400 Line Raw Scene	0.100
	401 - 800 Line Raw Scene	0.117
	801 - 1200 Line Raw Scene	0.133
	1201 - 1600 Line Raw Scene	0.150
	1601 - 2000 Line Raw Scene	0.167
	2001 - 2400 Line Raw Scene	0.183
	2401 - 3600 Line Raw Scene	0.233
	Full Pass Raw Scene	0.300
	0-1M Byte Image File	0.020
	1-2M Byte Image File	0.023
	2-3M Byte Image File	0.027
	3-4M Byte Image File	0.030
	4-5M Byte Image File	0.033
	5-6M Byte Image File	0.037
	6-10M Byte Image File	0.047
	10-15M Byte Image File	0.060
Archive Maintenance	Archive Tape Cleaning (Per Tape)	1.000
	Data Recovery (Per Full Recording)	0.333
	Data Processing (Per CD Set)	1.000

SERVICES AND FACILITIES COST ALLOCATIONS FORM 2006/07

Service/Facility

NEODAAS-Dundee

Full Cash Cost = £k

390.08

UNIT PRICING

Unit Price
(per operational
staff hour)

Price £k

0.122

HESA Inst. Code	HEI Name	HEI Dept. /NERC site	PI Surname	PI Title	PI Init	NERC Ref No	Fund. Mode	Fund. Type	SCIENCE AREA										Units	£'s/k				
									Atmos	Earth	Marine	T&F	EO	SBA	Polar	E/S	Climatech	Sus Economics			Underpinnc	SpecResearch	Other	
H-0073	University of Plymouth	Marine Studies	Lavender	Dr	S		NN	O				1						1	1	1			2.34	0.286
H-0001	Open University	Earth Sciences	Harris	Dr	A		NN	O		1										1			203.58	24.855
	NOCS	George Deacon Division	Hydes	Dr	D		CS	O			1								1	1			49.14	6.000
	Proudman Oc. Lab.		Proctor	Dr	R		CS	O			1							1	1	1			140.4	17.141
	NOCS	George Deacon Division	Lampitt	Dr	R		CS	O			1									1			992.32	121.152
H-0073	University of Plymouth	Marine Studies	Lavender	Dr	S	NER/O/S/2001/00680	Consortium	R			1		1					1	1				3.51	0.429
H-0160	University of Southampton	Ocean and Earth Science	Holligan	Prof	P	NER/S/I/2002/11128	NT	S			1									1			7.02	0.857
H-0180	University of Wales Swansea	Biological Sciences	Hays	Dr	G	NER/B/S/2002/00504	NT	R			1										1		52.65	6.428
	Cornwall College	Falmouth Marine School	Speedie	Mr	C		NN	O			1											1	11.70	1.428
H-0178	University of Wales, Bangor	Ocean Sciences	Bowers	Dr	D	NER/S/D/2004/12688	CofE	S			1		1					1		1			16.61	2.028
	NOCS		Achterberg	Dr	E		CS	S			1							1					80.14	9.785
H-0126	University of Liverpool	Earth and Ocean Sciences	Williams	Prof	R		CS	S			1							1					35.10	4.285
H-0178	University of Wales, Bangor	Ocean Sciences	Mitchelson-Jacob	Dr	G		NN	S			1									1			70.20	8.571
H-0178	University of Wales, Bangor	Ocean Sciences	Mitchelson-Jacob	Dr	G		NN	S			1									1			6.44	0.786
H-0173	University of St Andrews	Sea Mammal Research Unit	Hammond	Prof	P	NER/S/A/2003/11889	NN	S			1									1			35.10	4.285
H-0178	University of Wales, Bangor	Ocean Sciences	Simpson	Prof	J	NER/D/S/2002/00965	NT	R			1								1				17.43	2.128
H-0173	University of St Andrews	Sea Mammal Research Unit	Luke Rendell	Dr	L	NER/I/S/2002/00632	NT	R			1									1			0.58	0.071
	Marine Biological Assoc		Kirby	Dr	R		NN	S			1							1	1				10.30	1.257
H-0178	University of Wales, Bangor	Ocean Sciences	Bowers	Dr	D	NER/S/D/2004/12688	CofE	S			1		1					1		1			1.40	0.171
	NOCS		Dix	Dr	J		NN	R			1									1			5.00	0.610
	Natural History Museum		Young	Dr	J	NER/S/I/2003/12012	NT	S			1							1	1				10.30	1.257
	SAHFOS		Reid	Prof	C		NN	S			1												46.80	5.714
	Plymouth Mar. Lab.		Torres	Dr	R		CS	O			1												27.50	3.357
H-0172	University of Dundee	Geography	Cutler	Dr	M		NN	S			1		1						1	1			2.34	0.286
H-0116	University of Durham	Biological and Biomed. Sci	Hoelzel	Dr	R		NN	S			1									1			19.30	2.357
H-0160	University of Southampton	Ocean and Earth Science	Iglesias-Rodriguez	Dr	D	NER/s/A2006/14211	NT	S			1							1	1				46.80	5.714
	NOCS		Martin	Dr	A		CS	R			1							1					40.95	5.000
	CEH Banchory		Daunt	Dr	F		CS	R			1									1			5.00	0.610
H-0178	University of Wales, Bangor	Ocean Sciences	Mitchelson-Jacob	Dr	G	NER/S/A/2006/14084	NT	S			1									1			5.00	0.610
H-0154	University of Newcastle	Marine Science & Tech	Upstill-Goddard	Prof	R	SOLAS	T	R			1							1					58.97	7.199
H-0124	University of Leeds	Earth and Environment	Brooks	Dr	I	SOLAS	T	R			1							1					47.50	5.800
H-0124	University of Leeds	School of the Environment	Blyth	Dr	A	NER/S/A/2003/11275	NT	S	1										1	1			0.16	0.020
H-0157	University of Reading	Department Of Meteorology	Bracegirdle	Mr	T	NER/S/A/2002/10539	NT	R	1										1	1			0.11	0.013
H-0172	University of Dundee	Geography	Cutler	Dr	M		NN	S				1	1					1	1	1			4.02	0.491
H-0160	University of Southampton	Physics and Astronomy	Freearge	Dr	T		NN	S	1												1		15.72	1.919
	Plymouth Marine Laboratory	NEODAAS-PML	Groom	Mr	SB		INF	O			1							1	1	1			261.97	31.984
H-0178	University of Wales, Bangor	Centre for Applied Marine Sciences	Mitchelson-Jacob	Dr	EG		NN	O			1							1	1				10.00	1.221
	Marine Biological Association		Pingree	Prof	RD		NN	O			1							1	1				120.10	14.663
	Scottish Crop Research Institute		Ramsay	Dr	G		NN	O				1	1							1			1.52	0.186

HESA Inst. Code	HEI Name	HEI Dept. /NERC site	PI Surname	PI Title	PI Init	NERC Ref No	Fund. Mode	Fund. Type	SCIENCE AREA											SCIENCE PRIORITY AREAS					Units	£'s/k
									Atmos	Earth	Marine	T&F	EO	SBA	Polar	ELS	ClimateCh	Sus Economies	Underpinning Science	Specific Research	Other					
H-0117	University of East Anglia	Environmental Sciences	Renfrew	Dr	I	NE/C003365 /1	CS	O	1																99.94	12.202
	National Oceanography Centre	National Oceanography Library	Simpson	Mrs	P		CS	O			1														46.22	5.643
H-0172	University of Dundee	Electronic Engineering and Physics	Slater	Dr	M		NN	S					1												19.10	2.332
	British Antarctic Survey		Turner	Dr	J		CS	O	1																0.55	0.067
H-0204	University of Manchester	Earth, Atmospheric and Environmental Sciences	Vaughan	Prof	G		NT	S	1																0.12	0.015
	Centre for Ecology & Hydrology	Section For Earth Observation	Wilson	Mr	AK		CS	O					1	1											41.25	5.036
H-0172	University of Dundee	Electronic Engineering and Physics	Woods	Miss	A		NN	S			1		1												2.32	0.283
H-0177	University of Wales, Aberystwyth	Institute Of Maths & Physical Sciences	Worthington		R		NN	O	1																0.70	0.085
	Penryn (Individual)		Frampton	Mr	RM		CR	O	1				1												1.67	0.204
	Crewe (Individual)		Furr	Mr	P		CR	O	1				1												0.42	0.051
	PML Applications Ltd	Finance Office	Harding	Mrs	K		CR	O			1		1												23.76	2.901
	Falconer Museum		Joyce	Mr	A		CR	O	1				1												0.96	0.117
H-0141	Royal Holloway, University of London	Physics Department	Lea	Prof	M		CR	O					1	1											7.58	0.925
	Zooid Pictures Ltd		Philpott	Mr	R		CR	O	1				1												1.25	0.153
	GVA Grimley Ltd	Planning, Development & Regeneration	Rosendale	Mrs	N		CR	O	1				1												0.44	0.054
	c/o University of Dundee (Individual)	Geography	Scarth	Dr	A		CR	O	1	1			1												0.96	0.117
	Science Photo Library		Science Photo Library				CR	O	1				1												1.43	0.175
	c/o University of Dundee (Individual)	Applied Computing	Simpson	Miss	M		CR	O	1				1												1.25	0.153
	Edinburgh (Individual)		Taylor	Mr	D		CR	O	1				1												6.05	0.739
	Routledge Publishers Ltd.		Taylor	Miss	M		CR	O	1				1												3.58	0.437
	Nelson Thornes Publishers		Watson	Miss	N		CR	O	1				1												0.83	0.101
	Nelson Thornes Publishers		Wheelwright	Miss	C		CR	O	1				1												0.83	0.101
	Pearson Education		Wren	Miss	L		CR	O	1				1												0.42	0.051
	Kantonsschule Wettingen, Switzerland	Geographie	Forster	Mr	T		CR	O	1				1												0.44	0.054
	Space Consulting SA, Greece		Giavi	Mr	V		CR	O		1			1												0.71	0.087
	University Of Oslo, Norway	Mathematics	Gjevik	Prof	B		CR	O	1																0.47	0.057
	Geofysikk Institutt, Bergen, Norway		Gronas	Prof	S		CR	O	1																8.19	1.000
	Iceland (Individual)		Olafsdottir	Mr	U		CR	O	1				1												2.69	0.328
	Virserum, Sweden		Olsson	Mr	B		CR	O	1																2.47	0.302
	Instituto Superior De Agronomia, Lisbon, Portugal	Department Of Forestry	Pereira	Dr	JM C		CR	O					1												20.47	2.499
	VITO - Flemish Institute for Technological Research, Belgium	Centre for Remote Sensing	Piccard	Dr	I		CR	O					1	1											337.87	41.251
	Enel S.p.A., Torino, Italy	Energie Rinnovabili - Unità di Idrologia	Veronese	Mr	L		CR	O					1	1											7.90	0.965
																							3107.87	379.440		

SCIENCE PRIORITY AREAS:
 ELS Earth's Life Support systems
 Climate Change
 Sustainable Economies
 Underpinning Science
 Specific Research

4.5 NEODAAS-PLYMOUTH AND DUNDEE SINGLE-NODE OUTPUT STATISTICS

The majority of projects, users and publications receive joint support of both nodes of NEODAAS, i.e. through data acquired at Dundee and resulting products derived at Plymouth. As a result, the activities of the two nodes are too entwined to allow clear separation of the output performance measures in order to allocate them to each node. With approval of the Steering Committee, it has been agreed that single node output statistics cannot be provided for NEODAAS.

ANNEX 5: NEODAAS PUBLICATION DETAILS - CALENDAR YEAR 2006

NEODAAS publication outputs are listed below and relate to any activities supported individually by the Plymouth and Dundee nodes as well as activities supported by both nodes in collaboration.

NEODAAS staff are in bold.

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ANNEX 6: FINANCE

NEODAAS-PLYMOUTH

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NEODAAS-DUNDEE

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Planned Capital Expenditure

Additional CSCL telemetry receivers of the type already used by the Station will be acquired. Three new receivers will allow us to replace older S-band units which are almost obsolete and an X-band unit purchased from Alcatel which has failed.

There will be routine expenditure on items such as spare/replacement parts for antennas and reception equipment, upgrade/replacement of computer disks, printers etc. Commercial sales income is again expected to covers these requirements.

The current online storage systems hold complete archives of lower rate satellite data such as NOAA and SeaWiFS. They have been in use for the past 4 years and were intended to provide capacity for around 5 years of additional data when first installed. There will be a requirement to replace or upgrade these over the next 1-2 years and as storage costs reduce, the intention is to provide capacity for online storage of all archives including MODIS and MetOp. Available technology and costs must be investigated and expenditure on this will require additional funding.

ANNEX 7: SERVICE MANAGEMENT

NEODAAS-PLYMOUTH

List of staff with role, status, and percentage of time allocated to RSDAS duties:

- Steve Groom, Head of Service (15 % PML funded, B4)
- Dr Pete Miller, RSDAS manager (33%, B5)
- Dr Tim Smyth, MODIS Development (33%, B5)
- Dr Peter Land, ARSF & MODIS Development (33%, B6)
- Dr Jamie Shutler, MODIS & MERIS Development (50%, B6)
- Mr Rory Hutson, Data Analysis (80%, B7)

(2.45 Full-Time Equivalent including Head of Service)

NEODAAS-DUNDEE

Staff Numbers, Grades, Person-years per annum

- 1 Station Director (part time – 0.1 person-years per annum)
- 1 Clerical Assistant (part time – 0.1 person-years per annum)

Total Uo Dundee funded person-years per annum: 0.2

- 1 Grade 3 Scientific Officer/Station Manager
- 1 Grade 2 Software Specialist/System Manager
- 1 Grade 2 Software Specialist/System Administrator
- 1 Grade 2 Research Assistant
- 3 Grade C Technicians (1 for maintenance/occasional station operation, 2 shift operators)

Total NERC funded person-years per annum: 7.0

Scheduled SMAs and Implementation of Recommendations

The facility was reviewed as Dundee Satellite Receiving Station by the Services Review Group (SRG) in January 2002 and was scored on the standard criteria as follows:

- Need 5
- Uniqueness 4.5
- Quality of Service 5
- Quality of Science/Training 5

Average Score 4.88

The SRG also made the following comments and recommendations:

“An excellent facility supporting a wide range of NERC science. SRG recommended that DSRS continue to increase the number of satellites received and data archived and that non-S&F support for capital should be sought where possible. Continue support for five years.”

The next scheduled review as the NEODAAS facility is in 2008.

SUPPLEMENTARY ANNEXES FOR NEODAAS-DUNDEE ONLY

DUNDEE ANNEX

1. Future Developments
2. Targets and Milestones
3. Details of Projects Supported where not otherwise covered
4. Breakdown of User Categories for Cost Allocated Data Requests
5. Details of Equipment Performance/Failure/Repair
6. Publicity Activities
7. Staff Visits, Conferences Attended, Representation on Committees
8. Routine Satellite Tracking Schedule

DUNDEE ANNEX 1 – FUTURE DEVELOPMENTS

Receiver Hardware Upgrades

The Station's two S-band reception antennas are currently equipped with receivers built in Dundee over 15 years ago. They are only capable of receiving NOAA and SeaWiFS transmissions and many of their components are obsolete. The decision has been taken to build new CSCL design programmable receivers to replace the old units. These were primarily designed for reception in the X-band frequency range, but with additional multiplexing and signal conversion hardware they have been successfully tested for S-band reception of NOAA and SeaWiFS data. They offer the versatility to support all of the satellites currently received and planned to be received at Dundee for the foreseeable future in both S and X-band, so support for MetOp and NPP/NPOESS, for example, is included. Two CSCL receivers have been in use on the Station for the past 3-4 years with our main X-band antennas. The receiver designer, Paul Crawford, is now a full-time staff member at the Station, which brings the added benefit of in-house support.

Three new receivers will be built giving us five in total. The third new unit is needed to replace the Station's original X-band receiver, which was acquired from Alcatel around 10 years ago and recently failed (See Optional Annex 5). We will then have a common design of reception chain and interfaces for each of the Station's five tracking antenna systems, simplifying hardware testing and software support and providing major components which can be easily interchanged between systems. The cost of the new receivers and associated hardware will be covered by commercial income generated through sales and project participation.

An on-going and growing problem is interference in the S-band region, primarily from mobile phone base stations operating at 1710MHz and above. This is only 3MHz above the NOAA 1707MHz channel (0.18%) but the power levels can be as much as 40dB above (10,000 times greater) those from the satellite. They are also pulsed in nature, challenging the receiver's filters and gain control systems. The problem is exacerbated for the current NOAA-17 satellite, which has a signal level of only 25% of nominal following a transmitter problem 2-3 years ago. Some dropouts in received NOAA-17 data are therefore more common, though almost all data are still useable.

Some testing of the different receiver types revealed that the older Dundee receivers were better at coping with the interference problem than the newer CSCL all-digital design. As a result, we are investigating the possibility of building a switched analogue filter system for the CSCL receiver to provide better interference rejection along with the multi-mission capabilities of the new design.

In addition, we may need to consider modifying the RF front-end of the S-band antennas for greater dynamic range, as the ~40dB interference peaks we have observed are close to saturating the first stage in the reception chain.

Online Data Storage

Increasing the Station's online storage facilities has been identified as a longer term objective in previous reports and this is an area we would hope to take forward within the next 12-18 months. The benefits of online storage of complete archives have been evident in the past few years since our existing RAID storage systems were set up. They have provided sufficient capacity for the full 30-year archive of lower volume AVHRR data, the SeaWiFS and CZCS archives, plus recent MODIS and some geostationary satellite data. We have taken advantage of this in various respects including easier and more efficient data management (e.g. rapid production of backup copies on

new media to preserve the archive and additional copies for Plymouth and NEODC), immediate web based data access for users, rapid processing/reprocessing of large volumes of data both for delivery to specific projects and to improve the data quality through processing enhancements such as better image navigation.

The existing storage capacity on our RAID systems is adequate in the short-term to continue adding low volume AVHRR data from the NOAA satellites. However, the aim is to have enough capacity in future for online storage of all polar orbiting satellite data including higher volume MODIS and data from new satellites such as MetOp. We would also look to have additional capacity to provide higher resolution polar satellite browse imagery for eligible users and to make 15-minute geostationary satellite data available through the website. We believe these are realistic targets as storage costs continue to fall.

A basic assessment of future storage requirements has been carried taking into account the above targets and allowing spare capacity for an additional 3 years of new data. Replacement of the existing systems (approx 11 Terabytes) has also been allowed for as they will soon have been in use for 5 years. The total capacity to meet these requirements is estimated at around 48 Terabytes.

We would anticipate making a capital funding bid to pursue these targets. The cost of hardware to meet a 48 Terabyte storage solution depends on a number of factors such as technology employed, chosen vendor and ease of integration with existing systems. These would be fully investigated in preparing any bid, but as an indication of potential costs, current prices based on different technologies and vendors range from approximately £50k to £85k (excluding VAT).

General Developments

- The European MetOp satellite has been launched and is due to become operational in the near future. With Dundee already able to receive and process the data (see Mandatory Annex 7) plans to integrate MetOp reception into routine NEODAAS operations must be discussed between the Plymouth and Dundee nodes.
- A Nagios server is being set up for proactive monitoring of the main server, PC, UPS and networking components. Nagios is a host, service and network monitoring program. The system will run regular checks on the Station's equipment and alert staff to problems such as failed software services or hardware. The plan is to extend this facility to monitor environmental conditions inside the main server room and the Station's remote antenna equipment room in the University Tower Building. Neither of these areas is manned and failure of air conditioning systems and resulting impact on equipment is a concern. Environmental sensors will be acquired for both areas allowing the Nagios server to identify and warn of air conditioning failures. This should also allow email and/or text message alarms to be generated for out-of-hours failures, and possibly provide a means of automatically triggering system shutdowns in the event of failure to guard against them producing and operating at harmful temperatures.
- The existing geostationary satellite facilities provide access to an archive of all 6-hourly European Meteosat images collected at Dundee and the last 30 days of similar imagery from foreign satellites (IODC, GOES and MTSAT). Approximately the past 3 years (almost 17,000 scenes) of foreign satellite images are also held at Dundee and the intention is to make these available to users. Some preparatory work has already been carried out and it is planned to make the archive of foreign satellite images accessible in the near future. Storage requirements can be accommodated within the existing set up.
- In the longer term we hope to make 15-minute Meteosat data available to users after a 24-hour delay (EUMETSAT recently confirmed 15-minute data may be published 24 hours after reception). We have been archiving the data for approximately 12 months and can make it

available on request, but the volume of data and current storage facilities prevents us from providing online access. We will continue to collect, archive and catalogue the 15-minute data with a view to providing access if additional storage is procured.

- The new web based image gallery system described in Mandatory Annex 7 will be populated from a catalogue of processed high resolution images and be made accessible to registered users of the website.
- The possibility of transferring early MODIS archive data (approximately 5 years worth) from DLT to LTO will be considered. As well as the various benefits of LTO, this would mean that all DSRS data are archived in a consistent way using the same media.

DUNDEE ANNEX 2 - TARGETS AND MILESTONES

Service Capacity and Equipment Utilisation

For cost allocation purposes service capacity is measured in terms of available operator time (i.e. Shift Technicians), with other staff carrying out supporting activities, e.g. management, software/systems administration, maintenance and clerical duties. There was traditionally a trade off between the tasks of data reception/archiving, servicing user requests and archive maintenance work, but with greater levels of automation, all available standard passes from the operational satellites are now included in the routine reception schedule with scope for additional passes if required.

In 2006/07 approximately 35% of operator time was related to initial data reception/archiving and associated activities. Remaining capacity was mainly associated with providing data products cost allocated to users either directly or via Plymouth.

The satellite reception systems were used daily throughout the year. Data from 5510 NOAA and *SeaWiFS passes were received out of 5519 scheduled (success rate of 99.84 %), yielding around 390 gigabytes of data. MODIS data was received from 4587 Terra and Aqua passes out of 4608 scheduled (success rate of 99.54 %), yielding around 3 terabytes of data. Success rate figures do not include scheduled passes (or partial passes) not received for reasons outwith the control of the Station, e.g. satellite problems and broadcast interruptions by the satellite operator (see Optional Annex 5 for details).

(*SeaWiFS passes received for the year are stored in encrypted form but cannot be processed or distributed due to the current licencing situation.)

The effects of system failures, maintenance and downtime etc. are minimised by reorganising operations and making full use of available systems, e.g. two antennas are scheduled to track and record from the same satellite where possible. For NOAA satellites, where there is a failure to receive a scheduled pass, it is sometimes possible to take a replacement pass covering a similar area from one of the standby satellites. The willingness of staff to work out of hours and repair problems as they arise is another contributing factor to maintaining operations. Periods of system downtime are documented in Optional Annex 5.

Response Times and Data Delivery

All new data received at Dundee are delivered in near-real time to Plymouth for processing. This is particularly important for near-real time support of research cruises. Registered users of the web site also have access to current/recent data in near-real time.

For AVHRR and SeaWiFS data, the entire archives are online and can be accessed immediately via the web for eligible users requiring standard data formats. MODIS archive data must be restored from archive tape and processed for users on request.

Archive data requests from Plymouth are given highest priority and requests from users are given priority over other activities. Delivery times depend on workload, image search times, processing requirements, volume of data requested etc. In most cases, data delivery is within 1-2 days. Particularly large requests can be dealt with in batches with the first delivery within a week or two. No customer complaints were received in relation to response and delivery times.

User Satisfaction

Some recent, general comments from users are listed below. These are mainly received in the form of unsolicited feedback via the website, with many from non-scientific users and the general public.

- I am on the faculty in the department of meteorology at Penn State University. I would like to thank you for your Web site that allows my online adult students in tropical meteorology to access quality images over all the ocean basins. Rest assured that your Web site is an invaluable educational tool, and you are making a big difference in the learning of my students. Thanks again. (*Lee Greci, Pennsylvania State University, United States*)
- A contingent of NCAR Research Applications Lab is here in Saudi for a 5-6 month cloud assessment project. We love the quality of your full disk images. They are the best that we have been able to find that covers the region of Saudi Arabia from the Indian geostationary satellite. (*Art Rangno, National Center for Atmospheric Research, United States*)
- We're very happy at the moment. I've not been looking at the images religiously (bit frantic getting everything else ready), but it all looks great. Thanks again for all your support – just to compliment you, Dundee has been the easiest partner to work with! (*Dr Ian Renfrew, Univ. of East Anglia – near-real time imagery provided to support NERC-FAAM aircraft flying campaign for the international Greenland Flow Distortion Experiment*)
- As Pilot Commissioner of the Commonwealth of Massachusetts District 3 which includes the Waters of Nantucket & Vinyard Sounds, Buzzards Bay & Cape Cod Canal your service is particularly helpful for tracking storms that may affect the area. (*Captain John M. Gibbons, Pilot Commissioner D. 3, Massachusetts, USA*)
- Beautifully put together site. Great information and a great design made it very easy to navigate! Thanks! (*User in the UK*)
- On behalf of the Students I have been working with for the past two years and more, may I say a big thank you for the Dundee Satellite station web page. There is so much of interest on this site and so much discussion material we would need so much more time at our disposal...Great quality Images and a well laid out easily accessible site. (*User in the UK*)
- Congratulation for your Meteosat 2nd generation system: the precision of your pictures is fantastic! Thank you for this improvement. (*User in France*)
- The pictures are just amazing! I'm very pleased that we can see Snow, Lake, Fjord and Sea melt. It is particularly clear where we are going this year. Many thanks for your help. (*Prof. Michael Lea, Royal Holloway, University of London – images for NE Greenland expedition*)
- Many thanks for this - the images are superb, and I am sure we shall be able to use these in the display to good effect. Thank you all for your generosity. (*Alasdair Joyce, Senior Museums Officer, Moray Council, Scotland*)
- I am a registered user of this website since 1999. Every time I look at the site I feel I should give too much thanks for keeping this open to all users free of cost. YOU ARE SIMPLY GREAT. I am a simple user of images to show to laymen and amateurs. I do not do any research with the images, but know amateur level meteorology and your site keeps me encouraging users by showing practical utilities of advanced technologies to understand the earth. It is my humble request that you please do not charge for access in future at least for amateurs and general public!!!! Thanks for your new look to the site and all my wishes to all team members. (*Arvind C Ranade, Space Science and Astronomy, Vigyan Prasar – an Indian government science outreach organisation*)
- Our paper has been published in JASTP. Thank you very much for your support having provided the satellite image. It is indispensable to see any causative clouds which would trigger the sprites. (*User at University of Sheffield, UK*)
- A really wonderful site. Looking forward to having more features. Thanks! (*User in United States*)
- A great website. It would be even better if you had TOP TEN pictures of the day. (*User in the UK*)
- I downloaded the images yesterday. They are great and I'll look to choose 2 for the poster. (*User at University of Dundee, UK*)
- I would like to express to you my gratitude for the wonderful service you are providing to people like myself to view the changing weather conditions around the world. I have been viewing APT signals from Meteosat for 20 years plus, but alas this privilege has stopped. So I am very indebted to Dundee University for your excellent service. My brother (also a pensioner) received his registration from Dundee on the same day and is very pleased with the beautiful global pictures that are absolutely stunning in their clarity. Once again many thanks to all at Dundee University for this wonderful service you are providing worldwide. (*User in South Africa*)
- Have been using this wonderful site to access sat-images for many years now with thanks and with growing fascination! Thanks to all for this service. (*Jon Barker, ex British Antarctic Survey and Merchant Navy*)
- I am a meteorologist working with the US Department of Agriculture. I am very grateful for the data you provide via your website, and it has assisted me and my organization in years past. I was wondering if there are any plans to resume hourly image archives of the Indian Ocean. The hourly data is very helpful at assessing duration and intensity of synoptic and monsoon-related rainfall in key agricultural areas of India and Pakistan. Thank you for

your time and efforts. (*Eric Luebehusen, Meteorologist, USDA - World Agricultural Outlook Board/Joint Agricultural Weather Facility*)

- Thank you for the information. The second image is absolutely perfect and I would like a print please, showing the British Isles. Thank you for your wonderfully quick response. (*User in the UK*)
- Thank you very much for the photograph, it is perfect! (*User in the UK*)
- I just checked the downloaded file, everything is fine - I can open it correctly in ENVI, which is my main tool for data processing and visualization. So once again many thanks!
- I am quite content with your satellite pictures. I use them everyday not only in meteorological respect, but they are also very well produced and therefore an aesthetic joy. Many thanks for your good job. (*User in Germany*)
- Best images I have seen! You have the distance and resolution appropriate to the scanner.
- Thanking you sincerely for the use of the web site. Exceedingly helpful and educational site for grandchildren. (*User in the UK*)
- Wonderful pages! Keep up the great work. (*User in Finland*)
- We are indebted to you all at Dundee Satellite Station. I use the information while I am working with more difficult young people. The primary reason for this is to show examples of how the world in which we live is constantly changing hour by hour, minute by minute and even more quickly. We take great delight in trying to anticipate and spending time analysing the information. Thank you so much. (*User in the UK*)
- I am deeply impressed with your work and have now finished an ice chart for the Coast Guard. As the ice will be here for the next few days at least I would like to order images for the next two weeks, if possible. (*Dr Ingibjorg Jonsdottir, Institute of Earth Sciences, University of Iceland*)
- I am a recent graduate Meteorologist from the University of Reading where we found your website very useful in our work and research. I have now set up a personal (non-commercial) website for my UK thunderstorm research and photography and am asking your permission to use some "quicklook" imagery for featured thunderstorm event pages. (*Mark Seltzer, Director of www.ravenstorm.co.uk*)
- Good work. Thank you for the good quality images. Cyclones are very dangerous for us here but the water they bring is very important for or survival. (*User in Mauritius*)
- May I send you all a great big Thank you for the wonderful site you have. My client group have a keen interest in your vigorously updated site and we ALL have excellent discussions about the information you so professionally collate and allow us to view. (*User in the UK*)
- I highly acknowledge your services to mankind. Thanks to all your team for providing such a good service. (*User in India*)
- My sincere thanks for accepting my registration. Being in a faculty of meteorology, your cloud imagery gives us valuable information regarding location of systems and movement of clouds etc.
- Looks a very interesting site. Just starting to find my way around it. Bought a Collins gem "Weather" to help me interpret the satellite pics. (*User in the UK*)
- Just like to thank you people for the good work you're doing. I'm a Dutchman living in South-western Sydney, and am browsing your website images for cloud development coming from the Indian Ocean this way, and on the look-out for any 'lows' bringing much needed rain towards our eastern states. (*User in Australia*)
- I look at your images every day. I am very impressed with Meteosat Second Generation images. (*Canadian user living in the US in winter*)
- Thank you very much for the information and to your colleague who is also helping me. It is nice of you to have spent time helping me with my research. I am grateful for this. (*Undergraduate Student in Switzerland*)
- Some of these images are amazing! (*User in the UK*)
- Glad to fall back on your site – Bern University seems to be out of town looking for snow... Thank you. (*User in Switzerland*)

Web Statistics

A new website for the linked NEODAAS facility is under development and a key feature will be a common portal for access to data and products at both Plymouth and Dundee.

The existing facilities on the Dundee website are maintained and continue to contribute to science communication activities. They provide anyone with free access to information and non-scientific products such as reduced resolution browse imagery. The information below relates to the freely available facilities on the Dundee site.

Total number of user registrations: 301,576 Registrations for the year: 25,511
 Total requests/page hits for the year: 23.0 million Image requests for the year: 5.9 million

Breakdown of user categories for all registrations:

User Category	%
NERC or UK Higher Education project	16 %
Education	10 %
Research	7 %
Commercial	3 %
Personal interest	62 %

Website growth:

Year	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07
User registrations during the year	17,433	18,999	20,827	26,490	26,111	22,228	29,253	34,998	39,337	40,389	25,511
Total number of user registrations	17,433	36,432	57,259	83,749	109,860	132,088	161,341	196,339	235,676	276,065	301,576
Pages hit & image requests (million)	2.4	3.5	6.0	7.2	11.7	13.0	23.0	18.0	20.3	24.5	23.0
Image requests (million)	-	-	-	-	4.25	5.51	13.3	7.0	7.8	7.7	5.9

Notes:

Figures for page hits and image requests reduced after 2002/03 following introduction of password access to geostationary satellite images. These were previously available without registration, so demand dropped as some users are reluctant to register or have technical issues. For the same reason, the number of registrations increased in the next three years.

The reduction in image requests for 2006/07 is likely to be a result of changes in availability of Indian Ocean geostationary satellite images. These were previously transmitted on an hourly basis and widely used in that region during Monsoon season, for example. They are now only available on a 6-hourly basis despite requests to EUMETSAT. The overall number of image requests is still substantial, however.

Summary of Internal R&D Output

The following includes progress with items targeted in previous reports.

- One of the most significant events of the past year was the launch of the EUMETSAT satellite MetOp-A in October 2006 after several delays due to launch vehicle problems. This is the first European operational polar orbiting meteorological satellite. The MetOp series will provide the joint European/US polar system together with the ongoing NOAA series and future NPOESS satellites. MetOp's instrument suite includes the AVHRR and it is therefore of great importance to Dundee in continuing this data set. The Station had been preparing for MetOp for some time and a significant amount of new software and hardware development was already in place (details below), though a lack of documentation from EUMETSAT meant delays in all systems being functional until after real data was available.

On 25 October the AVHRR scanner was switched on with VIS data only and Dundee was the first site to post an image from this broadcast, though not the first to receive AVHRR data, as switch-on took place slightly beyond our horizon. Unfortunately, MetOp experienced some early problems, including two periods when direct broadcast of A-HRPT data, which includes full resolution AVHRR, was off. The decision was also taken to permanently turn off the LRPT, which includes low resolution data, due to on-board interference problems. Dundee receives A-HRPT, however, and this will be fully operational in future. MetOp was still in the commissioning phase at the time of writing and is due to become operational in May 2007.

- A significant amount of work was carried out in preparation for MetOp. Although the satellites continue the NOAA heritage with the AVHRR instrument, almost everything about the data transmission is different. This required upgrade of reception and processing chains, including receiver and data ingest hardware, ingest, real-time display and network transfer software and processing of the instrument data. An important step was to have all reception chains in alignment running the same software. Different versions had been in use previously, but all antennas now have identical software for easier use and future upgrades.

In spite of some difficulty obtaining information from EUMETSAT, MetOp reception was possible when transmissions began and refinements have been carried out subsequently. As overpass times can clash with the operational NOAA satellites, the Station's temporary 1.2m tracking antenna has been set up for MetOp reception to avoid any impact on normal operations. One of the data ingest computers was also upgraded to a dual-ingest system so that it can simultaneously ingest NOAA and MetOp data if necessary during orbit clashes. This system was even successfully tested with simultaneous NOAA, MetOp and MODIS ingest from three different antennas, which could prove useful in the event of failures.

- Received MetOp data are initially processed to a rather generic level-0 format, which may not be useful for most users. Dundee has developed software to process this to EUMETSAT's level-0 format and resulting files have been validated for compliance by EUMETSAT. Dundee has also developed a unique utility to convert the AVHRR data to HRPT format, which is much more widely understood by users. This means data can be run through "Landmark" processing used at Dundee for accurate coastline registration. It can also be converted to standard level-1b format requested by most users and used to create calibrated and reprojected data and images.
- Other work was undertaken to make data available in new and improved file formats. MODIS data was previously only available in HDF format, but is now supplied in HDF-EOS format and is better calibrated. AVHRR data was not previously available in HDF format, but conversion software has been written for this, and will be especially useful because of the different orbital

model used by MetOp AVHRR. Both MODIS and AVHRR data can now be supplied in GeoTIFF format. Geolocation and calibration information is available in HDF and GeoTIFF formats. AVHRR data can also be supplied in Autosat format, which is not common but used by the Met Office.

- During one of the broadcast outage periods for MetOp A-HRPT data, Dundee tried and succeeded in receiving the MetOp X-band data dump using the Station's normal X-band antennas. This is a high rate (60Mbit/sec) broadcast intended for the EUMETSAT primary reception site in Svalbaard (Norwegian Islands, around 78N) and reception in Dundee was a surprising achievement. We can only ever see around 60% of the data due to the dump period being partly beyond our horizon. However, depending on user interest, further investigation could be carried out to determine the geographical coverage which Dundee could provide with this data, and whether it would be feasible for the Station to receive this routinely.
- Repair work was carried out on the Dental Building 2.8m X-band antenna following problems during the latter part of 2005/06. As this was the first version of the Station's X/Y design antennas and involved major dismantling and reassembly, the decision was taken to undertake other upgrades and improvements at the same time. These included replacement of both shaft encoders and their mounting/coupling arrangements for improved reliability and compatibility with the other X/Y antennas. Complete rewiring of the antenna pedestal with an improved layout was also carried out to reduce problems and for easier maintenance.
- Various small, but useful improvements have been made to the software used to control and schedule the tracking antennas. A number of these changes were intended to help with multiple antenna/multiple receiver systems to optimise use of the systems when a number of satellites are simultaneously within range of the Station.
- Some work on theoretical and practical applications of the de facto 'standard' SGP4 satellite orbital model was done with a view to improving and standardising the satellite tracking code in use. This resulted in a brief presentation "International best practice for using two line element sets", P. Crawford, D. Vallado, R. Hujsak and T. S. Kelso, 57th International Astronautical Congress (2006), Valencia, Spain, 2-6 October, and the paper "Revisiting Spacetrack Report #3" by David A. Vallado, Paul Crawford, Richard Hujsak, and T. S. Kelso (American Institute of Aeronautics and Astronautics paper AIAA 2006-6753).
- The MetOp satellite also broadcasts orbital elements in SPOT format, with higher short-term accuracy than Two-Line Elements (TLE). Additional work has been done to make use of those elements for more accurate image navigation and on the accurate conversion from SPOT to TLE. As this is an area of wider interest, it is planned to publish the work in due course.
- Two new Sun Fire T2000 server computers were purchased and installed as planned. They are now used to provide the Station's web service. This was previously provided by an older machine along with various other services such as job processing, mail, NIS and FTP and each service had been suffering as a result. The new machines are identical computers and intended to give as high web availability as possible. After migrating the website to the new hardware, improved performance was immediately apparent and a significant load reduction on the original machine was noted. Another advantage of the identical computers is that upgrades can be performed with the offline system and services moved over while the other machine is upgraded. This has been a great benefit as operating system upgrades, for example, can take many hours. It also gives scope to experiment in areas such as database and clustering technologies without impacting on a running service.
- During 2005/06, the Station began archiving all newly received MODIS data on LTO-3 tape (400 Gbyte storage capacity) in preference to DLT tape. Advantages of LTO include increased capacity, better error recovery, robustness, media costs and a planned development path. We had also encountered DLT problems with both drive and tape failures. The move to LTO was also intended to address the issue of the ageing CD-ROM archives of lower volume AVHRR and SeaWiFS data. Complete LTO copies of these were prepared towards the end of 2005/06,

replacing several thousand CDs with only 12 LTO tapes. Subsequently, additional LTO copies of the AVHRR and SeaWiFS archives have been prepared and delivered to NEODC and NEODAAS-Plymouth. They replace the secure off-site CD archives at NEODC, drastically reducing fire-safe storage requirements which had become a problem, and provide Plymouth with local copies of the full archives for the first time to support routine operations there.

- AVHRR data are now routinely archived on LTO, which standardises the archiving procedure for all new data. An automated procedure has been developed to archive the data to tape and update a database containing information on file location and tape/track numbers. The previous system of archiving new data on CD continues at present for added security. One CD copy is produced and a copy of each full LTO will be prepared as they become available and sent NEODC for secure storage.
- Software development work on the planned image gallery for the website has been completed. This will be a significant improvement on the existing static webpage, which has a very limited selection of images from the archive showing interesting features. The gallery has a database driven approach, allowing users to easily search through specially prepared high resolution images from the archive based on criteria such as feature type, date and region of interest. It will highlight the range of applications for Dundee data, enhance the website's educational value and provide an excellent source of illustrative material for academics, teachers and publishers etc. Functional development is complete, including security aspects and setting up of a dedicated server. The gallery is currently being populated from an extensive collection of images prepared by the Station Operators and is expected to be made accessible to registered website users within a few weeks.
- The geostationary satellite image service was updated throughout the year to allow for the launch of new satellites and relocation of existing ones, e.g. Meteosat-9 replaced 8 and the first generation Meteosat-7 was relocated for Indian Ocean coverage. The current service offers access to all European Meteosat Second Generation (MSG) archive imagery and the last 30 days of imagery from foreign satellites (IODC, GOES and MTSAT). However, approximately the past 3 years worth of foreign satellite images are held at Dundee and the intention is to make these available also. In preparation, recent work has seen the archive purged of corrupt and incomplete scenes, setting up of automated archiving of data on LTO and an archive database established.
- General system administration included the patching of operating systems, replacement of failed components or system units and installation of new hardware as required. A number of hard disks failed in the Station's main RAID systems which provide online storage for the full AVHRR and SeaWiFS archives and other data. There were also a number of incidences of file corruption with these systems, and these were identified and fixed.
- All machines run local firewalls. These have been updated with new rules and policies to reflect the changing nature of the Station's network and to guard against failures of the access control on the main network switches. Intrusion detection software has been installed on a selection of machines as a further security measure.
- To minimise the impact of hardware failures, all new databases are backed up in real-time on another system.
- Extensive testing of open source load balancing and high availability systems has been undertaken in an effort to find a solution to provide a level of redundancy for the Station's IT systems. Such systems would be of benefit in the event of component failures and during periods of operating system patching and upgrades, for example.
- New lead-acid battery cells were purchased and installed in the Station's main Uninterruptible Power Supply systems, including the additional battery backup modules. The cells have a recommended replacement cycle of 4-5 years. A total of 200 cells were installed.

- The Station undertook some additional work for the ESA CONTRAILS project. The original specifications only called for contrail coverage of the US East coast to be assessed for the years 2000 and 2004. It was later decided that for consistency, this area should be assessed for every year of interest, as had been the case for European and North Atlantic areas. The Station acquired additional US East coast coverage data for 1985, 1990 and 1995 from the NOAA-CLASS archive, processing the data and delivering resulting contrail maps to project partners for analysis. This was the final Dundee contribution to the project.
- The Dundee archive catalogue has been part of the NASA EOS-IMS service for some years. Services such as this provide global search tools for those searching for EO data. IMS is migrating to a NASA system named ECHO. This requires a different way of providing catalogue search results. Discussions with NASA staff have taken place with a view to making Dundee data accessible via ECHO, but are on hold because of internal NASA matters. Similarly, ESA's Service Support Environment (SSE) aims to integrate catalogues from remote sensing organisations by hosting search servers at each site. A funding proposal to integrate the Dundee catalogue into SSE was unsuccessful, but opportunities in future funding rounds will be monitored.
- Online quicklook browse imagery was produced for all AVHRR and MODIS data received during the year. The entire archives are available in quicklook form for free online browsing.

Online browse image availability:	AVHRR	-	1978-present
	CZCS	-	1979-1986
	SeaWiFS	-	1997-2004
	MODIS	-	2000-present

DUNDEE ANNEX 3 - DETAILS OF PROJECTS SUPPORTED AND NOT OTHERWISE COVERED

The research cruises in the table below received near real-time support through NEODAAS using satellite data received directly at Dundee.

Dates	Project	Scientist(s)	Ship/Cruise
2006-03-25 to 2006-04-01	Irish Sea: Menai Bridge to Liverpool Bay area, taking GC-MS and measuring VOCs in surface waters and water column profiles.	Claudio Bravo & Dr Stephen Mudge, UWB	Prince Madog
2006-06-20 to 2006-07-09	NOCS: Core Strategic Research BICEP, EC ANIMATE PAP site in N. Atlantic (49 N, 16.5 W), Falmouth to Cork. Biogeochemistry and benthic biology.	Prof Peter Burkill, Drs Richard Lampitt and Adrian Martin, NOCS	Discovery 306
2006-07-11 to 2006-07-21	Univ. Wales Bangor: The structure of turbulence in shelf seas. Irish Sea.	Prof John Simpson, UWB	Prince Madog
2006-07-29 to 2006-07-29	MBA/PML: Trace metal speciation changes during a coccolithophore bloom. South of Cornwall.	Dr Declan Schroeder	Plymouth Quest
2006-11-06 to 2006-12-14	Surface Ocean - Lower Atmosphere Study (SOLAS): Deep Ocean Gas Exchange Experiment (DOGEE). North Atlantic, natural slicks.	Prof Rob Upstill-Goddard, Univ. Newcastle	Discovery 313
2007-03-21 to 2007-04-12	Surface Ocean - Lower Atmosphere Study (SOLAS): Field Observations of Sea Spray, Gas Fluxes and Whitecaps (SEASAW). UK to West of Scotland to Lisbon.	Dr Ian Brooks, Uo Leeds	Discovery 317

In addition to the above, four other cruises received near-real time support on a “commissioned research” basis.

Examples of projects/organisations that have received imagery or services on a commercial basis or limited free access to support non-commercial and educational activities:

- Over 10,000 scenes from the AVHRR archive were processed and delivered to the Flemish Institute for Technological Research (VITO). They are being used to create daily reflectance, radiance and brightness temperature composites and derive vegetation and crop yield indicators. This is for an EC Joint Research Centre project as part of JRC's MARS (Monitoring Agriculture with Remote Sensing) actions. The data from Dundee extends and fills gaps in an existing archive. MARS-STAT uses remote sensing information in combination with models to derive crop yield estimates and forecasts in support of the EC Agriculture Directorate and EU agricultural policy.
- A final contribution to the ESA Contrails project was made. Data for 1985 and 1990 were acquired from the NOAA-CLASS archive to provide additional historical coverage of the US East coast area. The data were processed using the previously implemented contrail detection algorithm and resulting contrail maps were delivered to partners DLR and KNMI for analysis.
- Fire and burning biomass studies on continental and global scales using remote sensing and GIS – Department of Forestry, Instituto Superior de Agronomia, Lisbon, Portugal.
- Snow monitoring for hydrological studies – Unit of Hydrology, Enel SpA, Turin, Italy.
- Spatio-temporal fire patterns in Portugal: The role of fire on landscape processes and patterns - impacts, risk assessment and fuel dynamics – Tropical Research Institute (IICT), Lisbon, Portugal.
- Assessment of snow and ice cover of Krumme Langso national park NE Greenland to support an informal expedition making wildlife observations – expedition authorised by and will report to the Danish Polar Centre – Prof Mike Lea, Royal Holloway, Univ. of London
- Geostationary satellite images used for research in to earthquake clouds and short-term prediction – Earthquake Prediction Center, New York.
- Development of natural disaster prediction procedures using thermal geostationary satellite images – Shanghai Fudao Natural Disasters Prediction Technology Developing Co., China.
- Strongly stratified atmospheric easterly flows over Svalbaard and wake effects of the islands – Mathew Reeve, Masters Student in Meteorology, University of Bergen, Norway.
- Feedback from Universities of Leeds and Reading indicates imagery is routinely used in discussion forums. The forums provide an opportunity for academics and students to discuss topical meteorological events. The group at Leeds also have an associated web site with links to relevant Dundee imagery and have been provided with access to high resolution imagery.
- Access to data to support investigations of meteorological events and publication of results in a Dutch weather amateur journal – Ton Lindemann, The Netherlands.
- Sequence of high resolution images to support climate anomaly research in the region of Barcelona and specifically the development of tornadoes and waterspouts – Manuel Massague, Amateur Weather Enthusiast/Professional Photographer, Barcelona, Spain.
- Test data provided for development of processing software for non-commercial use by weather enthusiasts and members of the Remote Imaging Group for example – Satsignal Software.
- Free quicklook Web images are used operationally by national weather services, e.g. Irish, US, Dutch, Danish and Czech services are known to use images for analyses.
- Various organisations such as the UK Met. Office and Irish Met Service use imagery for illustrative purposes in reports and articles.

DUNDEE ANNEX 4 - BREAKDOWN OF USER CATEGORIES FOR COST ALLOCATED DATA REQUESTS

The following table indicates the number and percentage of users within each category. Since commercial user requests often involve small amounts of work, the percentage of work done in servicing data requests for each category is listed to give a fairer reflection of how work is distributed – this information was extracted from the cost allocation return.

User Category	Number of Users	Percentage of Users	Percentage of Data Request Work
NERC	29	40.85 %	68.33 %
HEI	18	25.35 %	17.74 %
FEC	15	21.13 %	1.65 %
FECOS	9	12.68 %	12.27 %

NERC NERC Institutes or Grant Funded FEC Full Economic Cost (Commercial Sales)
 HEI Higher Education Institution (Free access) FECOS Overseas (Commercial Sales)

DUNDEE ANNEX 5 - DETAILS OF EQUIPMENT PERFORMANCE, FAILURE AND REPAIR

In the event of equipment failure, backup systems and/or prompt repair usually ensure that the effects on operations and services are minimal.

Main points for the year:

- No. of passes received: NOAA – 4664 * SeaWiFS – 846 MODIS – 4587
- No. of full passes lost: NOAA – 8 SeaWiFS – 1 MODIS – 21
- Success rate: NOAA – 99.83 % SeaWiFS – 99.88 % MODIS – 99.54 %

* SeaWiFS passes received for the year are stored in encrypted form but cannot be processed or distributed so far due to the current licencing situation.

Note: Success rate figures for data acquisition do not take account of data losses due to spacecraft operations and problems.

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- Repairs and upgrade work on the Dental Building 2.8m X-band antenna were completed. This followed previously reported shaft encoder problems with the antenna during the latter part of 2005/06. As this was the first version of the X/Y design antennas and encoder replacement required major dismantling and reassembly, the decision was taken to carryout other improvements (See Mandatory Annex 4). The work involved combined with poor weather meant the system was not re-commissioned until late April 2006.
- During the extended downtime period for the antenna mentioned above, the Tower Building X-band antenna and Ewing Building backup antenna were used to maintain normal MODIS reception schedules. Unfortunately, problems then developed with the Tower antenna before the Dental system was re-commissioned, resulting in intermittent failures over a few days and which accounted for over half of the lost MODIS passes for the year. The cause was water ingress into an antenna wiring junction box and cables. All affected cables and the junction box were

renewed. The junction box layout was also modified to reduce the risk of similar incidents in future.

- A fault in an underground high voltage cable caused a 6-hour mains power outage across the University campus. The Station's UPS systems maintained operations for around 90 minutes before an automatic controlled shutdown. Scheduled passes continued to be received before the shutdown, but a total of ten NOAA, SeaWiFS and MODIS passes were subsequently lost before power was restored.
- The first three NOAA passes of 2006 were lost because of a software bug producing a date change failure from December 31st to January 1st on the NOAA antennas. Each antenna was operating with a tracking schedule for the wrong date until staff arrived and corrected them. This problem had been noted before and has been rectified and tested.
- A small number of other passes were lost due to brief network faults and tracking or data ingest computer crashes.
- The Station's first X-band receiver failed towards the end of 2006. This was acquired in 1998 from Alcatel and was the only unit available for MODIS reception when these data were first transmitted. The receiver has limitations such as lack of versatility to receive from a wide range of satellites. It has also proved expensive to maintain and upgrade with factory returns to Belgium required. Rather than fund another repair, the Alcatel will be replaced by a new CSCL design receiver (See Mandatory Annex 4). The loss of the Alcatel has had no impact on operations, as it has mainly been used with the backup MODIS antenna in recent years and another CSCL test receiver has been loaned to the Station in case of emergencies.
- There were various computer hardware failures throughout the year. The most common items to fail are cooling fans, power supplies and hard disks. The usual cause for power supplies and fans is wear through constant use. This can also be true of hard disk mechanical parts, but it is more common for the disk surface to wear and stop holding data reliably. The Station's file servers mark a disk as bad in this case so that it can be swapped at a convenient time without loss of data.

Spacecraft operations and problems were also responsible for data losses or reception of corrupted data. These are summarised below.

- Degraded performance of the transmitter on NOAA-17 means that output power is about 25% of the nominal level. The weaker signal level also makes reception from NOAA-17 more susceptible to known sources of local interference and minor data dropouts are noted as a result (See Mandatory Annex 4).
- Data losses for Terra and Aqua are more common:
 - There are routine transmission breaks for Aqua while high rate data are downlinked to the NASA site at Svalbard. This also occurs occasionally with Terra.
 - Some short transmission breaks occur with Terra close to the Madrid area to avoid interference with NASA Deep Space Missions
 - Data are occasionally unavailable due to spacecraft manoeuvres.

DUNDEE ANNEX 6 - PUBLICITY ACTIVITIES

- The Satellite Station makes a significant contribution to science communication activities through its website. This provides general information about Station operations and satellites, plus links to many related sites. The most popular feature is the free browse imagery created in near real-time from data received at Dundee. This includes imagery for the entire archive of over 100,000 recordings from various polar orbiting satellites extending back to 1978. Recent images from geostationary satellites are also available and provide global coverage of the Earth. The site is popular with all categories of user including researchers, teachers, students and the general public. The images are also used operationally by satellite operators, national meteorological services, flight planning services and airline pilots for example.
- The Station provided a display alongside that of the Remote Sensing Data Analysis Service at the NERC Earth Observation Conference, Edinburgh in June 2006. A joint display was subsequently provided at the RSPSoc, Cambridge and Challenger Marine Science, Oban conferences in September 2006 to promote the linking of the two facilities to form the NEODAAS facility.
- Display materials are being provided for a reception area terminal at the Research Council Offices in Swindon. A dedicated web page presenting the most recently received satellite pass has been set up for this, as well as a PowerPoint presentation loop with a gallery of processed images. The images were chosen to illustrate science applications of data received at Dundee.
- The Station participates in University open days and pre/post application visits by prospective students etc. Regular visits are also arranged for individuals and groups interested in the Station. In the past year, these have included visitors from industry, academics, students and school pupils of all ages from primary to senior pupils participating in the University Summer School. Approximately thirty members of the Astronomical Society of Glasgow were also given a tour of the Station in May 2006.
- In some cases, school and further education staff are provided with free online access to high resolution imagery to support teaching. These facilities have also been provided for other groups such as the Air Training Corps to teach Air Cadets and the Met Office College to educate forecasters and trainee forecasters. In the latter case, students work towards a recognised qualification by World Meteorological Organization standards.
- On request, information and imagery is provided to teachers and individual pupils to assist with GCSE and class projects.
- National television and online news and weather broadcasters in the UK (ITN, BBC and GMTV), Ireland, Denmark, Norway, The Netherlands, Switzerland, Greece and Israel have been granted permission for occasional use of online quicklook imagery.
- A number of images are included in the Science Photo Library catalogue and are available for purchase.
- Requests for permission to use selected quicklook images on other websites are received on a regular basis and are normally granted subject to suitable credits being provided.

There are many examples where images are used as illustrations in books, magazines, CD-ROM's, newspapers etc. Those for 2006 are listed below – authors, publishers etc. are requested to credit NERC and the facility in all cases.

'Weatherbytes' published by UK Met Office – educational DVD of 5 minute films aimed at teachers and students for GCSE and A-Level studies of weather and climate.

'Weather: Spectacular Images of the World's Extraordinary Climate' by Storm Dunlop, published by Cassell Illustrated, September 2006 – contemporary reference book on weather.

'Key Geography New Foundations' published by Nelson Thornes, February 2006 - Educational textbook.

'Nature Activities – Weather Watcher', by John Woodward, published by Dorling Kindersley, March 2006 – Key Stage 2 Science book.

'Exploring Science Y9 Activebook' by M Levesley, published by Longman, March 2006 –Key Stage 3 Science book and interactive CD-ROM.

'AQA Science GCSE Foundation', published by Harcourt, March 2006 – GCSE Science textbook

'Nature Activities: Weather Watcher', published by Dorling Kindersley, April 2006 – National Science curriculum Key Stage 2 activity project book.

'Understanding GCSE Geography' by Ann Bowen and John Pallister, published by Harcourt, July 2006 – GCSE Geography textbook.

'AQA (B) Advanced Geography (2nd edition)' by David Redfern and Malcolm Skinner published by Philip Allan Updates, September 2006 – AS and A2 Geography textbook.

'OCR (B) GCSE Geography' by Michael Raw, published by Philip Allan Updates, September 2006 – GCSE Geography textbook.

'Wider Ground' by Derek Polley, published by Colourpoint Books – images used in whiteboard resource to accompany the GCSE Geography textbook for Northern Ireland market.

'Geography 360° Interactive Assessment CD-ROM 2' by Colin McCarthy and Stephen Sibley, published by Harcourt, May 2006 – GCSE Geography interactive CD.

'Revise Wise Geography', published by the Educational Company of Ireland, October 2006 - Junior Certificate textbook.

'Key Geography New Foundations' (Virtual Learning Environment), published by Nelson Thornes, November 2006 – CD version of Geography textbook.

'Key Geography New Foundations' (Just Click), published by Nelson Thornes, November 2006 – CD version of Geography textbook.

Mitchelson-Jacob, E.G., INTERREG IIIA: Methods of Assessing Trophic Status in the Irish Sea (MATSIS), University of Wales, Bangor, 2005.

Naudin, J.-J., Suivre les eaux du Rhône en Méditerranée occidentale (To follow water of the Rhone to the Western Mediterranean), Institut National des Sciences de l'Univers (INSU), 2006.

PML, Data Integration System for Marine Pollution and Water Quality (DISMAR), in *Plymouth Marine Laboratory Annual Review*, p. 17, 2006.

Smyth, T., Video exhibit on satellite remote sensing, National Marine Aquarium, Plymouth, 2006.

Promethean Technologies Group – images used for Key Stage 3/4 Geography training courses for teachers (non commercial).

Oxford and Cambridge Schools and Royal Society of Arts (OCR) – images to be used in OCR exam paper.

Edexcel Ltd. – online publication of images in past exam papers.

Educational Company of Ireland – images for Ordinary Level Geography sample exam paper.

Institute of Physics – Teachers workshop held at Department of Meteorology, University of Reading, April 2006.

Cheltenham Science Festival, June 2006 – images and web access available for a joint NERC and BNSC display stand.

Falconer Museum, Moray Council, Forres – images for a display including local weather and climate.

INTECH Science and Discovery Centre, Hampshire – images for display.

'GAP Response – European Windstorm Kyrill' report published by Natural Hazards Team, Benfield Ltd, January 2006.

National Environmental Technology Centre – images used in a short report for DEfRA regarding a UK air quality event, May 2006.

‘Triple Helix’ – international journal forum for students – permission granted to UCL based co-editor to reproduce images.

‘Surf’s up! A celebration of the life of surfing in Britain’ – exhibition by the Royal Albert Memorial Museum, Exeter in conjunction with the National Maritime Museum, Cornwall. March 2005 to late 2006 – travels to Falmouth, Swansea, Barnstaple, Bournemouth and Bristol. Imagery also used for a website accompanying the exhibition and learning materials for schools.

‘A Sea Change’ by Mark Stubbs, published in US Guideposts magazine, July 2006 – article on ‘Pink Lady’ trans-Atlantic rowing attempt and rescue.

‘Everest: Beyond the Limit’, produced by Tigress Productions, broadcast November 2006 USA, UK broadcast to follow – images for Discovery Channel TV documentary series.

BBC News online, 23 August 2006 – ‘Firefighters battle Greek blaze’ – image used in news item.

‘Kathimerini’ (Greek English language newspaper and online), 24 August 2006 – ‘Fires devastate more of Laconia and Cassandra’ – image used in news item.

Yedioth Internet – Israel's leading news and content website – permission granted to reproduce images on a daily basis.

Weather information website for sailing enthusiasts in Greece and & Turkey – permission granted to reproduce images.

Amateur weather enthusiast website on noctilucent clouds – permission granted to reproduce images.

‘Comando Tibidabo’ – website providing information on Barcelona’s weather and climate – permission granted to reproduce images.

‘Dockwalk’ (marine magazine), September 2006 – images used in article by Mike Broughton and Clemency Williams.

‘Downstream’ published by Federation of Petroleum Suppliers, 2006 – magazine for independent oil distributors in UK and Ireland.

npower employee magazine, Winter 2006 – image used on magazine cover.

GVA Grimley LLP – images provided for use on company brochure and report covers.

‘Freefall’ published by Advanced Analytic 2006 – satellite simulator software designed to run as a screen-saver.

DUNDEE ANNEX 7 - STAFF VISITS, CONFERENCES ATTENDED, REPRESENTATION ON COMMITTEES

S Parkes - representation on CCSDS (Consultative Committee for Space Data Standards) panel 1K.

N Lonie attended the British Association of Remote Sensing Companies Workshop, London in April 2006.

N Lonie and N Kirby attended the NERC EO Conference, Edinburgh in June 2006

S Parkes and N Lonie attended the Remote Sensing and Photogrammetry Society Conference at University of Cambridge in September 2006.

S Parkes and N Lonie attended the Challenger Conference for Marine Science, Oban in September 2006.

P Crawford visited EUMETSAT to test receivers on the recorded MetOp transmissions, June 2006.

A Brooks and P Crawford visited satellite a groundstation in New Caledonia and the ESA/EUMETSAT groundstation Maspalomas, Gran Canaria to assist with upgrades in September/October 2006.

N Lonie attended the NERC Earth Observation Centres of Excellence Meeting, London in February 2006.

DUNDEE ANNEX 8 - ROUTINE SATELLITE TRACKING SCHEDULE

Approximate pass times for the current daily tracking schedule are listed in the table below.

Satellite	Approx. Overhead Time (GMT)	Satellite	Approx. Overhead Time (GMT)	Satellite	Approx. Overhead Time (GMT)
NOAA-18	0130	*OrbView-2	1200	Aqua	0100
NOAA-18	0300	*OrbView-2	1330	Aqua	0230
NOAA-18	0430	*OrbView-2	1500	Aqua	0400
**NOAA-18	0600			Terra	1000
**NOAA-18	0900			Aqua	1130
NOAA-17	1000			Terra	1130
NOAA-18	1130			Aqua	1300
NOAA-17	1130			Terra	1300
NOAA-18	1300			Aqua	1430
NOAA-17	1300			Terra	2000
NOAA-18	1430			Terra	2130
NOAA-17	2000			Terra	2300
NOAA-17	2130				
NOAA-17	2300				

* The NASA-Orbimage contract to provide access to Orbview-2 SeaWiFS data expired in December 2004, resulting in the loss of data decryption keys for research receiving stations. Orbimage licencing terms to resume access are currently unacceptable. On the recommendation of the Steering Committee, reception and archiving of encrypted data continues in the hope that acceptable terms will be available later to preserve continuity of the archive.

** These passes provide good coverage of Northern Polar regions. They have been received since early 2007 to provide additional coverage for International Polar Year and possibly beyond.