

## INTERNATIONAL SOCIETY FOR PHOTOGRAMMETRY AND REMOTE SENSING

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SECTION 1TOPOGRAPHIC OPERATIONSINTRODUCTION

101. In addition to the production of standard scales of topographic mapping the scope of topographic operations undertaken during the period under review has ranged from projects at very large scales designed to meet specific user requirements, such as a 1:100 survey of a harbour breakwater, to much smaller scale work designed to provide a base for tourist information. Photogrammetric methods are employed where justified to revise the basic scales of the national survey whilst in coastal areas photogrammetric methods have been used to up-date navigational charts.

PROJECTS EXECUTED.

102. The Hydrographic Department, Ministry of Defence has used photogrammetric methods to assist in the production and maintenance of marine navigational charts. The work includes measurement of water depths and heighting of inter-tidal areas in addition to plotting topographical features where these are of use to the mariner. Underwater rocks and other hazards to navigation are detected and plotted. See also Section 3.

103. The Ordnance Survey (OS), having substantially completed the post-war re-survey of the three basic scales of mapping in Great Britain, is now primarily concerned with the revision of published material. This includes maintaining the archive of survey information and making it available to users in forms most suited to their needs. In 1982 OS conducted a detailed review of the future role of photogrammetry in its mapping programme which recommended modernization of equipment to provide increased productivity and faster response times and orders were placed for a Kern DSR1 analytical plotter and for equipment to convert three analogue plotters into automated work-stations. The review also gave rise to a field trial of the use of orthophotography for the revision of maps in rural areas. In another trial, small air photography contracts have been let outside the traditional flying season (March to October) to see whether winter photography can be used to supply the detail required for the OS map specification.

104. Modern aerial triangulation software (PAT-B and PATM-43) was acquired and introduced. It is expected that, besides improving solutions generally, this will lead to increased accuracy of control points supplied exclusively by photogrammetric means for the use of ground surveyors.

105. During the period covered by this report precise photogrammetric methods were used to resurvey at 1:1250 scale over 180 square kilometres of developing urban areas which were previously at 1:2500 scale and an increasing number of 1:1250 sheets have been revised annually using photogrammetric methods. Although the programme of recasting the old County Series plans of rural areas on to National Grid sheet lines at 1:2500 scale has been completed, each year some of these plans have been resurveyed. But increasingly the work at this scale has been revision; over 4000 plane-rectified enlargements were produced during 1980 to 1983 from 1:7500 scale normal-angle photography for revision by direct fit and trace methods. In addition, revision work was carried out on almost a thousand square kilometre sheets by precise stereoplotting from either 1:7500 scale normal-angle or 1:10 000 scale wide-angle photography. Forty-one routine accuracy tests of overhauled 1:2500 scale mapping, using points of detail coordinated by analytical aerial triangulation were completed during the period.

106. Most of the effort at 1:10 000 scale has been directed towards completing the metric contours at 5 or 10 metre vertical intervals over the whole country using 1:25 000 scale wide-angle photography. In areas where change has taken place and new photography has been acquired, revision of planimetric detail has been carried out at the same time. Metric contours have also been provided for over two thousand 1:10 000 sheets where the planimetry was derived from surveys at larger scales.

107. Aerial photographic products such as paper contact prints, enlargements and film negatives and diapositives are provided to public and private organizations against a fixed scale of charges. In addition, a small amount of work has been carried out on repayment, including specially commissioned aerial photography and the provision of contours at a non-standard vertical interval.

108. The Ordnance Survey of Northern Ireland has completed some 500 square kilometres of 1:2500 scale re-survey of rural areas. Revision of 1:1250 scale plans of Belfast and other urban areas has been completed and two small towns have been re-surveyed at this scale. Contouring at 10 metre vertical interval has been completed for 2520 square kilometres for 1:10 000 scale maps and also for four 1:50 000 scale maps. Over 15% of stereoplotting time has been spent on work for other government departments, the bulk of which has been at 1:500 scale for new road schemes. Various other tasks have been completed, mainly contour plots with varying vertical intervals on 1:2500 detail base, but also some at larger scales.

109. Control for stereoplotting of 1:2500 scale resurvey areas was supplied by AIM strip method with the strips being formed on-line. Photography was at 1:10 000 scale with blocks consisting of forty to fifty models covering approximately 60 km<sup>2</sup> (one 1:10 000 sheet) for each block. The work is done on a Wild Aviomap AMH (or A8) connected to a Wild EK22 Data Acquisition System which in turn is interfaced to a Hewlett-Packard 9825 Programmable Desk-top Computer. Block adjustment is completed off-line on the HP9825. A bonus of this method is the calculation of Absolute Orientation parameters derived from the AIM observations and the final adjustment results. These parameters are used for setting up models at plotting stage.

110. Among public utilities the Central Electricity Generating Board has used aerial photography for preliminary planning of overhead power-line routes as part of the national electricity distribution system. Photography of likely

routes was obtained at about 1:12 500 scale and used to plot contours along possible alignments on the existing 1:2500 Ordnance Survey plans.

111. In the private sector the pattern of activity reflects the widespread requirement for large scale surveys for special purposes. Typically, Survey and Development Services of Edinburgh have undertaken photogrammetric surveys ranging in scale from 1:1250 to 1:500 for planning and development purposes, pipeline routes, mineral extraction sites, construction sites and even championship golf courses. Associated companies have been engaged in activities recorded in Sections 2 and 4.

112. BKS Surveys Ltd have undertaken aerial photography in Malawi, parts of Central America, East Africa and colour aerial photography for mineral exploration in the Arabian Peninsula. Hydrographic surveys are also being undertaken for energy related development in the Gulf region. The company has installed a fully computerized mapping system capable of recording and storing information directly from aerial photographs or from ground supplied data in digital form. The company received the Queens Award for Export Achievement in 1983.

113. In early 1983 Clyde Surveys Ltd, Maidenhead, completed some 1400 square kilometres mapping of the River Aguam, Honduras, at 1:10 000 scale. The project was funded by the United Nations (New York) and supervised by Sir William Halcrow and Partners, London. Photography supplied by IGN Honduras was controlled by geodetic traversing and levelling and 57 sheets of 1:10 000 mapping with 2 metre vertical interval contours were compiled by digital stereocompilation.

114. Supplementary spot heights along river banks and irrigation channels were incorporated with the photogrammetric data to form a digital terrain model from which the consultants were able to simulate various flood patterns. It was thus possible to recommend engineering works to improve the agricultural infrastructure of the River Aguam Valley.

115. Although primarily concerned with research, development and education the universities and polytechnics have also undertaken various topographic projects either as student tasks or under other arrangements.

116. Thus University College London, Department of Photogrammetry and Surveying has carried out aerial triangulation projects to support archaeological mapping in the United Kingdom and overseas; mapping for archaeological work has also been carried out.

117. At the University of Newcastle upon Tyne, the Department of Surveying has undertaken a number of student mapping projects which have involved the use of aerial photogrammetry. In 1980, a 1:10 000 scale tourist map of the Malham area was produced for the National Trust. Similar maps have been produced of the Bolton Abbey area (1981) and the Chatsworth area (1982) for the Trustees of the Chatsworth Settlement. Other topographic mapping has been carried out in conjunction with research projects of other departments within the University. Wild A7 and Kelsh stereoplotters have been employed in this work.

118. The Polytechnic of Central London conducted tests on the relationship between photogrammetric control density and survey accuracy using medium scale aerial photography of Regents Park.

119. University College of Wales, Department of Geography, have undertaken a large number of operations relating to specialist studies including a complete re-survey at 1:2500 scale of a large coastal sand-dune complex. Other projects have included digital terrain modelling of areas liable to inundation; such projects have been undertaken in collaboration with public authorities and some have required specially commissioned air photo sorties. Equipment includes a Kern PG2 interfaced to an RM 3802 microcomputer and to a Honeywell 6080 mainframe computer.

#### PHOTOGRAPHIC COVERAGE

120. Complete photographic coverage of Great Britain has been available for a considerable number of years; this includes infra-red photography of most shore-lines. The recent trend in air photo acquisition has been to mount air photo sorties for specific projects as distinct from area coverage. Thus the Royal Navy may task its own aircraft to obtain photography required for particular hydrographic purposes, the public utilities obtain photography for defined purposes and the private sector specifies the photography required for individual projects.

121. Ordnance Survey carries out all stages of aerial survey from flight planning and taking of photography through processing, assessment and aerial triangulation to instrumental or graphical plotting followed by field completion and checking. Monochromatic film is used almost exclusively with infra-red sensitive film for tidal surveys. Aircraft and flight crew are hired from commercial companies but the Department provides its own cameras and operators. Three Zeiss (Oberkochen) RMK 30/23 and three Wild RC8R cameras are used. During 1980 to 1983 almost 1100 hours of flying in a total of 37½ aircraft months produced coverage of 31 600 square kilometres at a variety of scales. Of this over 98% was of acceptable quality. Two aircraft were used in 1980 and 1981, one for the full flying season of March to October and one for a shorter period. In the 1982 and 1983 seasons a single Douglas C47 aircraft was used with great success.

122. Film processing was carried out using a Pakarol automatic film processor but at the end of 1983 this was about to be replaced by a Pakotone machine. Other processing equipment includes two Cintel electronic contact printers, a Kodak automatic paper processor and two Zeiss (Oberkochen) rectifiers.

123. At the Ordnance Survey of Northern Ireland the Wild RC5 aerial camera was replaced in mid-1982 by a Wild RC10. This has since been fitted with a PEM system and a Zeiss NT1 Navigation Sight is used. A local air taxi company's Piper Aztex which was modified to take the equipment permits the use of any short spells of suitable flying weather. Photography is flown at all the normal scales for topographical mapping within the limitation of a 10 000 feet ceiling. The bulk of photography is 1:10 000 for 1:2500 plotting.

#### INSTRUMENTATION

124. The present indications are that although the technology of analytical photogrammetry is now firmly established, a substantial amount of work is still produced by analogue methods. All contributors to this report have referred to their use of analogue instruments but most are now employing analytical systems also.

125. At Ordnance Survey observations for aerial triangulation are made on Hilger and Watts stereocomparators with preparation work by Wild PUG 4 and PUG 2 point transfer devices. The computations are carried out using a suite of programs on the Department's mainframe computer. During 1980-83 approximately 1650 stereograms per year were observed and adjusted.

126. At the Ordnance Survey of Northern Ireland stereoplotting equipment consists of three Wild A8 Autographs, one with TA table; a Wild Aviomap AMH and TA table and one Wild B8 Aviograph which has recently been fitted with a triaxis locator and encoders and linked to a TA Table; a Wild EK22 Data Acquisition System; a Zeiss snap marker; Wild PUG 4 Point Transfer Device; two Milligan Electronic Printers for the production of photographs and diapositives and supporting equipment.

127. At the Directorate of Overseas Surveys (DOS) two microcomputers were purchased primarily to assist in the Directorate's aerotriangulation programme. One, a BBC Microcomputer, is to be dedicated to digital output from the Wild A10; the second, a CROMEMCO Microcomputer accepts data from three suitably encoded Wild A8s. Projects requiring orthophoto maps have been undertaken using the two Officine Galileo Orthophoto Simplex G6 instruments commissioned since the last congress.

128. Experiments continued in order to reduce map production costs. Digitizing at plotting stages has now been discontinued and all the Directorate's large scale compilations (primarily 1:2500 scale) are now hand digitized after the instrumental plots have been field checked. A Ferranti Master Plotter was used to produce the final maps from this digital data. The automated equipment is also used to prepare base plots, master frames for large scale maps, graticules and field survey control diagrams.

129. Since the last Congress, DOS has introduced the PATM-43 Aerial Triangulation package developed at the University of Stuttgart. DOS is running PATM-43 on a 16 bit PDP 11/34. The type of computer restricts the size of blocks that can be run with the result that DOS does not deal with blocks of greater than 750 models.

#### MANPOWER

130. Whilst detailed statistics for all contributors to this report are not available there are indications that in the four years under review there have been several reorganizations in both the public and the private sectors which have resulted in some savings in manpower. An example, planned for the near future, is that on 2 April 1984 the Directorate of Overseas Surveys (DOS) ceases to be a part of the Overseas Development Administration and will transfer to Southampton to become the Overseas Surveys Directorate (OSD) of the Ordnance Survey; the move will take place between April and September 1984. These new arrangements will not affect the Directorate's existing abilities to assist developing countries in basic land surveying and mapping under the UK programme of technical co-operation and to provide cartographic training for overseas personnel. The secondment of experienced technical and professional staff to overseas governments will continue as will the provision of advice on technical and professional training, new equipment and techniques.

SECTION 2NON-TOPOGRAPHIC OPERATIONSINTRODUCTION

201. Whilst the large national enterprises with statutory responsibilities for mapping and charting have continued to develop and exploit the photogrammetric processes, some of the smaller organizations have taken the opportunity of applying photogrammetry to a wide variety of situations where such treatment has provided the means of obtaining results with optimum speed, predictable reliability and, in some situations, in comparative safety.

PROJECTS

202. Examples of the different applications of non-topographic photogrammetry are summarized in the following paragraphs.

203. Using very large scale photography to survey contours at 0.5 m vertical interval the Central Electricity Generating Board were able to construct wind tunnel models of the terrain to predict ash and water vapour fall-out from chimneys and cooling towers and hence to gauge the effect on the environment of proposed power stations.

204. Longdin and Browning (Surveys) Ltd have employed photogrammetric methods to detect strains which occurred during the construction of off-shore oil platforms.

205. Photarc Surveys Ltd and Neptune Surveys Ltd have been involved in many projects ranging from architectural elevations, strata plane identification and slip surfaces on rock faces, engineering pipework surveys, monitoring tunnel deformations and underwater stereophotography and the related photogrammetry.

206. As in the case of topographic operations the universities and polytechnics have also engaged in non-topographic projects. At the university of Newcastle upon Tyne the Department of Surveying has been involved in the following non-topographic operations:

- a. Footprints of the static foot in load, produced from expanded polyethylene foam, Plastazone, have been measured to provide a quantitative analysis of the sole of the foot. The measurements are used by orthopaedic surgeons to study the form and development of foot deformities and in the assessment of the results of surgical and other treatment.
- b. Changes in facial shape resulting from treatment by orthodontic and surgical means have been measured.

Photography for use in these projects has been taken with a stereometric camera constructed from a pair of Multiplex projectors according to a design by Beard. Measurement has been by Wild A7 stereoplotter when contoured plots are needed or by Zeiss (Jena) Steko 1818 stereocomparator when spatial coordinates only are desired.

207. The Photogrammetric Unit of the Institute of Advanced Architectural Studies of the University of York continued to provide a photogrammetric service for the

Department of the Environment (DOE), Directorate of Ancient Monuments and Historic Buildings (DAMHB). The principal products of the Unit were 1:50 scale drawings of elevations of facades of the Ancient Monuments in the care of the DAMHB. These are normally very detailed drawings showing every stone and architectural detail of the facade. The Unit also produces 1:20 scale drawings and rectified photography when appropriate. During the period of the report, surveys have been carried out at over fifty monuments, including important buildings such as Richmond Castle, Kenilworth Castle and Bury St Edmunds Abbey.

208. The Polytechnic of Central London carried out photogrammetric accuracy tests and also conducted deformation tests on reinforced concrete. A current cable-net project is concerned with the testing of a model of a cable-net roof structure and comparing photogrammetrically observed values with computer predictions.

209. At University College London non-topographic photogrammetry continued to be a major interest of the Department of Photogrammetry and Surveying. The traditional applications in archaeology have continued in the monitoring of a wall painting in Canterbury Cathedral whilst the plotting of skin ulcers and bones has contributed in the medical field.

210. New applications have been explored in the engineering field: building heights have been measured so that models to test wind currents can be constructed, and photographs have been taken of offshore oil rigs, the Edinburgh Castle rock and motorway bridges. A Kern DSR1 analytical plotting instrument has been purchased, particularly to help with non-topographic work and one of the first projects in which it has been used is in the measurement of pipework in chemical plant, and also in highly tilted photography of Richmond Castle, Yorkshire for the Institute of Advanced Architectural Studies (IAAS), York. Work has continued on underwater photogrammetry.

211. The University of York was host to the ISPRS Commission V symposium held on 5th - 10th September 1982 and attended by 177 delegates from 26 countries. The theme was Precision and Speed in Close Range Photogrammetry and 58 papers were presented. Included were a report by the National Physical Laboratory of investigations into stability of photographic emulsions and in the context of architectural photogrammetry, a paper entitled "Castle Howard Revisited": the location of a well known television serial, and the site of one of the earliest applications of architectural photogrammetry in the United Kingdom. See Section 7.

SECTION 3REMOTE SENSING OPERATIONSINTRODUCTION

301. The period 1980-84 has been one of consolidation and one in which the basis of a co-ordinated national programme has been set out. Important new facilities have been developed for data processing, new organizations have been set up throughout the United Kingdom for the application of remotely sensed data in research and resources surveys and the opportunities for training in remote sensing techniques have been transformed.

302. The leading government ministry involved in satellite remote sensing is the Department of Trade and Industry which through its chairmanship of the National Remote Sensing Programme Board (NRSPB), first meeting December 1982, has begun to co-ordinate a £14 000 000 national programme. From mid-1983 General Technology Systems Ltd acted on behalf of the Programme Board in a co-ordinating capacity. The major activities managed by the Board were the UK preparations for the ESA, ERS.1 satellite and the services and projects of the National Remote Sensing Centre at the Royal Aircraft Establishment (RAE), Farnborough. The NRSPB also co-ordinates these activities with the substantial remote sensing programmes of the National Environment Research Council (NERC) and the Science and Engineering Research Council (SERC).

303. Remote sensing interests were focussed during 1983 by a Parliamentary Select Committee on Science and Technology, which through a sub-committee on remote sensing and digital cartography examined the potential national role of remote sensing in the context of likely developments in digital cartography and geo-information systems.

DATA RECEPTION AND ACQUISITION

304. Meteorological data were received routinely by the UK national station at RAE, Lasham, at the NERC facility at the University of Dundee and in a number of other universities. Meteosat, CZCS, and AVHRR data were made available to UK and other users. An experiment in high-rate data transfer by satellite (SPINE, 1981-83) was carried out between the ESA Landsat station in Kiruna (Sweden) and the UK National centre at RAE, Farnborough. In 1982 a number of time dependent users joined in the AGRISPINE experiment which provided MSS data within a few hours. NERC acquired an aircraft in 1983 and Hunting Geology and Geophysics acquired a Daedalus Scanner thus enabling the reading acquisition of 11 channel MSS data. Thermal scanning for heat conservation studies were available through Clyde Surveys.

DATA PROCESSING

305. Many commercial and governmental organizations have installed special data processing facilities which include the new Meteorological Office system for short-term weather forecasting which uses a combination of ground radar data and satellite imagery. Of particular interest has been the growth in facilities which offer services to multiple user communities; in the public sector RAE, Farnborough, NERC and several universities provide general purpose facilities. Commercial organizations which now provide remote sensing data processing facilities for their clients include Huntings, ERSAC, Nigel Press Associates, Geosurvey International, PNC and Logica.



306. At the Directorate of Overseas Surveys a 2-sheet map of Nepal was prepared from system corrected negatives and Band 6 multi-spectral Landsat imagery; a traditional light source was provided by reversing the sun azimuth in the mountain areas not covered by snow. Return Beam Vidicom (RBV) imagery from Landsat 3, conventional photography and existing maps were used to supplement the interpretation of topographical detail.
307. Since 1980 the Directorate has been cooperating with the Regional Centre for Services in Surveying and Mapping, Nairobi, on the production of 1:1 000 000 scale maps of East Africa based on Landsat imagery. In March 1981 a member of the Directorate's staff attended the RESSM Workshop in Nairobi and lectured on photomapping and imagery mapping techniques followed by practical demonstrations at the Survey of Kenya.
308. The Ordnance Survey supported a joint investigation with the Department of the Environment of the potential of synthetic-aperture radar imagery. The study was carried out by University College London as part of a joint ESA/JRC sponsored project. The results indicate that the geometry and interpretive problems of the imagery severely limit its usefulness for topographic mapping.
309. In 1980 a joint project with the National Remote Sensing Centre sought to measure the accuracy with which Landsat MSS data could be transformed to the National Grid and current investigations include a study of simulated SPOT imagery at University College London sponsored jointly with the NERC. The Ordnance Survey is also a principal investigator in the Spacelab metric camera experiment.
310. At University College London the remote sensing activities have increased considerably during the period under review. Reports on the use of simulated SPOT data and of SAR 580 data for mapping have been prepared and preparations are in hand for the metric camera experiment on the Spacelab flight and for the application of the data obtained. The Department of Photogrammetry and Surveying has contributed to the purchase of an I<sup>2</sup>S digital image processor for remote sensing work at University College London.
311. The Remote Sensing Unit of the University of Aston in Birmingham has been engaged in a wide range of contract work in addition to research work reported in Section 4. Tasks have included land use, reclamation and pollution, vegetation and cultivation, regional geology and soil erosion, agricultural development and site investigation. In addition to its own equipment the Unit has access to other equipment through the National Remote Sensing Centre and other organizations.
312. The Hydrographic Department of the Ministry of Defence in co-operation with the UK Remote Sensing Centre at Farnborough have processed several LANDSAT MSS scenes and plots have been produced showing coastline inter-tidal features and approximate bathymetric contours. The GEMS image processing system is used for this work.
313. The Queen's University of Belfast have used aerial photographs at scales of 1:10 000 and 1:20 000 for the production of vegetation and peat erosion mapping in Northern Ireland. Black and white prints were used for interpretation and plotting was carried out on a Wild B8S plotting instrument.
314. Research and Development in remote sensing is included in Section 4.

SECTION 4RESEARCH AND DEVELOPMENTINTRODUCTION

401. The general trend in research and development has been in the application of well established photogrammetric theory to new areas of endeavour. This has been largely due to the increased availability of small computers which can if required be dedicated to particular systems and interfaced to existing instruments.

402. The need to measure and monitor the performance and behaviour of underwater structures has stimulated the development of underwater photogrammetry whilst elsewhere, projects have extended from close range industrial applications of photogrammetry to the processing of satellite imagery and remote sensing.

THEORY AND METHODS

403. University College London, Department of Photogrammetry and Surveying, has undertaken a major research project for the measurement of small objects using stereoscopic viewing under a microscope; the hardware and associated software are currently under development. Other research is being conducted in the field of remote sensing to develop methods of mapping with SPOT data and with MSS data from an airborne Thematic Mapper. An I<sup>2</sup>S digital image processor and a Kern DSRI analytical plotter are being used for this work. A research project on multi-station bundle methods has been completed and research has been initiated into the use of a computer in the design of close range photogrammetric triangulation. Research has also been conducted in industrial applications and stereometry.

404. Also at University College London, Department of Anatomy, the analytical restitution of a stereopair of micrographs from a scanning electron microscope has been developed using a dedicated microcomputer interfaced to a specially designed stereometer.

405. At the University of Newcastle upon Tyne a major research project has been concerned with the development of a system for underwater photogrammetry from a manned submersible craft. The system uses commercially available equipment and permits rapid presentation of results from on-site analysis. Objects at depths of 180 metres have been measured to an accuracy of  $\pm 2.5$  mm from a range of 3 metres. A research project investigating the application of non-metric photography in medical photogrammetry was completed in 1981.

406. The University of Bristol has recently employed photogrammetric methods for research into the mechanism of bird flight and a current research project is investigating deformations of embankment dams. The method uses a model of the dam viewed in section through a perspex sided box. Earlier research projects examined flow patterns and wave heights in a scale model of the River Severn Estuary.

407. North East London Polytechnic is currently conducting research and development in three main areas:

- a. The use of low cost mono comparators for use in a microcomputer - based system for map revision using single air photographs.
- b. The stability, capabilities and applications to topographic and close range photogrammetry of the Officine Galileo Digicart analytical plotter.
- c. The potential of remote sensing techniques for the detection of abandoned and derelict land.

408. At the University of Sheffield a continuing research project concerns the location of disused mineshafts. In common with other old coalfield areas Sheffield contains many uncharted and hazardous derelict mineshafts. Short of close drilling or stripping the surface material no wholly satisfactory method has been available for detecting and plotting the old mines. Of the many possible alternatives involving the detection of energy anomalies work has so far been confined to seismic methods involving a multi-radial spread of wave paths between the seismic source and the seismometers over the probable shaft site. Sophisticated methods of summation of the effects of several initial seismic waves and the use of portable data logging equipment capable of handling this process have been used. Many difficulties have arisen in the system used but these are indications that success can be achieved in many cases. Methods of detection involving heat flow and magnetic field variations are being investigated on a theoretical basis and equipment is being designed.

409. Research projects at the Remote Sensing Unit of the University of Aston in Birmingham have ranged from mapping, monitoring and predicting soil erosion using air photography to mapping and monitoring desert encroachment using LANDSAT imagery. Current research projects include investigations into the applications of remote sensing to water resource surveys, to coastal despoilation and to monitoring pollution.

410. The Ordnance Survey of Northern Ireland initiated in 1981 a feasibility study of the possibility of introducing digital mapping techniques and a supporting topographical data base. It is proposed that stereoplotters will be integrated into the system as stereo data capture stations.

#### HARDWARE

411. In general research and development in the field of hardware has been concerned with adapting and modifying commercially available equipment to meet specific requirements.

412. The Hydrographic Department of the Royal Navy is currently developing a new survey camera mounting for its helicopters, and combinations of plotting equipment and computers have been developed to increase cartographic output.

413. Under the heading of Research and Development the Remote Sensing Society reports several development activities including image displays, hard-copy devices, computer systems and software. Examples are summarized as follows:

- a. The Sigma ARGS image display system is now in operation; less powerful display systems have also been developed by Gresham Lion.

- b. The latest SPECTRASCAN colour film writer represents a significant improvement in hard-copy quality and speed, the first system having been installed at RAE in 1983.
- c. An airborne synthetic aperture radar processor was developed by the Marconi Research Centre.
- d. High speed array processors are under development by ICL and GEC and a high-throughput image interpretation computer is under development by Logica.
- e. The GEMS image processing computer system is now in service at four remote sensing centres in the UK. DIAD Systems also produce a range of low-cost image processing systems.
- f. Special software for remote sensing applications has been developed by such companies as Logica, System Designers and Nigel Press Associates.

Additionally UK commercial and academic bodies participated in the SAR 580 synthetic aperture radar campaign. RAE, with Huntings as sub-contractor, managed the West European phases of the campaign. RAE was responsible for the calibration of the W European flights and the associated SAR processing. UK experiments have been prominent in post-flight work. NERC organized campaigns in September 1982 and August, September 1983 to simulate SPOT and Thematic Mapper data. In 1983 Hunting Geology & Geophysics purchased a Daedalus Scanner and this equipment was used in the 1983 NERC campaign. In May 1982 airborne MSS data were acquired for the Ministry of Agriculture and other organizations to generate SPOT simulation data to evaluate the potential of such data for geological applications and land-use mapping.

414. Other remote sensing research and development activities include the appointment of the University of Reading and NERC as NASA Principal Investigators for Landsat 4 Thematic Mapping Image Data. The NERC Institute of Oceanographic Sciences and RAE, Farnborough were selected as Principal Investigators in the NASA SIR-B mission due in 1984.

415. In the quality assessment programme, work continues in SERC on the infra-red microwave Along Track Scanning Radiometer (ATSR) selected by ESA for precision sea-surface temperature measurements from ERS-1. SERC also flew an airborne combined altimeter/scatterometer over the Bering Strait off Alaska as part of a joint NERC/SERC study of sea-ice.

416. Neptune Surveys Ltd have developed a 70 mm underwater stereocamera system said to be the first fully integrated underwater stereo-photogrammetric camera produced. The camera system weighs about 25 kgs in air and less than 0.5 kgs in water and has a 200-frame film capacity and flash system. The optics include a refraction correction system and a réseau plate, and the safety cage incorporates a unit for underwater calibration. There is also a 35 mm version for very close range work. Applications include the measurement of pitting in welds on underwater structures. The equipment is depth-rated to 600 metres. A longer range system is also under development.

417. The Grassland Research Institute have reported experiments with a helium-filled kite as a camera platform to assist agricultural research. It is expected that the low level photography will permit the study and measurement of

rejected herbage, botanical composition and damage or disease in grazed pastures. A 35 mm camera is suspended in a gimbal system and the shutter is released by radio control.

418. Ordnance Survey commissioned Ross Instruments Ltd to develop an instrument to view and compile from large-format stereo-orthophotographs in order to carry out a field trial of the use of orthophotography for the revision of maps in rural areas.

419. Ross Instruments Ltd developed the Reflex Metrograph which can be used to measure objects up to 30 x 30 x 30 cm as well as for the measurement of photographs, plans and X-ray photographs. Ross Instruments Ltd have also developed their SFS-3 Stereocomparator with a range of 100 x 100 mm designed for small format photography and electron micrographs.

420. Survey and Scientific Instruments Ltd have introduced their PI-1a mono-comparator. Provision is made for scanning either by microscope or by miniature CCTV. The format is 260 x 260 mm and linear encoders provide a resolution of 0.005 mm.

421. Cartographic Engineering Ltd have introduced the SB 215 Zoom Stereosketch designed for photo interpretation and for direct comparison of images at different scales. The instrument is thus particularly suitable for rapid map revision.

SECTION 5EDUCATIONINTRODUCTION

501. The information provided in this section is summarized from contributors' reports and only major items of equipment are included. All the educational establishments have the computing facilities to meet their requirements and therefore these are not included.

UNIVERSITIES AND POLYTECHNICS

502. The University of Aston in Birmingham. The Remote Sensing Unit has a small staff and is equipped with Wild A7 and B8 plotters and supporting instrumentation; it has access to equipment for viewing and analysing satellite imagery. The aims of the unit are:

- a. To carry out research into the applications of proven systems of remote sensing.
- b. To evaluate newly developed and developing sensors.

The unit operates an exchange au pair scheme for foreign graduate students and a limited number of research studentships are available.

503. The Queen's University of Belfast. The Department of Geography has a Wild B8S plotter and access to the university aeroplane for air photo acquisition. A course in remote sensing is provided as part of the undergraduate programme in the geography degrees and includes air photo interpretation, evaluation of LANDSAT, SEASAT HCMM and airborne thermal and radar imagery. Delivery of a WSR 513 satellite receiver is expected.

504. The University of Bristol. The Department of Civil Engineering has a survey camera, a Zeiss stereocomparator, a CP1 plotter and smaller plotters. Students receive a 12-lecture course in photogrammetry and remote sensing supported by tutorials and practical work.

505. University College London.

- a. The Department of Photogrammetry and Surveying has a teaching staff of six, one research fellow, two research assistants, three technicians and five full time research students. Besides the well established MSc courses in photogrammetry and in surveying the Department now offers an MSc in numerical methods in photogrammetry and surveying and contributes to the teaching and organization of the inter-collegiate University of London MSc in remote sensing. The Department also carries out service teaching to civil engineers, geographers, geologists and others. Approximately half the students in the Department come from countries outside the United Kingdom.
- b. The Department has maintained its level of modern equipment with the purchase of a Kern DSR1 analytical plotting instrument and microcomputers for teaching. A short course on analytical plotters was conducted in 1983.

c. The Department has continued to encourage the dissemination of information and professional activities by supporting the editor of The Photogrammetric Record. See Section 6. The Department also hosted an international conference on Industrial and Engineering Surveys in September 1980.

506. The University of Newcastle upon Tyne.

a. Photogrammetry is taught within the Department of Surveying which is well equipped with modern instruments. Major items of photogrammetric equipment are: six stereoplotters, a stereocomparator, a single metric camera and a stereometric camera. The BSc Honours degree in Surveying Science and the BSc Joint Honours degree, where Surveying Science is studied jointly with Computing Science, Geography, Geophysics, Mathematics, Physics or Statistics, include a considerable element of photogrammetry. Elementary courses in photogrammetry are also given to students studying other subjects such as architecture, civil engineering, mining and town planning.

b. Facilities exist for suitably qualified graduates to undertake research in photogrammetry leading to higher degrees (MSc and PhD).

507. The North East London Polytechnic.

a. Photogrammetry is taught in the Department of Land Surveying which offers a wide network of courses in land and sea surveying topics. The BSc Honours Degree course includes mapping and photogrammetric studies in all three years. In the third year, specialist studies in analytical photogrammetry instrumentation are offered. Some of these lecture programmes include certain aspects of remote sensing.

b. The courses designed for students taking the final examinations in the Land Survey Division of the Royal Institution of Chartered Surveyors include one for students preparing for the option paper in photogrammetry. The courses associated with Technician Education Council (TEC) Higher Certificate and Higher Diploma in land surveying include the photogrammetric option. Short courses in both practical and theoretical photogrammetry are also run from time to time in response to specific demands.

508. The Polytechnic of Central London. The Unit of Civil Engineering offers a BSc degree course which includes photogrammetry. The Unit has a photogrammetric camera, a 6-projector Multiplex bar, a Santoni Stereomicrometer, Wild B9 Plotter, a modified Hilger and Watts Stereocomparator, supporting instruments and computer interfaces. Students, usually not more than two in any one year, carry out investigatory photogrammetric projects in the final part of their course. Many of the students are from foreign countries.

509. The University of Sheffield. Photogrammetric Studies are undertaken in the Department of Civil and Structural Engineering where equipment includes a photo-theodolite, stereometric camera, two stereocomparators, a Wild A5 plotter and supporting instruments. Facilities are offered for post-graduate studies.

510. The University of Surrey. The Department of Civil Engineering has conducted a short course in remote sensing for practising civil engineers and

engineering geologists. The aim of the course was to introduce participants to current remote sensing techniques and how these could be applied to civil engineering projects. The course includes a visit to the National Remote Sensing Centre at RAE Farnborough. Photogrammetric equipment within the department includes a Thompson Watts Mk II plotter, Hilger and Watts stereocomparator, Multiplex plotter, Wild P32 cameras and supporting instruments.

511. The University College of Wales. The Department of Geography offers photogrammetry or remote sensing as options for Honours Degree geography students. Of an annual intake of 120 about 10 include specialist studies in photogrammetry and 15 do likewise with remote sensing. Equipment was summarized in paragraph 119.

512. The University of York. The Institute of Advanced Architectural Studies has contributed to the field of principally mid-career education in architectural photogrammetry in a number of ways. Several specialist courses have been mounted solely on architectural photogrammetry during this period. Numerous lectures have been given both to Institute courses, and to many other interested groups. A number of papers have been produced on the subject (see Section 7; Bibliography Dallas RWA).

#### LEARNED SOCIETIES

513. The Photogrammetric Society maintains a programme of regular monthly technical meetings from October to March. It also runs the biennial Thompson Symposia, one of which was held at the University of Birmingham in 1982. In addition to UK speakers, lecturers have been invited to these events from France (one lecturer on SPOT and Spacelab, one on map revision at IGN), the Federal Republic of Germany (on analytical plotters and numerical photogrammetry), Canada (on digital techniques for 1:50 000 mapping and revision), Switzerland (on revision of topographic maps) and Denmark (on mapping northern Greenland). Bursaries are offered to help young members of the Society attend the Thompson Symposia: these are financed by investing income accruing from sales of "Photogrammetry & Surveying: A Selection of Papers by E H Thompson 1910-1976", a memorial volume published by the Society. The Society's careers leaflet was reprinted for the Surveying & Mapping 81 conference and has been widely circulated in an attempt to publicise career ideas and opportunities. Finally, the Society has sponsored an annual short course on architectural photogrammetry at the University of York; this has run as one module in a longer course on conservation techniques in architecture.

514. The Remote Sensing Society reports that remote sensing courses increased as elements in undergraduate education in physics, atmospheric physics, information sciences, civil engineering, geology and geography in both universities and polytechnics. Post-graduate training continued via research degrees in ten universities and polytechnics and in 1983 an MSc in remote sensing was offered in the University of London, and another was planned for 1984 at the University of Dundee. Training in remote sensing was carried out by a large community of scientists, about fifty, in a wide variety of disciplines reflecting the multi-disciplinary nature of the subject. The community increased by at least ten per cent per year. Research students graduated at the rate of three to five per year throughout the period. In 1983/84 there were 14 MSc students at the London course. Participation by overseas students was limited but is expected to increase.



515. Short courses in numerous applications were organized throughout the period especially in the University of Dundee on off-shore and engineering applications, in the University of London on renewable resources, and in the University of Surrey on civil engineering. One day and more extended conferences were convened regularly by the Remote Sensing Society, and the education sub-committee of the Society together with the Education Working Group of the National Remote Sensing Centre (NRSC) co-ordinated national discussion on education in remote sensing.

#### GOVERNMENT ORGANIZATIONS

516. The Directorate of Overseas Surveys has continued to offer 15-20 practical technician training places each year in cartography (topographic and thematic), basic air survey, photogrammetry, cartographic photography and photo-mechanical techniques for staff of overseas departments. Training is arranged on a government to government basis with most students funded through The British Council Technical Cooperation Awards but 8 were funded from other sources such as United Nations or directly by their own governments. Between January 1980 and December 1983 trainees came from a variety of departments including Town Planning but the majority were from Lands and Surveys and Geological Departments from a total of 29 countries; in all 70 completed and a further 9 were continuing their training. Each course was individually designed by the Directorate to meet the needs of the trainee and his department; most courses were 10 - 12 months but some were 18 - 24 months. For more experienced personnel shorter, higher level courses were arranged on special subjects including cartographic drawing, office management, photomapping and geological map specifications.

517. The Directorate continued to assist with training by seconding senior survey, photogrammetric, cartographic and reprographic staff to overseas departments on short and long term assignments.

518. The Directorate continued to co-operate with North East London Polytechnic over the setting up and running of special short courses such as the 12-week Middle Management Course for Staff in Lands and Survey Departments (originally set up in 1977 with subsequent courses in 1980, 1982, 1984) and the one year college Diploma course in Cadastre which started in November 1983.

519. In 1982 the Directorate prepared "A report on full time training facilities in the UK in Land Survey, Photogrammetry, Remote Sensing, Cartography and Map Reproduction (including Printing), Cadastre, Land Resource and Management Studies and Hydrographic Surveying which are available to overseas students" which was presented to the 5th UN Regional Cartographic Conference in Cairo, February 1983. Copies of the revised edition, published June 1983, are available from the Directorate.

520. At Ordnance Survey, staff recruited into Photogrammetric Services (formerly Air Survey Branch) are selected from within the Department and undergo a two-month course of in-house training before beginning production work.

SECTION 6PUBLICATIONSPERIODICALS

601. "The Photogrammetric Record" is published half-yearly by the Photogrammetric Society and during the period of this report has continued from Volume 10 Number 55 (April 1980) to Volume 11 Number 62 (October 1983). It is the official journal of the Society: members of the Society receive it automatically and others may subscribe. The circulation is 1250. The object of the "Record" is to cover photogrammetry in the wide interpretation which the term has come to assume. It is intended to provide a record of original research, both theoretical and empirical, which will contribute to the advancement of photogrammetric knowledge and to the application of photogrammetry in widely diverse fields. It is generally acknowledged to be one of the foremost photogrammetric journals and has maintained high standards of content and style for over 30 years.

602. In addition to papers, which include transcripts of lectures and discussions at the Society's technical meetings and Thompson Symposia as well as work from other authors, the "Record" contains shorter contributions, reviews and abstracts of recent photogrammetric literature, notes, correspondence and items of Society business and general interest.

603. The Remote Sensing Society via its publisher Taylor and Francis, launched the "International Journal of Remote Sensing", which is now running at over 900 pages per annum comprising six issues. The Society published annual proceedings of its technical conferences on:

Geological and terrain analysis studies (1981)  
Matching remote sensing technologies and applications (1982)  
Remote sensing and the atmosphere (1982), and on  
Rangeland monitoring and management (1983).

Shorter publications appeared on radiometry (Remote Sensing Society) cloud cover (1983) (Dundee University), civil engineering (1983) (University of Surrey), Spot simulation (1983) (Ministry of Agriculture).

604. Aerial Archaeology is published by and available from the Aerial Archaeology Foundation, East Dereham, Norfolk, and the Royal Photographic Society of Great Britain publish their Newsletter edited by F J Worton.

SERIES PUBLICATIONS

605. The North East London Polytechnic publishes a series of Working Papers; of these the following are relevant:

- a. First Steps in Remote Sensing (R K Bullard and P J Lakin).
- b. First Steps in Photogrammetry (G M Sears).

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WILSON, D R. Air Photo Interpretation for Archaeologists. Batsford, London, 1982. 245 pp.

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606. "Photogrammetry & Surveying: A Selection of Papers by E H Thompson 1910-1976", a volume of 359 pages incorporating appreciations and obituary of E H Thompson, a wide selection of his published work and a list of his publications, was published by the Photogrammetric Society in 1977. It is still in print and continues to sell throughout the world.

607. The Photogrammetric Society has published, jointly with the Royal Institution of Chartered Surveyors, a reference handbook entitled "Directory of Research and Development in the Fields of Land Survey, Geodesy, Photogrammetry and Hydrographic Surveying".

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SECTION 7PROFESSIONAL SUBJECTSTHE PHOTOGRAMMETRIC SOCIETY

701. The Photogrammetric Society was formed in 1952 for the benefit of those with a genuine interest in photogrammetry. Members of the Society include surveyors, engineers, foresters, medical specialists, earth scientists concerned with photo-interpretation and many others who are aware that photogrammetry can help solve their measurement problems. Membership includes both corporate bodies and individuals.

702. The Society serves its members by publishing "The Photogrammetric Record", holding regular technical meetings, seminars and conferences and acting as a representative of the photogrammetric profession in the United Kingdom. The Society is represented on the British National Committee for Photogrammetry and Remote Sensing and encourages members to participate in the activities of ISPRS.

703. The affairs of the Society are entrusted to a Council of 16 members, comprising President, two Vice-Presidents, Honorary Secretary, Honorary Treasurer and 10 members of Council, all elected annually, and the retired President. Council has committees which organise technical meetings, the production of "The Photogrammetric Record", social functions and special projects and oversee financial and executive matters.

704. The Society has a library, housed in the Department of Photogrammetry and Surveying at University College London. It consists mainly of photogrammetric journals received in exchange for "The Photogrammetric Record" as well as a substantial collection of scientific books which were formerly in the possession of E H Thompson.

705. In addition to its regular activities described above, the Society deals with a variety of requests for advice, information and comment. In 1983, for example, it submitted evidence to the House of Lords Select Committee on Science and Technology Sub-Committee on Remote Sensing and Digital Mapping and to the Royal Society Working Party on the Support of Geodesy in the UK.

706. The Society presents two biennial awards, the President's Medal and the President's Prize. The President's Medal is awarded to exceptional individuals who have made outstanding contributions to photogrammetry. In 1981 it was awarded to F J Worton for work on films and processing, and in 1983, to J W C Gates for contributions to close range photogrammetry. The President's Prize is awarded to the author(s) of the paper in "The Photogrammetric Record" adjudged to be the most meritorious, primarily on the basis of originality of content and the value of the paper to photogrammetry. In 1981 it was awarded to S I Granshaw for his paper "Bundle adjustment methods in engineering photogrammetry", and in 1983, to P J Scott for "The reflex plotters: measurement without photographs".

THE REMOTE SENSING SOCIETY

707. The Remote Sensing Society gained formal representation on the British National Committee for Photogrammetry (BNCP) in 1983 and thereby became an affiliate of ISPRS for the first time. BNCP changed its title to the British



National Committee for Photogrammetry and Remote Sensing (BNCPRS) in 1983 to reflect its enlarged membership.

708. Statistics and Organization. By the end of the reporting period the membership of the Society was 650, half of whom were overseas members; some 20% were student members, reflecting a youthful membership profile. The Society has a 22-member Council with six sub-committees. The number of scientific and technical staff wholly or partly engaged in remote sensing has increased during the reporting period by an estimated 50%.

709. Legislative Basis of Professional Activities. The Society is a charitable organization and a company limited by guarantee. Its role is to promote and coordinate scientific and professional activities in remote sensing by organizing meetings and publications. It began to investigate the development of procedures for establishing and extending standards of professionalism in the field of remote sensing and the project is continuing.

710. Awards. The Society selects the recipient of the annual Remote Sensing Society-Eurosense Award for the best article on a remote sensing theme by a European scientist. Other awards are being contemplated.

#### COORDINATING BODIES

711. The National Committee for Photogrammetry and Remote Sensing assumed its title in 1983 when the then National Committee for Photogrammetry accepted the application of the Remote Sensing Society to join the Committee. Representation on the committee includes the learned Societies and the national survey organizations.

712. Financial responsibility for ISPRS Commission V during the period 1980-84 was accepted on behalf of the United Kingdom by the British National Committee for Photogrammetry and especially by the Royal Institution of Chartered Surveyors and the Photogrammetric Society.

713. The Directorate of Overseas Surveys undertook responsibility for the organization and management of the quadrennial Conference of Commonwealth Surveyors, held in Cambridge in July 1983. 140 representatives from 36 Commonwealth countries and 10 non-Commonwealth countries attended, and most UK organizations, both from public and private sectors who employ land or hydrographic surveyors, were represented. The 13 technical sessions, each devoted to a particular subject, provided a forum for exchange of information and opportunities for discussions on a wide range of survey and mapping aspects including new technology and computer applications, education, training facilities and methods. It was the unanimous wish of the delegates that the Conference should continue to be held, and preferably in the UK.

714. The Royal Institution of Chartered Surveyors, the Photogrammetric Society, the British Cartographic Society and the Hydrographic Society, and other societies associated with the survey and mapping industry, collaborated to mount Survey and Mapping 81, the first UK national survey and mapping conference of its kind. The conference took place at Reading University in April 1981.

IN MEMORIAMMAJOR GENERAL R LLEWELLYN BROWN, CB, CBE, MA, FRICS, FRGS

It is with deep regret that we record the death of Major General R Llewellyn Brown. He died after a short illness on 17th July, 1983, within a week of his 88th birthday.

He was a member of Council of the ISP, now the ISPRS, from 1952 to 1964 and President from 1956 to 1960. He managed the affairs of this international organization forcefully but with great tact and diplomacy and photogrammetrists throughout the world still recall with great pleasure his handling of the IXth International Congress in London in 1960, culminating in the spectacular banquet in the Guildhall. He was made an Honorary Member of ISP in 1960, a rare and thoroughly deserved honour.

Reginald Llewellyn Brown was the son of Colonel F D M Brown, VC, and was educated at Wellington and the Royal Military Academy. Whilst still a cadet he was on a walking tour in the Harz Mountains when the Great War started and in consequence he was interned for the duration of that war. After the war he entered enthusiastically into his career in the Royal Engineers and from 1921 to 1926 he was seconded to the Colonial Office for topographical survey work in the Gold Coast (now Ghana). During this tour he lost his right arm in a shooting accident.

From 1929 to 1939, he was involved in the early application of photogrammetry to surveying, firstly while on a survey of the proposed Haifa-Baghdad railway and, later as Officer in charge of Air Survey and Revision in the Ordnance Survey. Typically, while in Palestine, he took the opportunity of learning to fly, being taught by Squadron Leader (later Air Marshal) Atcherley of Schneider Trophy fame.

The Second World War gave him the opportunity of displaying both his professional skills and powers of leadership. He spent the whole war overseas, first in France, then in the Middle East, North Africa and Italy. In a remarkable career this period in the Mediterranean must rank as one of the highlights. Under his direction the use of aerial photography for survey purposes was greatly developed both in scope and in technique. It was due to his foresight that the region of the Alamein battlefield was thoroughly mapped at a time when many thought that such maps would never be wanted. Ultimately the number of Military Survey personnel deployed under his direction approached 3500 with an area of responsibility of nearly a million square miles. This large survey organization depended almost entirely on aerial photographs of one kind or another for the making of new maps and the revision of existing maps. Those who remember him in the Mediterranean will not forget his zeal, energy and optimism, particularly when things were going badly. He was awarded the CBE in 1941 and the US Legion of Merit in 1945, which justly indicate the massive contribution he made in the allied war effort.

After the war he was appointed Director of Military Survey from 1946 to 1949 and then Director General of the Ordnance Survey of Great Britain from 1949 to 1953. On retiring from the Army in 1953, General Brown applied himself energetically to furthering the progress of the newly created professional and learned societies related to the survey profession. He played a leading part in the formation of the Photogrammetric Society, served on its Council for 21 years

and was President from 1957 to 1959. He was the President's Medalist in 1963 and became an Honorary Member in 1965.

He was a founder member of the Land Surveyors' Division of the Royal Institution of Chartered Surveyors in 1949 and served on the Divisional Council for over 30 years. He was an active fellow of the Royal Geographical Society, being a Councillor, then Vice-President and Foreign Secretary; he was awarded the Founders Gold Medal in 1978.

He was a vigorous sportsman and played rugby both for the Army and for Kent, captaining both teams in 1921; he also fenced for the Army in that year. After the loss of his arm he played golf to a handicap of eight, using a special grip of his own design, he drove his motor car with urgency and flair and, as mentioned already, he learned to fly. In his later years he maintained his interest in golf and rugby and he was always to be seen at the Inter-Services games. Together with his wife he founded a workshop for the disabled.

General Brown was a man of remarkable courage and talent whose loss will be felt throughout the photogrammetric community. We offer our deepest sympathy to his widow, son and three grandchildren.

J E ODLE, OBE, FRPS

It is with deep regret that the death is recorded of J E Odle, OBE, FRPS, on 11 June 1983. He was the Treasurer of the International Society for Photogrammetry and Chairman of its Finance Committee during the years 1956 to 1960, a period which coincided with the presidency of the late Major General R L Brown.

John Elsdon Odle was born on 25 March 1915, the son of Edwin Vincent Odle. At the age of 16 he became an apprentice printer and rose rapidly to a supervisory position. In 1939 he was appointed General Manager of the Williamson Manufacturing Company which, during the second World War, was concerned with the production of multiprinters, gun cameras and reconnaissance cameras. In 1941 Odle was appointed Chairman of the Aircraft Manufacturers' Group responsible for the co-ordination of aerial camera production at six different factories. These made a total of over 100 000 cameras for the Royal Air Force.

After the war efforts were concentrated on peacetime aerial photography and photogrammetry, and the company produced Multiplex equipment and survey cameras which were used extensively both in the United Kingdom and overseas. In 1948 Odle was appointed Joint Managing Director of Williamson with Colin Williamson, and together much help was given in sponsoring the first British Chair of Photogrammetry and Surveying in London University. In 1952 he devoted much skill and effort to the formation of the Photogrammetric Society and became the first Chairman of the Executive Committee of the Society.

As Chairman of the British National Committee for Photogrammetry he presented the ISP President's Chain and Badge at the Xth International Congress held in Lisbon in 1964. This gift to the International Society from the Photogrammetric Society, London, and the Royal Institution of Chartered Surveyors was made to mark the success of the 1960 Congress in London.

In 1961 Odle was elected a Fellow of the Royal Photographic Society and represented that Society on the Photogrammetric Society's Council from 1961 until 1972. In 1962 he was awarded the OBE for his services to air photography, a most recognition for the inspiration and encouragement he had given over the years to many research projects. By this time, much of the work of Williamson was concerned with the manufacture of cameras for the RAF, including the F49 Mark IV, which is still in service.

He was elected Chairman of the British National Committee for Photogrammetry in 1963 which Committee had done so much in organizing National Exhibits and National Reports for International Congresses of Photogrammetry since 1956. He became President of the Photogrammetric Society in 1963, serving in that capacity until 1965, and he was awarded the President's Medal at the Annual General Meeting of the 15th November, 1966. He was elected an Honorary Member at the Annual General Meeting on the 21st November, 1972.

In March 1966, Odle accepted an invitation to become an Honorary Member of the Association of Royal Air Force Photography Officers, subsequently presenting, on behalf of the Williamson Manufacturing Company, a Chain of Office to the Association as a visible token of the long friendship with the Royal Air Force.

During the late 1960s, Williamson were becoming more involved with microfilm cameras and equipment and X-ray film processors and, in 1966, Colin Williamson relinquished the Chairmanship. In consequence, Odle became both Chairman and Managing Director of the Company and following a merger with Negretti and Zambra he became a member of the board of that company until his retirement in 1975.

He was a keen sailor and served on the General Committee of the Royal Corinthian Yacht Club for several years; he was also a member of the Royal Thames Yacht Club. After retirement he became a member of the Real Club Nautico in Palma.

John Odle, a courageous man, will be missed greatly by his family and friends and is survived by his widow Doris, by Angela, his married daughter, and by his sister, Mrs Elizabeth Turner, to whom we offer our deepest sympathy.

SECTION 8ADDRESSESORGANIZATIONS OTHER THAN EDUCATION AND RESEARCH

<u>Name</u>	<u>Address</u>	<u>Telephone</u>	<u>Correspondent</u>
Central Electricity Generating Board	Burymead House Portsmouth Road Guildford Surrey GU2 5BN	0483-69951	H D Nunney
Directorate of Military Survey	Elmwood Avenue Feltham Middlesex TW13 7AF	01-890-3622	Deputy Director
Directorate of Overseas Surveys	See Overseas Surveys Directorate		
Grassland Research Institute	North Wyke Okehampton Devon EX20 2SB	083782558/9	J R B Tallwin
Hunting Surveys Ltd	Elstree Way Boreham Wood Herts WD6 1SB	01-953-6161	J D Leatherdale
Hydrographer of the Navy	Marine Science Branch 5 Ministry of Defence Taunton Somerset TA1 2DN	0823-87900 Ext 241	G J Dawson
Kodak Ltd	Kodak House Station Road Hemel Hempstead Herts HP1 1JU	0442-61122 Ext 54	R Harris
Land Resources Development Centre (Overseas Development Administration)	Tolworth Tower Tolworth Surbiton Surrey	01-3995281	
Longdin & Browning (Surveys) Ltd	Old Castle Llanelli Dyfed SA15 2SR	05542-57401	W S Longdin
Meridian Airmaps Ltd	Marlborough Road Lancing Sussex BN15 8TT	09063- 2992/5	Dr M W Grist

Nature Conservancy Council	Roughmoor Bishop's Hull Taunton Somerset TA1 5AA	0823-83211 R A Fenton
Ordnance Survey	Romsey Road Maybush Southampton SO9 4DH	0703-775555 Manager, Air Survey Ext 531
Ordnance Survey of Northern Ireland	83 Ladas Drive Belfast BT6 9FJ	0232-58225 M J D Brand
Overseas Surveys Directorate	Ordnance Survey Romsey Road Southampton SO9 4DH	0703-775555
Photogrammetric Society	c/o Department of Photogrammetry and Surveying University College London Gower Street London WC1E 6BT	01-3877050 K B Atkinson
Remote Sensing Society	c/o School of Oriental & African Studies University of London Malet Street London WC1E 7HP	01-6372388 Dr J A Allan (Chairman)
Royal Institution of Chartered Surveyors	12 Great George St Parliament Square London SW1P 3AD	01-222-7000 The Secretary Land Surveyors Division
Survey & Development Services	1 Atholl Place Edinburgh EH3 8HP	031-228- T K Paton 1446
Transport and Road Research Laboratory Department of Transport	Crowthorne Berks RG11 6AU	03446-3131 W Heath

#### EDUCATION AND RESEARCH

University of Aston in Birmingham, Dept of Civil Engineering	Gosta Green Birmingham B4 7ET	021-359- Dr W G Collins 3611 Ext 4362
Department of Geography Queen's University of Belfast	Belfast BT7 1NN	0232-45133 Dr R W Tomlinson

University of Bristol Dept of Civil Engineering	Queen's Building University Walk Bristol BS8 1TR	0272-24161 Prof R T Severn Ext 134
University of Cambridge, Committee for Aerial Photography	Mond Building Free School Lane Cambridge CB2 3RF	0223-358381 D R Wilson Ext 354
Polytechnic of Central London Civil Engineering Unit	35 Marlylebone Rd London NW1 5LS	01-486 5811 M G Burry
University of Glasgow Dept of Geography	Glasgow G12 8QQ	041-339- Prof G Petrie 8855 Ext 7403
Hatfield Polytechnic Division of Civil Engineering	PO Box 109 College Lane Hatfield AL10 9AB	07072-68100 Cr C M G Francis Ext 362
University of London:		
Imperial College of Science and Technology, Dept of Civil Engineering	Imperial College Road London SW7 2BU	01-589-5111 S K Sharma
University College London: Dept of Anatomy & Embryology	Gower Street London WC1E 6BT	01-387-7050 Prof A Boyde
University College London: Dept of Photo- grammetry and Surveying	Gower Street London WC1E 6BT	01-387-7050 Dr I J Dowman
University of Newcastle upon Tyne Dept of Surveying	Newcastle upon Tyne NE1 7RU	0632-328511 I Newton Ext 2445
North East London Polytechnic, Dept of Land Surveying	Longbridge Road Dagenham Essex RM8 2AS	01-590-7722 C D Burnside Ext 2011
Portsmouth Polytechnic:		
Dept of Geography	Buckingham Building Lion Terrace Portsmouth PO1 3HE	0705-27681 T H Rawkins Ext 348
School of Military Survey	Hermitage Newbury Berks RG16 9TP	0635-200371 Commandant

University of Sheffield Dept of Civil & Structural Engineering	The University Mappin Street Sheffield S1 3JD	0742-78555	Dr C J D Laurence
University of Surrey Dept of Civil Engineering	Guildford Surrey GU2 5XH	0483-71281	T J M Kennie
University College of Wales Dept of Geography	Llandinam Building Penglais Aberystwyth Dyfed SY23 3DB	0970-3111	R L Collin
University of York The Institute of Advanced Architectural Studies Photogrammetric Unit	The King's Manor York YO1 2EP	0904-52606	R W A Dallas