

ENGINEERING DESIGN: A NATIONAL ASSET

A Position Paper prepared by the IEAust National Panel on Design

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Introduction

The major role of the engineer is the creation of national well being and security through the design and implementation of products, processes and technical systems of broad social utility. Design is the essential discipline of the engineer; it distinguishes engineering from science and mathematics, it is a fusion of creativity and technical discipline; it involves imagination, struggle and compromise. New technologies such as computer aided design have placed the design activity back on centre-stage within the profession. However there is much more to engineering design than technology, and it reaches far beyond the profession; it is a socially oriented activity. The need to conserve and recycle scarce resources and to safeguard our environment offers engineers a unique challenge to contribute to the achievement of sustainable socio-technical systems.

The Design Spectrum

The products of engineering design are ubiquitous in our society. They form our industrial, commercial, domestic and personal infrastructure. Examples include large public works such as water and electricity supply systems; building and structures; transportation systems; equipment for forestry; mineral extraction and agricultural production; downstream processes for adding value to raw materials; vehicles and industrial equipment; communication networks and computer systems, health and consumer items together with the facilities for manufacturing all of these.

Engineering design itself forms part of a broader spectrum of design activities ranging from textile and fashion design, graphic and interior design, architectural and industrial design, to engineering design.

Australian Perspective's and Trends

There are excellent examples of design from all areas of engineering in Australia. It is therefore regrettable that too few engineers in Australia are involved in innovative design

work; engineers here are more likely to be involved in purchase decisions, installation operation and maintenance of industrial equipment and machines, rather than in the design and manufacture of such equipment. Many local companies have relied upon the safe and easy option of importing designs and manufacturing under licence. Short-term accounting goals have denied many worthwhile projects the opportunity of realistic project pay back periods.

In Australia, excellent designers have traditionally been forced into management roles by the lack of high-level career paths in design. Attitudes of antipathy towards industrial designers, who are the natural professional companions of engineering product designers, have been common. These situations are in sharp contrast to those in many European countries.

Due to the sustained downturn in Australian industry and the factors referred above, competent designers in all areas are now a rapidly diminishing national resource.

Concurrent design and simultaneous engineering are bringing design and manufacturing closer together, making for more timely and hence competitive products and processes. In the past in Australia the preoccupation of engineering designers has too often been on technological details and manufacturing efficiency, rather than on providing products which have a clear lead in perceived value in the marketplace. Other countries have the opposite attitude which, together with a dedication to high quality, acts to their great advantage. While it is unrealistic to expect Australia to design and manufacture a complete range of manufactured goods, it should be remembered that our competitors, without our natural resources and population, have approached this goal much more closely than we have. Currently, however, an increasing number of Australian firms are successfully addressing overseas niche markets relating to a wide variety of economic endeavours.

Community Perceptions

The work of engineering designers is often taken for granted, until something goes wrong and attracts damaging, sensational publicity. As a nation we would benefit from a greater understanding and appreciation of the role of engineering design in the creation of desirable lifestyles. Most European countries have enviable design reputations and, equally importantly in the longer term, self-images. In Australia, the various 'Made in Australia' campaigns have raised the level of consciousness of local consumers. Unfortunately, however, they also tended to conceal the fact that much of what we manufacture is not designed here. A more appropriate emphasis, both for industry and the community, would be 'Designed and Manufactured in Australia'.

Engineering design excellence needs to be promoted and a rational design image for Australia needs to be brought to a personal level, perhaps by manufacturers acknowledging designers in advertising.

Engineering Design Education

In the post-war period the engineering sciences have become the dominant focus in engineering education, to the detriment of design and other applications – orientated aspects of professional practice. This is evident at both the teaching interface and in staff profiles. Engineering design education will remain staff-intensive, and at a time when design and manufacturing educations should be on the increase, we lack the necessary people and facilities to mount courses. Postgraduate students have not been encouraged to study and research in the design area, in which a framework for scholarship and research is emerging. The proposed Advanced Engineering Centres have the potential to address the need for engineering design education to grow in stature, subject to the availability of suitably qualified and experienced design staff, which is always extremely difficult to recruit. As academic promotion remains largely research-based, design academics tend not to fit the academic system well and to fare poorly in promotions.

National design competitions such as the Warman Trophy are helping to raise the profile of engineering design amongst school students and within engineering courses. These people are the living crucibles out of whom our future possibilities will be poured; technical creativity and individuality needs to be fostered at all levels of education, just as literary self-expression is now fostered.

Summary

If Australian social and economic realities are to improve, design will be an essential component of the revival process. Good design is the vital seedbed for profitability or other measures of success in technically-oriented activity and not, as is often perceived, simply a cost to be minimised. It requires strategic market research and corporate planning. Many of the clever people needed by the clever country will be well educated, innovative engineering designers who are well versed in modern manufacturing techniques, who will need appropriate recognition and career paths and who, above all, will provide products which would markets greatly prefer. Much of the revival activity will occur in small-to-medium sized enterprises with the flexibility to react quickly to opportunities. Much of Australian industry will address niche markets.

Position Statement

Design is a primary function of the engineering profession.

Engineers are leading participants in the total spectrum of design.

Design excellence is an essential prerequisite for future national well being and security and the achievement of new technological eras.

Government policies and legislation should be such as to create incentives and remove impediments to the development of an entrepreneurial design-based manufacturing industry in Australia in relation to both export goods and import replacement goods.

Design should be seen as the inevitable central activity linking Research to Development. Accordingly R&D should become RD&D and Design should benefit from schemes similar to those currently available for R&D.

Innovative design should provide a responsible lead to the developing frontier of standardisation; it should not be unnecessarily constrained into stereotype manifestations by standardisation.

Synergistic attitudes and relationships must be developed and fostered between engineering designers and industrial designers, who are natural professional companions.

Young, imaginative engineers must be attracted to, and given the opportunity to perform high-level design work. Women have a unique and vital contribution to make in engineering design. High-level career paths must be available to retain excellent designers.

Professional engineering education should encourage an applications-oriented framework to the teaching of engineering science material and a greater emphasis on project work of a design nature, which provides problem-based learning within a need-to-know environment. Design-based academics should not suffer poor career prospects in comparison with their research-orientated colleagues.

A determined outreach should be made into the early years of pre-tertiary education to encourage and foster technical creativity and to provide an awareness of the attractions of a career in engineering.

Steps to promote an understanding and appreciation of the nature and importance of design, and to develop a national design image, are to be encouraged at all levels of the community.