

**THE UNITED KINGDOM NATIONAL REPORT
FOR PHOTOGRAMMETRY AND REMOTE SENSING
1996 - 2000**

Prepared for the UK National Committee for Photogrammetry and Remote Sensing
by

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KEY WORDS: United Kingdom, National Report, activities, developments, organisations.

ABSTRACT:

The National Report of the United Kingdom describes current activities and new developments in photogrammetry and remote sensing during the period 1996-2000. The balance between photogrammetric and remote sensing interests is tabulated and new research, recent implementations and organisational developments are considered. The increasing use of digital imagery, the availability of imagery via the Internet, and the imminent merger between the Photogrammetric Society and the Remote Sensing Society are noted as features of the report period.

COMPILATION OF THE REPORT:

This short report follows the pattern of earlier reports, particularly in respect of the ISPRS restriction on page length. The information presented is derived partly from 4-pp questionnaires circulated to UK organisations in February 2000 and partly from other reports and the authors' personal knowledge of activities. The authors are members of the Photogrammetric and Remote Sensing Societies respectively, and the first author is additionally co-chairman of the UK National Committee for Photogrammetry and Remote Sensing. Much of the corresponding 1996 report (Kirby and Malthus, 1996), which has the same authors as this report, remains valid, and so the structure of the present report has been varied to avoid repetition. This report has also been varied because of the smaller number of completed questionnaires on this occasion. Opinions expressed by questionnaire respondents and by the authors do not necessarily reflect the views or policy of the UK National Committee.

1. INSTITUTIONS AND PUBLICATIONS

The UK National Committee for Photogrammetry and Remote Sensing is the adhering body to the International Society for Photogrammetry and Remote Sensing and its membership and joint funding are derived from the Royal Institution of Chartered Surveyors, the Photogrammetric Society and the Remote Sensing Society.

At the time this report is being prepared, the Photogrammetric Society and the Remote Sensing Society are at an advanced stage of a merger which should be fully implemented by 2000-2001. Merger talks, which had earlier also involved several other UK learned societies and institutions, began in 1998 and led to the establishment of working groups on a large range of technical and administrative issues. The memberships of the two Societies voted in August 1999 by overwhelming majorities in favour of the merger, which will require the formation of a new limited company. A new society name, reflecting the future in this scientific field, is envisaged. However, for the period 1996-2000, the two Societies have still functioned independently, and therefore justify separate sections in this report.

The Photogrammetric Society, which was founded in 1952, currently has 284 UK and 158 overseas individual members, which represents an overall drop of 11% on the total of individual members reported in 1996. There are also 31 corporate members, including 6 overseas corporate members, which represents a drop of 20% on four years ago. The decreases are thought to be due to declining support both for learned societies in general and for photogrammetry as a separate technology.

The official journal of the Society is the *Photogrammetric Record* which is published twice yearly and is issued free to members. Since October 1996 the *Photogrammetric Record* has published 69 refereed articles of which the authors of 40 articles are resident in the UK and 29 resident abroad. In addition, numerous shorter contributions and reports have been published, the authorship equally divided between the UK and overseas. Substantial book reviews are also a feature of the journal. Reflecting the journal's international nature, since the April 1998 issue the journal

has carried the subtitle "An International Journal of Photogrammetry", and an international editorial board has been appointed. In November 1999, a presentation was made by the Photogrammetric Society to Mr Keith B Atkinson following his retirement as Editor of the journal 1976-1999 and previously as Assistant Editor 1965-1976. Following the merger, it is planned that the *Photogrammetric Record* will continue to be published and distributed as previously.

The Remote Sensing Society was established in 1974 and celebrated its 25th year of existence in 1999. As well as co-ordinating and promoting remote sensing activities, a significant role of the Society is in the encouragement of commercial and government participation in remote sensing, both nationally and internationally. Current membership levels are relatively stable at around 800 members of which 63 are corporate members.

Following changes introduced during the last review period, individual membership ranges from Ordinary, to Members or Fellows depending on peer-reviewed levels of qualification, experience and achievements in remote sensing. Considerable emphasis is placed on Corporate membership which is open to commercial organisations, research institutions or university departments. Student membership is also available and represents a significant and active group within society.

The society continues to operate its Special Interest Groups in Archaeology, Education, GIS, Geology, Field Spectroscopy and Ocean Colour and SAR. Whilst some SIGs struggle to maintain momentum, this collection has been augmented by a new group in Modelling and Advanced Techniques (MATSIG). The official publication of the Society is the *International Journal of Remote Sensing*, still running at 18 issues per year and which is now available to members at heavily discounted rates. It also publishes a quarterly Newsletter, an annual report and occasional monographs. The Society operates an electronic mailing list containing general information and notes on opportunities relevant to remote sensing. A number of awards are given by the Society ranging from the Remote Sensing Society Award and Gold Medal for distinguished achievement in remote sensing to travel bursaries and support for research in progress. The major event is the Annual Conference (proceedings now available on CD-ROM) at which the Annual General Meeting of the Society is held. Other one and two day meetings and workshops are held, often run by the Special Interest Groups and in conjunction with other Societies.

Both Societies have large overseas memberships and cater for the needs of these members by promoting their research and providing a forum for the exchange of expertise and knowledge. The Societies also actively maintain links with other related Societies both within the UK and abroad. Principal amongst these is collaboration with the European Association of Remote Sensing Laboratories (EARSeL), and with the European Organisation for Experimental Photogrammetric Research (OEEPE).

The agreed merger between the Photogrammetric and Remote Sensing Societies has not yet brought any further realignments within the geomatics industry. Within the Association for Geographic Information (AGI), the Survey & Mapping special interest group, formed in 1994, has not maintained any momentum, but the annual conference and exhibition of AGI, which has moved location from Birmingham to London, usually attracts some photogrammetric and remote sensing speakers and exhibitors. The British Cartographic Society remains as an independent learned society, and the National Association of Aerial Photographic Libraries (NAPLIB) remains an independent but small organisation promoting the use and preservation of aerial photographs. In 1999, NAPLIB published the second edition of its *Directory of Aerial Photographic Collections*, which has over 700 entries and a changed layout to incorporate a postcode index.

Within the report period, there have been a substantial number of new UK publications in photogrammetry and remote sensing, including:

- 1996 - *Close Range Photogrammetry and Machine Vision*, K B Atkinson (editor). Whittles Publishing, Caithness.
- 1996 - *Mapping the World*, A S Macdonald. Her Majesty's Stationery Office, London.
- 1996 - *Small Format Aerial Photography*, W S Warner, R Graham and R E Read. Whittles Publishing, Caithness.
- 1997 - *The Advanced Very High Resolution Radiometer (AVHRR)*, A P Cracknell. Taylor & Francis Ltd., London.
- 1997 - *Framework for the World*, D W Rhind (editor). Geoinformation International, Cambridge.
- 1997 - *Earth Observation Data Policy*, R Harris. Wiley, Chichester.
- 1997 - *Above All Unseen: the Royal Air Force's Photographic Reconnaissance Units 1939-1945*, E Leaf. Patrick Stevens Ltd., Sparkford.
- 1997 - *The Care and Storage of Photographs*, D R Wilson. NAPLIB, Swindon.
- 1998 - *Images of the Earth: a guide to remote sensing*, 2nd edition, S A Drury. Oxford University Press, Oxford.
- 1998 - *Digital Imaging*, R Graham. Whittles Publishing, Caithness.
- 1998 - *Window on the World*, CD-ROM, British National Space Centre and Remote Sensing Society.
- 1999 - *Computer Processing of Remotely-Sensed Images: An Introduction*, 2nd edition, P M Mather. Wiley, Chichester.
- 1999 - *Advances in Remote Sensing and GIS Analysis*, P M Atkinson and N J Tate (editors). Wiley, Chichester.
- 1999 - *Directory of Aerial Photographic Collections in the United Kingdom*, 2nd edition. National Association of

- Aerial Photographic Libraries, Dereham, Norfolk.
- 2000 - *Window on the UK 2000*, CD-ROM, British National Space Centre and Remote Sensing Society.
- 2000 - *Datums and Map Projections for Remote Sensing, GIS & Surveying*, J C Iliffe. Whittles Publishing, Caithness.
- 2000 - *Manual of Aerial Survey: Primary Data Acquisition*, R Read and R Graham. Whittles Publishing, Caithness.
- 1996-1999 *Proceedings of the Annual Conferences of the Remote Sensing Society*. RSS, Nottingham.
- (in preparation) - *Guide to Specifications for Vertical Air Survey Photography and Digital Imagery*, Royal Institution of Chartered Surveyors, for International Federation of Surveyors.

2. DATA ACQUISITION AND PROCESSING

Investment in aerospace survey photography and digital imaging has continued at a steady pace in the UK over the past four years, leading to the introduction of new technology and working methods.

2.1 Aerial survey photography

Two major aerial photographic projects were started in 1999 to provide a record of the UK from the air at the turn of the century. In the first project, Aerofilms Ltd and the National Remote Sensing Centre Ltd. collaborated to produce accurately-controlled 1:10,000 scale colour photography for the UK Perspectives Maps Company. In the other project, Cooper Aerial Surveys produced 1:11,000 scale colour photography for the Millennium Map Company. For each project, photography acquired throughout 1999 resulted in nearly complete coverages by the end of the year, the balances being acquired early in 2000.

Most aerial survey photography in the UK continues to be acquired using 23 cm x 23 cm metric cameras with colour film mostly in the form of colour negative materials giving normal colour reproduction. Colour film is now in widespread use in a dual role for measurement and interpretation, and positive prints are preferred because of the logistics and economics associated with the negative/positive photographic reproduction process. B & W film is still used, for example by Ordnance Survey, principally for topographic and cadastral mapping on the grounds of cost effectiveness in materials and processing, and because of its superior resolving power.

Vertical small format aerial photography (SFAP) has become an accepted, though still minor, method of acquiring photocover, particularly where clients can exploit their own PC-based photogrammetric/GIS software and for interpretation where the photography does not require to conform to rigorous metric standards. Cheap desktop digital scanners for a 24 mm x 36 mm format image on 35 mm film have also contributed to the wider use of SFAP. The proportions of film types used with SFAP are currently about 83% natural colour, 24% colour infra red (CIR), and 13% B & W. The high proportion of CIR film is accounted for by the popularity of Kodak DCS 420 and 460 CIR cameras; a high proportion of all the CIR film used in the UK civil sector per year is by SFAP.

2.2 Cameras and navigation

Most aerial survey photography in the UK continue to be acquired using 23 cm x 23 cm metric cameras; Leica, and Zeiss RNK and LMK cameras are all in use. W Vinten Ltd. manufacture a range of both photographic and opto-electronic cameras, suitable for aerial reconnaissance and interpretation. For example, the Vinten 70 mm photographic cameras continue to be used for SFAP.

The use of GPS based systems for photo-navigation has been widely adopted, because of the perceived advantages of achieving more precise flight lines and the potential for reducing errors in navigation. Nevertheless, experience is showing that GPS systems are not entirely trouble-free, suggesting that thorough training is needed in their use, backed by knowledge of the air navigation methods that evolved before GPS had been introduced. In the UK, numerous navigation systems are in use, including the Tracker System, Computer Controlled Navigation System 4, Autonomous GPS and real time L-Band Differential GPS and dead reckoning and Ordnance Survey maps continue in use.

2.3 Airborne digital imaging

Commercial airborne digital imaging is now offered by Aerofilms Ltd. using a Daedalus AADS 1238 multispectral scanner and by the Natural Environment Research Council using a Daedalus AADS 1268 multispectral scanner and a CASI scanner. Using the DCS CIR cameras with their narrower spectral range, the GeoTechnologies company has participated with the Royal Photographic Society (Aerospace Imaging Section) to evaluate image quality of CIR film. The prospect of digital air survey cameras being produced by LH Systems and Z/I Imaging is generating considerable interest in the UK. The long-term storage and retrieval of original imagery in digital form are major considerations.

2.4 Satellite remote sensing

Two UK companies have programmes for the construction of remote sensing satellites. Surrey Satellite Technology Limited (SSTL) designed and built the UoSAT-12 mini-satellite as part of their internally funded research and development programme. The satellite carries a medium resolution panchromatic camera and a multi-band twin camera multispectral imaging system. Both the panchromatic and multispectral systems employ an area array CCD at the focal plane of each camera. Both the satellite bus and sensor systems were designed and built by SSTL, and the satellite was launched on the 21st April 1999 into a circular 651 km orbit, inclined at 65 degrees. The satellite is functioning as expected.

Sira Electro-Optics Limited have built a Compact High Resolution Imaging Spectrometer, (CHRIS), for the British National Space Centre. The design called for a small instrument to be flown on the European Space Agency miniature satellite PROBA. CHRIS will provide multispectral coverage over the range from 400 nm to 1050 nm with a minimum spectral resolution in the range between 2 and 10 nm. The ground sampled distance will be 25 m.

2.5 Development of web-based processing facilities

With Internet resources now routinely used in both commercial and research environments, the period 1996-2000 has seen much development of facilities taking advantage of the new ways of operating that such technology provides. One example is the Image Web Server technologies developed by Earth Resources Mapping. This technology uses wavelet compression technology to serve imagery of significant sizes interactively to a large number of users. Compressed image files can be downloaded and then uncompressed on the clients own computer, which greatly reduces delays in downloading files across the Internet. The technology is generic; the facility can be integrated within a number of different image processing and GIS software packages.

Earth Observation Sciences has developed related software products such as Catalogue and Browse (CBS), specifically developed for management of environmental data and which enables users to search for and browse data including imagery, to view search results and to order products through a WWW interface. The technology can ingest data from existing databases, interface to remote sites/network stations as well as incorporate data from a variety of satellite sensors.

2.6 Development of Internet based teaching materials for remote sensing

Along with the publication of the *Window on the World* CD-ROM (see below), a significant development in education for students of remote sensing is the National Learning Network for Scotland, developed as a collaboration between the Universities of Paisley, Edinburgh and Dundee. The aims of the project, funded by the Scottish Higher Education Funding Council, were to produce and evaluate teaching and learning materials for remote sensing in all Scottish Higher Education Institutions. These are available over the Web and are integrated with three "virtual laboratories" that enable more exploratory learning. The emphasis was placed on short interactive, multimedia lessons on key topics in the background science and technology of remote sensing and a sample of application areas.

In addition to the high quality web-based materials, the consortium have also co-ordinated and shared video-conference lectures and seminars which take advantage of the high bandwidth available on the Scottish Metropolitan Area Networks (MANs). The project is now completed and an excellent set of teaching resources can be accessed at: <http://www.nln.met.ed.ac.uk/welcome.htm>

3. RECENT ACTIVITIES

Individual activities are not necessarily representative of the continuous day-to-day implementations of photogrammetry and remote sensing in the UK, but three major and varied UK events from the report period are noted.

The principal technical symposium in photogrammetry and remote sensing in the period 1996-2000 was the ISPRS Commission II symposium held at Cambridge July 13-17, 1998 under the title "Data Integration: Systems and Techniques". Reports on this highly successful symposium have been published elsewhere. The symposium proceedings are published by ISPRS as Volume XXXII, Part 2, Commission II (1998).

Close-range photogrammetry was employed in 1997 as an integral part of the fabrication of the largest sculpture ever produced in Britain. The "Angel of the North" was made from 200 t of steel with a body 20 m high and a wingspan of 54 m. It was completed in February 1998 on a prominent site adjacent to the A1(M) road and East Coast main railway line at Gateshead. The Department of Geomatics, University of Newcastle, working from a plaster cast, produced a 3-D CAD model at 1:10 scale from which surface measurements were used to fabricate the full-sized sculpture.

The Remote Sensing Society (through its trading company RSS Enterprises Ltd) brought together consortiums, which developed the *Window on the World* and *Window on the UK 2000* CD-ROMs on behalf of BNSC, which were distributed free with the Sunday Times on 13 September 1998 and 9 April 2000, respectively. Additional related copy appeared in the Colour Supplement and other sections of each issue. The CD-ROMs were written in HTML, and are navigated just like a Web site. Satellite imagery, aerial photographs, video, graphics and text were all used to explain the principles of earth observation techniques and illustrate applications of data derived from satellites. Additionally, games and other activities were included to both entertain and educate users.

The intention of the CD-ROMs was to raise public awareness of earth observation as a tool for increasing the understanding of Earth system processes and thereby enhancing the welfare and quality of life by the better informed management of resources. The CD-ROMs were aimed at both business and education users and were designed for users with little knowledge of remote sensing.

4. SIGNIFICANT CHANGES IN THE PERIOD 1996-2000

Within the individual organisations responding to the questionnaire, by far the most frequent change in the photogrammetric community relates to the increased use of digital technology. The movement from analytical to digital, noted in the national report 4 years ago, has intensified more recently. Most companies that have only recently started operations with imagery (either aerial or close-range) use digital processes exclusively, and may have started with no previous experience of analytical photogrammetry.

Specific software packages for handling digital data were listed by one-third of all respondents, these being either standard commercial packages or, for example in the case of As-Built Solutions Ltd., a panoramic photogrammetric/CAD tool developed in house.

Within the remote sensing community, most corporate members indicated little change in activities or even modest expansion in terms of staff numbers during the 1996 to 2000 period. However, two respondents noted significant reductions in personnel over the period, noting a four-fold decrease in one case and a five fold decrease in the other. Despite this, the development of Internet based 'Wizards' and WWW servers allowing the greater ability to search and interrogate image archives and data catalogues has been a significant development (see 2.5 above). Similarly, the development of SAR interferometric techniques and continued success of the ERS-1 and 2 and Radarsat 1 platforms has seen the utilisation of SAR interferometry become almost routine in certain applications.

Other trends which were noted were:

- orthophotography as a normal product
- airborne radar being developed for mapping and heighting
- the reduced costs for certain remotely sensed products such as Landsat 7 data
- integration of Lidar data with aerial photogrammetric and remotely sensed imagery for UK sites

In respect of the most significant developments in photogrammetry and remote sensing in the UK during the period 1996-2000, there was less comment than 4 years ago on government policies and much more specific reference to technological issues. A major consolidation and boost to the industry has been provided by the continuing massive upgrade in technology, including digital workstations with substantial computer power and user-friendly software from specialist software companies.

The UK commercial initiatives to provide national air photo cover at large scale, available as relatively cheap products to anyone via a website, are thought likely to increase the public's appreciation of aerial imagery, as well as provide a viable market. Similarly, the Application Development (ADP) and LINK programmes initiatives funded by OST and DTI/BNSC have seen a number of corporate member companies and research institutions collaborating on bringing near-to-market technologies to commercial viability or, in the case of LINK, developing research ideas further over a range of applications with potentially global relevance. Significant examples include ship detection and oil slick monitoring techniques using radar imaging sensors.

Although the Ordnance Survey's policy of contracting mapping services to independent companies was generally welcomed, at the same time the tendency for private and government companies in the UK and W. Europe to contract work to Asia and E. Europe was deplored as detrimental to the home-based photogrammetric industry. A general shortage of trained specialist photogrammetrist in the UK was noted.

Delays in obtaining funds for approved projects from Europe, both as part of Framework IV/V projects as well as from the European Space Agency were seen to have had significant impact on the viability of some remote sensing companies during the period. However, the restructuring of activities within ESA, which has enhanced its role, was seen as a positive move in improving the relevance and efficiency of the activities it undertakes and in enabling UK companies to continue to win significant funding within its projects. The continued functioning and developing applications of radar image data from the ERS and Radarsat platforms was seen as a significant factor in

development of new applications during the 1996-2000 period.

5. SUGGESTED CHANGES IN THE PERIOD 2000-2004

Commercial companies are optimistic about the future of both photogrammetry and remote sensing, as indicated in Table 5.1. Within remote sensing, considerable optimism for the expansion of the industry was felt as a result of a number of factors including the continued deployment of high resolution satellite sensors such as IKONOS opening up new areas of application and the continued development of routines and applications for SAR interferometry. The impact of the involvement of commercial companies in the development and deployment of new sensors in space was seen as a highly positive move, mainly through the introduction of competitive and areal-based pricing policies, such as that offered for IKONOS data by SpaceImaging. This has already seen changes in pricing policies for new data from Landsat 7, a significant change from the policies for data from previous Landsat platforms. In addition, the continued integration of remote sensing and geographical information systems was seen very much as a positive move which would be significantly enhanced by the increasing importance of the Internet.

Table 5.1. Forecast of UK activities 2000-2004

	Photogrammetry	Remote Sensing
Expanding	11	12
Constant	3	2
Diminishing	3	0

6. SOURCES OF INFORMATION

The *Photogrammetric Record*, edited by P R T Newby, and the Photogrammetric Society Newsletter, produced three times a year by D M Stirling, are the main sources of information on photogrammetric activity in the UK. A list of corporate members is published in every issue of the *Record* and of individual members in each April issue. Information about photogrammetry can also be found on the Society's WWW pages at <http://www.photsoc.org.uk>

The main sources of information on UK remote sensing activity include the Remote Sensing Society's official publications: the *International Journal of Remote Sensing*, edited by A P Cracknell, the Newsletter, edited by V Thorne, and occasional monographs. Information about the Remote Sensing Society and its activities can also be found on its WWW home page:

<http://www.the-rss.org>

Following merger, the Societies' Newsletters will combine and the WWW pages will also combine at a new website.

ACKNOWLEDGEMENT

The authors of the report wish to acknowledge the assistance of Corporate Members of both the Photogrammetric and the Remote Sensing Societies in providing information.

REFERENCE

Kirby, R. P. and Malthus, T.J. 1996. The United Kingdom National Report for Photogrammetry and Remote Sensing 1992-1996. In: *International Archives of Photogrammetry and Remote Sensing*, Vienna, Austria, Vol.XXXI, Part B6, National Reports pp.86-93.