



THE AUSTRALIAN NATIONAL UNIVERSITY

FACULTY OF ENGINEERING AND INFORMATION TECHNOLOGY

ANNUAL REPORT 2001

DEAN'S REPORT

The Faculty established the Faculty Office early in 2001. The office took over the functions previously provided by the Joint Faculty Office, with the Faculty of Science, and

the Faculties Resources Office. One of the major initiatives was the increase in student recruitment activities both internationally and throughout southern New South Wales. As a result, the Faculty had its first substantial mid-year intake of students. Six local students and 16 international student commenced studies in July 2001. The mid-year intake will be a

regular feature of our future recruitment activities.

The Department Computer Science, for the first time in many years, filled all academic positions toward the end of 2001. This was a pleasing development given the increase in workload brought about by the full implementation of the Bachelor of Software Engineering and the establishment of the Master of Information Technology (in eScience). Sustained growth in student enrolments has made the Department a very high workload environment.

The Department of Engineering was affected by the departure of a number of key staff members during 2001. At one stage it had only 8 permanent academic staff. That number recovered to 11 by December and a number of positions were advertised. The major activity in the Department was a major restructuring of the Bachelor of Engineering Program. Eight new Engineering Majors were introduced, allowing students a much greater freedom of choice in electives and named degree programs. Active publicity focusing on the available Majors generated considerable interest. It is likely that this development will reverse the recent decline in BE numbers.

STATEMENTS OF ACHIEVEMENT AGAINST STRATEGIC DIRECTIONS IMPLEMENTATION PLAN

1. *Enhance our International Reputation and Develop our International Roles*

- a) The Faculty has actively sought international collaboration and enrolments from international students. Faculty members made over a dozen

visits to South East Asia and Europe in a program to increase the number of international students.

- b) As part of the Faculty's international activities, the Faculty established agreements relating to advanced standing status with eight high quality international educational institutions. As a result of the active recruiting campaign in First Semester 2001, 16 international students commenced studies in Second Semester. This was the first time that the Faculty has actively sought second semester enrolments.
- c) The income from International Fees increased from ~\$400,000 in 2000 (or 8% of the Faculty's Block Grant) to ~\$580,000 in 2001 or 10% of the Block Grant. The active recruitment program was commenced in 2001 with the aim of increasing the international income to 30% in 2005.

2. *Identify our National Roles*

- a) With RSISE, the Faculty actively participated in the preparation of the National ICT bid for the establishment of a Centre of Excellence in Information and Communication Technologies to be funded by the Federal Government.
- b) Members of the Faculty are active in the Australian Association of Engineering Education and the Australian Computer Society.

- c) The Dean is currently Chair of the Group of Eight Deans of Engineering and Associates. Dr Cardew–Hall held the position of Branch Chair of the Australian Branch of the Institution of Mechanical Engineers. Dr Keith Lovegrove is Chair of the Australian and New Zealand Solar Energy Society.

3. *IMPROVE THE EDUCATIONAL EXPERIENCE OF OUR STUDENTS*

- a) In 2001 plans were introduced to develop a series of Engineering Majors in the BE program which allowed the introduction of degrees with the name of the specialization in the title such as BE (Communication Systems), BE (Mechatronic Systems) etc. Market research found that students entering the systems–oriented BE degree were uncertain of the discipline area and the career opportunities that they would be studying. The introduction of the named degrees has greatly assisted the marketing effort.
- b) At the same time as the Engineering Majors were introduced the structure of the program was changed to allow students to undertake a series of double degrees in five years without any increase in workload above the standard 48 units per annum. This too has greatly assisted the marketing effort.
- c) The Faculty has actively encouraged RSISE and RSPHYSSE to participate in the presentation of the Engineering Majors, and in supervising project students. This collaboration has been very beneficial to the Faculty and its students.

- d) The Tutoring Quality Program in the Department of Computer Science was overhauled and refocused to improve the teaching of the Department’s numerous part–time tutors.

4. *Enhance our Research Performance*

- a) The Faculty continues to support and sponsor research of the highest quality. The Faculty received approximately \$4M in research income in 2001. There were 26 journal articles authored or co–authored by academic staff in 2001.
- b) The Centre for Sustainable Energy Systems attracted new external grants in 2001 totaling in excess of \$700,000.
- c) The Faculty, through the Department of Computer Science, actively supported the successful bid for a Cooperative Research Centre for Smart Internet Technology.

5. *Enhance our Role in Research Training*

- a) A web–based system, aimed to introduce potential students to all academic staff across the IAS/Faculty boundaries was implemented by the Program Convenor in the Department of Engineering. This ensures that the research interests of the student can be matched as well as possible to the research expertise of the academic staff, and vice–versa. The supervisor/student relationship receives attention at regular yearly progress reports, and student/staff have access to the Postgraduate Studies Coordinator and Head of Department. ANU Graduate Students

Association offers a campus-wide forum for exchange of ideas, views, and a learning field for new arrivals. An important aspect of research training is the provision of an effective progress monitoring system which allows the student to measure his/her progress, and become aware of expectations and deliverable outcomes. The recently established Student Services section established in FEIT provides such a service, and in collaboration with the Graduate Convenor, ensures that students' needs are cared for and that their productivity is not impaired.

- b) Postgraduate students in the Engineering Program have access to infrastructure equal to, or better than, that in most top Australian universities. In many cases, the collaboration between Faculties and Research Schools opens up new possibilities for the graduate student. The University maintains and continuously improves central facilities such as Libraries, EMU, supercomputing, etc.
- c) Postgraduate students in the Computer Science and Technology Program have supervisory panels drawing on RSISE, FEIT, CSIRO and industry.
- d) Through its international recruitment activities, the Faculty actively sought to increase the number of international postgraduate students.

6. *Continue to Develop our Staff*

- a) Staff development and a commitment to enhance staff skills and to provide career advancement opportunities remain a key

focus. In 2001, a time management course was offered for all staff, and several general staff attended supervisory management workshops. Academic staff will also be encouraged to attend these workshops.

- b) Staff also participated in courses in computer skills, English language, safety and first aid and other technical courses. Attendance at conferences for both general and academic staff is supported and encouraged.

7. *Develop a Comprehensive Information Plan for the University*

The Faculty has been an active participant in the development of the University's Information Plan and supported the program with expertise and staff exchanges.

8. *Seek Appropriate Partnerships and Alliances, both Academic and Business*

- a) The Faculty has strong research relationships with Origin Energy, Telstra, Solarhart, Fujitsu and Ford Australia. Advantra, Airservices Australia, Boeing Australia and Mastech Asia Pacific all provide scholarships for Faculty students.
- b) The Faculty is developing plans to expand and formalize its relationships with industry with the development of an Industry Alliance.

9. *Improve our Professional (Consulting) Activities*

The professional skills of the Faculty make a significant contribution to the nation in a number of ways. In 2001, the Faculty successfully bid for R&D grants valued at ~\$1.3m.

Faculty members have been involved in individual consultancies. Members of the Faculty have worked in support of the **ACT Accrediting Panels** and collaborations have included **CSIRO**, the **Japanese Advanced Institute for Science and Technology**, the **ACT Electoral Commission**, **Federal Office of Road Safety**, **Commonwealth Department of Transport and Regional Services**, **ANSTO**, the **Australian Greenhouse Office**, the **CRC for Renewable Energy**, the **ACT R&D Fund** and the **Sustainable Energy R&D Fund**.

10. Develop an Asset Maintenance Plan

The Faculty records all its assets in accordance with University policy. All assets have been coded in line with the ESP Assets Management System and an annual asset check procedure implemented.

11. Diversify Funding Base

The Operating Grant in 2001 was \$5.935M, which included \$580K in international student fees and \$4M in new and carry-over R&D funding. The aim is to increase funding from international student fees from 10% to 30% of the Operating Grant. An aggressive marketing and recruitment campaign has been implemented with

approximately \$177K being spent on non-salary international recruitment and promotional activities.

12. Link Unit Strategic Plans to University Strategies

The Faculty has in place a Strategic Plan which it reviews on a periodic basis. Modifications will be made to bring the Plan into line with the University's mission and strategies paper, "Preparing Ourselves".

BUDGET PERFORMANCE

The Faculty finished 2001 with a modest operating surplus. This, together with the cash carried forward from 2000, allows the Faculty to enter 2002 in a good financial position.

GENDER EQUITY PERFORMANCE

The Faculty continued its initiatives in implementing strategies to target gender equity issues. Engineering and computer science are traditionally difficult areas in which to attract female academics, but the Faculty was successful in appointing a full-time female academic staff member in both the Department of Engineering and the Department of Computer Science, and making an additional half-time appointment in the Department of Engineering.

The Faculty operates a Women in Engineering and Information Technology Network. The aim of the network is to disseminate information to female school students highlighting engineering and information technology as viable career options, and to encourage female students to

continue to achieve in these non-traditional discipline areas. It also organized a number of guest speakers to speak on relevant gender equity issues. Speakers included Ms Sheryle Moon, former Testra Businesswoman of the Year and Vice President of the Computer Science Corporation, and Ms Anne-Marie Englund, a former Faculty student who is now Production Engineer with Cochlear.

SIGNIFICANT ACHIEVEMENTS IN RESEARCH AND TEACHING

The Faculty was an active participant in the commencement of the Smart Internet Technology CRC. The ANU is one of 4 major University partners and FEIT, in the form of the Department of Computer Science, is half of the ANU contribution.

Members of the Department of Computer Science developed a number of advanced algorithms in the fields of data warehousing, waveless division multiplexing networks and parallel algorithms.

An outcome of research by Dr Andres Cuevas (Centre for Sustainable Energy Systems, Department of Engineering) was the fabrication of highly efficient silicon solar cells which have set a record for achieving the highest lifetimes and the best surface passivation ever measured using thin layers of both silicon oxide and silicon nitride. The results clarify the ultimate performance limits of silicon solar cells and other electronic devices, and they indicate new directions to reach those limits.

The Centre for Sustainable Energy Systems has received a major grant from the Australian Greenhouse Office for its work on solar energy

systems. The grant, valued at \$1.6M over 2 years, will commence in 2002. The Centre is also involved in R&D work with an industry partner (Origin Energy) which received a grant from the Australian Greenhouse Office for \$1M.

Total student numbers in the Department of Computer Science (measured as EFTSUs) reached 387.8. This is an average compounded increase of 10% yearly since 1994. The Department has handled this rate of growth very effectively, partly by diversifying academic staffing as well as sources of student enrolment.

In September 2001 the Faculty and Sun Microsystems signed a letter of intent to establish a Sun Center of Excellence. Details of the center are under discussion, but the broad theme will be programming paradigms, tools and algorithms for large shared memory parallel processors. The project has been initiated through seed funding and a hardware grant from Sun Microsystems.

STUDENT NUMBERS

In 2001, the number of new undergraduate students enrolled was 305. 71 students enrolled in the Bachelor of Engineering, 178 in the Bachelor of Information Technology and 56 in the Bachelor of Software Engineering. Eleven percent of the total number were international students.

**Table 1: EFTSU figures: 1991–2001
Department of Computer Science**

Year	Postgrad	Grad Dip	Ugrad	Total
2001–DETYA	5.6	4.5	328.2	338.3
2001 –ISF	2.9		46.6	49.5
2000–DETYA	5.5	0.0	46.6	49.4
2000–ISF	0.0	0.0	35.94	35.94

1999-DETYA	9.25	0.0	288.84	298.09
1999-ISF	1.0	0.0	23.9	24.9
1998-DETYA	10.0	0.4	244.2	254.6
1998-ISF	2.0	0.0	21.4	23.4
1997-DETYA	12.75	0.67	226.39	239.81
1997-ISF	2.0	0.0	24.30	26.3
1996-DETYA	12.0	0.6	181.5	194.1
1996-ISF	2.0	1.5	34.8	38.3
1995-DETYA	16.0	1.0	179.0	198.0
1995-ISF	3.0	1.0	24.0	28.0
1994-DETYA	13.5	4.0	176.9	194.4
1994-ISF	4.5	2.0	24.0	35.3
1993-DETYA	8.5	5.8	187.3	201.6
1993-ISF	6.5	4.0	34.1	44.6
1992-DETYA	9.5	9.0	204.9	223.4
1992-ISF	6.0	4.0	45.4	55.5
1991-DETYA	9.0	5.5	203.3	217.9
1991-ISF	6.0	2.0	37.2	45.2

Professor Brendan McKay (Department of Computer Science) was awarded an ARC Professorial Fellowship for a project titled "Practical and Theoretical Aspects of Structure Enumeration", to commence in 2002. The value of the grant is \$515,667.

Dr Matthew James (Department of Engineering) was elected a Fellow of the Institution of Electrical and Electronics Engineers (IEEE).

Dr Wiefa Liang (Department of Computer Science) was elected a Senior Member of the Institution of Electrical and Electronics Engineers (IEEE).

Table 2: New enrolments in Bachelor of Engineering and combined course programs – 2001

Year	Total	Male	Female	Full Fee-paying Overseas Students
1990	55	46	5	4
1991	82	58	13	11
1992	98	68	15	15
1993	76	60	11	5
1994	74	57	10	7
1995	87	74	9	4
1996	113	89	16	8
1997	92	77	15	3
1998	81	71	10	2
1999	96	82	14	5
2000	90	76	14	5
2001	71	59	12	3

Students

UNIVERSITY MEDALLISTS

Grubb, Grant
Ng, Kee Siong
Sheard, Benjamin
Tipson, Shaun

DEAN'S AWARD

Modrak, Kris

DEPARTMENT OF COMPUTER SCIENCE

Australian Computer Society (Canberra Branch) Prize

Walker, Emma

MAJOR PRIZES, HONOURS, AWARDS (STAFF AND STUDENTS)

Staff

Advantra Prize for Computer Networks

Excell, David

Advantra Prize for Software Engineering

Freeman, Jonathon

Horsley, Silas
Marshall, Robert
Phongsajjanukul, Nopparat
Potts, Joshua
Thow, Joshua
Walker, Emma

Computer Science Prize

Ng, Kee Siong
Paul Thistlewaite Memorial Scholarship
Lovell, Julia

Mastech Asia Pacific Women in Software Engineering Scholarship

Hall, Victoria

Mastech Asia Pacific IT Equity and Merit Scholarship

Chen, Michelle

DEPARTMENT OF ENGINEERING

National Undergraduate Scholarship

Davies, Gregory
Jeffery, Christopher

ANU Honours Scholarship

Modrak, Kris

Airservices Australia Scholarship for Third Year Engineering

Williams, Michael

ANUTECH Lisa Brodribb Scholarship for Women in Engineering

Cuccuru, Kathrine

ANUTECH Scholarship for First Year Engineering

Barnes, Rosemary

ANUTECH Scholarship for Second Year Engineering

Goodwin, Rhys

ANUTECH Scholarship for Third Year Engineering

Heaney, Warwick

ANUTECH John Morphett Scholarship for Fourth Year Engineering

Shortt, Julian

Boeing Australia Scholarship for Third Year Engineering

Excell, David

Boeing Australia Scholarship for Fourth Year Engineering

Sheard, Benjamin

Glenn Dickins Engineering Scholarship

Sim, Kristy

International Student Scholarship

Chai, Chee Tak

Teh, Yee Ham

FACULTY SCHOLARSHIP

Layzell, Ian

von Brasch, Arved

GRANTS AWARDED IN 2001

2001 *Boron Diffusion Induced Defects in Oxide Masks*, (**A. Blakers**), FRFG, \$13,400

2001 *Formalising the Shlaer–Mellor Software Analysis and Design Method* (**R. Goré**), FRFG, \$11,400

2001 *Expressive Power and Complexity of Temporal Logics for Model–checking*, (**R. Goré**), Australian Academy of Science and French Embassy Scheme, \$7,000

2001 *Mirror Cleaning System for Large Area Solar Concentrators* (**G. Johnston**), FRFG, \$6,900

2001 *Mirror Cleaning System for Large Area Solar Concentrators*, (**G. Johnston**), DETYA, \$7,102

2001 *Investigation and Improvement of a Thermochemical Solar Energy Storage System*, (**K. Lovegrove**), FRFG, \$19,600

- 2001 *Investigation and Improvement of a Thermochemical Solar Energy Storage System*, (**K. Lovegrove**), DETYA, \$20,174
- 2001 *Finding Genes with Kernel Based Machine Learning Methods*, (**A. Smola**), FRFG, \$25,732
- 2001 *Fabrication and Characterization of a Specially Structured Material with Regulated and Articulated Porosity for Filtration and Slow Release*, (**Z. Stachurski**), FRFG, \$4,200
- 2001 *Edge Recombination in Silicon Solar Cells*, (**M. Stocks**), DETYA, \$17,910
- 2001 *Edge Recombination in Silicon Solar Cells*, (**M. Stocks**), FRFG, \$17,400
- 2001 *Security Infrastructure of Electronic Voting for Australian Federal Election*, (**C. Wu**), FRFG, \$6,200
- 2001–2002 *Improving Stamping Die Design Methodologies*, (**M. Cardew–Hall**), DETYA, \$1,000
- 2001–2002 *Progressing 24–Hour Solar Power Technology toward Commercialisation*, (**K. Lovegrove**), ACT Chief Minister’s Department, \$148,426
- 2001–2003 *Low Cost 25% Efficient Silicon Concentrator Solar Cells*, (**A. Blakers**), ARC, \$150,000
- 2001–2003 *The Solar Energy System Controller*, (**A. Blakers**), CRC for Renewable Energy, \$200,000
- 2001–2003 *A Novel Louvre Concentrator*, (**A. Blakers**), CRC for Renewable Energy, \$240,000
- 2001–2003 *Formation Mechanism of Boron Nitride Nanotubes Produced by Reactive Ball Milling*, (**Y. Chen**), ARC, \$210,563
- 2001–2003 *Robust Control of Nonlinear Systems*, (**M. James**), ARC, \$194,000
- 2001–2004 *Robust Flight Control of Autonomous Small–Scale Aircraft*, (**R. Mahony**), \$66,876

FUTURE DIRECTIONS

The key challenge facing the Faculty is to generate growth through the diversification of income. It is likely that Government funding will be pegged at a growth rate no greater than 3%. At that rate, the Faculty does not have sufficient critical mass to maintain the existing

programs in the long term. The major focus, therefore, is to increase international student fee income. International student fee income was 10% of the Block Grant in 2001 and has the potential to grow to 30% of the Block grant. The Faculty's international marketing effort has been assisted greatly by the fall in value of the Australian dollar.

In order to maximize the international income, new Masters programs are being introduced. The Master of Information Technology in eScience commenced in 2001 and a Master of Engineering is being planned to commence in 2003. Significant investment in international marketing will continue. It is also important that the local student numbers are maintained. This will also require a continued and possibly expanded marketing effort, coordinated with the University's marketing.

In order to maintain the relevance of our programs and the high levels of student employment after graduation (100% in a recent survey), it is important that the Faculty involve industry more in our curriculum development and student project activities. The Faculty is planning the establishment of an Industry Alliance which will give industrial partners access to career activities, course development and student project work.

COMPLIANCE WITH ANU ENVIRONMENTAL POLICY

The new Ian Ross Building, in which Engineering and Faculty Office staff are located, became fully operational in 2001. In keeping with the Faculty's intense research in the area of design of solar energy systems, the building incorporates some advanced design features, including environmentally responsible

aspects. It uses passive environmental systems as a means of providing occupant thermal comfort and energy efficiency. The northern side of the building is oriented to make use of the winter sun to assist in heating the building. In-slab hydronic heating and a large thermal building mass provide the ideal method for temperature regulation during the winter months. The hydronic heating is currently gas powered but this method can be later adapted to use solar concentrators to provide clean free heat.

Improving the energy efficiency of the traditionally designed Computer Science and IT Building awaits detailed energy auditing.

