

# AUSTRALIAN PHOTOGRAMMETRIC SOCIETY

NATIONAL REPORT 1976 - 1980

14TH CONGRESS OF THE INTERNATIONAL SOCIETY FOR PHOTOGRAMMETRY

HAMBURG 1980

The Australian Photogrammetric Society (APS) was founded on the 1st December 1965 to ensure that Australia was represented at the International Society for Photogrammetry by a representative society instead of by an individual correspondent. The APS operates "under the auspices of" The Institution of Surveyors, Australia and The Australian Institute of Cartographers.

Full details of the APS Rules of Business were published in "The Australian Surveyor" June 1975, Vol. 27, No. 2 and "Cartography" Vol. 9, No. 2, July 1975.

The aims and objectives of the Society are:

1. The Australian Photogrammetric Society is an organisation devoted to the advancement of Photogrammetry in Australia.
2. The aims of the APS shall be:
  - (a) to sponsor meetings of people interested in photogrammetry and to promote communications, discussions, lectures, visits and exhibits.
  - (b) to encourage research in the field of photogrammetry by creating Commissions and working groups concerned with aspects of photogrammetry.
  - (c) to circulate records of discussions and results of research.
  - (d) to participate in the affairs of the International Society for Photogrammetry.

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This report has been prepared in March 1980 by the Federal Executive of the APS from material supplied by the National Correspondents. Further information can be obtained by directing your enquiries to:

Australian Photogrammetric Society,  
Box 1020H, G.P.O.,  
MELBOURNE, 3001, Australia.

Colour Photography

A major aspect is the increasing use of colour photographs. Kodak 2443 colour infra-red, Kodak 2445 colour negative film as well as black and white photography have been recorded by National Mapping at scales from 1:80,000 to 1:145,000. Colour infra-red photography is developed to negative (positive developing not available in Australia), and very good quality results were obtained. Kodak 2445 colour negative film recorded on the super-wide angle camera at 1:145,000 provided maximum coverage and water penetration for mapping coastal, island and reef areas.

The Australian Survey Office, Canberra, records 80% of its photography in colour which is used for mapping and environment/ecological studies. Mostly, scales are greater than 1:10,000. Kodak 2448 film is being used with a Wratten 12 filter to obtain water penetration down to 20 m from which reef shape can be presented at 1:5000 scale on rectified photo-maps.

In Tasmania, both the Lands Department and the Forestry Commission have made extensive use of colour photography, while the Western Australia Lands Department has used Kodak 2445 colour film.

Camera Calibration

The South Australian Department of Lands has established a Field Test range at Willunga for camera calibration under operational conditions.

The range covers an area of 8 x 8 kms and has 121 ground control points targetted annually and photographed with a selection of cameras from flying-heights which parallel those used for particular photogrammetric applications.

Image coordinates are observed on Zeiss P.S.K. stereo comparators, and corrected for film distortion if a reseau camera is involved.

Flight Systems and Navigation

The South Australian Department of Lands operates a Rockwell Turbo-Commander 690A with a Litton LTN72 inertial navigation system to guide the aircraft automatically to the area of operation and as a tool by the navigator in the more precise guidance of the aircraft during the acquisition of aerial photographs. Error rates are reported to average at 1 km per hour.

National Mapping states that the inertial based camera attitude indicator reported on in 1976 is still under development, and commission trials are expected in 1980.

National Mapping is also currently undertaking photographic missions with a Gates Learjet 25C aircraft with doorway camera pod and the GNS 500A Omega navigation system. Total unit costs involved for a 23-day mission during October 1979 in tropical NE Australia, of which 94% was wide angle photography over an area of 275,000 km<sup>2</sup>, were 44<sup>c</sup>/km<sup>2</sup> or \$6.64 per line km. Photography at the scale of 1:80,000 is used for 1:100,000 map revision. Photography lines generally follow the old RC9 photography lines and hence it is possible to re-use some of the existing photogrammetric control

points.

### Image Quality

At the University of N.S.W., A/Professor J. C. Trinder is a member of ISP Commission I Working Group 1/1 on Image Quality. Current research is directed towards the determination of granularity of aerial films under different conditions, and its effect on visual observations. Results of this investigation are reported in the references listed below.

### References

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- J. C. TRINDER. "Aerial Photography Granularity and its Influence on Visual Performance". Paper presented to ISP Congress, Hamburg, 1980.

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COMMISSION II

INSTRUMENTATION FOR  
DATA REDUCTION

R.G. ROBERTS

Developments of instrumentation in Australia during the past four years have, with one exception, followed predictable lines of development. These developments include the building up of an automated digitizing system on conventional analogue stereoplotters from existing computer components. This development has occurred in most State and Commonwealth mapping organizations.

The one major exception has been the development of a completely new stereo digitizer by M. H. Elfick and M. J. Fletcher. During the past four years these two private individuals, at their own expense, have produced a prototype analytical stereoplotter which can be treated as a standard peripheral to a commercial microprocessor. The instrument has been designed to carry out all the normal photogrammetric operations and has a point resolution of 12 microns. The equipment is currently supported with some 30 computer subroutines including inner, relative and absolute orientations. Aerial triangulation programmes will be available in the future.

The first series production of four instruments is being constructed for Qasco Pty. Ltd. Brisbane, Queensland, and it is hoped to have an instrument on display at the Congress in Hamburg.

Whilst there has been a great awareness of the four working groups in the area of Commission III, no major or significant developments in those areas have been reported in Australia by either institutions or individuals. Instead much effort has been spent on the consolidation of analytical methods in aerotriangulation, and preparing the way for the introduction of digital mapping.

In the area of aerotriangulation-adjustment the polynomial method is being phased out and replaced by packaged bundle adjustment programs obtained from overseas. One State organization has been very active in analytical AT and its application to the registration of cadastral boundaries based on occupation. Using a test range, accuracies of 3  $\mu$ m at picture scale have been reported using targetted images on reseau photography and applying third order affine corrections for photographic distortions.

The trend towards analytical photogrammetry is further evidenced by the arrival of various analytical plotters in Australia. So far they have mainly been used for data capture in connection with AT. However, there is an awakening interest in terrestrial and close-range photogrammetry which will widen the application of the analytical plotters because of their mathematical ability. Improving the accuracy of photogrammetric systems by the inclusion of self-calibration parameters is actively being pursued by universities for the purpose of industrial photogrammetry.

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**COMMISSION IV****TOPOGRAPHIC AND CARTOGRAPHIC  
APPLICATIONS****D. I. GLENDINNING**General

As the result of a general tightening of Australian economic development most mapping organizations are operating with reduced staff.

The national 1:100,000 mapping program involving a total of some 3071 maps was intended to be finished before 1980, but only 1646 maps are designed to be carried to full colour publication.

The remainder which occupy the lesser developed central area of the continent are destined for publishing in the form of orthophotomaps at 1:100,000 and, with line detail extracted, these maps will provide the basis of a second edition 1:250,000 map coverage of the Australian continent (50 m contours).

New Equipment and Mapping Systems

Sales of analogue instruments during the past four years have been small. It has been a period of experimentation and practical application of computer assisted photogrammetric and cartographic practices.

"AUTOMAP" introduced into the Royal Australian Survey Corps in 1976 is the most advanced of the Australian computer assisted systems designed to reduce the labour intensive activities associated with topographic map making. A by-product of the process is a digital data bank from which derived mapping can be produced.

"AUTOCHART". During 1979 the hydrographic system was introduced and whilst this cannot be considered to be photogrammetric in character, it is interesting to note that this system observes a basic file structure similar to AUTOMAP with a significant enhancement of the central feature control file concept and a change in the philosophy of symbol generation. This has led to the feasibility of achieving full automation of cartography to the final reprostat stage.

Both at government level and in private enterprise, digital mapping has shown marked advances during the past four years. From a somewhat simple application in cadastral mapping there is evidence of further digital applications in what are eventually designed to become fully automated topographic systems. With increasing activity in the acquisition of data in digital form, the National Mapping Council has recommended a standard for the exchange of such data. A draft standard prepared by the Standards Association of Australia is now being circulated for public review.

The Highways Departments in both New South Wales and South Australia are active in digital research and since 1975 when the South Australian office purchased its initial equipment, their's has been a leading practical development, based upon a digital mapping system (SAMS) and a highway design package (MOSS) with "in house" stereoplotting, computing, digitising and XY plotting facilities. The basic mapping scale is 1:1000.

#### Revision

The most significant thing about topographic map revision systems in Australia is the continuing dependence upon remapping as the principal tool of revision. This is most certainly the case in large scale work and, whereas in medium scales there are systems of revision involving rephotography with manual editing and field inspection, remapping has continued to be the most consistent approach to the problem.

A map revision program is being developed by the Division of National Mapping to establish the priority for the revision of maps. Revision of existing maps (at 1:100,000 and 1:250,000 scales) at intervals not exceeding ten years will take precedence over the production of new maps.

#### Thematic Mapping

There is an expanding demand for thematic mapping in Australia which involves the processes of aerial photography and remote sensing. Thematic mapping in the past has invariably been derived mapping and whilst this may still be the major machinery for such work, satellite imagery and orthophotomaps are providing an economic and most sought after base for the portrayal of a variety of environmental themes. Some excellent off-shore studies have been completed by private enterprise and research organizations using photogrammetry and remote sensing (Byrne and Honey, 1977). In a test, bathymetric data was compiled independently by both photogrammetry and remote sensing and the effectiveness of both systems in shallow water bathymetry, summarised. The results suggest that in shallow water regions of little known bathymetric data both systems provide effective substitutes, but most particularly they serve to provide a basic background of bathymetry for the economic planning of precise hydrographic surveys.

## Orthophotomaps

Australia has guided the work of Working Group IV.5 (Orthophotography and Photomapping) for the past four years and among the activities of the Working Group has been an Australia wide producer and user survey in orthophotomapping and a world survey to assess the present state of the art. From the world survey a group of orthophoto samples has been prepared in microfiche form to accompany the report of the Working Group to the Hamburg Conference.

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COMMISSION V

NON-TOPOGRAPHIC  
PHOTOGRAMMETRY

I. A. HARLEY

A picture emerges of greatly increased activity throughout the country, more particularly in the routine uses with standard equipment, rather than in experimental or novel applications. An important factor is the increased availability of suitable photographic equipment; modern metric cameras are now held in every State of Australia ranging from stereometric cameras for police work to the most versatile single camera systems. Specialised plotting equipment is not common except for police use.

A growing awareness of the need for photogrammetric recording of historic buildings, monuments and sites was noted in the Australian National Report, Helsinki, 1976. This has become the biggest single field of activity in non-topographic photogrammetry in Australia; State and Federal Government offices and universities have almost all engaged in architectural photogrammetry.

The University of Melbourne in particular has become a major centre in investigations into the recording of buildings and sites. They have undertaken a number of architectural photogrammetry projects ranging from streetscape surveys to large scale detailing of ornate carvings. During the past two years their most important work has been in the field of archaeological recording, in particular the application of terrestrial photogrammetry to the recording and analysis of Aboriginal rock paintings and engravings. Field pilot projects have been conducted in remote areas of Australia including the north west of Western Australia and the Kakadu National Park in the Northern Territory.

There are many reports of instances in which standard photogrammetric methods have been used in civil engineering: for example, for studies in slump of spoil heaps in open-cut mining, surveys of road detail and bridge sites, bridge deformation, photo-montage, deformation of buildings and of models of engineering structures.

At the University of New South Wales analytical bundle determinations with extreme convergence ( $\pm 45^\circ$ ) have been used to give high accuracy measurement both of model structures and of a constructed 7-storey building, in both cases using a "metric" camera. Respective accuracies reported are 0.1-0.3 mm and 2.5 mm. In each case annular targets were used on the surface of the structure.

Standard methods have been used in medical work at the Universities of Queensland and Melbourne.

The use of "non-metric" cameras has increased. Underwater measurement using 35 mm cameras is reported from both the West Australian Institute of Technology (on behalf of the Maritime Museum) and from the University of Newcastle (for the stereoscopic monitoring and measuring of the marine environment near ocean outfall sewers). High precision work ( $\pm 0.14$  mm) has been performed at the University of New South Wales using Hasselblad

cameras to measure coordinates for the study of relative bone movements in the foot-ankle complex when in motion (using a cadaver). The Department of Main Roads, New South Wales, and the National Measurement Laboratory, C.S.I.R.O., have used non-metric cameras for micro- and macro-photogrammetry in studies of hardness testing and pavement texture (for skid resistance).

Problems continue in the availability of suitable photographic plates. Cut film is frequently used in those metric cameras with a register glass and also, cemented to glass plates, in metric cameras with an open focal-plane frame. Long delays in delivery of suitable colour film material and problems with geometric instability of colour diapositive material have been reported; the production of small numbers of colour diapositives for non-topographical use is found to be both extremely expensive and very time-consuming.

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COMMISSION VI

ECONOMIC, PROFESSIONAL AND  
EDUCATIONAL ASPECTS

A. ADAMEC

The last four years witnessed an increase in the use of analytical methods in quantitative photogrammetry in Australia. Access to computers in the public and private sectors facilitated the shift from analogue to analytical methods.

Available U.S. satellite information, in addition to multispectral aerial photography, is responsible for increased use of qualitative remote sensing, in particular in the fields of environmental studies.

The professional standing of the formally educated photogrammetrist has established itself and there is an increasing number of surveyors, cartographers and engineers specialising in photogrammetry.

Course details of photogrammetric teaching available in Australia on both the professional and technical level are contained in the various handbooks of educational institutions.

Photogrammetry is taught as a service subject in other courses as well as a course of major studies in photogrammetry.

The number of published articles and research publications is increasing greatly from year to year as more and more research is completed in the discipline.

Three levels of photogrammetry are taught in Australian schools:

1. Technician level

Survey technicians, cartographic draftsmen and some engineering draftsmen learn elementary photogrammetry as a part of their technical education.

2. Graduate level

Professional courses in surveying and cartography have a substantial content of photogrammetry. Some tertiary institutions include photogrammetry as a major into their cartography courses.

### 3. Postgraduate level

Some tertiary institutions offer postgraduate studies in photogrammetry. These are of graduate diploma, masters and Ph.D. levels. The degrees awarded for photogrammetric research are not necessarily postgraduate degrees in photogrammetry, but rather in engineering or applied science.

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COMMISSION VII

INTERPRETATION OF  
DATA

D. O'CONNOR  
H. J. HOUGHTON

Since 1976 there has been a progressive use of infra-red photography for the monitoring and assessment of vegetation. It will be realised that the main source of knowledge in this area relate to Northern Hemisphere situations, but now a body of knowledge is accumulating on applications of arid zone and coastal vegetation in Western Australia. The main material used is conventional photography. Vertical photographs are used for initial assessment and regular monitoring missions are now being conducted along the Western Australian coast, using twin 35 mm cameras, taking oblique photographs from as low as 500 ft altitude. This is proving to be a very economical method of updating the material shown on the basic vertical coverage.

An interesting use of an old technique has also been applied with success to tracing pollution patterns on rivers and offshore waters. Oblique photography and perspective grids are found to provide a very cost-effective means of recording rapidly changing surface patterns.

There has been an increase in research in the use of spectral radiometers to study electromagnetic radiation reflected from plants. It has long been suspected that infra-red photographs contain more information for plant and vegetation mapping, and field and laboratory radiometric measurements now confirm that this is so.

Aerial photography is now being used as the main tool in wetland management in many parts of Western Australia. The photographs are used for delineation of the wetland areas and establishing buffer zones as the main tool for management. LANDSAT imagery is also being tested for this purpose.

During the past four years there has been increasing interest in the potential of remote sensing data for assessing and monitoring a variety of renewable and non-renewable resources. More recently, the construction of facilities capable of directly receiving remotely sensed data from the Landsat series of earth observation satellites (Australian Landsat Station, Alice Springs) will make possible resource monitoring studies over large areas.

Research into the use of satellite data for multi-level studies of resources has been confined to several research organisations, including the Divisions of Mineral Physics, Computing Research, Land Resource Management and Land Use Research of the Commonwealth Scientific and Industrial Research Organisation (C.S.I.R.O.); The Australian National University and various Institutes of Technology.

The routine integration of digital satellite data into inventory and monitoring programmes is seen as the next development in remote sensing within Australia. To date Australia does not have a national centre for remote sensing, nor is there a single authority responsible for a national remote sensing programme. In the particular case of Landsat, the Department of Science and the Environment is responsible for the processing of satellite data received by the Australian Landsat facility, while distribution and data analysis is envisaged as a State responsibility. There exists an Australian Liaison Committee on Remote Sensing by Satellite (ALCORSS) consisting of representatives from the Commonwealth and each State Government, tertiary establishments, research organisations and the mining industry. Each State has a State Advisory Committee to examine its individual needs.

The Remote Sensing Association of Australia provides a forum for those interested in remote sensing, and has branches in all States. The Association also produces a Directory of Australian Remote Sensing Activities, which provides information on those individuals and groups active in remote sensing.

In addition to the "Directory of Remote Sensing Activities" currently being revised by the Remote Sensing Association of Australia, the proceedings of the "Landsat 79" Conference should provide more complete information on the application of remotely-sensed data to resource investigations. These proceedings are in press and should be available by mid-1980.