The Committee Secretary,
Senate Education, Employment and Workplace Relations Committee,
eewr.sen@aph.gov.au.

Dear Secretary,

I write on behalf of the National Committee on Engineering Design (NCED), which is a committee within the College of Mechanical Engineers, Engineers Australia (EA), in response to the current inquiry into the shortage of engineering and related employment skills, and its impact on infrastructure development.

For some years, NCED has been watching with some concern as 'design' in university engineering courses (particularly mechanical design) has been downgraded by a range of factors. These include:

- increased student numbers;
- absence of students' practical, background experience (and indeed their lack of interest in practical engineering);
- decreased staff numbers;
- the retirement of the brigade of practical engineers who have been the backbone of design teaching for many years; and
- downgrading of design laboratory and workshop facilities;
- the replacement of the aforesaid brigade with new, young staff recruited on their research ability, but with little, if any, practical design experience; and
- a focus by universities on research output as a means of bringing in additional funding, thereby virtually eliminating design as a desirable academic career.

It is NCED's contention that there is a significant shortage of skilled engineering designers in the mechanical-design area. This contention is based partly the experience of two members of NCED who run small design consultancies. They have significant difficulty in recruiting either experienced or freshly graduated engineers. We are also aware of a current initiative by Mr Ken Bracher, working with Victoria Division of EA, pointing out the huge loss of engineering design in the mining, oil and gas industries to offshore design offices. A follow-on effect of loss of design is the loss of Australian manufacturing activity and the loss of use of Australian materials. It is our understanding that EA is currently considering Mr Bracher's submission.

Regarding the supply of Australian engineering designers currently coming out of Australian universities, we depend mainly on a survey of about-to-graduate students conducted in 2009 [1]. Although the number of responding students was smaller than we would have liked (206) they came mainly from 6 university campuses scattered across Australia. The results showed that barely 2% of

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[1] Carol Russell and Alex Churches (2010) "Design in mechanical engineering: Australian students' perceptions and expectations" *ConnectEd 2010 – 2nd International Conference on Design Education 28 June – 1 July,* Sydney

students aspired to a career in engineering design. This amounts to approximately 40 students per annum from a cohort of approximately 2000 graduates in mechanical engineering Australia wide - laughable if the situation were not so serious. Based on this evidence, it is suggested that a review of the way mechanical-engineering design is taught in university courses is urgently needed. However, this is a major initiative which will take years to feed through to industry.

NCED has for some years been proposing the establishment of an Australian Graduate School of Engineering Design and Manufacture as a means of creating a pool of top-notch, gifted, creative engineering designers ready to take on the challenges of designing in industries which have not yet been conceived – industries in which Australia could have the potential to be a world leader. The concept for the School is a 'hothouse' environment in which bright young graduates 'catch' design from gifted practical instructors. This will not of course overcome all the present problems listed above, but impresses as something which could be implemented relatively quickly (more quickly than changing current design courses), and has the potential to provide the spark of genius which could then trickle down to a wide range of Australian design and manufacturing activity.

For background information, a copy of the draft Executive Summary of the draft Business Plan for the proposed Graduate School is attached.

Yours faithfully,

Chair, NCED,

1 February 2012.

Proposal to Create a New Graduate School of Mechanical Engineering Design and Manufacture in Australia

Prepared by the National Committee on Engineering Design,

College of Mechanical Engineers, Engineers Australia

26 April 2011

EXECUTIVE SUMMARY

When Engineers Australia's *National Committee on Engineering Design* first began to consider this project, we believed the need for a significant upgrade of Australian mechanical-engineering design was relevant to a few of the higher level design activities. Whilst we were aware that much of Australian manufacturing had, over the past decade, moved off-shore to countries with lower costs, we were convinced that the benefits of carefully managed high-level engineering design integrated with value-adding niche manufacture remained within Australia's grasp. In view of recent developments, including those in mining, oil and gas and the proposed submarine design and manufacturing project, we are convinced that the need for more and higher level design to be taught in Australian universities, and for the creation of world-class Australian engineering designers, are not 'niche' matters, but are a matter of survival for Australian industry. We see world-class Australian engineering design as the catalyst for increased productivity leading to a significant increase in the scope and wealth of Australia's industry. Keeping design concepts and ownership in Australia, even if a significant proportion of manufacture has to be done overseas, still contributes to Australia's future and wealth.

Very obvious areas of direct application of Australian design include:

- The massive Australian mining, oil and gas industries;
- Needs arising from climate change, including renewable energy technologies;
- Emerging areas in nano-technology;
- Established initiatives such as Warman (now Weir Minerals) slurry pumps, the Cochlear Bionic Ear and Resmed appliances for sleep disorders;
- Austal Ships and Australia's generally advanced ship building industry.

To achieve this, our proposal is to establish Australia's first Graduate School of Mechanical Engineering Design and Manufacture, focusing strongly on mechanical-engineering design, broadly defined to include adjoining areas such as industrial design and integrated manufacture. It is envisaged that the Graduate School will be a joint venture between one or a small group of Australian universities, and Engineers Australia through their College of Mechanical Engineers and its *National Committee on Engineering Design,* together with strong industry, government and philanthropic support and sponsorship.

Although the need for a Graduate School arises directly from Australian industry's need for more highly skilled and more highly qualified professional

engineering designers and manufacturers if improved engineering productivity is to be achieved, the shortcomings begin at undergraduate level. We have serious concerns regarding the current level of engineering-design teaching in Australian universities and the consequent low level of practical design ability of current graduates who, poorly equipped though they may be, are currently setting the standard of engineering design within much of Australian industry and are the feedstock for the proposed Graduate School.

Our research shows that, under the current university system, approximately 2% of graduating students express interest in following a career in engineering design. These students are poorly catered for in the current system, with its focus on theoretical design analysis and little design practice. Whilst the low percentage of interested students may well reflect dissatisfaction with current courses and the way they are taught, the same system, with its crammed theoretical content, ill serves the 98% who have no wish to be career designers but must understand the design philosophy and method, and be given sufficient ability to cater for routine design tasks.

Creation of a Graduate School allows reassessment of current undergraduate courses, decreasing high-level theory and replacing it with increased practical content, including integration with manufacture, thereby providing a better match between 98% of students and industry needs other than specialist design, while allowing 2% of students to undergo an additional year of intensive design instruction and experience to equip them for their chosen career.

In short, our product is Australia's future career designers and manufacturing engineers, our customers are Australian industry and the beneficiary is the Australian nation.

It is our plan to implement the Graduate School by collaborating with an Australian university, or small group of universities, offering funding raised from Australian industry, government and philanthropists, capitalising on existing university infrastructure and existing academic staff for specialised theoretical material, but insisting on established practical engineering designers and manufacturing engineers for core staff. The involvement of industry is crucial in order to maintain ongoing relevance to industry needs, and part of the plan is to involve industry in providing real-world projects as well as their designers and manufacturers to help oversee students working on those projects. The concept of a Designer in Residence, an eminent practising designer appointed and paid for a session or a year, will, if it can be implemented, assist in keeping the School in the forefront of emerging design trends.

A recent trend is the suggestion that universities in their present form will cease to exist as the sole repositories of knowledge, with a move towards a multitude of on-line university courses with students free to 'cherry pick' courses and subjects of interest. Nevertheless, we agree with the concept espoused by Prof Gordon Wray (Loughborough University, now retired, personal communication) that 'you cannot teach students design – they have to catch it', the implication being that they have to catch it from someone already 'infected'. Whilst the Committee will continue to monitor very closely design-teaching developments and improvements in video-conferencing, we are firmly of the opinion that the 'hothouse' environment we plan can, for the foreseeable future, be achieved only

by students interacting with like-minded students and ‘infected’ staff at a single location.