

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

ANNUAL REPORT APRIL 2008 – MARCH 2009

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 statement
2. Steering Committee Membership & Terms of Reference
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ANNEX 1: MISSION STATEMENT

MISSION STATEMENT

of the

NERC Earth Observation Data Acquisition and Analysis Service

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

NEODAAS will:

- routinely acquire and archive direct broadcast data available from various polar orbiting satellites, specifically the European MetOp series and United States NOAA series, Terra, Aqua and *Orbview-2.
- acquire other satellite data of value to the community and available through subscription to international agencies such as NASA, NOAA and ESA.
- acquire data from the European Meteosat geostationary satellite and data from non-European geostationary satellites relayed via Meteosat.
- supply data and derived products to customers in a timely fashion appropriate to the customer's reasonable requirements.
- provide services *complementary* to those reliably available through NASA or ESA.
- ensure data products meet international standards for formats or quality where defined.
- provide advice on the availability, use and processing of data to ensure efficient use of resources throughout the community.
- operate procedures for access to services, to ensure the best science is supported.
- support NERC public outreach activities.

In order to achieve its mission NEODAAS will:

- operate a satellite receiving station and associated systems at NEODAAS-Dundee to receive, archive and disseminate data from the satellites of interest;
- operate facilities at NEODAAS-Plymouth for processing and analysis of Dundee data and other data acquired by NEODAAS;
- operate facilities for transfer of data between the NEODAAS nodes for processing and analysis at Plymouth – all new polar satellite data received at Dundee to be network transferred to Plymouth in near-real time;
- produce a backup copy of Dundee archive data for routine transfer and secure storage at the NERC Earth Observation Data Centre;
- maintain a Website with access to facility information and browse imagery for registering users including the public, and access to higher level data and products for eligible users;

- maintain awareness of developments in the Earth Observation/data analysis fields, act as a point of contact with agencies such as NASA, NOAA and ESA with a view to acquiring data from future EO satellites, 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 national and international infrastructure in terms of comparable facilities;
- maintain awareness of customer satisfaction and needs through regular contact;
- actively seek funding opportunities for its customers and itself;
- maintain close contact between NEODAAS Plymouth and Dundee staff and with 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 provides 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. Other users include UK/overseas government and commercial organisations, overseas researchers and individuals using freely available Website facilities for personal interest.

* NOTE: Activities associated with the Orbview-2 satellite are subject to data decryption information being available from the satellite operator. Following a change in licencing terms, data received since December 2004 are archived in encrypted form which cannot be processed or distributed at present. NEODAAS continues to acquire encrypted data with a view to obtaining more favourable terms for decryption at some point to extend this archive.

Plymouth Marine Laboratory/University of Dundee/NERC Scientific Facilities and Technology Group
December 2007

ANNEX 2: STEERING COMMITTEE MEMBERSHIP & TERMS OF REFERENCE

MEMBERSHIP AS AT JUNE 2009

Dr Gay Mitchelson-Jacob (Chair) 06/05	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 Gill Malin 06/05	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 06/05	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
Dr Sietse Los 06/09	Department of Geography Swansea University Singleton Park Swansea SA2 8PP	s.o.los@swan.ac.uk Tel: 01792 295144 Fax: 01792 295955
Mr Andrew Fleming 12/07	British Antarctic Survey Madingley Road Cambridge CB3 0ET	AHF@bas.ac.uk Tel: 01223 221451 Fax: 01223 362616
Ms Gisela Ager 06/08	British Geological Survey Kingsley Dunham Centre Keyworth Nottingham NG12 5GG	gjag@bgs.ac.uk Tel: 0115 9363100 Fax: 0115 9363200
Dr Bianca Hoersch 06/08	European Space Agency Via Galileo Galilei Casella Postale 64 00044 Frascati Italy	Bianca.Hoersch@esa.int Tel: + 39 06 941801 Fax: + 39 06 94180371

Ex Officio

Dr Ruth Kelman	NERC Earth Observation Programme Polaris House North Star Avenue Swindon SN2 1EU	rkel@nerc.ac.uk Tel: 01793 411558 Fax:
Dr Steve Parkes sparkes@computing.dundee.ac.uk	Satellite Receiving Station School of Computing University of Dundee Dundee DD1 4HN	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	pim@pml.ac.uk Tel: 01752 633485

	West Hoe Plymouth PL1 3DH	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	mcmman@nerc.ac.uk Tel: 01793 442635 Fax:
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 the Science Delivery Director on aspects of the operations of NEODAAS

The Science Delivery Director, 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 the Science Delivery Director 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 Science Delivery Director.
7. To provide advice to the Science Delivery Director at other times as appropriate.

Membership Constraints

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

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

This section removed prior to publication on the web, contact the facility for details.

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. Applications are accepted in support of PhD projects; other student applications (e.g. MSc or BSc) are not reviewed or cost-allocated, but are undertaken on a best-endeavours basis within the Training/Education remit of NEODAAS.

During this year, NEODAAS supported 49 projects in total, 20 of which were new applications that were reviewed. The new applications requiring review were graded as follows:

APPLICATIONS: DISTRIBUTION OF GRADES (Current FY — 2008/09)								
	$\alpha 5$	$\alpha 4$	$\alpha 3$	$\alpha 2$	$\alpha 1$	β	R*/Pilot	Reject
NERC Grant projects	0	9	0	0	0	0	0	0
Other academic	0	3	1	0	0	1	0	0
Students	1	4	0	0	0	0	1	0
Pilot	0	0	0	0	0	0	0	0
TOTAL: 20	1	16	1	0	0	1	1	0

4.2 DISTRIBUTION OF PROJECTS

All applications (new and ongoing) supported by NEODAAS can be mapped onto NERC's Science Areas and Science Priorities, as a percentage of the Full Cash Cost:

Science Area	Number of Projects	Allocated Cost (%)
Atmospheric	2	3.3
Earth	2	0.9
Marine	22	54.1
Terrestrial and Freshwater	2	1.1
Earth Observation	15	19.8
Science-based Archaeology	0	0
Polar	6	20.7
TOTAL	49	100

Science Priorities	Number of Projects	Allocated Cost (%)
Climate System	13.58	25.8
Biodiversity	12.58	30.4
Earth System Science	9	21.3
Sus. Use of Nat. Resources	5.92	9.2
Natural Hazards	2.92	2.3
Env., Poll. & Human Health	4.75	10.4
Technologies	0.25	0.6
TOTAL	49	100

4.3 APPLICATIONS SUPPORTED DURING FY 2008/9:

HEI Name (as per HESA list)	PI Surname	App. No.	Application Title	Grade	Fellow	PhD	Complete
University of York	Carpenter	SOLAS	SOLAS Cape Verde Observatory	α4			1
University of East Anglia	Robinson	SOLAS	SOLAS-ICON Cruise	α4			1
NOCS	Holligan	BAS	Drake Passage: Falklands to Rothera	α4			1
BAS	Fleming	BAS	Cruise support: Pelagic Communities, etc.	α4			
University of Newcastle	Barr	08/17	City-scale Earth observed metrics of building and neighbourhood heat vulnerability	α4		1	
University of St Andrews	Hammond	08/16	Investigating temporal and spatial variation in distribution of the harbour porpoise (<i>Phocoena phocoena</i>) on the west coast of Scotland	α4		1	
University of Plymouth	Howell	08/15	Predictive species distribution modelling to aid Marine Spatial Planning	α4	1		
University of Dundee	Jones	08/14	Vegetation change in Angus	α4			
Offshore Farms, Totnes	Gibbon	08/13	Pacific oyster (<i>Crassostrea gigas</i>) settlements	α3			1
University of Manchester	Allen	08/12	VOCALS, and VAMOS Ocean-Cloud-Atmosphere-Land Study	α4			1
Proudman Oc. Lab.	Hopkins	08/11	Liverpool Bay and Irish Sea Coastal Observatory	α4			
University of Aberdeen	King	08/10	Ecosystems of the Mid-Atlantic Ridge at the Sub-Polar Front and Charlie-Gibbs Fracture Zone (ECOMAR) – Bigelow Cruise	α4			
University of Plymouth	Hardman-Mountford	08/09	An intercomparison of bio-optical techniques for detecting phytoplankton size class from Earth Observation (EO)	α5		1	
Plymouth Mar. Lab.	Rees	08/08	Atlantic Meridional Transect	α4			
Marine Biological Assoc.	Schroeder	08/07	Molecular characterization of exceptional harmful algal blooms in the Celtic Sea Shelf-Break	α3		1	
RSPB	Booker	08/06	Understanding plankton blooms in relation to seabird foraging patterns	α4			

HEI Name (as per HESA list)	PI Surname	App. No.	Application Title	Grade	Fellow	PhD	Complete
University of Leeds	Brooks	08/05	Arctic Summer-Clouds Ocean Study (ASCOS) and the collocated study of Arctic Mechanisms of Interaction Between the Surface and Atmosphere (AMISA)	α4			1
University of Southampton	Tyrrell	08/04	Ocean acidification and coccolithophores	α4		1	1
NOCS	Hartman	08/03	Synthesis of European fixed point time-series observatory data	α4			1
University of Aberdeen	Macleod	08/02	Spatio-temporal distribution and ecology of cetaceans and marine turtles in Angola and the southern Gulf of Guinea	α4		1	
University of East Anglia	Malin	08/01	Production of DMS and DMSP by coccolithophores	α4	1		1
NOCS	Lampitt	07/15	Autonomous measurements of carbon fluxes in the North Atlantic bloom	α4			
Plymouth Mar. Lab.	Hardman-Mountford	07/13	Investigation of seasonal and spatial variability in CO ₂ exchange over the NW European Shelf.	α5		1	
University of Strathclyde	Cunningham	07/12	Assimilation of Remote Sensing Data into Shelf Sea Hydrodynamic Models	α4		1	
Plymouth Mar. Lab.	Gilbert	07/10	Analysing the phylogenetic and functional diversity of bacteria and archaea at L4	α4			
Plymouth Mar. Lab.	Miller	07/09	Ecosystems of the mid-Atlantic ridge at the sub-polar front and Charlie-Gibbs fracture zone (ECOMAR)	α4			
Plymouth Mar. Lab.	Miller	07/08	Expediting exploitation of the Rothera AVHRR archive	α4			
University of Glasgow	Gore	07/07	Basking Shark Satellite Tagging	α3			
University of Liverpool	Williams	07/06	Ocean Circulation and the Carbon Cycle	α4			1
Heriot-Watt University	Mair	07/05	Hydrographic and biological variations in the Gulf of Panama: ENSO teleconnections.	α4		1	1
Proudman Oc. Lab.	Sharples	07/04	Horizontal patchiness in thermocline mixing. Do oceanographic characteristics and predator-prey behaviours define critical marine habitats?	α4			
University of Bangor	Mitchelson-Jacob	06/22	Minke Whale habitat ecology (Tetley)	α4		1	

HEI Name (as per HESA list)	PI Surname	App. No.	Application Title	Grade	Fellow	PhD	Complete
University of Glasgow	Gore	06/20	Ecology of Whale Shark around Mahe, Seychelles	α4		1	1
NOCS	Martin	06/18	Biophysical interactions in the Iceland Basin (BIB) cruise, Oceans 2025 Theme 2	α4			1
University of Southampton	Iglesias-Rodriguez	06/17	Calcifying phytoplankton in a changing ocean; Export production - new approach using proteomic signatures	α4		1	
University of Durham	Hoelzel	06/16	Foraging ecology and population genetics of the Minke Whale in the North Atlantic	α4		1	
University of Dundee	Cutler	06/14	Remote sensing of European lake ecosystem parameters	α4		1	
Plymouth Mar. Lab.	Torres	06/13	Residual circulation of the Ria de Vigo: dynamics and hydrography	α5			
University of East Anglia	Renfrew	05/DSRS/ 3	Greenland Flow Distortion Experiment	α4			1
University of London	Culloch	05/17	Conservation of Pakistan's marine cetacean biodiversity and pelagic environment	α3			1
University of Swansea	Hays	04/7	Habitat use by marine vertebrates: synergistic use of geolocation with satellite remote sensing	α4			
NOCS	Lampitt	02/13	ANIMATE: Atlantic Network of Interdisciplinary Moorings and Time-series for Europe (BICEP)	α4			
NOCS	Hydes	01/20	FerryBox (BICEP)	α4			
Proudman Oc. Lab.	Proctor	01/18	POLCOMS development	α4			1
University of Plymouth	Lavender	00/7	Development of algorithms for processing ocean color imagery from European coastal waters	α5			
Open University	Harris	00/19	Emplacement of lava flow fields and tube systems at Etna volcano: satellite insights	α4			
Plymouth Mar. Lab.	Groom	-	In-house research	-			
Marine Biological Assoc.	Pingree	-	No specific project – weekly supply of enhanced photo print browse images	-			
NOCS	Simpson	-	No specific project – browse image products for use by local researchers	-			

	Plymouth Mar. Lab.		Miller	Dr	P	07/08	NE/C508277/1	NERC	NT	R						1	0.33			0.33	0.33				3	1		2.0
	Plymouth Mar. Lab.		Miller	Dr	P	07/09	NE/C513018/1	NERC	Consort	R			1					1							2	2		1.9
	Plymouth Mar. Lab.		Gilbert	Dr	J	07/10		NERC	CS	O			1					0.5	0.5						1	1		1.0
H-0169	University of Strathclyde	Physics	Cunningham	Dr	A	07/12	NE/F00947X/1	NERC	NT	S				1				0.5	0.5						1	0		0.5
	Plymouth Mar. Lab.	CASIX	Hardman-Mountford	Dr	N	07/13	NE/F008155/1	NERC	NT	S			1					0.5	0.5						2	4		2.9
	NOCS		Lampitt	Dr	R	07/15		NERC	CS	O			1						1						4	3	29	6.9
	BAS		Fleming	Mr	A	BAS	BAS	NERC	CS	R						1		0.5	0.5						4	5	196	27.9
H-0117	University of East Anglia	Environmental Sciences	Malin	Dr	G	08/01	NE/B501039/1	NERC	NT	R			1		1			0.5	0.5						3	2		2.4
H-0170	University of Aberdeen	Biological Sciences	Macleod	Dr	C	08/02		NERC	NN	O			1		1				1						7	7		6.8
	NOCS		Hartman	Mrs	S	08/03		NERC	T	R			1		1			0.5			0.5				8	7		7.3
H-0160	University of Southampto	Ocean Sciences	Tyrrell	Dr	T	08/04		NERC	T	S			1			1		0.33	0.33		0.33				7	5	73	14.6
H-0124	University of Leeds	Atmospheric Sciences	Brooks	Dr	I	08/05	NE/E010008/1	NERC	NT	R			1			1		0.5			0.5				6	4	47	10.5
	RSPB		Booker	Ms	H	08/06		NERC	NN	O			1		1			0.5	0.5						2	1		1.5
	Marine Biological Assoc.		Schroeder	Dr	D	08/07		NERC	NN	O			1		1				0.5			0.5			5	6		5.3
	Plymouth Mar. Lab.		Rees	Dr	A	08/08		NERC	T	R			1		1			0.33	0.33		0.33				5	5	46	10.4
H-0073	University of Plymouth	Marine Studies	Hardman-Mountford	Dr	N	08/09	NE/F008694/1	NERC	CofE	S			1		1						1				6	8		6.8
H-0170	University of Aberdeen	Ocean Sciences	King	Dr	N	08/10		NERC	Consort	R			1		1			0.5			0.5				1	0		0.5
	Proudman Oc. Lab.		Hopkins	Dr	J	08/11		NERC	T	R			1		1			0.25		0.25	0.25		0.25		8	8		7.8
H-0204	University of Manchester	Atmospheric Sciences	Allen	Dr	G	08/12	NE/F019874/1	NERC	NT	R		1			1			0.33			0.33		0.33		10	7		8.3
	Offshore Farms, Totnes		Gibbon	Capt.	P	08/13		NERC	NN	O			1		1			0.5			0.5				4	3		3.4
H-0172	University of Dundee	Life Sciences	Jones	Prof	H	08/14		NERC	NN	O				1		1			0.25	0.25			0.25	0.25	7	3		4.9
H-0073	University of Plymouth	Biological Sciences	Howell	Dr	K	08/15	EP/C508750/1	EPSRC	NN	O			1		1			0.5	0.5						5	4		4.4
H-0173	University of St Andrews	Sea Mammal Research Unit	Hammond	Prof	P	08/16	NER/S/2006/14299	NERC	T	S			1		1			0.5				0.5			3	1		2.0
H-0164	University of York	Chemistry	Carpenter	Dr	L	SOLAS	SOLAS	NERC	T	R		1			1						1				7	5		5.8
H-0117	University of East Anglia	Environmental Sciences	Robinson	Dr	C	SOLAS	SOLAS	NERC	T	R			1		1						1				8	4		5.9
																							187	149	422	214.1		

92 72 51 EK

4.4 (CONTD.) COST ALLOCATIONS FY 2008/09: 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.

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

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:

$$\begin{aligned} \text{Full Cash Cost of DSRS} \div \text{Total Capacity} &= \text{Unit cost} \\ 471.50 / 3195 &= \text{£ } 0.148\text{k} \end{aligned}$$

(Note: Full Cash Cost for NEODAAS-Dundee 2007/2008 is £ 471.50k - provided by NERC in March 2009.)

Free Web Based Browse Image Archives and Gallery Services

The NEODAAS-Dundee website provides free access to archives of browse images and a gallery for users who register. The facilities are used extensively at all levels, including support for research and training activities and images often appear in publications. There are several million image downloads annually. It is not possible to allocate costs against the thousands of individual users and so an overall figure of 15% of NEODAAS-Dundee cost is allocated as a “block figure” to reflect usage of these facilities.

Note:

The procedure for allocating Dundee costs to Plymouth users who are supported using Dundee data was updated in 2007/08. This avoids duplicating their details on the Dundee return and simplifies the process. The notes in the first row of each return explain how this has been done.

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 2008/09

Service/Facility

NEODAAS-Dundee

Full Cash Cost = £k

471.50

UNIT PRICING
Unit Price
(per operational staff hour)
Price £k
0.148

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				
									Atmospheric	Earth	Marine	Terrestrial & Freshwater	Earth	Science Based	Polar	Climate System	Biodiversity	Sustainable Use of Natural Resources	Earth System Science	Natural Hazards	Environment, Pollution and	Technologies						
	NOTE: 60% of NEODAAS-Dundee cost is allocated against NEODAAS-Plymouth users as they account for a majority of Dundee data scientific usage, i.e. these are NEODAAS users supported by Plymouth using Dundee data. The amount shown here is the overall amount allocated to these users. As indicated in the Plymouth return, this may be shared evenly as an overhead across all Plymouth applications if a total cost per application is required. The figure is based on Dundee allocations against users in this category over recent years.																								1917	282.900		
H-0157	NEODAAS-Dundee browse image archives and gallery - available to/accessed by all NEODAAS website users.							INF	O	0.25	0.25	0.25	0.25	0.5		0.5		0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	479.25	70.725
H-0172	In-House Development	NEODAAS-Dundee	Parkes	Dr	S		INF	O	0.25	0.25	0.25	0.25	1											1		382	56.373	
H-0154	University of Newcastle	Civil Engineering & Geosciences	Barr	Dr	S		NN	S		1			1				0.5			0.5						8.7	1.284	
H-0124	University of Leeds	Earth and Environment	Brooks	Dr	I	NE/E010008/1	NT	R	1						1		0.5			0.5						105.3	15.540	
H-0172	University of Dundee	Geography Department	Cutler	Dr	M		NN	S				1	1				0.33	0.33	0.33							0.583	0.086	
H-0117	University of East Anglia	Environmental Sciences	Dorling	Dr	S		NN	O	1								0.5			0.5						13.202	1.948	
H-0172	University of Dundee	Environmental and Applied Biology	El-Aswed	Mr	T		NN	S				1	1				0.5	0.5								5.64	0.832	
	Plymouth Marine Laboratory	NEODAAS-PML	Groom	Mr	S		INF	O			1						0.2	0.2	0.2				0.2			109.633	16.179	
H-0124	University of Leeds	School of Earth and Environment	Hurst	Mr	C		NN	O				1					0.5		0.5							6.351	0.937	
H-0157	University of Reading	Meteorology Department	Lawson	Mr	J		NN	O	1											1						0.948	0.140	
	Plymouth Marine Laboratory	Remote Sensing Group	Miller	Dr	P		CR	O			1		1									0.33	0.33	0.33		8.809	1.300	
H-0160	University of Southampton	National Oceanography Centre	National Oceanography Library				CS	O			1						0.5			0.5						32.256	4.760	
H-0169	University of Strathclyde	Physics Department	Neil	Miss	C	NE/F00947X/1	NT	S			1		1				0.33			0.33				0.33		5.223	0.771	
	Marine Biological Association		Pingree	Prof	R		NN	O			1						0.5			0.5						56.712	8.369	
H-0117	University of East Anglia	Environmental Sciences	Renfrew	Dr	I	NE/C003365/1	CS	O	1						1		1									0.747	0.110	
H-0114	University of Cambridge	Scott Polar Research Institute	Wadhams	Prof	P		NN	O			1				1		0.5			0.5						1.538	0.227	
H-0157	University of Reading	Meteorology Department	Wood	Dr	C		NN	O	1											1						2.004	0.296	
	c/o University of Dundee (Individual)		Burch	Mrs	G		CR	O	1				1							1						0.477	0.070	
	Edinburgh (Individual)		Farquhar	Mr	I		CR	O	1				1							1						0.477	0.070	
	Tiger Aspect Productions Ltd.		Frost	Miss	A		CR	O	1				1							1						0.45	0.066	
	The Glasgow Academy School		Gwynne	Mr	N		CR	O				1								0.5	0.5					2.235	0.330	
	Pearson Education Ltd.		Jones	Miss	K		CR	O	1				1							1						0.44	0.065	
	Harper Collins Publishers		Mahon	Mrs	A		CR	O	1				1							1						0.897	0.132	
	Welsh Assembly Government	CAEC Communications	Pope	Miss	S		CR	O			1									1						0.03	0.004	
	Royal Meteorological Society	Weather Magazine	Prichard	Mr	R		CR	O	1							1				1						0.975	0.144	
	Science Photo Library		Science Photo Library				CR	O	1				1							1						0.867	0.128	
	Nelson Thornes Publishers		Sharp	Mrs	S		CR	O	1				1							1						0.447	0.066	
	Hodder Education		Teevan	Miss	R		CR	O	1				1							1						1.794	0.265	
	Terrestrial Television Productions		Woolridge	Miss	A		CR	O	1				1							1						0.477	0.070	
	University College Cork, Ireland	Department of Geography	Cawkwell	Dr	F		CR	O	1				1				0.33			0.33			0.33			2.334	0.344	
	Gyldendal Publishing, Norway		Ekstrand	Miss	A		CR	O	1				1							1						0.447	0.066	
	University Of Oslo, Norway	Department Of Mathematics	Gjevik	Prof	B		CR	O	1											1						0.96	0.142	
	University of Iceland	Institute of Earth Sciences	Jonsdottir	Dr	I		CR	O			1				1		0.5					0.5				12.875	1.900	
	Netherlands (Individual)		Lindeman	Mr	T		CR	O	1													0.5	0.5			1.998	0.295	
	Institut Cartografic de Catalunya		Martinez i	Dr	L		CR	O					1	1						0.5						9.828	1.450	

SERVICES AND FACILITIES COST ALLOCATIONS FORM 2008/09

Service/Facility

NEODAAS-Dundee

Full Cash Cost = £k

471.50

UNIT PRICING
Unit Price
(per
operational
staff hour)

Price £k

0.148

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				
									Atmospheric	Earth	Marine	Terrestrial & Freshwater	Earth	Science Based	Polar	Climate System	Biodiversity	Sustainable Use of Natural Resources	Earth System Science	Natural Hazards	Environment, Pollution and	Technologies						
	(ICC), Spain		Rodrigo																									
	Norwegian Water and Energy Administration	Hydrology Department	Mengistu	Mr	Z		CR	O				1	1						0.5	0.5							0.517	0.076
	Danmarks Meteorologiske Institut		Pedersen	Dr	L		CR	O			1				1		0.5					0.5					12.198	1.800
	Weather Underground, USA		Schwerzler	Mr	C		CR	O	1													0.5	0.5				8.132	1.200
Total																											3,195	471.500

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 2008

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.

REFEREED PAPERS (37)

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ANNEX 6: FINANCE

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ANNEX 7: SERVICE MANAGEMENT

NEODAAS-PLYMOUTH

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

- Mr Steve Groom, Director (10 % PML funded, B3)
- Dr Pete Miller, NEODAAS manager (25%, B5)
- Dr Tim Smyth, Link with NCOF and NCEO (5%, B5)
- Dr Peter Land, ARSF & MODIS Development (10%, B6)
- Dr Jamie Shutler, MODIS & MERIS Development (58%, B5)
- Mr Rory Hutson¹, Data Analysis (66%, B7)
- Dr Stephane Saux-Picart², Development (23%, B6)
- Mr Peter Walker³, Systems and development (11%, B6)

(2.1 Full-Time Equivalent including Director)

¹Departed December 2008

²Joined October 2008

³Joined December 2008

NEODAAS-DUNDEE

Staff Numbers, Grades, Person-years per annum

- 1 Station Director (part time – 0.1 person-years per annum)
Total Uo Dundee funded person-years per annum: 0.1
- 1 Grade 3 Scientific Officer/Station Manager
- 1 Grade 2 Software Specialist/Systems Manager
- 1 Grade 2 Software Specialist/Systems Administrator
- 1 Grade 2 Research Assistant/Electronics & Communications Engineer
- 3 Grade C Technicians (1 maintenance/station operator cover, 2 shift operators)
Total NERC funded person-years per annum: 7.0

Our Software Specialist/Systems Administrator left at the end of February 2008. His replacement, Jon Bowyer, was appointed in August 2008.

Scheduled SMAs and Recommendations

NEODAAS was reviewed by the Services Review Group (SRG) in March 2008 and was scored on the standard criteria as follows:

- Need 5.0
- Uniqueness 5.0
- Quality of Service 5.0
- Quality of Science/Training 5.0

Average Score 5.0

SRG comments were:

“NEODAAS is an indispensable facility adding to the only long-term archived continuous record of satellite data. User-community and the uptake by it are increasing. The user-survey was good and showed the community is highly satisfied. NEODAAS has a needy core market in the cruises it supports. This user-

community would struggle to get the data from elsewhere. There is also a track record away from the main business of marine science: in atmospheric science and EO. NEODAAS is integral to several NERC programmes. It has a very successful, large outreach judging from the website hits. Lots of publications and many are in high profile journals. SRG was impressed by the quality control. DSRS has a good international reputation. SRG was impressed with the management of the facility, given that it has only been a joint facility for two years.”

The next scheduled review of NEODAAS is in 2013.

ANNEX 8: USER SATISFACTION AND COMPLAINTS

The user feedback below has been collated from recent email and website registration comments, for example. These are some of the comments received over the past year or so, most of which are unsolicited. They provide an indication of user satisfaction as well as illustrating the wide range of NEODAAS users.

- Thanks very much for the information about obtaining and using your images in a book. By the way, I found your image gallery very helpful in finding nice examples of the images I want to use – it's a great tool. **(Dr Pete Inness, Dept. of Meteorology, University of Reading)**
- The images are great and are really helping us define our experiment location... Thanks so much for your support throughout the cruise. The region we were working in was cloud covered for a lot of the time, but the glimpses we got were very helpful, especially around the time that we were laying the patches. **(Dr Pete Strutton, Oregon State University, GasEx III cruise in Southern Ocean)**
- I would like to inform you of our use of an image from your site in a paper we have written. I am funded by NERC so it was good to see you were also part of NERC. Your site was very helpful. **(David Coles, Ultrasonic & Underwater Acoustics PhD Student, University of Southampton)**
- This is to let you know that I've used one of your images in an internal technical report at the European Centre for Medium Range Weather-Forecasting (ECMWF). Thanks for providing a very useful image archive. **(Alan Geer, ECMWF)**
- A couple of students have used your excellent services. We have of course used NEODAAS for cruises and for various publications such as by myself and by Sue Hartman which are now in press. **(Dr Richard Lampitt, National Oceanography Centre, Southampton)**
- Thanks to you all for your continuing support of SOLAS D325. **(Dr Gill Malin, University of East Anglia)**
- Many thanks for your assistance and patience in the provision of the satellite image today. It looks absolutely fantastic. **(Redpath Design Agency, Edinburgh)**
- Many thanks for the images. That is fantastic. I hope my presentation generates some productive discussion - I will let you know about any interesting theories! **(John Lawson, Meteorology Student, University of Reading)**
- We are performing an experiment in the Indian Ocean group Seychelles. We are flying a superpressure balloon at an altitude of 60mb which releases the latest NCAR DropSonde. We will use the images to make informed decisions about when to release the sondes. The cloud and IR images will be extremely valuable. **(Jack Fox, National Center for Atmospheric Research, Boulder, USA)**
- Thank you so much. I never meant for you to do so much work. My students will really appreciate it. We use your website frequently here and it is one of the best there is. Keep up the great work. **(Lee Grecni, Senior Lecturer in Meteorology, Penn State University, United States)**
- In situations where our usual source of data for satellite imagery is unavailable, these will provide a useful backup to produce routine forecast products. **(User from UK Met Office)**
- Simply to thank you for registering me as a user. I am astonished and delighted with the wonderful information and pictures now available. **(User in the UK)**
- Thank you for the images. I'll probably modify our programme for the 1st part of the 2nd leg so that we can visit one station near the Irish coast where we see some coccolithophore blooms... Thank you very much for the new images. Again, they help me a great deal in deciding where to go next... At Station 12, judging by the color of the water, we believe that there are coccolithophores present. **(Dr Lei Chou, Université Libre de Bruxelles, PEACE cruise in N Biscay)**
- Since 2000 till present we have analyzed all the stages of the Mediterranean and Black Sea cyclones' evolution using "METEOSAT" satellite pictures using your website. **(Prof Elena Voskresenskaya & Dr Yuriy Ratner, Marine Hydrophysical Institute, Sevastopol, Ukraine)**
- I am working as a quality evaluation team leader for IRS images. I am interested in coarse resolution images over globe for verification purpose for India's forthcoming Oceansat-2 satellite mission. **(Bankim Shah, Indian Space Research Organization)**
- The quicklooks will give me support in analysing the South America synoptic-scale weather. My research looks for relationships between convection initiation and low level water vapor fields in both meso-alfa and meso-beta scales for the region of São Paulo State. **(Ricardo Hallak, Post-doc Researcher, University of São Paulo, Brazil)**
- Many thanks for getting back to me so quickly – that's fantastic that we can use some of the images. I know they will be of great use to our students and other schools planning to use our weather site. **(Phil Woodcock, Teacher, Notre Dame High School, Sheffield)**

- I am working as an operational forecaster in support of NATO armed forces (particularly concerned with aviation safety). I have previously used your images while at sea and found them very helpful. (**Charmian Leaver, Royal Navy**)
- Checking weather and ice situation in N-Atlantic in relation to bird migration. I have been registered for many years. (**Gudmundur A. Gudmundsson, Icelandic Institute of Natural History**)
- I would like to use your site as a supplemental weather resource for flight planning purposes. I provide flight support for individual owner/operators of the Eclipse 500 Very Light Jets. Thank you very much. (**Steve Mineck, Eclipse Aviation Corporation, Albuquerque, USA**)
- I do a lot of sailing and therefore appreciate your meteorological information a great deal. (**User in Ireland**)
- The images were great. I have used them descriptively, and they give an excellent idea of the amount of turbulence in the wake downstream of Svalbard during the wake events I had decided to study more closely. (**Matthew Reeve, Meteorology Masters Student, University of Bergen, Norway**)
- As a flying instructor I like to look at your AVHRR and MODIS images to see what the weather charts really mean! You don't realise how much you'd miss it till you can't get access. Thanks for doing a great job. (**User in the UK**)
- I received the photograph and it is fantastic. Thanks again for all your help. (**User in the UK**)
- We need your satellite images for daily forecasting for Bangladesh Air Force. (**Momenul Islam, Bangladesh Air Force**)
- I notice you have put up a gallery of imagery which is very enjoyable to look through. Well done! (**Bob Stewart, Freelance Researcher**)
- I want to thank you for the excellent service you offered me! (Near real-time MODIS data for Super CEPCO North Sea/English Channel pollution control exercise) (**Dr Barbara Bulgarelli, EC Joint Research Centre, Ispra, Italy**)
- Thank you for the fantastic gallery you have. There are two of us writing a book on satellite images and we would like to include one of the images from the gallery. (**Dr Ingibjorg Jonsdottir, Institute of Earth Sciences, University of Iceland**)
- The information on this site is so good you do not know. I am trying to give met support to Bhavik Ghandi who is rowing the Atlantic Ocean solo. Good information indeed! Thank you very much. (**User in the Canary Islands**)
- Your satellite images are very helpful in forecasting rainfall for the farming community in particular and agriculture in general. (**User in India**)
- New website 'look' and image gallery speed is great! Another great addition to an already great site. Thanks. (**User in the UK**)
- Today's full disk of Africa, particularly the RSA, in color showing the cold fronts approaching is magnificent and just what I am looking for to keep tabs on our local weather. I have bookmarked this page for my daily checks. Thanks for making these splendid images available for free. (**User in South Africa**)
- Thanks for your services. We use this information in the agriculture works. (**User in Chile**)
- I must say that the satellite pictures are very useful to me because I administrate a website about weather phenomena. (**User in Sweden**)
- I am very grateful for your website. As a meteorologist I am finding it very helpful to access and use your satellite images. (**Charles Langton Vanya, Malawi Meteorological Services**)
- I'm a cricket groundsman and like to know what the weather is like. I have been using your site for about 10 years. (**User in the UK**)
- The visit to the University was great and the pupils really enjoyed themselves. I think one of the highlights was a trip to the top of the Tower building as the satellite dish moved just as we were all standing next to it. Very impressive! (**Teacher, Blairgowrie High School**)
- I am a meteorologist from Iran. Thanks for your website. I usually use your images.
- Thanks very much for all the work – a brilliant service. I intend to use the images in training sessions for our forecasters. Part of our work is to issue warnings of conditions affecting Island roads. The images will also be useful in future training courses for staff that are responsible for gritting operations. (**Alan Hisscott, Senior Met Officer, Isle of Man Department of Transport**)
- I log on each day to get an overview of the current European weather situation. I'm a pilot and find your service a very useful supplement to pre-flight weather briefings.
- I'll send you copies of the papers as well as acknowledge you in them. Thanks again. Your service is simply amazing! (**Prof Kent Moore, University of Toronto**)
- I got so accustomed to your excellent pictures, that I am quite worried as to what might have happened. Will you be back up and running soon? (**User in Austria**)
- I am an aerial survey navigator and travel to many parts of the globe to carry out projects. Having good quality up-to-date satellite images makes our assessment of the weather so much easier. (**User in Indonesia**)

- I have now registered and find your website most informative and easy to use. Thank you for allowing me to use it.
- A friend of mine is working on a regional TV channel and finds your images more helpful to forecast local weather without relying much on the official national weather site. **(User in Chennai, India)**
- I have been visiting your site daily, religiously for the past 5 years or more. Congrats on the new look of your web site. You are doing a great job. **(User in the UK)**
- Thank you for giving me a chance to share some knowledge about the satellites. **(Kyaw Lwin Oo, Weather Forecaster, Dept. of Meteorology, Myanmar)**
- I was afraid that your service wouldn't be continued, as it is the best I found so far and I use it every day.
- May I wish you and all the team a very pleasant and peaceful Christmas season. May all your Isobars be well spread out and hope that you are not occluded from the responsibilities you all have outwith the station – bringing sunshine to your family and friends and continuing to keep us all informed of the +/- metrics throughout the year. **(Michael & Students, Russia)**

USER COMPLAINTS

NEODAAS received no formal complaints during the year.

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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. Details of Equipment Performance/Failure/Repair
5. Publicity Activities
6. Staff Visits, Conferences Attended, Representation on Committees
7. Routine Satellite Tracking Schedule

DUNDEE ANNEX 1 – FUTURE DEVELOPMENTS

Online Storage System

A new online storage system is being procured for the Station with the aid of NERC funding. This will replace ageing equipment and provide increased capacity to support future requirements and developments. Further details and progress with this are contained in Dundee Annex 2.

Once commissioned and acceptance testing has been satisfactorily completed, we can then begin to integrate the system into Station operations. The first priority will be to transfer across all online archive data stored on the old equipment and ensure the data are accessible to the relevant systems and processes to maintain existing services. We can then begin to utilise the increased capacity by copying other data to the online storage that are currently only stored on tapes. The MODIS archive, which now extends back almost 10 years, is the main data set in this case. It is likely to take several weeks to complete this, but all of the Station's polar satellite data will then be available online. Thereafter, we can look to provide enhancements to the facilities already available and investigate other possible areas of development. One possibility is to provide high resolution imagery which can be easily accessed and navigated by eligible users in a similar way to the existing quicklook imagery. This would replace the rather convoluted process of users ordering higher resolution images through a web interface, with the images being generated on-demand from raw data. We can also consider making 15-minute geostationary satellite data available online. Our available storage capacity has prevented this, although we have approval to publish these data. Other possibilities are to investigate standard products that we may be able to provide from the online data using freely available processing software and providing access to other instrument data contained in the direct broadcast data streams received at Dundee, such as atmospheric sounder data. NEODAAS-Plymouth data processing equipment that is hosted at Dundee can also benefit from the new storage facilities through direct access to the full Dundee archive and additional storage resources that may be required for processing of near-real time and on-demand products.

Satellite Missions

The Station is well prepared to receive from a range of other direct broadcast EO satellite missions that will be of interest to the user community. NOAA-19 is the last of the NOAA series of satellites carrying the AVHRR instrument and was launched in February 2009. It is currently going through the in-orbit commissioning phase. Our software will be updated for the new satellite and sensor calibration tables calculated from pre-launch measurements. We will begin receiving data routinely as soon it is operational and Plymouth processing systems are ready. The US NPP/NPOESS series of satellites are to be the replacements for the NOAA series, Terra and Aqua. NPP (NPOESS Preparatory Project) will be the first in the series and the latest information we have is that this is scheduled for launch early in 2011, subject to approval from funding agencies. Again, the Station is prepared as far as possible for this and further preparations can only be carried out as more technical information becomes available.

Other missions of particular interest at the moment are the Chinese FengYun-3 series of meteorological satellites and India's Oceansat-2. The first of the Chinese series (FengYun-3A) was launched during 2008. It transmits different instrument data on both S-band (VIRR) and X-band (MERSI). Unfortunately, the transmissions and data formats do not match international standards. Our receivers were programmed based on pre-launch information, tested with post-launch transmissions and updated. We had some success receiving and processing data at a basic level, but now need instrument and data format information to interpret the received data e.g. packet layout, sensor geometry and calibration.

Oceansat-2 is due to launch in 2009 and carries instruments including the Ocean Colour Monitor 2 (OCM2), which is obviously of interest to our colleagues at Plymouth. Information from the Indian Space Research Organization (ISRO) indicates that direct reception of Oceansat-2 data should be possible by entering into a

commercial agreement with Antrix Corporation (commercial wing of ISRO), but other than one acknowledgement, no information has been provided despite several enquiries to Antrix and ISRO.

For the Chinese and Indian missions, it appears that contacts may be required at higher levels through NERC or BNSC, for example, in order to obtain the necessary information or gain access to data. We have requested assistance with this through the NERC EO Programme.

The possibility of a resuming access to SeaWiFS direct broadcast data was raised in an email from NASA in September. This indicated that they are looking at the possibility of arranging licences for non-US stations in exchange for being provided with a copy of all received data. NEODAAS responded positively to this and also offered to provide access to encrypted data collected over the past 4-years. NASA confirmed they are extremely keen to have Dundee rejoin the station network and to add the data from 2004-present to their archive. There have been no further developments so far.

General Developments

- A new version of a circuit board is being designed for our tracking antenna systems. This board is the main interface between an antenna and the associated control computer and also provides a range of control functions such as brake and emergency safety loop operation. Although, each of our antenna systems have working boards at present, some components from the original design are now obsolete and so we will update the design to use available components. At the same time, various design improvements will be included such as more status indicators and test point for easier fault diagnosis, improved surge protection and lower power consumption components for less power dissipation/risk of burn-out.
- Once the new storage system is operational and has been populated with all of our archived polar satellite data, the possibility of producing a copy of our early MODIS archive data (approximately 5 years worth) on LTO tapes will be considered to replace the current DLT tapes. This is a more realistic proposition when data are already stored online rather than having transfer from tape to tape. As well as the various benefits of LTO, this would mean that offline copies of all Dundee data are archived in a consistent way on the same media.
- Some work has already been carried out on software that provides website access to the geostationary satellite imagery. This has greatly improved maintainability for future updates, which may include a database driven search facility to improve access to the images.
- For system administration, more monitoring has already been implemented. The “Nagios” system performs checks on data ingest, processing and storage systems while other systems have features for monitoring themselves and their components. However, there is scope for more improvements to be carried out in this area in the coming year.
- A new intranet site is being implemented to record and track tasks, problems, support requests etc. related to the Station’s hardware, software and operations. This has already been used to some extent and has improved sharing of information by providing a single point of reference for staff. The system can be expanded to provide additional features. For example, the creation of an internal knowledge base/wiki for documentation purposes is being considered.
- The possibility of using AVHRR data distributed through the EUMETCast system can be investigated if there is a requirement for this in user community. The data are distributed after reception at a network of European groundstations and could provide coverage beyond the normal Dundee footprint. One option would be to make use of the data for the duration of specific user projects, such as research cruises.

DUNDEE ANNEX 2 - TARGETS AND MILESTONES

Service Capacity and Equipment Utilisation

For cost allocation purposes, capacity is measured in terms of available Station operator time (i.e. Shift Technicians), with other staff carrying out supporting activities, e.g. management, software/systems administration, maintenance and clerical duties. All standard passes from the operational satellites are included in the routine reception schedule and there is scope for additional passes if required.

The satellite reception systems were used daily throughout the year. Data from 6583 NOAA and *SeaWiFS passes were received out of 6589 scheduled (success rate of 99.91 %), yielding around 450 gigabytes of data. MODIS data was received from all 4507 scheduled Terra and Aqua (success rate of 100 %), yielding around 3.0 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 Dundee Annex 4 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 equipment faults, 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 a standby satellite. Staff response to out-of-hours calls when problems arise also contributes to maintaining operations. Periods of system downtime are documented in Dundee Annex 4.

Response Times and Data Delivery

All new data received at Dundee are made available to Plymouth for processing in near real-time. This is particularly important for research cruise support. Registered users of the website 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 images and data in standard formats. Standard browse images for the MODIS archive are also available, but higher resolution images and data must be restored from archive tape and processed for users on request. The archive of images for all geostationary satellite data received at Dundee is also available for immediate access.

Archive data requests from Plymouth are given highest priority and direct 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 a few days. Particularly large requests are normally processed in batches and the first delivery is within a week or two.

Web Statistics

The website for the linked NEODAAS facility includes a common portal for access to data and products at both Plymouth and Dundee. Relevant web pages for both nodes have a common appearance including a standard NEODAAS banner.

The facilities on the Dundee pages continue to contribute to science communication activities. They provide anyone with free access to information and products such as reduced resolution browse imagery and an image gallery. The information below relates to the freely available facilities on the Dundee site.

Total number of user registrations: 330,014 Registrations for the year: 13,018
 Total requests/page hits for the year: 27.7 million Image requests for the year: 6.9 million

Breakdown of user categories for all registrations:

User Category	%
NERC or UK Higher Education project	16.8 %
Education	10.9 %
Research	7.4 %
Commercial	3.1 %
Personal interest	61.8 %

Website trends:

Year	1996/97 to 1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
User registrations during the year	*20,937	26,111	22,228	29,253	34,998	39,337	40,389	25,511	15,420	13,018
Total number of user registrations	83,749	109,860	132,088	161,341	196,339	235,676	276,065	301,576	316,996	330,014
Pages hit & image requests (million)	*4.8	11.7	13.0	23.0	18.0	20.3	24.5	23.0	26.6	27.7
Image requests (million)	-	4.25	5.51	13.3	7.0	7.8	7.7	5.9	6.3	6.9

* These are annual average figures over the first four years that statistics were gathered.

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 were reluctant to register and others had technical issues. For the same reason, the number of registrations increased for the next three years and subsequently dropped.

The reduction in image requests for 2006/07 was 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.

Summary of Internal R&D Output

The following includes progress with items targeted in previous reports.

- Five new programmable telemetry receivers have been manufactured and installed at the Station to upgrade reception capability. Each one is now part of a reception chain for the five steerable/tracking antennas operating at Dundee. They are used to receive signals from the polar orbiting satellites that provide the main data sets collected and distributed by NEODAAS. The receivers were built to a design developed by one of the NEODAAS-Dundee team and used for our main X-band frequency antennas over recent years. Additional hardware has been built and upgraded so that the receivers can be used for a wider range of satellites than originally designed for, including the S-band frequency range. Along with their programmable capability, this means the receivers will support current and future satellite missions due to be received at Dundee over the next few years. Two of the new units have replaced older X-band receivers of the same design that are now available as spares, two have replaced obsolete S-band receivers and the other new unit replaces a failed X-band receiver which was purchased from Alcatel several years ago and has now failed. We now have a common design for all tracking antenna reception chains. This simplifies testing and support and provides components and spares that are compatible with each chain.
- As indicated above, the new receivers were designed to cover the X-band frequency range of transmissions used by some EO satellites. In order to work with the lower S-band frequency range used by NOAA satellites, for example, it was necessary to provide additional interface hardware for each receiver in the form of an “IF Multiplexer”. The multiplexer selects the appropriate input signal line (X or S-band) depending on the satellite being tracked and carries out “upconversion” of the frequency in the case of S-band signals. The output from the multiplexer is then compatible for input to the receiver for either X or S-band missions. The multiplexer also supports a GPS antenna which can be used for precise timing control of the receiver’s frequency synthesis system and to provide a network time reference for computer systems. Two multiplexers were built for use in each of the Station’s two S-band antenna chains.
- Additional work was carried out on the X-band reception chains to improve their dynamic range and protective filtering to limit the effects of local interference. A small filter circuit was designed, built and installed in the RF downconverter on each antenna that converts the received satellite signal to the intermediate frequency (IF) input to the receivers. An input filter/amplifier circuit board was also designed, built and fitted in each of the associated new receivers.
- A 2008/09 NERC capital allocation of £94k was confirmed for Dundee to acquire a new online storage system. The existing systems have greatly benefited operations over the past few years in terms of efficient data management, immediate data access for users and scope to quickly process/reprocess large volumes of data. However, they have become increasingly difficult to maintain and their replacement is overdue. As well as replacement, we have been seeking to provide a system with high availability, no single point of failure, better read/write performance and significantly increased storage capacity (currently around 11 Terabytes) which can be easily expanded, as the older systems can only hold some of our archive data sets, e.g. higher volume MODIS archive data is stored only on tapes. The plan for the new system is to have enough online storage capacity for all polar satellite data, including MODIS, plus new data that will be acquired over the next few years. The additional capacity will also enable us to improve the Station’s services and investigate other enhancements. Our initial target was to provide around 50 Terabytes of storage which can be easily increased as required.

Procurement of the new storage has been a slower process than anticipated. This was partly due to staff changes, as initial research into possible options and vendors had been undertaken by a colleague who left in early 2008. Available staff time then meant that progress was restricted until a replacement was appointed in August. Our staff then made a concerted effort to progress things, meeting with a number of vendors and making site visits, while seeking advice from colleagues at the University of Dundee, NEODAAS-Plymouth and elsewhere. Staff also attended the annual Storage Expo in London and made

contact with other vendors. This detailed research was necessary to establish realistic specifications for our budget and to provide the requirements information for our tender documentation which was issued openly through the EU system. The tender process also has built in delays, but was completed by the end of the 2008. Twelve tenders were received, which is apparently above average. These were assessed and following clarifications with the most likely vendors, a contract was awarded to Latitude UK at the end of February for a Sun based storage solution. This is based on Sun's new "open storage" 7000 series. It includes two 7410 storage head servers clustered in an "active-passive" failover arrangement for redundancy/high availability. The 7410 heads manage disk trays containing a total of seventy two 1 Terabyte SATA hard disks. Solid state disks are also included and used to increase read/write performance. There are also dual power supplies in all items and dual connections between all disks. The system has a very competitive expansion cost and accepts standard SATA hard disks from any vendor. Latitude has also provided two X2250 servers with 10-Gigabit network connections to the storage heads. These will be used as new processing nodes with high bandwidth access to the online storage. Installation and commissioning of the new system was being carried out at the end of March and a full range of agreed tests must be satisfactorily completed before the system is fully accepted.

- The Station's Server Room has been extended into a recently vacated office to provide an area approximately three times the size of the original room. The room houses many of the Station's computer systems such as data processing, online storage, web servers and network equipment and was already filled to capacity, so the extension was essential in terms of accommodating existing equipment as well as the new online storage system that is being procured. Some of our other servers have been moved into the room and NEODAAS-Plymouth has also been able to proceed with plans to expand their processing system hosted at Dundee. An additional air conditioning system has been installed in the extended area, so that we have two independent systems, each of which has the capacity to cool the entire area. This will protect against failure of one aircon which has caused problems in the past. Station staff also installed the required power and network cabling infrastructure and new UPS facilities in order to relocate existing equipment and in preparation for the new systems.
- A new portable air conditioner has been installed in our remote equipment room in the University's Tower Building. Software was written to control this based on the room temperature and the system appears to be working well.
- As previously reported, Dundee hosts a Dell Cluster data processing system that is owned and operated by NEODAAS-Plymouth. All near real-time data which were previously transferred to the Plymouth site are now moved to the local system. This eliminates the delay in transferring full pass data sets between sites, so processing can begin shortly after data reception is complete and derived products can be created and delivered quickly. The system has been operational over the past year and was recently expanded with the addition of several more cluster nodes, a backup master server and a new network switch to increase processing capacity and reliability. This required installation of a new full height rack plus the necessary power distribution and cable management. The new rack hosts the complete processing system of 10 cluster nodes and 2 master servers.
- The EUMETCast system, through which EUMETSAT distributes geostationary satellite data and other data sets, was changed to use a different satellite (Eurobird-9). Our reception system was reconfigured to receive transmissions from the new satellite. Various problems arose with the reception system. These were eventually resolved by replacing the data ingest PC and receiver card and moving to a Linux operating system and Linux-based reception software.
- The recently launched online image gallery has been expanded with several hundred new images being added. The gallery allows users to easily search through images from the archive that have been carefully selected and prepared to highlight applications as well as specific features and events. It enhances the educational and public interest aspects of the website and provides a source to identify case studies for academic and student projects. Approximately one thousand images are now available and others are added as they are identified from the archive and as new events arise. User feedback on the gallery has been encouraging.
- Some website developments were also associated with the gallery such as improved search options, the ability to refine search results and better navigation between image information pages and images.

Underlying code was also improved to make future development work easier. Front pages to various areas of the website have been updated for a consistent visual style and adoption of more up-to-date web standards.

- Tracking and ingest software was upgraded to allow for installation of the new receivers and associated hardware in the reception chains. Robustness of the reception process was also improved by software changes for better fault handling, improvements to monitoring/logging for fault finding purposes, the ability to control more aspects remotely and upgrades to device drivers.
- Tracking antenna scheduling software has been upgraded in a number of ways. This includes provision for satellites which can transmit two signals simultaneously at different frequencies (e.g. MetOp and FengYun) and allowing more complex scheduling. Predictions can now be generated for periods when satellites are transmitting. Previously, schedules were only based on predicting when satellites would be above our horizon and took no account of known periods when transmissions would be switched off. This optimises scheduling, so that it is possible to arrange the tracking times for periods when the satellite is above the horizon and also transmitting. This means more satellite passes can be tracked when they are close together or even if they partly overlap.
- Several improvements were made to software used for creating high resolution, reprojected images. These included enhanced grids and coastline overlays, more real-time visualisation and better handling of noisy data and calculation of high-resolution pixel sizes.
- Paul Crawford co-authored a paper on satellite orbit determination which was presented at the “AIAA/AAS Astrodynamics Specialist Conference 2008”. Accurate information on the orbit of satellites is very important for their safe and effective operation, as the recent collision of the Iridium satellite showed. The major source of information on orbiting debris and dead satellites is the US government's Two Line Elements (TLE). Historically, these are used to separate satellite radar returns from possible incoming missiles, but the process of generating TLE in a manner consistent with the corresponding orbital model has been poorly documented and often restricted due to security concerns. This paper covered work intended to make the process of reliably generating consistent orbital elements easier for space agencies and satellite operators around the world, enabling them to make better use of the TLE with their own (and usually more accurate) observation data in predicting situations such as close encounters that present a risk of collision.
- Browse imagery has been produced for all EUMETCast “essential services” geostationary satellite data received during the year. The complete archives of geostationary satellite images are available for free online browsing

Geostationary browse image availability:	Meteosat	-	2002-present
	IODC	-	2005-present
	GOES-East	-	2006-present
	GOES-West	-	2006-present
	MTSAT/GMS	-	2006-present

- Similarly, quicklook browse imagery was produced for all AVHRR and MODIS data received during the year. The entire archives of polar satellite images are available in quicklook form for free online browsing.

Polar 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

Other projects/organisations that have received imagery or services on a pay-as-you-go basis or limited free access to support non-commercial, research and educational activities:

- Near real-time MODIS imagery for monitoring of ocean current boundaries and sea ice around Iceland – Dr Ingibjorg Jonsdottir, University of Iceland.
- Near real-time MODIS imagery for operational charting of sea ice around Greenland – Dr Leif Toudal Pedersen, Danish Meteorological Institute.
- Climate change and variability in the Black Sea and Mediterranean region associated with processes in the ocean-atmosphere system – Dr Yuriy Ratner, Marine Hydrophysical Institute, Sevastopol, Ukraine.
- Study of heavy rainfall events in Estonia from 1961 to 2005 – Dr Piia Post, University of Tartu, Estonia.
- Development project to study burnt areas of Northern Spain – Institut Cartogràfic de Catalunya, Spain.
- Near real-time MODIS and AVHRR data for Environment Agency AlgaRisk pilot project to monitor algal blooms – Dr Peter Miller, Plymouth Marine Laboratory.
- Near real-time MODIS data for SAMS and Crown Estates marine project west of Scotland – Dr Peter Miller, Plymouth Marine Laboratory.
- Hydrology research & management of water resources – Norwegian Water and Energy Administration.
- Development of a climatology of Mesoscale Convective Systems over the UK (for an undergraduate dissertation) – Dr Steve Dorling, University of East Anglia.
- Investigation of cirrus cloud cover and aircraft contrails over Ireland – Dr Fiona Cawkwell, University College Cork, Ireland.
- Investigation of an unusual snow event in Southern England during December 2006 – Dr Curtis Wood, University of Reading.
- UK air quality and pollution study 2007 for a government annual report – Mr Andrew Cook, AEA Energy & Environment.
- Assessment of the state of sea ice between Spitsbergen and the island of Edgeøya in the Svalbard archipelago for a proposed expedition – Mr Neal Gwynne, The Glasgow Academy.
- Geostationary satellite images used for research in to earthquake clouds and short-term prediction – Earthquake Prediction Center, New York.
- Geostationary satellite data used to support free online weather information and forecast services – Chris Schwerzler, Weather Underground, Michigan, USA.
- Feedback from Universities of Leeds and Reading indicates imagery is routinely used in forums that provide an opportunity for academics and students to discuss topical meteorological events. The group at Leeds also have an associated website with links to relevant Dundee imagery and higher resolution images have been prepared in some cases.
- Access to data to support investigations of meteorological events and publication of results in a Dutch weather amateur journal – Ton Lindemann, The Netherlands.
- Test data provided for development of processing software for non-commercial use by weather enthusiasts and members of the Remote Imaging Group, for example – Mr David Taylor, Satsignal Software.
- Free quicklook Web images are used operationally by national weather services, commercial companies and other organisations, e.g. a few that have indicated they use imagery for analysis include

personnel from UK, Irish, US, Dutch, Danish, Czech and Indian weather services, air forces in India, Pakistan and Bangladesh, NOAA, NASA and Surrey Satellite Technology Ltd.

- Various organisations such as the UK Met. Office and Irish Met Service use imagery for illustrative purposes in reports and articles.

DUNDEE ANNEX 4 - 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. Dundee has an excellent record for successful reception of scheduled satellite passes and figures for 2008/09 continued to be high, while repair work on the antennas and reception systems was limited.

Main points for the year:

- No. of passes received: NOAA – 5750 * SeaWiFS – 833 MODIS – 4507
- No. of full passes lost: NOAA – 6 SeaWiFS – 0 MODIS – 0
- Success rate: NOAA – 99.90 % SeaWiFS – 100.00 % MODIS – 100.00 %

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

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

- One lost pass was from the NOAA-15 satellite. The satellite has degraded transmitter performance that results in data losses on some passes. This particular pass had losses for a lengthy period after the start time and so our systems aborted the reception process. The reception software has been adjusted to be more tolerant in these situations.
- The other lost NOAA passes were over a two day period when tracking errors began to occur with the Dental Building S-band antenna. The problem was traced to some minor corrosion on a circuit board in the antenna that produced errors in the antenna's position measurement for the elevation axis. This was resolved after the board was replaced. Three replacement passes were also taken from the standby NOAA-15 satellite on the second day to minimise the impact.
- Water ingress caused problems with the Tower Building X-band antenna after a split developed in a protective membrane window that seals the antenna's front-end feed against the weather. The feed was dismantled and the components dried out. No permanent damage had occurred and the unit's RF characteristics were found to be as expected when tested. A heavier PTFE material has been used for the new sealing window and provides a much more robust solution without impacting on signal reception. No scheduled MODIS passes were lost during this period, as our backup X-band antenna was used to maintain operations.
- Corrosion in a safety limit switch connector caused a couple of problems with the Tower Building S-band antenna over a 2-3 week period. The fault was identified after the antenna aborted satellite tracking at one point and repair work was promptly completed. The Station's other S-band antenna was available to receive data from all passes scheduled during these incidents, so there were no losses.
- The air conditioning system in the main server room "tripped" on a few occasions during spring/early summer before service engineers identified and corrected the problem. A standby portable air conditioner, which switched on automatically above a set temperature, meant that the impact of these incidents was less significant than before. Although the room temperature was higher than preferred during these periods, routine operations were maintained. The recent extension of the server room and installation of a second fixed air conditioning system should further reduce the impact of this type of failure in future.
- There were many disk space shortages during the year, which entailed a lot of shuffling of data between relatively small file servers to prevent anything being lost. A crucial file server and processing

computer is really showing its age and fails regularly. Its tasks have been moved temporarily to other computers. The new storage system will solve these issues once operational.

- There were various computer hardware failures throughout the year as expected. These included cooling fans, power supplies, motherboards, hard disks, optical and tape drives, etc.

-

Spacecraft operations and problems are also responsible for data losses or reception of corrupted data. The main points are summarised below.

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- There was a break in Terra direct broadcast for approximately two weeks in June 2008. This was due to problems with the primary direct broadcast transmitter, which were eventually resolved.
- Other incidents with Terra's data formatting equipment meant that no data was available for periods on 16 April, 8 September and 20-24 December 2008.
- Although Dundee can only receive encrypted SeaWiFS data, ongoing problems with the spacecraft since the beginning of 2008 meant data were frequently unavailable, including an extended period from mid-June to late August. The satellite was not in imaging mode at these times, but reports from NASA and the satellite operator indicated the instrument and spacecraft appeared to be healthy and they believed patches to the spacecraft software would resolve the problems. The satellite was more reliable for the rest of the year from August, although there were two short periods in October and January when no data were available.
- The operational transmitter on the NOAA-17 satellite operates with output power at 25% of the nominal level. It continues to function and data quality is nominal, but the weaker signal makes reception more susceptible to local interference with minor data dropouts sometimes noted as a result.
- The standby NOAA-15 satellite also operates with limitations, but can be used to maintain coverage during data loss events such as those described above.
- As previously reported, MetOp-A was not expected to provide any direct broadcast data following the failure of a power amplifier in the primary direct broadcast transmitter soon after launch. After investigations, EUMETSAT reported that these amplifiers were found to have a high sensitivity to heavy ion radiation. Despite this, EUMETSAT have started to use the secondary transmitter on the satellite in recent months to provide limited direct broadcast coverage over Europe and the North Atlantic, where ion radiation is less of a problem. This is only available for southbound (daytime) passes and for areas south of 60°N. This equates to approximately 25% of the daily coverage Dundee would receive from a fully operational NOAA satellite, and so we have taken the decision to continue receiving full coverage from NOAA-18 in preference to MetOp-A. This could be reviewed depending on user community preference.
- Other common data losses for Terra and Aqua are:
 - 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 which are received there.
 - Data are occasionally unavailable due to spacecraft manoeuvres.

DUNDEE ANNEX 5 - PUBLICITY ACTIVITIES

- NEODAAS-Dundee makes a significant contribution to science communication through website facilities. This includes general information about the Satellite Receiving Station's operations and satellites, plus links to many related sites. The most popular feature is browse imagery created from data received at Dundee. This provides imagery for the entire archive of over 120,000 recordings from various polar orbiting satellites extending back to 1978. Near real-time and archive images from geostationary satellites are also available and provide global coverage. 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.
- NEODAAS provided material for NERC EO facilities displays at the Remote Sensing and Photogrammetry Society Annual Conference, University of Exeter in September 2008 and the NERC National Centre for Earth Observation (NCEO) Programme Launch, London in March 2009.
- NEODAAS provided material for a BNSC/NERC EO exhibition stand at the International Astronautical Congress, Glasgow in September 2008. The event included a dedicated Climate Day and public access sessions.
- Material has also been provided for a reception area display at the Research Council Offices in Swindon. A dedicated web page has been set up to show the most recently received polar satellite pass and a PowerPoint presentation includes a gallery of processed images that illustrate applications of NEODAAS data and specific events.
- NEODAAS-Dundee participates in University open days and pre/post application visits by prospective students etc. Visits are also arranged regularly for individuals and groups interested in the Station. In the past year, these have included academics, students, school teachers and pupils of all ages, remote sensing company representatives, a group of amateur astronomers and artists.
- In some cases, school and further education staff are provided with free access to higher resolution imagery to support teaching or projects, e.g. to assess conditions for a proposed expedition to Svalbard by senior pupils of The Glasgow Academy. These facilities have also been provided for other groups such as the Air Training Corps to teach Air Cadets and meteorology training services such as the Met Office College to educate forecasters.
- On request, information and imagery is provided to teachers and individual students and 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 imagery.
- Images from the NEODAAS archive are included in the Science Photo Library catalogue and are available for purchase.
- Requests for permission to use selected NEODAAS 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 identified for 2008 are listed below – authors, publishers etc. are requested to credit the facility in all cases.

- 'Airship Technology' (Cambridge Aerospace Series) by G. A. Khoury (Editor), J. D. Gillett (Editor), published by Cambridge University Press, August 2008 – technical book for those interested in designing, building and flying airships of today.
- 'Comparing Development: Rich or Poor?' by Boardworks Ltd., 2008 – Key Stage 3 Geography interactive electronic resource for school teachers.

'This is Geography 2' by J Widdowson, published by Hodder Murray, November 2008 – Key Stage 3 Geography Pupil's Book & Dynamic Learning Disc.

'Essential Mapwork Skills' (Welsh Edition), by Simon Ross, published by Atebol/ Nelson Thornes, March 2008 – Key Stage 4/5 Geography textbook.

'Exploring Science 8' by Mark Levesley, Penny Johnson, Steve Gray, published by Longman, 2008 – Key Stage 3 Science textbook and CD-ROM.

'geog.2' (3rd edition) by RoseMarie Gallagher, Anna King and Susan Jenkinson, published by Oxford University Press, November 2008 – Geography resources and planning CD-ROM for 11-13 year-olds.

'Interpreting synoptic charts and satellite images' by Lucy Prentice, published by Nelson Thornes, 2008 – Article in 'GeoActive Online' series for GCSE Geography students.

'Le cours des Glénans' edited by Le Seuil, 2008 – a book about sailing for the French sailing school Les Glenans.

'Meteorology for Seafarers' (3rd Edition), by R.M Frampton & P.A. Utridge, published by Brown, Son and Ferguson Ltd., 2008 – technical book for professional seafarers.

'Météorologie, 100 expériences pour comprendre les phénomènes météo', by Yves Corboz, published by Belin Editions, June 2008 – book of experiments for understanding weather phenomena.

'State and Evolution of the Baltic Sea, 1952-2005: A Detailed 50-Year Survey of Meteorology and Climate, Physics, Chemistry, Biology, and Marine Environment' by Rainer Feistel, Günther Nausch, Norbert Wasmund, published by John Wiley & Sons, Inc., May 2008.

'Seydlitz Thüringen 6' by Wolfgang Bricks, Heike Bütow and Petra Fischer, published by Schroedel, November 2008 – school Geography textbook (German).

'Teach Yourself Weather' by Peter Inness, published by Hodder Education, November 2008 – comprehensive book and practical guide to weather and the workings of the atmosphere.

'Today's World' (Book 3 – New Edition) by Liam Ashe and Kieran McCarthy, published by The Educational Company of Ireland (Edco), 2008 – Geography textbook for Higher and Ordinary level secondary school students.

'Verdens vilde vejr' (The world's wild weather) by Jesper Theilgaard, published by Gyldendal, 2008 – factual book telling the story of historical and recent weather disasters and the future implications of climate change.

'Weather (Eyewitness Companions)' published by Dorling Kindersley in association with the Met Office, November 2008 – a comprehensive book on meteorology and climate for the layman – from teenagers to adults.

'Understanding the Weather' – Open University Level 1 science course (S189) presented in world print/ebook.

Süddeutsche Zeitung (German Daily newspaper), 12th 13th July 2008 – article on Polar Lows research that made extensive use of NEODAAS archive.

Sonntags Zeitung (Swiss Sunday newspaper), Sunday 27th July 2008 – article on Polar Lows research that made extensive use of NEODAAS archive – gallery image also used as an illustration in the article.

Oxford Cambridge and RSA Examinations (OCR) – images to be used in 2008/09 OCR exam papers and subsequently for revision website and CD ROM.

'Academic General Practice in Scotland: Securing the Future' – cover image for booklet by the Royal College of General Practitioners – Scotland.

University of Dundee – imagery used for 2008/09 University prospectus.

College of Life Sciences, University of Dundee – imagery used for college marketing literature.

'Harry & Paul' produced by Tiger Aspect Productions for BBC, broadcast on BBC 1 Autumn 2008.

'Risk and Reward: 2007 EMEA Liability Insurance Buyers Report', published by EMEA Communication and Marketing Group, Marsh Ltd., February 2008 – risk management report for the European transport and logistics sector.

'Scottish Aerospace Industry' brochure by Scottish Development International/RIG Partnership – permission granted for use of gallery image.

'Severn Tidal Power Project' – Welsh Assembly Government/UK Dept. of BERR project – permission granted for use of image as visual identity in project literature, reports, websites etc.

Chester Sailing & Canoeing Club (<http://www.chestersailingclub.com/>) – permission granted to reproduce images.

German amateur weather enthusiast website by Mario Lehwald (<http://www.seewetter-kiel.de/>) – permission granted to reproduce images.

South African amateur weather enthusiast website by Kobus Botha (<http://www.weatherphotos.co.za/>) – permission granted to reproduce images.

Unmanned Spaceflight.com (<http://www.unmannedspaceflight.com/>) – permission to reproduce images on forum.

'www.wales.com' – Welsh Assembly Government funded website – information resource aimed at overseas users.

Iain Farquhar (Retired meteorologist/Expert witness) – permission granted to reproduce images in weather reports for personal injury cases.

DUNDEE ANNEX 6 - STAFF VISITS, CONFERENCES ATTENDED, REPRESENTATION ON COMMITTEES

S Parkes – Member of the UK Centre for Earth Observation Instrumentation (CEOI) Steering Committee.

A Brooks attended the International EOS/NPP Direct Readout Meeting 2008, Bangkok, Thailand, April 2008.

S Parkes and N Lonie attended the Remote Sensing and Photogrammetry Society Conference (RSPSoc), University of Exeter, September 2008.

A Brooks attended the EUMETSAT Meteorological Satellite Conference, Darmstadt, Germany, September 2008.

A Brooks, P Crawford and J Bowyer attended Storage Expo 2008, London, October 2008.

A Brooks and P Crawford visited the ESA/EUMETSAT satellite groundstation Maspalomas, Gran Canaria to assist with upgrades, November 2008.

S Parkes attended the NERC National Centre for Earth Observation (NCEO) Programme Launch, Royal Institution, London, March 2009.

Information was provided on Aqua-MODIS direct broadcast interruptions in particular for the ESA/EUMETSAT SpaceOps Conference, May 2008.

DUNDEE ANNEX 7 - 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-15	0600			Terra	1000
**NOAA-18	0600			Aqua	1130
**NOAA-18	0900			Terra	1130
NOAA-17	1000			Aqua	1300
NOAA-18	1130			Terra	1300
NOAA-17	1130			Aqua	1430
NOAA-18	1300			Terra	2000
NOAA-17	1300			Terra	2130
NOAA-18	1430			Terra	2300
NOAA-17	2000				
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 beyond.