SCHOOL OF SURVEYING

REPORT

1976 - 1977
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1. GENERAL

1.1 INTRODUCTION

After spectacular increases in the School's commitments over the past six years, the increases appear to be steadying down. Over the period 1971-76, full-time student numbers more than doubled. Due to the increase in commitments, the School was suffering in 1976, serious shortages of staff, equipment and accommodation. A period of consolidation is needed in order to catch up on these requirements.

In the present economic difficulties, financial grants for education have been pegged, and the University as a whole is striving to come to terms with a steady state situation, after decades of continuous growth. In these circumstances, the School is fortunate to be able to report on some increases in academic and support staff for 1977, a move of the whole School to new and larger accommodation, and the possibility of a substantial grant for new equipment. However, these increases do not solve all the School's problems.

1.2 STAFF AND ADMINISTRATION

Four new teaching staff positions were allocated for 1977, two lectureships and two tutorships. The two lectureships will be allocated to the areas of general surveying and land information systems, and the tutorships to photogrammetry and surveying. Some difficulty has been experienced in attracting applicants with practical experience in photogrammetric plotting. The new support staff positions are for a technical officer in surveying, a technical officer in cartographic reproduction and a programmer in geodesy. The programmer’s position represents a first for the School as it is funded from University funds and is specifically for research.

There are now 27 academic staff positions and 19 support staff. Due to the size of the School, new administrative arrangements have been introduced. Each senior member of staff has been allocated an area of responsibility. Within each area, other staff organise individual tasks, generally with active assistance from the Administrative Officer. For
example, a lecturer is in charge of enrolments. During enrolments he is assisted by other academic staff and office staff. He is responsible to the senior staff member who deals with the area of Student Administration. The senior staff are members of the School Executive and report to the Executive on their areas of responsibility.

These areas of responsibility are:

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<tr>
<th>Name</th>
<th>Area</th>
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<tbody>
<tr>
<td>Prof. R.B. Forrest</td>
<td>Finance</td>
</tr>
<tr>
<td>Prof. P.V. Angus-Leppan</td>
<td>Courses &amp; Teaching</td>
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<td>A/Prof. G.G. Bennett</td>
<td>Personnel</td>
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<td>A/Prof. R.S. Mather</td>
<td>Student Administration</td>
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<td>A/Prof. J.S. Allman</td>
<td>Research &amp; Publications</td>
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<tr>
<td>Dr. J.C. Trinder</td>
<td>Survey Camps</td>
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<tr>
<td>Dr. A.J. Robinson</td>
<td>Computing Facilities</td>
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1.3 NEW ACCOMMODATION

When the Visiting Committee last met, in April 1976, it was expected that one Department of the School would move into the new Extension to the Mechanical Engineering Building as soon as it was completed. This move, and a similar move by one Department of Civil Engineering, was designed to relieve the pressure in the overcrowded Civil Engineering Building, for two or three years, until the planned extension to Civil Engineering was completed. However when the report of the Universities Commission was published, it became clear that funds for the Civil Engineering Extension would not be granted for at least six years, and probably not for ten years or more.

The Dean, Professor Pink, raised the question of whether the geographical split of two schools could be avoided. The first plan was to move all the offices and some of the laboratories of the Surveying School into the new Mechanical Engineering Extension, leaving behind the photogrammetry laboratories and the astronomy observatory, because they are difficult to move. Detailed investigation showed that this plan would be unworkable, and not acceptable to the School. After further intensive investigations and lengthy negotiations, the School was able to obtain sufficient space in the Mechanical Engineering complex. Eventually the University also agreed to undertake the necessary conversion and reconstruction. The solution is pleasing to the School of Civil Engineering, which can now bring all its staff into the one building, and it has advantages for the School of Surveying as it provides a much needed increase of about 60% in accommodation.

The move began in December 1976, when most of the staff moved into their new offices, and will be completed in June 1977, by which time the construction and conversion of all laboratories will be completed. Some outstanding problems remain, such as provision for an instrument store and a workshop convenient to the new location. The Dean is investigating a number of possible solutions.
In the Mechanical Engineering Extension the School occupies the fifth and sixth floors, part of the fourth floor, and the roof area. In addition, there is a group of laboratories on the fifth floor of the old Mechanical Engineering Building, and a small instrument store on the ground floor.

1.4 EMPLOYMENT PROBLEMS

The current downturn in surveying activity has brought two problems which directly affect the students and graduates. The first is the difficulty encountered by fourth year students in obtaining their professional experience, and the second is the difficulty experienced by graduates in obtaining suitable employment.

The professional experience is essential, since it is a formal subject in the course. The School's Professional Training Officer cooperates with the N.S.W. Divisional Office of the Institution in seeking positions and placing students. Notices have appeared in the Bulletin on several occasions and surveyors have responded to the limit of their ability. But some students will complete their courses with an outstanding requirement for professional training. Since the causes of their deficit in training are outside their control and ours, we are reluctant to hold back their degrees.

From a questionnaire distributed during January 1977 it appeared that 23 of the 71 graduates who completed in 1976 were still without jobs. On the initiative of Mr. T. Meakin, the Department of Labour and Industry has been investigating a scheme whereby these graduates could be employed on a special allowance. It is hoped that a report on this investigation can be presented at the meeting of the Visiting Committee.

2. UNDERGRADUATE COURSE

There have been only minor alterations in the course. The changes in Land Studies subjects, mentioned in the 1976 Report, were approved and are being implemented in 1977. The following new or revised subjects are introduced:

Year 3

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<td>Land Law I</td>
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Year 4

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The Bathurst Survey Camp which would normally have been held in February 1977, was moved to the November-December period in 1976. This became possible because, with increasing "continuous assessment", the third year students had few, if any, final examinations in the November examination period. The change was tried as an experiment. There have been no major difficulties and preliminary comments have been mainly favourable. However the final assessment has not been
completed. From the students' point of view, the advantage is that the period for professional training, January to July, is now unbroken. From the point of view of staff, it keeps them with a heavy commitment right up to Christmas Eve, but avoids the commitment for preparation commencing in mid January.

During 1977 it is planned to review the Bachelor of Surveying course, with the aim of submitting plans for a revision in 1978, for implementation in 1979. Before working on the detailed structure, a number of questions have to be discussed in order to clarify the aims of the revision. These include the desirable work load, the split between lectures, tutorials, practicals and private study and the total number of subjects, as well as the general philosophy behind the course. When it comes to the structure of the course, decisions will have to be made on retention of the sandwich course, its structure, the period of professional training, the proportion of elective material and the form in which it is to be offered - as individual subjects or in optional strands.

The course revision is in the hands of a special committee chaired by the Head of School, comprising Heads of Departments and a representative from each of the Departments.
3. ENROLMENTS.

Total undergraduate enrolments in 1976 were 433 which represented an increase of 4% over the previous year. The trend in the decline of part time and sandwich students which I referred to in my report for 1975 continued in 1976 and as figures in the table below indicate, the number of students following a full time course has more than doubled between 1971 and 1976.

Post graduate enrolments have remained fairly constant, although a slight increase is expected during 1977.

<table>
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<th>ENROLMENT DATA</th>
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<tr>
<td><strong>B. Surv. - Full-time</strong></td>
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<td><strong>Year</strong></td>
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<td>Total F/T</td>
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| **B. Surv. - Part-time** |
| **Year** | **1971** | **1972** | **1973** | **1974** | **1975** | **1976** | **1977*** |
| 1       | 24      | 24      | 32      | 44      | 8       | 15      | 25       |
| 2       | 15      | 16      | 13      | 11      | 24      | 4       | 8        |
| 3       | 14      | 16      | 12      | 11      | -       | -       | -        |
| 4       | 8       | 13      | 14      | 12      | 10      | -       | -        |
| 5       | 12      | 7       | 10      | 8       | 7       | 5       | -        |
| 6       | 10      | 14      | 7       | 14      | 9       | 6       | 6        |
| 7       | 18      | 14      | 18      | 9       | 14      | 10      | 7        |
| Total P/T, B. Surv. | 101    | 104    | 106    | 115    | 72      | 40      | 46       |

| **B. Surv. - Sandwich** |
| **Year** | **1971** | **1972** | **1973** | **1974** | **1975** | **1976** |
| 1       | -       | 24      | -       | -       | -       | -       |
| 2       | -       | 17      | -       | -       | -       | -       |
| 3       | -       | 14      | 16      | 17      | -       | -       |
| 4       | -       | 19      | 16      | -       | -       | -       |
| 5       | -       | 38      | 52      | 52      | -       | -       |
| Total F/T, P/T, Sandwich | 257    | 284    | 332    | 385    | 415    | 433    | 438      |

| **Miscellaneous** |
| **Post Graduate** |
| **Ph.D** | 2 | 6 | 5 | 6 | 4 | 5 | 9 |
| **M. Surv.** | 5 | 4 | 3 | 3 | 7 | 8 | 7 |
| **M. Surv. Sc.** | 8 | 7 | 7 | 8 | 5 | 6 | 5 |
| **Total** | 15 | 17 | 15 | 17 | 16 | 19 | 21 |

* Estimated
4. **DEGREES AWARDED**

The following degrees will be awarded during the year:

**Bachelor of Surveying:**

- Honours, Class I: 4
- Class II, Division 1: 7
- Class II, Division 2: 11, 22
- Pass: 49

**Doctor of Philosophy:**

- **E.G. Anderson**

- **A.W.H. Keersley**
  - Thesis: "The computation of deflections of the vertical from gravity anomalies"

5. **AWARDS**

The Institution of Surveyors, Australia, New South Wales Division, sponsors annually two students in Parts 4-8 of the Bachelor of Surveying Course.

The 1976 awards were made to:

- Mr. Chris Clifford Colman
- Mr. Peter Charles Schofield

Mr. Stephen Gregory Choy and Mr. Brian Phillip Rogers who won the awards in 1975 are due to complete the course this year.

The Gold Medal awarded annually by the Board of Surveyors to the most distinguished graduand of 1977 has been awarded to Mr. Geoffrey Alan Cook, B.Surv., Honours Class I. This medal is to be presented to Mr. Cook at the Annual Graduands Dinner on 4th May, 1977.
6. VISITORS TO SCHOOL

Dr. Vidal Ashkenazi, Reader in Surveying, Department of Civil Engineering, University of Nottingham, visited the School for four weeks. He is a leading figure in geodesy in the United Kingdom. He was very active during his visit, giving a 25-hour lecture series on Geodetic Control Networks which was attended by most of the staff of the School as well as graduates and visitors. He also led a two-day seminar on Doppler Satellite Systems.

Professor P. Yoeli, Professor of Cartography and Surveying at University of Tel Aviv, gave a series of lectures in Computer Assisted Cartography. Professor Yoeli has developed the computer programmes which plot mapping detail, automated contouring, analytical hillshading and other related procedures.

Professor K. Lambeck of the Centre de Physique du Globe, Paris, during his period as a visiting Professorial Fellow in the Research School of Earth Sciences, visited the School for two days to lecture to undergraduate students and discuss research programmes with staff and postgraduate students.

Other visitors to the School included:

Professor Desmond C. O'Conner, Professor of Environmental Sciences, Murdoch University, Western Australia.

Dr. A.J. Brandenberger, Professor and Head of Department of Photogrammetry, Laval University, Quebec. He lectured on the economics of surveying and mapping, and the progress of world cartography.

Mr. Don Canty, Head of School of Surveying, South Australian Institute of Technology.

Mr. F.L. Clarke and Dr. J.C. Fryer from Department of Civil Engineering, University of Newcastle.

Mr. Sjef Bervoets, Reader, Chairman of Department of Surveying, University of Melbourne.

Mr. P. Flinn, Senior Lecturer in Surveying, University of Otago, New Zealand.

Mr. D. Gordon, Senior Lecturer in Surveying at University of Canterbury, New Zealand.

Dr. George Smith, College of Optometry, University of Melbourne, Victoria.

Mr. Bruce Lambert, Director of National Mapping, Queanbeyan, New South Wales.

Mr. Tony Bomford, soon after taking up his new appointment as Director of National Mapping, visited to discuss the current situation in geodesy and ways of increasing cooperation.

Dr. E.G. Anderson, Division of National Mapping.
6. VISITORS TO SCHOOL (contd)

Mr. Brian Barlow, Bureau of Mineral Resources, Canberra.

Mr. D. Jenkins, Hydro Electric Commission, Tasmania.

Dr. Harvey L. Mitchell of Division of National Mapping, Queanbeyan.

Captain Andrews and Warrant Officer Strautins of the Royal Australian Survey Corps.

Messrs. Keith Sinton, Tony White and John Copley of Commonwealth Department of Construction.

Messrs. Phil Dynes and Mr. Paul Robinson of Commonwealth Department of Services and Property.

Messrs. Heydon and Wellspring of Australian Survey Office, to discuss measurement of building deformations, using photogrammetry.

Mr. A. Lozzi, Department of Motor Transport, Sydney.

Mr. Bob Alderton, Private Practice and Mr. Brian Murphy, Reader in Surveying, University of Melbourne, to discuss reciprocal recognition of overseas professional qualifications.

Messrs. Phil Dynes and John Curdie of the Institution of Surveyors, for discussions on assessment of overseas surveying qualifications.

Mr. Don Trask, Anzac Fellow, from New Zealand Aerial Mapping, Hastings, New Zealand.

Mr. John Curdie, private surveyor, to discuss the establishment of a sub-committee of New South Wales Division of Institution of Surveyors, Australia, on Land Management.

Mr. Terry Meakin, Student Liaison Officer of the New South Wales Division of Institution of Surveyors, Australia.

Mr. L. Bulla of Carl Zeiss Pty. Ltd. (West Germany).

Mr. A. Cawthorne of Wild Australia Pty. Ltd.

Mr. M. Stevens of Hewlett Packard Australia Pty. Ltd.

Mr. C.J. Plumb of AGA Products Pty. Ltd., Sydney.

Mr. Urs Frey, Wild Heerbrugg, Switzerland.

Mr. J. Shepherd of Wild (Australia) Pty. Ltd.

Mr. W. Fackender of N.I.C. Instrument Company

Mr. Dieter Loschner of Carl Zeiss Jena.

Mr. Jacques Grenot of IBM Australia Ltd. and Mr. Kevin Shepherd of Hood Sailmakers.
6. VISITORS TO SCHOOL (contd)

The following attended the fifth series of Research Seminars in Geodesy, held by the School at the end of August:

Dr. E.G. Anderson, Division of National Mapping.
Mr. Brian Barlow, Bureau of Mineral Resources.
Mr. S.G. Bervoets, University of Melbourne.
Mr. Alan Brady, N.S.W. Institute of Technology.
Mr. D. Certuti, Darwin.
Dr. J.G. Fryer, University of Newcastle.
Mr. J. Glassock, Queensland Institute of Technology
Mr. T.A. Herring, University of Queensland
Mr. F.J. Leahy, University of Melbourne
Mr. I.D. Lloyd, Division of National Mapping.
Capt. D. Mcluskey, Royal Australian Survey Corps, Canberra.
Mr. S.M. Nakiboglu, University of Queensland.
Mr. A. Roelse, Division of National Mapping, Canberra.
Mr. A. Sprent, Tasmanian College of Advanced Education.
Mr. G.H.V. Thomson, Royal Melbourne Institute of Technology.

The following attended the Lecture Series "Geodetic Control Networks" given by Dr. Vidal Ashkenazi:

Mr. D. Barsby, Dept. of Mapping & Surveying, Queensland.
Mr. S. Greening, Dept. of Main Roads, Sydney.
Mr. S. Hudson, Dept. of Mapping & Surveying, Queensland.
Mr. I. Macreth, Australian Iron & Steel, Wollongong.
Mr. W.E. Sainsbury, Dept. of Main Roads, Sydney.
Mr. F. Speering, Irrigation and Water Supply Commission, Queensland.
Mr. A. Watson, Central Mapping Authority, Bathurst.
7. **STAFF.**

7.1 **General.**

*Appointments.* There was only one addition to the teaching staff of the School during the year under review. This was a position of tutor to which Mr. Paul C. Covell, a former graduate of the School, was appointed in July 1976. Offers of appointment were made to two Lecturers and a Tutor in March 1977.

*Promotions.* Drs. A. J. Robinson and A. Stolz, were promoted to Senior Lecturers in July 1976.

*Study Leave.* Associate Professor J. S. Allman returned from study leave in July 1976, after spending a year in Canada with the geodetic division of the Surveys and Mapping Branch, in the Department of Energy Mines and Resources, Ottawa.

Dr. A. H. W. Kearsley proceeded on study leave in December and proposes to spend a year in the Department of Geodetic Science at Ohio State University, which is the premier institution in the United States in physical geodesy and satellite geodesy.

7.2 **Visits by Staff.**

During his study leave Dr. A. Stolz visited the following Institutions:

- Jet Propulsion Laboratory Pasadena California.
- Cooperative Institute for Environmental Sciences, Boulder, California.
- NASA Headquarters, Washington, D.C.
- U.S. Naval Observatory, Washington, D.C.
- Goddard Space Flight Centre, Maryland.
- National Geodetic Survey, Maryland.
- University of Texas at Austin, Texas.
- McDonald Observatory, Fort Davis, Texas.

In February 1976, R. S. Mather visited the Geographical Survey Institute, Tokyo 4th February, 1976.

- Daidaira Observatory. Laser ranging facilities, University of Tokyo.
- Tokyo Astronomical Observatory and Earthquake Research Institute, University of Tokyo.


Associate Professor R. S. Mather, during his visit to Germany in June 1976, visited the following Institutions:

- Universität Bonn (Institut fur Theoretische Geodäsiie)
- Technische Universität Darmstadt (Astronomische Geodäsie und Satelliten Geodäsie)
- Hochschule der Bundeswehr, München (Astronomische Geodäsie und Physikalische Geodäsie)
- Technische Universität Graz, Austria.
7.2 Visits by Staff (Contd)

Technische Universität München
Deutsche Geodätische Forschungs Institut, München
European Space Agency, Darmstadt

Dr. J. C. ˇrinčer visited the following institutions en route to and in Helsinki:

The ITC, Enschede, Netherlands for discussions with a number of members of staff;
The Technical University of Hanover (Institute of Photogrammetry);
The Technical University of Stockholm, Divisions of Photogrammetry and Applied Optics.
The Technical University of Helsinki.

During his trip to Austria, Dr. F. K. Brunner visited the Institute of Geodetic Surveying, Technical University, Vienna.

On a recent trip to Germany, Associate Professor R. S. Mather visited the Max Planck Institute for Radio Meteorology, University of Hamburg, on 28th September 1976.

A series of seminars on Professional Training was organised jointly by the Institution of Surveyors and the School. The following members of staff attended Regional Institution of Surveyors Seminars at Wollongong, Parramatta, Orange and Port Macquarie:

Prof. P. V. Angus-Leppan, Dr. A. J. Robinson,
Mr. I. P. Williamson, Dr. G. J. Hoar, Dr. G. J. Holden,
A/Prof. G. G. Bennett, Mr. B. Forster

Associate Professor G. G. Bennett and Mr. J. Reuger attended the 19th Annual Survey Congress held at Broadbeach, Qld., between the 15th and 21st May 1976.

Dr. G. J. F. Holden and Dr. S. U. Nasca attended the Second Australian Cartographic Conference in Adelaide from 29th September to 3rd October, 1976.

Dr. Holden visited the School of Surveying SAIT in Adelaide in April. He also visited the Mapping Branch, S.A. Lands Department.

Associate Professor R. S. Mather visited the CSIRO/Division of Fisheries and Oceanography on 21 May to meet with Captain Paul Wolff from Jet Propulsion Laboratory, California, for discussion on the forthcoming SEASAT Mission.

Professor R. B. Forrest attended a Remote Sensing Seminar held by the N.S.W. Science & Technology Council, Sydney.

Professor P. V. Angus-Leppan visited the Division of National Mapping and the Academy of Science, Canberra for discussions on the 1979 General Assembly of the International Union of Geodesy and Geophysics.
7.2 Visits by Staff (Contd)

Professor R. B. Forrest visited Department of Main Roads to view current results of stereophotogrammetric measurement of rock aggregate samples, a co-operative undertaking by DMR and National Measurements Laboratory.

Mr. I. P. Williamson visited the following organisations for discussions on applications of data banks. Registrar General's office, IBM, Surveyor General, Institute of Technology.

Messrs. B. Forster and I. P. Williamson visited Dames and Moore, Environmental Consultants with regard to their use of data banks and remote sensing.
7.3 STAFF PUBLICATIONS


MATHER, R.S. Some Possibilities for Recovering Oceanographic Information from the SEASAT missions. Uniserv G 24 (1976), 103-122.

7.3 Staff Publications (contd)

MAUGHAN, M.  *Adjustment of Observations by Least Squares.*  Monograph No. 6, School of Surveying, Univ. of N.S.W. (1975), 57 pp.


STOLZ, A.  McDonald UTO Results and Implications for the EROLD Campaign.  *Proceedings of Symposium on Scientific Applications of Lunar Laser Ranging*, (Texas, 1976), (with P.L. Bender, 1st author).


7.4 PRIZES, AWARDS, ELECTIONS AND APPOINTMENTS.

Professor P.V. Angus-Leppan has been appointed Chairman of the Organising Committee for the XVII General Assembly of the International Union of Geodesy and Geophysics, to be held in Canberra in December 1979.

Associate Professor R.S. Mather was awarded the Deutscher Akademischer Austauschdienst Travel Grant to visit German Universities at Bonn, Darmstadt and München for the period June to July 1976.

Associate Professor G.G. Bennett has been invited to join the Special Study Group "Application of Inertial Techniques to Geodesy".

The Committee of the Institution of Surveyors, N.S.W. Division has appointed the following members of staff to the standing sub-committees:

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<tr>
<td>Dr. A.H.W. Kearsley</td>
<td>Discussion Group</td>
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<td>A/Prof. G.G. Bennett</td>
<td>Executive; Papers and Publications (Convener)</td>
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<td>Darwin Congress (Convener); Surveyors' Act Review; Qualifications</td>
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<tr>
<td>Dr. G.J. Hoar</td>
<td>Social</td>
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<tr>
<td>Dr. G.J.F. Holden</td>
<td>Papers and Publications</td>
</tr>
<tr>
<td>Mr. B. Forster</td>
<td>Land Management</td>
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<td>Mr. I.P. Williamson</td>
<td>Land Management</td>
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Dr. A.J. Robinson received research grants from the Sydney County Council and from the School of Surveying Research Grants an additional amount for research into precise edm.

Dr. F.K. Brunner received a grant also from the School's Research Grants for use of adiabatic atmospheric models for the reduction of microwave edm.

Mr. K.I. Groenhout received a grant from the School's Research Grants (1976) for investigation of systematic errors in astronomical azimuth observations.

Mr. J.M. Rueger received a grant from the School's Research Grants (1976) for short and long term stability of electronic distance measurement instrument's frequencies.

Professor P.V. Angus-Leppan has been appointed External Examiner of the surveying course at the Universiti Teknologi Malaysia.

Messrs. B.C. Forster and I.P. Williamson have been appointed as Associate Members of Urban Development Institute.

Mr. B.C. Forster was appointed as a member of the N.S.W. Higher Education Board Assessment Committee, to examine the proposed Diploma of Appl. Sci. (Valuation) at Hawkesbury Agricultural College.
7.4 Prizes, Awards, Elections and Appointments (contd)

Mr. J. Rueger has been invited to join Study Group C in Commission 6 of the International Federation of Surveyors (FIG).

Associate Professor R.S. Mather was awarded a substantial grant from the Australian Research Grants Committee (ARGC) for the determination of sea surface topography off north-eastern Australia using the GEOS-3 satellite.

Professor R.B. Forrest and Dr. J.C. Trinder were re-elected to the Australian Photogrammetric Society N.S.W. Division Executive Committee.
7.5 Lectures, Conference Papers.

Dr. J. C. Trinder presented a paper, by himself and Dr. S. U. Nasca entitled "Tests on the Mapping Applications of LANDSAT Images" at the 13th Congress of International Society of Photogrammetry, at Helsinki.

During the period 11 June to 5 July, Associate Professor R. S. Mather, whilst on an overseas visit, gave the following lectures:

"Satellite Altimetry" at the Universitat Bonn.
"Ocean Geoid Determinations" at the Technische Universitat Damstradt
"Marine Geodesy" at the Hochschuleder Bundeswehr, Munich.
"Precise Gravimetric Geodesy" at the Technische Universitat, Graz.

During his study leave spent at Joint Institute for Laboratory Astrophysics, Boulder, USA, Dr. A. Stolz presented the following lectures:

"Problems connected with the Definition of a Geodetic Reference Frame at the ± cm level" and "Geocentre Motion and Geodetic Point-Coordination". Talks were also presented to Earth Physics Applications Group, Jet Propulsion Laboratory, Pasadena, June 1975, and Joint Institute for Laboratory Astrophysics, Boulder, July, 1975.
"Seasonal Motion of the Earth's Centre of Mass Resulting from Variations in Air Mass and Ground Water", a talk presented at LURE team meeting, Washington, DC, June 1975.
"Earth Rotation Measured by Lunar Ranging: Preliminary Results", presented at LURE team meeting, Washington, DC, October 1975.

Associate Professor Mather gave a lecture to the Inter Union Commission for Radio Meteorology Colloquium on Radio Oceanography at Hamburg on 29th September 1976. The title was "On the realization of a system of reference in four dimensions for Ocean Dynamics."

Dr. G. J. F. Holden gave a lecture on "International Responsibility for Aeronautical Charting" to General Meeting of Australian Institute of Cartographers in Adelaide on 2nd April.

A talk was given by Mr. P. S. Amin to the Australian Photogrammetry Society, NSW Division, at the UNSW on "The CPI plotter and its applications". This talk was followed by a demonstration of the plotter.

Professor P. V. Angus-Leppan was leader of the Institution of Surveyors' Discussion Group on the new Manual of the Integrated Survey Grid. He was Editor of the Manual.
7.5 Lectures, Conference Papers (Contd)

Dr. A. Stolz gave the following lecture at the Division of National Mapping, Queanbeyan on 28th May: "Accuracy Obtainable for Universal Time and Polar Motion from a network of Lunar Laser Ranging Stations".

Dr. A. J. Robinson lectured at the 52nd Annual Conference of the N.S.W. Staff Surveyors' Association on "E.G.m. and its Practical Use" on 14 April.
8. RESEARCH

Department of Surveying

Approximate Adjustment of Traverse Networks
A semi-rigorous technique is being developed for the adjustment of traverse networks using a desk-top calculator.

Name of Researcher
G.G. Bennett

The Adjustment of Very Large Networks
Various methods are being investigated for the adjustment of continental or very large triangulation networks.

J.S. Allman

Computer Applications in Surveying
Software is being developed for the application of computers (desk-top to main-frame) to problems in classical Geodesy, Photogrammetry and general Surveying.

W. Kent

Investigation of Errors in Laplace Azimuth Observations
Various sources of error in a large number of Laplace azimuth observations made by the Division of National Mapping are investigated. In addition to these observations from all parts of Australia, a series of observations are also being carried out near Sydney.

K.I. Groenhout

Precise Electronic distance measurement Calibration
A precise edm calibration base is being established. Methods are being developed for the calibration of edm instruments with a special interest in studying the long term effects on the calibration.

A.J. Robinson

J.M. Rueger

P. Covell

Short and Long Term Stability of Electronic distance measurement Instrument Frequencies
The effects of quartz oscillator ageing are investigated with special interest in long term stability. The short term stability is being determined under varying temperature and operating conditions.

J.M. Rueger

Calibration, Standardisation and Field Observation Corrections with the Kern Mekometer ME 3000
Appropriate methods of calibration and standardization are being investigated, with a view to clarifying the necessary corrections to field observations.

J.M. Rueger

Indirect Electronic Distance Measurement using Plane Mirrors
In this technique, all distances are obtained as a difference of two original observations. The increase in precision obtained using this method in relation to ordinary edm instruments is analysed.

J.M. Rueger

Surveys for Relocation and Reconstruction of Historic Sites.
The investigation concentrates on Joadja, a derelict mining town in southern N.S.W. The town was abandoned about 1900 and little evidence of its existence remains on the surface of former buildings, etc. Edm and conventional survey techniques have been used in conjunction with the photogrammetric interpretation of very old photographs to locate former features in three dimensions.

G.J. Hoar
8. Research (contd)

Department of Geodesy.

**Determination of Sea Surface Topography off North Eastern Australia Using the GEOS-3 Spacecraft**
This Principal Investigation on the GEOS-3 Mission is the subject of an Agreement between NASA and the Department of Science. High resolution radar altimetry is being analysed for the shape of the geoid, sea surface topography and gravity field models in the Tasman and Coral Seas.

Solution of the Geodetic Boundary Value Problem using Mixed Data Sets
This Project investigates the potential of satellite altimetry data when correctly combined with surface gravity information, to determine regional slopes of the sea surface with special reference to the Coral Sea.

**Earth Model Improvement using Satellite Altimetry**
Computer systems are being developed to combine satellite altimetry data with gravity anomalies to improve the model of the Earth's gravity field for use in satellite orbit improvement. Simulation analysis is being carried out to establish the sensitivity of the solution procedure.

**The Recovery of Ocean Tides in the Coral Sea**
Programs are being developed to recover the major constituents of the ocean tide from satellite altimetry data. It is planned to study the abnormal ageing of the tide in the Coral Sea using this new type of data.

**Tidal Gravity Profiles in Australia and Papua New Guinea**
This joint project with the International Centre for Earth Tides, Bruxelles & the Bureau of Mineral Resources, Geophysics, Canberra and funded by ARGC, is now completed. The results are published in UNISURV G 25.

**Earth Tide Effects on Geodetic Observations**
Variations of gravity due to the loading effects of various ocean tide models have been computed. The results of this research should enable all quasi-radial range measurements to extra-terrestrial sources to be reduced to ±2 cm from any site in Australia.

**Analysis of Lunar Laser Ranging (LLR) Data**
LLR data gives information on the Earth rotation rate and polar motion. Preparations are underway for the analysis of data obtained during the EROLD (Earth Rotation by Lunar Distances) campaign.
B. Research (contd)

Atmospheric Effects on LLR Measurements
Atmospheric loading changes the position of the geocentre and causes polar motion. Short period variations are being investigated.

Geodetic Applications of LLR in the Determination of Earth Dynamic Processes
Comparison of latitude variations at McDonald Observatory by LLR with BIH values has been performed for the year 1974 and attempts made at correlation with geophysical occurrences. Improvement of plate motion and nutation models by LLR and the simulation of diurnal polar motion using LLR are also studied.

Determination of Vertical Refraction from Heat Flux Measurements
Heat flux measurements are used for the determination of representative refraction coefficients for a short line of sight (about 500 m long). Special consideration is given to the reciprocal refraction coefficients.

A Micrometeorological Model for the Atmospheric EDM Reduction
A new atmospheric model for edm reduction has been developed using the laws of atmospheric physics. The application of this model is tested on actual microwave distance measurements.

Investigation of Humidity Transfer in the Atmospheric Boundary Layer
Data from the Wangara Experiment collected by the Atmospheric Physics Div., CSIRO, is used for a study of the humidity transfer processes and the resulting water vapour pressure distribution in the atmospheric boundary layer. The effect of humidity transfer on microwave edm is also being studied in detail.

Variability of the Atmospheric Parameters along an EDM Path
The data for the Caithness Baseline experiment carried out in 1964 is used for this study. Several atmospheric models have been tested for the atmospheric reduction of microwave edm.

Deflections of the Vertical from Gravimetry
Attempts have been successful in computing deflections of the vertical from gravity anomalies in a disturbed region in northern NSW, with a precision equivalent to that obtainable by astro-geodetic means. The results are given in UNITSURV Rep. S 15.
B. Research (contd)

Transformation from Doppler system to AGD coordinates
Investigations are being made into the transformation of
coordinates derived from Doppler satellite receiver
observations on the NML9D system into coordinates on the
Australian Geodetic Datum which is known to have
distortions. The three dimensional transformation is
analogous to the conformal transformation in two
dimensions, and the solution should be applicable generally.

Meteorological Factors and Refraction
A new derivation of formulae for refraction from the
eikonal equation and investigation of the possible
methods of application.

Preparation of a High Precision Gravity Anomaly Data
Bank for Australia
Data provided by the Bureau of Mineral Resources, Geology
& Geophysics has been used to prepare a precise gravity
anomaly data bank for sea surface topography studies.
Results of the data bank AUSGAD 76 are given in
UNISURV G 25.

Updating Geocentric Orientation Parameters for AGD & NAD
Geocentric orientation parameters obtained by
gravimetric means by Mather for AGD and NAD are being
updated to be consistent with Goddard Earth Model 8.

Four Dimensional Geodesy from Secular Variation in
Gravity
Simulation studies have been completed for the recovery
of geocentre motion and Earth model changes from
determinations of secular gravity changes. The optimum
configuration of stations was investigated and the
results will be presented at the Trieste Symposium on
Secular Variations in Gravity.

Geodetic Reference Systems for Crustal Motion Studies
The effect of plate motions on geodetic reference systems
is the subject of this simulation study with special
reference to the effect on the geoid over long periods
of time. It is planned to present the results at the
Stanford University Symposium on Recent Crustal Movements.

Application of Geodesy from Satellites to Geodynamics
Models are being developed for geodynamic effects with
a view to introducing four dimensional concepts to
geodetic coordinates. The sensitivity of methods of
solution presently used in dynamic satellite geodesy
to geodynamic processes will be investigated.
8. Research (contd)

Short arc Methods in Dynamic Satellite Geodesy
Software is being developed to determine Earth parameters, improved station positions and orbit refinement using short arc methods. Such systems could be applied to Doppler methods.

Deduction of Earth Strains from Repeated Geodetic Measurements
A new method has been developed for the calculation of the incremental strain tensor from repeated geodetic measurements using the "inner coordinates" of a network.

Department of Photogrammetry

Correction of LANDSAT Multi-Spectral Scanner Imagery
Appropriate formulae have been derived for printing corrected pictorial LANDSAT images on a photogrammetric plotter. The investigation is being extended to the production of corrected images from computer compatible tapes of LANDSAT images.

Small Scale Topographic Mapping from Spacecraft Imagery
The use of LANDSAT imagery to cover the whole of Australia is being investigated. The immediate objective is the development of a procedure for the cheap routine revision of the 1:250 000 Topographic Series. A number of enlargements rectified within the required map accuracy standards have been produced.

Improvement in LANDSAT image data resolution by digital analysis.
The interest is in the application of the "Least-squares" deconvolution technique.

Design and Construction of Single-image Comparator
The precision photogrammetric comparator is being developed from separate components. The goal is both to save money and to obtain an instrument which can later be modified to form part of a more ambitious photogrammetric system.

Structural deformation measurement by analytical photogrammetry.
Analytical methods have been used to measure temporal changes in buildings and civil engineering structures that give high precision

Assessment of the Cartographic Plotter (CP1)
The investigation involves the comparison of the theoretical and mechanical aspects of CP1.
8. Research (contd)

Remote Sensing Urban Residential Patterns
The projects sets out to examine the correlation that may exist between urban residential value patterns and variables, particularly those pertaining to the environment, that can be interpreted from aerial photography of varying scales and emulsion types. Multi-stage sampling is envisaged, ranging from LANDSAT imagery as a first stage, to progressively larger scales of aerial photography. Multivariate statistical techniques will be used to investigate the relationship between the spatial distribution of photogrammetrically derived variables and property values.

Subdivision Control
The project investigates the importance of the Local Government Act in the expansion of the cadastre in N.S.W. In particular, the statutory controls and procedures in relation to the sub-division of land and the relevant decisions of the Local Government Appeals Tribunal will be examined with regard to their enforcement.

Requirements for an Integrated Land Data Bank for Rural New South Wales
The theory of land data banks are developed with special reference to systems used overseas. The existing land data banks in N.S.W. are studied with a view to their possible integration into a total system. A model land data bank will be established for the rural districts around Bathurst.

Computer Programme for Adjustments
Two programmes for the formation and solution of large systems of Normal Equations and selected columns from the normal inverse have recently been completed. Testing of the programmes currently is taking place with a view to adjusting the Australian Geodetic Network using the same observations as were used in the 1966 "Rod" adjustment.
9. EQUIPMENT.

The normal equipment grant was suspended in 1975 and 1976. However the School was granted a small sum from a special equipment grant in 1976, and some equipment was purchased on research funds. A start was made on purchasing components for the precise monocomparator, the first module of an image analysis system, a major facility in photogrammetry. Equipment purchased for the new cartography laboratory included a contact printer and a reproduction camera (ESKOFOT). Miscellaneous items included an additional typewriter, a TEXAS SR52 calculator with printer, a set of magnetic compasses and a set of electronic stopwatches for astronomy. The School will soon have available three terminals to the CYBER computer, two of these dedicated for research purposes.

The increase in class sizes, in combination with the shortage of funds for equipment, has led to a serious situation. The School needs about $80,000 to make up its sets of standard field equipment. Such basic items as theodolites, levels, barometers and edm instruments are urgently required. Through lack of equipment, students do not have practical exercises during their course in, for example, precise levelling or barometric heighting, while in other spheres, such as edm, their experience is severely limited. This year's grant of $32,500 for equipment will cover only a small proportion of the very basic needs.

Shortage of equipment for photogrammetry has long been a difficulty. An assessment by Professor Forrest and his staff, of future developments in stereoplotters and their costs, has led to a significant change in direction. The conclusion is that, rather than purchase a very expensive analogue stereoplotter, the teaching and research interests of the School can best be served by building up a flexible, multipurpose image analysis system. This system would include a control computer, a precise comparator, a computer-controlled plotting table, and other units.

The School's HP 98/30 Calculator was connected to the University's Cyber Computer by a data line and special interface. One example of system operation would be as an analytical plotter, but it would be a very versatile system, capable of a variety of uses. It now appears that there is a possibility of funding the development of such a system through a new University fund entitled, Equipment: Major Projects (EMP). A request has been made for the funds and given a high priority by the Faculty, but the allocations have not yet been announced.

10. DONATIONS

Kern & Co. Ltd., Switzerland, gave the School a set of colour slides on new geodetic instruments.
11. SCHOOL PUBLICATIONS

UNISURV S Series

The effect of Topography on Solutions of Stokes' Problem

The Computation of deflections of the vertical from gravity anomalies

UNISURV G Series

An Australian Journal of Geodesy, Photogrammetry & Surveying
June 1976 Unisurv G 24

December 1976 Unisurv G 25

Copies of the above publications will be available at the Meeting of the Visiting Committee.

12. BIOGRAPHY – NEW STAFF MEMBER

P.V. COVELL Tutor

Paul Covell graduated from the University of New South Wales in 1975. He joined the School in July 1976 as a Tutor. He is presently engaged in research into the precise calibration of electromagnetic distance measuring equipment, for his Master of Surveying degree.