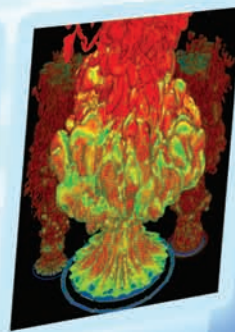
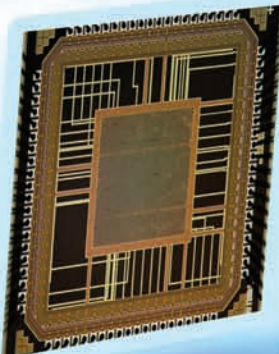


National Science Board

MOVING FORWARD TO IMPROVE ENGINEERING EDUCATION



November 19, 2007



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MOVING FORWARD TO IMPROVE ENGINEERING EDUCATION



November 19, 2007

National Science Board

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November 19, 2007

MEMORANDUM FROM THE CHAIRMAN OF THE NATIONAL SCIENCE BOARD

SUBJECT: *Moving Forward to Improve Engineering Education*

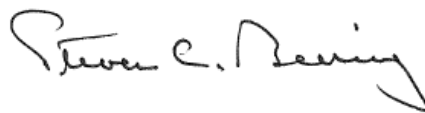
This report of the National Science Board (Board) lays out our findings and recommendations for the National Science Foundation (NSF) to support innovations in engineering education programs. The Board, established by Congress in 1950, provides oversight for, and establishes the policies of, NSF. It also serves as an independent body of advisors to the President and Congress on national policy issues related to science and engineering research and education.

In March 2005, the Board undertook an examination of recent recommendations addressing changes in engineering education and implications for the engineering workforce. This effort built upon the work of the National Academy of Engineering (NAE) in its report, *The Engineer of 2020: Visions of Engineering in the New Century*, as well as recent Board policy reports that identified issues of concern for the domestic engineering workforce.

Moving Forward to Improve Engineering Education synthesizes the results of two Board-sponsored workshops and significant Board deliberations. The first workshop was held at the Massachusetts Institute of Technology in October 2005 and included a range of experts representing broad interests in engineering education. For the second workshop, held at the Georgia Institute of Technology in November 2006, 23 leading deans of engineering (or equivalent) and the NSF Assistant Director for Engineering participated in discussions that identified needs for change in engineering education and model programs to address those needs.

Throughout the process, the Board maintained a dialogue with NAE and coordinated with the NAE “Engineer of 2020” project. Our recommendations in this final report address issues of public perception of engineering, retention of students in engineering majors, responsiveness of engineering education to change in the global environment, and needs for additional data to support policy and planning.

We hope that you will join the Board in supporting the critical national need for innovations in engineering education in order to both sustain a globally competitive engineering workforce and enhance career opportunities for our future engineers.



Steven C. Beering
Chairman
National Science Board

National Science Foundation

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Acknowledgments

Those who contributed to this study are too numerous to mention individually. Invited participants in the two workshops that provided the bulk of the input to our findings and recommendations are included in Appendices I and II.

We are deeply grateful for the excellent cooperation of and dialogue with Dr. William Wulf, the immediate past President of the National Academy of Engineering (NAE), and Dr. Charles Vest, the current NAE President, throughout this project, as well as the special assistance provided by Mr. Richard Taber, Program Officer, NAE.

Others who played less visible but still vital roles include Ms. Frances Marrone, Senior Administrative Assistant to Dr. Daniel Hastings, who coordinated the arrangements for the first workshop at the Massachusetts Institute of Technology, and Dr. Sue Ann Allen, Executive Assistant to the President, and Dr. Don Giddens, Dean of the College of Engineering, who coordinated the arrangements for the second workshop at the Georgia Institute of Technology.

We are especially appreciative of the cooperation and efforts of the National Science Foundation (NSF) Assistant Directors for Engineering throughout this project, including Dr. John Brighton and his successor, Dr. Richard Buckius, who is the current Assistant Director. We also appreciate the special assistance provided by other NSF staff involved in engineering education, including Dr. Russell Pimmel, Program Director, Division of Undergraduate Education, Directorate for Education and Human Resources, and Ms. Susan Kemnitzer, Deputy Director, Division of Engineering Education and Centers, Directorate for Engineering, both of whom briefed Board Members on the history of NSF engineering education programs and prepared presentation materials for the second workshop.

The National Science Board Office provided excellent and essential support throughout this project. Especially deserving of recognition are: Ms. Clara Englert, Science Assistant, who provided the primary staff support for this effort; Ms. Ann Ferrante, Writer-Editor, for editorial and publishing support; and Ms. Jennifer Richards, Science Assistant, for preparation of the final report and distribution. Dr. Michael Crosby, the Board's Executive Officer and Board Office Director, provided guidance and support to all aspects of the Board's effort.

Process for Producing the Report

This study was initiated and led by several Members of the National Science Board's (Board's) Education and Human Resources (EHR) Committee – Drs. G. Wayne Clough, Daniel Hastings, and Louis Lanzerotti. The Charge from the Board to the EHR Committee, *Workshop on Engineering Workforce Issues and Engineering Education: What are the Linkages?* (NSB-05-41), was approved at the Board meeting on March 30, 2005.

The purpose of the initial workshop was to “focus on recent recommendations for changes in engineering education and implications for the engineering workforce . . . to move the national conversation on these issues forward in a productive way by calling attention to how engineering education must change in light of the changing workforce demographics and needs.” The Charge further noted the opportunity to work in parallel with the National Academy of Engineering (NAE) “Engineer of 2020” project, which called for reform in engineering education. The Board's study included the following range of inputs.

- The Selected Bibliography includes published background materials for the study.
- Two well-attended public workshops were held at major academic institutions offering engineering degrees:
 - Massachusetts Institute of Technology, October 20, 2005: *Engineering Workforce Issues and Engineering Education: What are the Linkages?* The workshop focused on broad issues in engineering education, with faculty, students, and representatives from employers and engineering professional societies. (See: Appendices I and III)
 - Georgia Institute of Technology, November 7, 2006: *Moving Forward to Improve Engineering Education*. The workshop focused on the National Science Foundation's (NSF's) role in encouraging change in engineering education; 23 leading deans of engineering (or equivalent representative of their institution) and the NSF Assistant Director for Engineering participated in the discussion with Board Members. (See: Appendices II and IV)
- Board Members coordinated with the President of the NAE to consider how the Board's effort would complement that of the NAE “Engineer of 2020” project. They held informal discussions over the course of the study and a formal meeting on August 8, 2006.
- Board Members met with NSF senior staff of the Directorate for Engineering and other staff involved in engineering education on August 8, 2006 for a presentation on and discussion about NSF's history of involvement in engineering education, and a review of the success of its programs. The Board consulted with NSF senior management for the NSF Directorate for Engineering throughout the project.

