AUSTRALASIAN ASSOCIATION FOR ENGINEERING EDUCATION

NEWSLETTER

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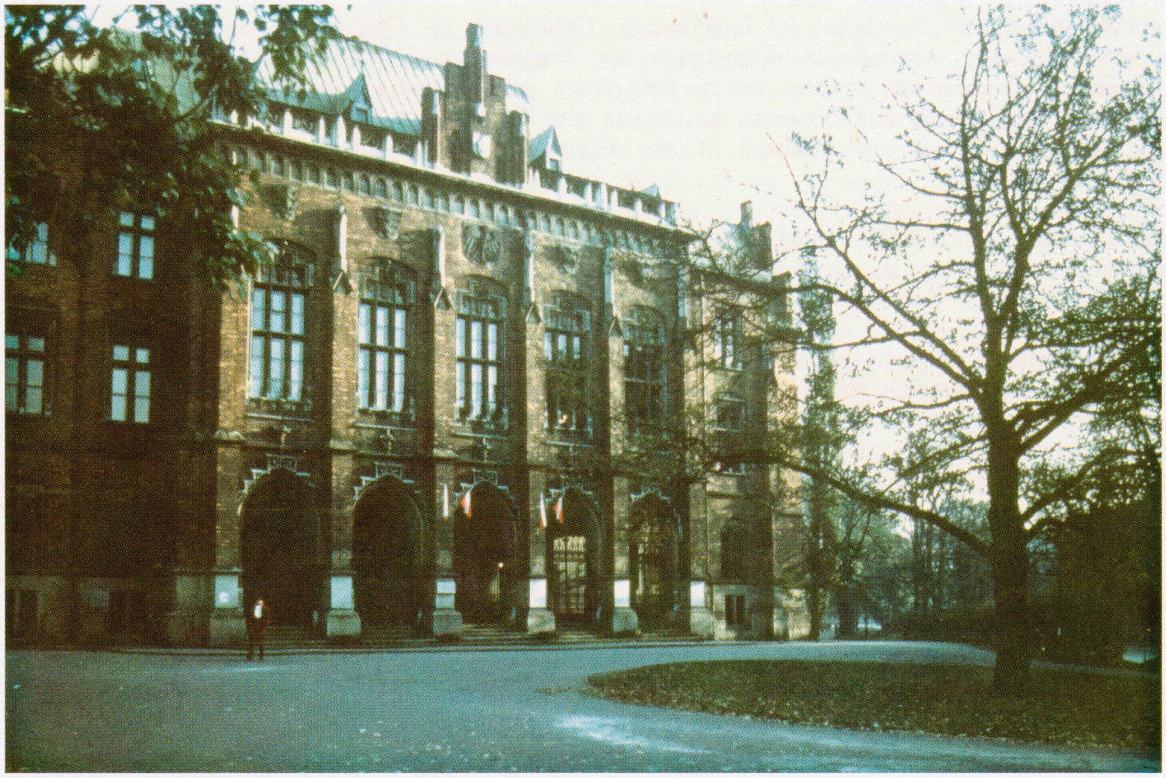


The AAEE has now moved into the international arena by sponsoring and organising the East-West Congress on Engineering Education, which will be held at Jagiellonian University, Cracow, Poland, between 16 and 20 September, 1991. Over 100 papers from a total of 30 countries have been accepted for presentation at the Congress. You are cordially invited to attend this important international gathering. Full invitation, with more details, is presented overleaf. Picture above shows Jagiellonian University's main building, that will host the Congress.

EAST-WEST CONGRESS ON ENGINEERING EDUCATION

under the theme:

Improving Training Methodologies

JAGIELLONIAN UNIVERSITY, CRACOW, POLAND

16-20 SEPTEMBER, 1991

AN INVITATION TO ATTEND THE CONGRESS

This first East-West Congress on Engineering Education under the theme *Improving Training Methodologies* organised jointly by Australian and Polish academics and industry representatives, to be held at Jagiellonian University in Cracow, Poland, is a special occasion for the Australasian Association for Engineering Education (AAEE). The AAEE endeavours to respond to the needs for closer international collaboration on engineering education, in general, and between Australasia and Central and Eastern Europe, in particular. The AAEE, who is the sponsor of the Congress, cordially invites you to attend this important gathering.

Considering the Gulf War and the world's recession, the response from the international academic and industrial communities may be regarded as excellent with the submission of over 100 papers from a total of 30 countries. We are, indeed, very fortunate that the Congress papers cover almost every aspect of engineering education, emphasising the important theme *Improving Training Methodologies*. The papers present important concepts, ideas and achievements of engineering educators and industry leaders who are involved in engineering education and industrial training. The papers should provide the basis for excellent discussions and stimulate future collaborations on an international scene. The authors represent a number of leading tertiary institutions worldwide which are particularly concerned with the status and quality of engineering education and industrial training.

The Congress program has been devised to incorporate a number of plenary sessions, paper sessions and panel discussions. A number of distinguished persons, who represent both academia and governmental bodies, will present keynote addresses and lead useful discussions. In addition, the Congress will host the 4th Meeting of the International Liaison Group on Engineering Education. Also, it is anticipated that an exhibition of teaching material and equipment will coincide with the Congress.

The Congress program also gives the opportunity for some relaxation and enjoyment for participants and their guests. Cracow, as the former capital city of Poland, offers the visitor beautiful surroundings and a number of historical and other places of interest. It provides everyone with a variety of exciting activities and many tourist attractions.

Therefore, I have real pleasure in inviting you all to the Congress and wish you not only successful formal activities but also a pleasant and enjoyable stay in Cracow.

Zenon J. Pudlowski
Program Committee Chairman

PRESIDENT'S REPORT - AAEE 1990

Several matters of some importance to the quality and scope of engineering education have surfaced over these last few months.

The AVCC produced a report which, amongst other things, highlighted the growing shortage of good staff in our universities available to train the graduates we will need for the future. We hear often, and it is my firmly held belief, that many of these extra graduates MUST be engineers in those areas best able to address the national imperative - Australia's overseas debt.

The Minister for Higher Education, Mr Peter Baldwin, responded to the AVCC's report with the suggestion that higher degrees are not necessary for academic staff. He misses the point completely so far as engineers are concerned. We don't even have enough BE graduates let alone PhD graduates to make academics! To make matters worse, Peter Baldwin is a graduate engineer from Sydney University Electrical Engineering. Maybe my predecessors did not do enough to inculcate in the new graduates of that time an understanding of how the university worked and how engineers fit into and contribute to solving the national needs. A lesson is there for all of us.

Higher degrees do indeed play an important part of the development of engineers. The traditional PhD, with its emphasis on new knowledge, still stands as the central path to a training in research and scholarship. But as engineers, we do need to continually question the "sacred cows" of education - and the PhD is one of those. But unlike some, I am led to reflect on what engineering is about and what role it has in the nation. I come to see a distinction between the technology-focus of much of our university education and the engineering needed in Australia with its emphasis on the role of financial and economic factors as well as relevance to the community's expectations and values. Engineering I see as more related to the design process than the discovery process, on synthesis rather than analysis.

Increasingly, I am coming to see that there is scope for a specifically ENGINEERING higher degree in which advanced engineering knowledge is combined with a training in advanced engineering project management and design in which financial and resource (including human resource) elements are important. Such a degree is complementary to the PhD in engineering or the higher degrees such as DEng, etc. It is, perhaps, an EngD which would introduce a balance into our universities and a new type of graduate engineer who, no matter which career direction they take, will have developed, under the guidance of the experienced expert, that excitement which comes from knowing that they are the ones with the perspectives and tools to actually achieve development and change. Why, they would even make better politicians!

On another note, I am very pleased to hear of the progress in organisation for our next annual conference in Adelaide. I was also very impressed with the current state of attendance and papers to be presented to the East-West Congress in Cracow in September. To have at the conference such distinguished members of the Polish Government and industry illustrates at least one nation where there is a clear recognition that it will be through engineering education that national economic development will occur. Only through economic development will there be the resources and quality of life enabling us to be no longer pre-occupied with our physical well-being. Then we can concentrate on our personal development and self-fulfillment. I only wish that we could get this appreciation and understanding in complacent Australia.

Professor Trevor W. Cole
Department of Electrical Engineering
The University of Sydney
President of the AAEE

IPENZ'S EXPECTATIONS OF EDUCATED GRADUATES

This article was prepared by members of the Education Committee, following the article entitled, *What is a professional engineer?*, by the Membership Task Committee, which appeared in the March issue.

The institution's requirement for corporate membership is an engineering degree from a recognised university. University education is preferred because it involves full-time study and the desired exposure to modern equipment and laboratory facilities. In addition, the university provides an environment in which students can gain a broader education from engineering studies alone.

The proper university education should equip engineering graduates with a sound knowledge and understanding of engineering fundamentals. This should include:

* Mechanics, thermodynamics, electrodynamics and generally the physical principles upon which engineering is based.
* The analytical techniques of engineering.
* Knowledge of engineering materials and their behaviour.
* The techniques used in costing and examining the economics of engineering works.

This fundamental knowledge is a relatively stable component of engineering education; it is the foundation for the lifetime development of engineers and an essential ingredient in enabling engineers to cope with new problems and the changing needs of their profession.

Specialised knowledge

Graduate engineers should have specialised knowledge in their chosen field of engineering as well as an up-to-date knowledge of the technology of that field. This knowledge enables graduates to contribute after a relatively short time in the workplace. Important as specialised knowledge is, it should not be at the expense of a sound education in engineering fundamentals.

Specialised knowledge and current technology are subject to rapid change and engineering schools need to have these elements of their courses under frequent review. Equally, graduates should understand that if they are to remain up-to-date in their field they must, through self study or by participating in courses and conferences, see to their own continuing education.

The nature of engineering

Engineering graduates must appreciate the essential nature of engineering. Thomas Tredgold's 1828 definition of engineering enshrined in the Royal Charter of the Institution of Civil Engineers is still the one which is most useful: *Engineering is the art of directing the great resources of power in nature for the use and convenience of man.*

Engineering is more than science; it is essentially the art of using science to develop and control the resources of nature for the benefit of society. Economic design is the central activity of engineering although not all engineers end up practising as designers.

Engineers are involved in defining and solving problems, in designing and constructing engineering works and systems, in designing and producing goods and services, in maintaining and operating works and systems, and in managing engineering organisations and industries.

Engineering involves not only technological skills but also the ability to organise and direct the work of others and the ability to seek and secure the necessary resources to undertake engineering work. For this reason engineering graduates should have some knowledge of organisation and management, financial management, and engineering economy.

It is important that engineering graduates be able to communicate effectively, both verbally and in writing to the specialist and the non-specialist. The Institution attaches considerable importance to engineering graduates being effective in the use of the English language.

Social and environmental dimensions

Graduate engineers should appreciate that engineering works have social and environmental costs as well as financial costs and that these must be carefully considered in evaluating the benefits of engineering proposals, in executing projects, and in developing new technologies. Technology has had such far-reaching impacts on society and on the environment and can produce changes at such a rate that society has become increasingly concerned to see that these factors are properly considered.

Professional responsibility

Graduate engineers should have an appreciation of the requirements of the Engineers' Registration Act, the role of the Institution as a professional body and as a learned society, and of what is required of graduates in becoming professional engineers, following their graduation.

Graduate engineers should have been acquainted with the ethical standards that the engineering profession imposes on its members and with what society has a right to expect of members of the profession. Graduate engineers should have been acquainted with the nature of engineering contracts and of the legal environment in which professional engineers practice.

THE NEW ZEALAND SCENE

Prof. David Elms

In the last few years, the changes in New Zealand have been significant, and the pace of change is increasing. The changes have been both social and economic, and the very stucture of society is changing. Economically, the country is in a bad recession, with high unemployment and many business failures as well as a reduction in overseas income as traditional markets have faltered or been closed. Socially, people can no longer rely on a socially secure society with a high employment rate and government guaranteed health, education and social security. In addition, New Zealanders of European descent have increasingly had to come to terms with the central place of the Maori in society. The governmental and social structure of New Zealand has changed with the privatisation of many large government organisations and at the same time a thorough revision of local government. Some of the privatised organisations were major employers of engineers, such as the Ministry of Works, the Forest Service, Air New Zealand and New Zealand Railways. And although the education system is still for the most part state-owned and government-controlled, in that sector, too, far-reaching changes are taking place at all levels.

Change is certainly necessary. In many ways, perhaps most, the changes are for the good. New Zealand Rail, for instance, now moves more freight than eight years ago with a staff reduced from 22,000 to 6,500 and with only half the rolling stock; and this year for the first time ever, perhaps, it made a profit. However, there are problems of considerable

concern. The first is that often there seems to be no coherent overview of the process. Change is made piecemeal with little attempt to integrate it within a total-system context, which is a dangerous limitation when making changes within a society that has evolved organically to become an intricate and highly complex system. Other problems are that the people managing the change are not always well-qualified for the job, that the forced pace of change may be too fast for a well-managed response, and that there is a doctrinaire focus on short-term goals. There is thus both excitement and frustration in the current scene, and engineering education knows both.

Traditionally, professional engineers in New Zealand have been taught in the universities, principally in the schools of engineering at Auckland and Canterbury, and, more recently, at Massey University. As of last year, however, the 27 polytechnics have been given the right to grant degrees, and some are working towards developing engineering or technology degrees. From others, there are initatives for new relationships with the universities: first year engineering degree studies might, for instance, be undertaken at a local polytechnic with the student carrying on to a university after that.

A major reason for new initiatives is that the present review of the education sector is far-reaching. The Government has set in place the New Zealand Qualifications Authority whose task is to control all educational qualifications in New Zealand, except for university degrees. The aim of the Authority is threefold: to rationalise the range of New Zealand qualifications, to modularise teaching to increase flexibility, compatibility and clarity of aim, and to move from norm-referenced assessment to standards-based assessment. The polytechnics teaching engineering subjects are moving towards modularised courses. This is no easy matter as it needs a great deal of effort - more, indeed, than hard-pressed staff can provide without relief from part of their teaching load. The pace of change is limited by resources. Alternatively, if the pace is forced too hard, without additional resources, the quality of both decisions and results suffers.

Although the universities continue to control their own degrees, they need to react to the changes around them, in the school and polytechnics. It is therefore in the interests of engineering degrees to themselves move towards a compatible modular approach in the long run, in order to improve flexiblity of entry into their courses. They need to provide for multiple paths of entry from both schools and polytechnics. The need for flexibility also means the schools of engineering must work in modules compatible with the rest of the university to help with the growth of interdisciplinary qualifications such as commerce/engineering, management/engineering or environmental science/engineering. Technology courses for commerce students would seem to be an excellent idea.

Another area of concern is the future supply of engineering students. Engineering clearly has a negative image in society, with ambitious students (and parents) seeing the path to success leading through commerce and law rather than engineering, and with technology being in some sense a second-rate occupation. The negative image is particularly the cause of many girls in schools not seeing professional engineering as an attractive and feasible career. A major effort is being mounted at Auckland and Canterbury to reach schoolgirls and their teachers and parents, to give them a positive image of engineering.

Perhaps the most important development of all, though, is the growing realisation that there is a fundamental change in the nature of the engineering graduates required by industry, and in the nature of their training. More flexibility is required, more management techniques and an emphasis on general problem-solving skills. This is in addition to a sound technical grounding, or, if you like, a change of focus and emphasis to relate engineering training more to the real nature of engineering in practice, which needs technical competence and broader people-related skills in roughly equal measure. But here, again, there is the practical difficulty of focussing the necessary energy for change from within an already hard-pressed body of teachers.

Finally, there is the position of IPENZ, which is active in monitoring courses, assessing new initiatives and looking at changing requirements. It is also increasingly proactive in engineering education. The step IPENZ has taken of fully supporting AAEE in New Zealand is thus not only significant, but is precisely the right action at this time.

Professor Devid G. Elms
Dean of Engineering
University of Canterbury
Christchurch, New Zealand
Executive Comittee Member of the AAEE

OPENING OF THE MACHINES AND DRIVES LABORATORY

Dr G. Ledwich

On the fifth of April, 1991, a new era in the teaching of Power Engineering at the University of Queeensland was begun. After more than two years of development, a system of 10 computerised machine workstations was officially opened by Mr Neil Galwey, Queensland Electricity Commissioner.

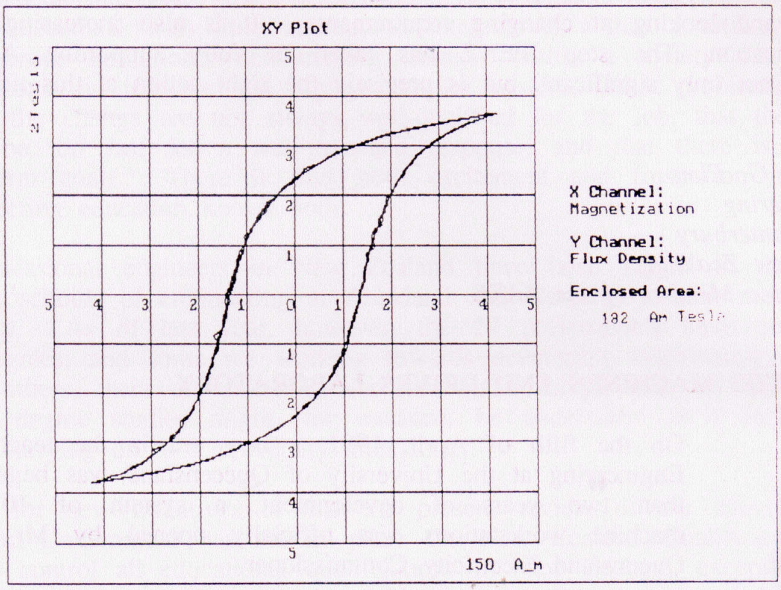
The development was prompted by the demolition of a World War II aircraft hanger that has served as the electrical machines laboratory since 1950 when, The University of Queensland moved from the centre of the city. A new 5 level building for Engineering was to be built and we were reluctant that the motors bought by the founding professor of Electrical and Mechanical Engineering in 1910 would be re-installed.

The 10 new workstations are an example of systems engineering providing an integrated connection of drive motors and computers. The Electronic Drive systems provide a flexible system for energizing and loading the motors using representative industrial equipment. Previously, the students would spend more than 40% of the practical session wiring the supplies, control rheostats, field control resistors, loading resistors, and meters. The rest of the session was spent writing tables of results from the various meters. With little time to graph results as the experiment progressed, wrong concepts or faulty measurements were not discovered until after the experiment was completed.

The present systems enable external loads and meters to be used, this feature is only used when desirable to teach a special aspect. For most experiments the student uses potentiometers and meters built into the front panel to control the drive and monitor the results. The monitoring is all performed by ground reference +/- 10V transducers. Each of the monitored signals is sent to the data acquisition system on the IBM compatible computer.

The software for the data acquisition and display was produced by Mike Sowter seconded from the Queensland Electricity Commission. The user is presented with a pull down menu system to perform time plots, X-Y plots, spectral or harmonic analysis, as well as phasor displays. The phasor display presents the experimental data in the diagramatic form used by the texts to describe motor operation so the interpretation of the operation is much more directly tied to theory.

An example of the use of the computer system shows the data acquisition system displaying the voltage and current of transformer energization as a B-H curve, with the software used to change the units from volts and amps to the correct magnetic units. The enclosed area of the curve, indicating energy loss is computed on request.



Students from Electrical and other Engineering departments have been using the laboratory since the beginning of 1991 but experiments using the software system started in April. The provision of the required data to operate a computer network and advanced drives has gone through several revisions as we learn the misunderstandings that can arise. The student response to the simple and colourful graphing and hard copy has been positive. All that is required now is to fully revise the experiment sheets so that more probing analysis is performed, since with the new equipment, most students are finished the required work in less than two thirds of the allotted time.

The flexibility of the hardware connections and software interface combined with a system focusing on student safety make this SPEED (Systems for Power Engineering Education) Laboratory a development of which the team at The University of Queensland can be proud. We are encouraging access by other institutions in South East Queensland. The first visit will be from the University College of Southern Queensland in Toowoomba studying Power Electronics.

The development was supported by QEC and GEC-ALSTHOM and the Australian Government. The system concept and project management was performed by Dr Gerard Ledwich, while the construction and designs were by the technical staff of the department.

Dr Gerard Ledwich
Department of Electrical Engineering
The University of Queensland
Brisbane, Australia

A REMINDER TO RENEW AAEE OF MEMBERSHIP

At the Annual General Meeting the Executive Committee did not seek the increase of membership fees, and it was decided that membership fees for 1991 remain the same as they were in 1990. Association members are kindly asked to renew membership, and to encourage their colleagues who are not members of the AAEE to join our Association. Although fees are payable by June 30 each year, we would appreciate it if members would pay their dues as soon as possible so that we may more effectively plan the 1991 budget. A call for renewal of membership is therefore made and a single-page reminder is included in this issue.

NEW MEMBERS OF AAEE

Dr Donna C. Nelson is presently an Associate Professor of Civil Engineering, California State Polytechnic University (Pomona). She has held Faculty positions in Civil Engineering at Purdue University, California Polytechnic State University (San Luis Obispo) and the Papua New Guinea University of Technology in Lae, PNG. She holds degrees in Civil Engineering from the University of California Berkeley (PhD), Texas A&M (MEng), California Polytechnic State University, San Luis Obispo (BSCE) and is a registered Professional Engineer in the State of Texas. Her primary research interests are in the areas of transportation, in developing regions and engineering education.

In addition to her teaching and research work, Dr Nelson serves on several national transportation and engineering committees in the United States and is associate editor and co-author of the new *Manual of Transportation Engineering Studies* being published by the US Institute of Transportation Engineers. She served as the 1990 Director of the Indiana Chapter of ITE. She is also a partner in her husband's (James V. Strueber, AIA, ARAIA) architectural practice.

Dr Nancy Law graduated from the University of Hong Kong with a BSc in 1976, a MPhil in 1982 and a CertEd in 1984. She was awarded a PhD from the University of London Institute of Education in 1990. Dr Law began her teaching career as a Physics teacher and head of Computer Studies department at St. Paul's College in Hong Kong. She joined the University of Hong Kong in 1986 as a lecturer in the Department of Curriculum Studies, specialising in Physics and Computer Studies education. In February, 1991, she took up her present appointment as educational developer at the School of Electrical Engineering at the University of Technology, Sydney. In this role, she works on a research project to identify causes of low completion rates in the undergraduate electrical engineering courses and to develop teaching and selection methods which take into account individual differences, so as to improve the completion rates.

The research interests of Dr Law includes conceptual development in everyday contexts and its interaction with school learning, development and use of computer based learning software and the application of artificial intelligence tools in education.

2ND INTERNATIONAL SYMPOSIUM FOR ENGINEERING DEANS AND INDUSTRY LEADERS

A Second International Symposium for Engineering Deans and Industry Leaders will be held at UNESCO Headquarters in Paris, France, between July 16 and 20, 1991. This is a follow-up to the 1989 Symposium at Ohio State University and is sponsored by UNESCO, with appropriate engineering education groups invited to co-sponsor (eg ASEE, Engineering Dean's Council, SEFI, IGIP). The AAEE also has been invited to become a co-sponsor of this Symposium and the invitation was accepted.

The scientific program is to be developed by Donald Glower, Russel Jones, Curtis Tompkins and Dueb Lakhder. As outlined by the organisers, the program will cover projected action-oriented events, such as:

* Development of sister university programs, pairing appropriate engineering schools in developing and developed countries for interchange programs.
* Development of mechanisms for industry-university interaction, particularly in developing countries.
* Development and maintenance of a comprehensive and accurate database on engineering education internationally (eg worldwide list of engineering schools, current leaders, enrolments, etc.).
* Development and maintenance of information clearing house in teaching equipment, courseware, etc., used in engineering education.

* Development of programs to promote completion of education (to doctorate) of faculty at engineering schools in developing countries.
* Promotion of educational equivalency agreements, accreditation mechanisms, curricular standards, etc.
* Development of an ongoing worldwide organisation of engineering deans.

Participants expected to attend are leaders in engineering education, and industry leaders concerned about university interactions on technology in developing countries. Papers from potential participants are sought, on all of the program topics listed. Abstracts (100 words) to be sent by March 15, 1991 to Dr Russel C. Jones, 205 McDowell Hall, University of Delaware, Newark, DE 19716, USA. Tel: 302-451-6074 and fax: 302-451-6504.

Registration information and further details on the Symposium can also be obtained from: Dr Boris Berkovski, Director, SC/EST, UNESCO, 7, place de Fontenoy, 75700 Paris, France. Tel: 45 68 39 01 and Fax: 33 1 43 06 11 22.

Reduced hotel rates have been arranged at the two conference hotels:

Hotel Meridien
Hotel Nikko

Blocks of rooms have been reserved for participants. Reservation forms will be sent to registrants.

A registration fee of 1000 French Francs will be charged to all participants to cover conference meals, tours, etc. Symposium, participants from industrialised countries will cover all their own expenses. Participants from Third World Countries will have their travel and living expenses subsidised from non-symposium sources. Requests for such a subsidy should be sent to UNESCO, at the above address.

Paris - the place to go.

3RD ANNUAL CONVENTION AND CONFERENCE

under the theme:

Broadening Horizons of Engineering Education

Venue: The University of Adelaide, South Australia

Dates: Sunday 15 to Wednesday 18 December 1991

CALL FOR PAPERS

Traditional views of engineering education must change if we are to respond satisfactorily to social, industrial and professional needs. Important contemporary issues must be dealt with to *Broaden Horizons of Engineering Education.*

A call is made for papers and other contributions. Suggested topics for conference papers relating to the theme of the conference may include:–

* Articulation and credit transfer.
* Postgraduate education and training.
* Higher degree students - where are they?
* Continuing education.
* Bridging courses.
* Engineering technology programs.
* Co-operative relations with science.
* Teaching design.
* New teaching technologies.
* Student motivation.
* Quality of education.
* Computer-based education.
* Management education.
* Distance education.
* Overseas marketing of educational services.
* Competency-based learning.
* Engineering - employers' views.
* Co-operative education.
* Equity initiatives
* Engineering in school curricula.
* The growing secondary/tertiary gap.

Prospective authors should submit abstracts of 250-400 words in length outlining aims, content and conclusions of their papers, indicating the sub-theme into which they fall. The abstracts should include author(s) name(s), affiliation, mailing address, fax and phone number, and they must be received before 15 July 1991. All correspondence relating to the conference and proposals for papers should be addressed to:

Dr Caryl Cresswell
Organising Committee Secretary
Department of Mechanical Engineering
The University of Adelaide
GPO Box 498, ADELAIDE, SA 5001, Australia

Congress participants will experience the beauty of the city of Cracow, which hosts the AAEE sponsored East-West Congress on Engineering Education this September. Picture above shows the Marketplace with the famous St. Mary's church.

For details of the Association and membership applications write to the Editor:

Dr Zenon J. Pudlowski, Department of Electrical Engineering, The University of Sydney, SYDNEY, NSW 2006, Australia, Tel. (02) 692 2000, Fax: (02) 660 4706 or (02) 692 3847

Association members and tertiary institutions are invited to contribute to the Newsletter on matters relating to membership and engineering education.

Send contributions to the Editor at the address above.