ChE book reviews

THE NEW ENGINEERING RESEARCH CENTERS: PURPOSES, GOALS AND EXPECTATIONS

National Academy Press, 2102 Constitution Avenue NW, Washington, DC 20418

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This book is the outgrowth of a symposium, "The New Engineering Research Centers: Factors Affecting Their Thrusts," held on April 29-30, 1985, under the auspices of the National Research Council's Commission on Engineering and Technical Systems (CETS).

The new Engineering Research Centers (ERCs) program was initiated by the National Science Foundation. Selected from 142 proposals, six Engineering Research Centers (involving a total of eight universities) were announced in early April of 1985, and are now in operation.

The papers published in this book were presented at the symposium to introduce the new centers to the engineering community at large and are grouped under the captions: 1) The National Goal, 2) The Center as a Reality—Plans, Mechanisms and Interactions, and 4) The Future—Challenge and Expectations.

Dr. George A. Keyworth II, Science Advisor to the President, described the "national goal" with this statement: Improving the U.S. position in international industrial competitiveness.

From several sections of the book the following quotations will highlight the important concepts behind the creation of the ERC program.

> **The ERC program is a result of the realization that our engineering schools are becoming increasingly engineering-science oriented, with greater and greater emphasis on analysis of narrowly focused topics. While analysis in engineering science is an important facet of engineering, it is clear that we have neglected synthesis-oriented skills such as design, optimization of engineering systems, and system integration. (p. 39)**
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> **We have to increase our effort in the kind of research that bridges the gap between fundamental scientific research and application. This kind of research is engineering research. (p. 20)**
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> **We need more engineering research, and we need more engineering graduates who understand how to do engineering research. We need to put them to work in those areas where economic competitiveness is at stake; and we need to make sure that the knowledge they generate and the guidance they provide permeate the whole engineering community, not just the research community alone. We need wider and stronger bridges between the people doing engineering in industry and the people teaching engineering and doing research in universities. (pp. 22-24)**
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> **The Engineering Research Centers are to "Bridge Gaps" (pp. 23-26): Bridging Gaps Between University and Industry; Bridging Gaps Among Engineering Disciplines; Bridging Gaps Within the Innovative Process.**

The ERCs are required to have "industrial participation" and, in addition to research, must also have an "education" component.

The six new Engineering Research Centers are

Systems Research Centers (University of Maryland, Harvard University)
Center for Intelligent Manufacturing Systems (Purdue University)
Center for Robotic Systems in Microelectronics (University of California, Santa Barbara)
Center for Composites Manufacturing Science and Engineering (University of Delaware)
Engineering Center for Telecommunications Research (Columbia University)
Biotechnology Process Engineering Center (MIT)

The six ERCs are only the first contingent of what the NSF expects eventually to grow to some twenty centers, each with an average annual budget of $2-5 million. This book will be valuable to those schools with the aspiration to apply for a new Engineering Research Center. □

ENGINEERING GRADUATE EDUCATION AND RESEARCH

Panel on Engineering Graduate Education and Research, John D. Kemper, Chm., National Academy Press, Washington, D.C., 1985. $14.95

Reviewed by
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This monograph is part of an overall study of engineering education and practice in the United States conducted under the auspices of the National Research Council. As the title implies, the study examines the present status of graduate engineering education and its relationship to graduate research. In the conduct of the study, the Committee reviewed the data and conclusions of previous comprehensive engineering studies including the *Report on Evaluation of Engineering Education* (Grinter Report), the President's Science Advisory Committee report entitled *Meeting Manpower Needs in Science and Technology* (PSAC Report), and the ASEE *Goals of*

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REVIEW: Grad Education

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Engineering Education (Goals Study). The present study summarizes the data from these reports and updates this information to 1983 with many informative tables and graphs. For example, information in this survey includes the BS, MS, and PhD degrees awarded in engineering since 1950, the most recent engineering degrees by field and level, the PhD employment of engineers since 1960, the number of foreign born awarded advanced degrees in engineering since 1970, the changes in the student-to-faculty ratios over the last decade, the average monthly salaries offered to new engineering graduates by field since 1965, the women and minorities obtaining degrees in engineering since 1978, the average research investment per PhD degree for the top thirty advanced degree granting institutions, and a comparison of the weekly professional activity of engineering research faculty with those of other disciplines. The gathering of these data in one place makes the monograph a valuable reference for all educational scholars and policy makers.

The data in this study are used to predict the number of PhDs that will be awarded in engineering during the 1983-88 time period. The conclusion from such a prediction is that on the average an additional 100 engineering PhDs will be awarded annually during this period and that this will be insufficient to fill the present faculty vacancies in engineering as well as restore the student-to-faculty ratio that existed back in 1976. The study argues that the latter is necessary if the United States is to meet the increasing competition from those foreign nations where the productivity growth has surpassed that of this nation during the past decade. Additionally, the study notes that each engineering discipline is facing many new challenges, some of which will be difficult to meet with the present number of overloaded faculty and deteriorating facilities, particularly when interdisciplinary aspects are involved.

Based on this premise, the study makes several recommendations. Not surprisingly, these recommendations are similar to ones voiced by many concerned engineering educators for close to a decade. Many of these individuals would agree that the number of U.S. citizens pursuing doctorate work needs to be increased (the study suggests 1000 additional students per year), the graduate stipends need to be increased to make graduate study more attractive, the facilities and equipment for research need to be upgraded, more minorities and women are needed in the graduate engineering program, stronger ties need to be developed between industry and engineering education, and a stronger MS program needs to be available for part-time industrial students to aid in maintaining their engineering competency. The study suggests that the Federal government, universities, and industry provide the necessary assistance where most appropriate.

Sadly, no new mechanisms or strategies are offered to make the needed inroads on these long-standing problems. There is little evidence provided to convince policy makers that the solution of these problems will once again make the United States competitive with other nations and reverse the present staggering trade deficits. In short, the study is a good summary of what has happened in engineering education over the past three decades, but it presents very few innovative ideas as to how the situation can be improved and the required investments justified. □