

To: The Engineering Faculty

From: Curriculum Reform Task Force (CRTF)

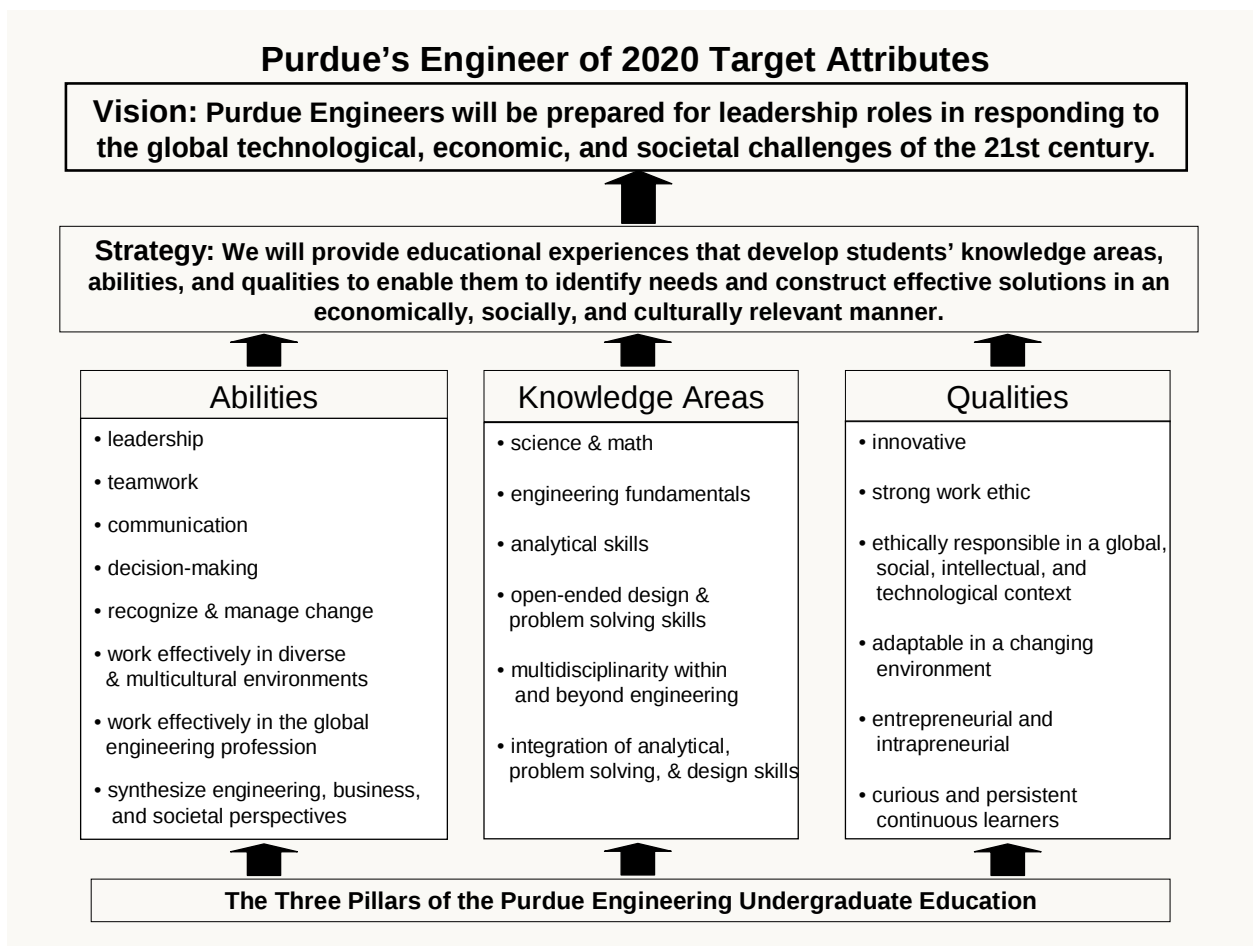
Date: April 9, 2007

Subject: Adoption of the Purdue Engineer of 2020 Target Attributes

After two years of careful study and deliberation involving faculty (through focus group interviews, School faculty meetings, and a faculty survey), industry (via industry/academic workshop) and students (by focus group interviews), the Curriculum Reform Task Force (CRTF) recommends that the faculty of the College of Engineering adopt the Purdue Engineer of 2020 Target Attributes as our prediction of the key attributes that will be important for future graduates, and provide educational experiences to cultivate these attributes as appropriate within each school's curriculum. This action is now submitted to the Engineering Faculty with a recommendation for approval.

Michael T. Harris
Professor
School of Chemical Engineering
Co-Chair, Curriculum Reform Task Force

James D. Jones
Associate Professor
School of Mechanical Engineering
Co-Chair, Curriculum Reform Task Force



SUPPORTING DOCUMENTATION

Motivation

Purdue has a long and widely recognized tradition of educating high quality engineers, and intends to sustain that tradition. Recent national and international trends, validated by surveys of our own graduates, indicate that what is required of an excellent engineer now has evolved from past expectations. The attributes that characterized industry and alumni demands of engineering education in the 1970s-1980s (when Purdue was an unquestioned leader in undergraduate engineering education) have changed substantially in the past two decades. The proposed Target Attributes allow us to extend our tradition of excellence while remaining adaptive to changing demands and expectations.

As one illustrative example of this trend, Figure 1 below shows two plots of alumni surveys from 1994 and 2000 (the last one just before our 2001 ABET visit). In these plots, we surveyed alumni 1-5 years in 1994 (graduates from '89-'93) and alumni 1 and 5 years out in 2000 (graduates of '95 and '99). We asked two questions regarding each of our 14 outcomes. How important is this outcome to your company or organization? How effective are our Purdue graduates in their performance in this outcome area? The most interesting part of the comparison is that in 1994 the alums ranking of the importance of the outcomes were very dispersed (e.g., several items like 3c-global/societal context and 3d-world affairs and cultures were ranked very low - as unimportant). However, these same outcomes and several others were ranked as considerably more important by 2000. In essence, by 2000 alums seemed to be saying that good technical skills alone are necessary, but no longer sufficient to be successful in the professional workplace. Now employers want the whole package (not just good technical skills, but other professional skills as well). This data shows definitive evidence of industry's trend toward seeking more well-rounded engineers. It is the opinion of the Curriculum Reform Task Force that this trend is continuing with an even broader array of attributes being deemed essential to be an effective engineer in the future.

It is important to state that the proposed target attributes are not intended to replace or ignore other important needs to improve the quality of the educational experiences of the Engineering graduates such as reducing class size, integration of classes across the curriculum, improving classroom conditions, implementing and fostering student mentorship, and improving the laboratory and classroom infrastructure. Also, it is not our intent in this proposal to ignore the challenges that arise in implementing these outcomes and the burden on each school. These details (both methodologies and supporting resources) will have to be addressed in the coming months and years as we together work to build educational experiences to foster development of these attributes. Furthermore, this proposal is not intended to imply that current and past educational practices of the Schools have been in any way inferior. In fact to the contrary, Purdue University has been widely respected as one of the key leaders in undergraduate engineering education as demonstrated by our high rankings both by practicing engineers and faculty across the country. The intent of this proposal is to maintain and further this leadership role by identifying and adopting broadly defined curricular goals that will better meet the changing needs of industry and academia.

Background

With the recent release of the NAE report "The Engineer of 2020", Dean Linda Katehi established the Curriculum Reform Task Force in November 2004 co-chaired by Leah Jamieson (ECE) and Jim Jones (ME) whose mission is to: 1) develop a list of the attributes that we believe will be critical to the success of Purdue engineering graduates in the future (specifically the year 2020), and 2) begin the process of identifying and implementing educational experiences that

will foster development of these critical attributes. With Dean Katehi's recent departure, Dean Jamieson has clearly reconfirmed our ongoing commitment to follow through with this initiative.

The first step in this process has by design taken roughly two years to formulate because of the importance of incorporating the input of many different constituents (e.g., faculty, administrators, students, employers) including the opportunity for several feedback loops (see the Task Force milestones appended at the end of this EFD). As you can see from this summary, the faculty have been involved in every step of the process.

Implementation Philosophy

Due to the complex nature of this visionary effort, it is not possible to articulate a detailed implementation plan with a definitive timetable because the plan and timetable will (by necessity) vary school by school. However, what can be shared is the College's philosophy for implementation.

Resources – This will not be an unfunded mandate. Resources from the College will be provided to assist Schools in fostering these attributes in their curricula. First, the College plans to sponsor an *Annual "Engineer of 2020" Attribute Workshop* on three attributes each year. For the three focus attributes chosen, we will invite leading representatives (knowledgeable in the focus attributes) from academia and industry to attend the workshop and share their experiences in fostering these attributes in their own organizations. Our hope is that our Purdue faculty will gain insight from these workshops on how they can foster these attributes here at Purdue. The attributes chosen each year will rotate, ultimately addressing all of our key attributes over a 7 year cycle.

Second, the College plans to establish an *"Engineer of 2020" Seed Grant Program* to fund project ideas leading to the development of these attributes at Purdue. The Seed Grant Program will be closely aligned with the annual "Engineer of 2020" Attribute Workshop so that faculty pursuing ideas derived from the workshop will have a funding source to support their projects. Proposals will be reviewed annually on a competitive basis. Project ideas that transcend individual Schools will be particularly well received. The funding levels and number of grants supported in the "Engineer of 2020" Seed Grant Program is currently under discussion and we expect it will be established by spring 2007.

The *Curriculum Reform Task Force (CRTF)* will serve as the coordinating body overseeing this effort. The CRTF will help foster the sharing of best practices and keeping individual Schools informed about the College's progress in this effort.

Targets not Requirements - In making this proposal, it is important to state that these attributes are identified as targets, not requirements. The implementation process will inherently occur at different rates for different programs. Likewise, there is not an expectation that all of the attributes will be developed simultaneously. Some attributes will be easier to incorporate into the curriculum and others inherently more difficult. This document is intended to indicate that the new attributes will be our collective target and everyone will begin working toward making some progress in the selected areas that it deems most critical.

Implementation Methods Determined by Schools - Different programs will have the freedom to choose the methodology that they think will be most effective in cultivating these attributes. Certainly our hope is that the various programs will share best practices, but there is a clear recognition that our various programs are unique and may require differing approaches to develop these attributes.

Emphasis May Differ School to School - Based on constituent feedback, some programs may place greater emphasis on some attributes than other programs. This is a perfectly reasonable and expected result since the constituents of our various programs will inherently have differing viewpoints as to the relative importance of the various attributes. In addition, it is expected that different programs may incorporate additional discipline-specific attributes not represented in the Purdue Engineer of 2020 Target Program Attributes.

Conclusion

After two years of deliberation and careful study by the CRTF in concert with the faculty, the CRTF believes that to maintain and further our leadership role in undergraduate engineering education, it is essential that we adopt the Purdue Engineer of 2020 Target Program Attributes. We submit EFD 15-06 for discussion and hopefully approval by the faculty.

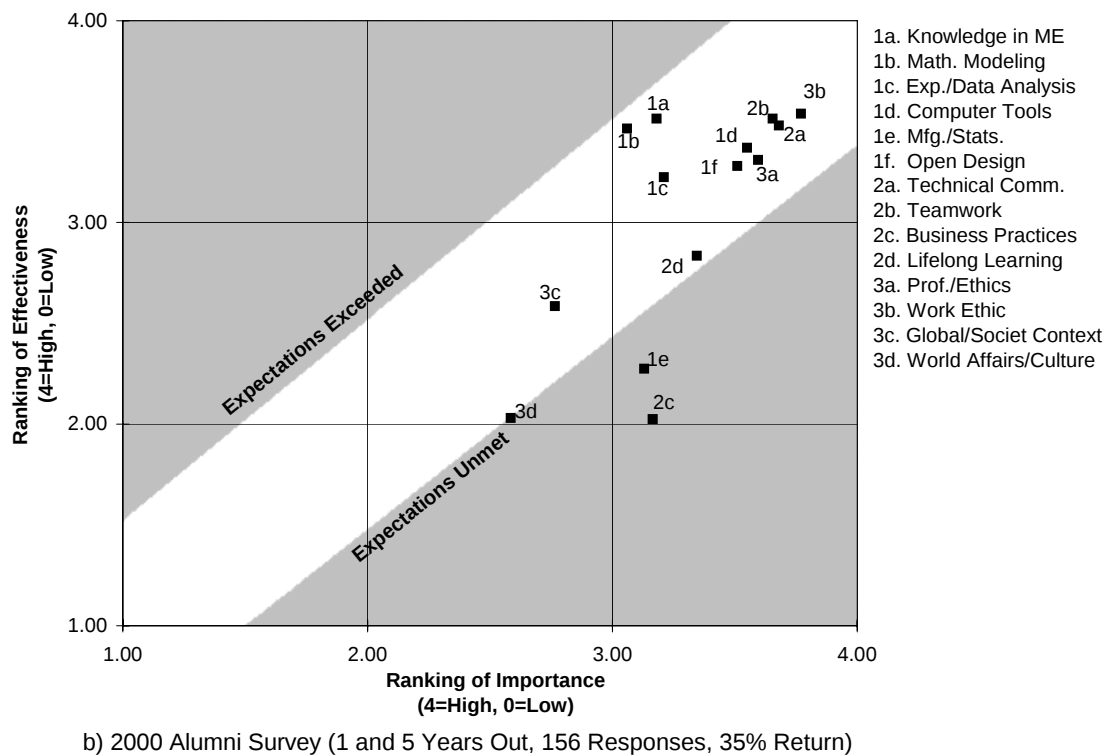
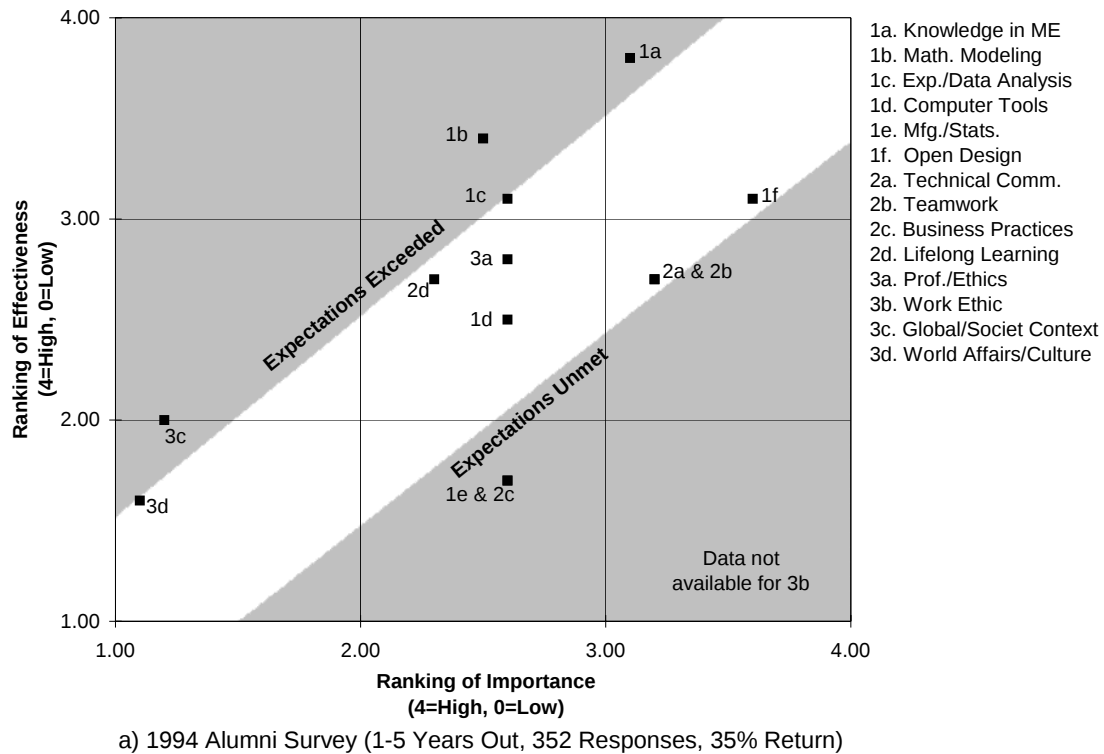


Figure 1. Scatter Plots of Importance versus Effectiveness of ME Program Objectives as ranked in a 1994 Alumni Survey and a 2000 Alumni Survey.

Task Force on Curriculum Reform Milestones

- › **November 2004:** Task Force created
 - Review and discussion of the NAE report “The Engineer of 2020”
- › **Spring 2005:** Discussions in Schools’ faculty meetings
- › **Spring 2005:** Attributes “long list”; surveys, focus groups, and ranking by task force members, EAC members, ENE’s IAC members, and students
- › **August 2005:** Faculty focus groups involving 25% of faculty, conducted by Lipman Hearne
 - Future professional settings, attributes of future engineers, Purdue’s performance, areas in need of change, obstacles to change
 - Agreement on need for change; variance in sense of urgency
- › **August 2005:** *Designing Engineering Curricula for the 21st Century* Workshop at Purdue
 - Keynote: Wm. A Wulf, NAE President
 - Panel of national leaders in engineering education reform: Steve Director (Drexel), Richard Miller (Olin), Karan Watson (Texas A&M)
 - Industry leaders panel: Cathleen Barton (Intel), Pat Galloway (Nielsen-Wurster), Tom Malott (Siemens), Joel Spira (Lutron), David Swain (Boeing)
 - Standing-room-only faculty audience
- › **October 2005:** Preliminary work presented at *Frontiers in Education Conference* and *NAE Center for the Advancement of Scholarship in Engineering Education (CASEE)* meeting
- › **November/December 2005:** Faculty survey ($\approx$ 50% faculty participation)
 - Vision, strategy, attributes
- › **February 2006:** Revisions based on survey results
- › **March/April 2006:** Task force members are leading discussions with Schools’ curriculum committees, faculty committees, ABET coordinators, student groups, advisory committees
- › **April 2006:** Participated in Big10+ Associate Deans meeting on *The Engineer of 2020*
- › **April 2006:** Endorsement of vision, strategy, and attributes by the Engineering Leadership Team
- › **October 2006:** Proposal to adopt the Purdue Engineer of 2020 Target Program Outcomes distributed to the faculty for consideration.

Members of the Task Force on Curriculum Reform

Mike Harris (DOE, co-chair)	Eckhard Groll (ME)
Jim Jones (ME, co-chair)	Elliott Slamovich (MSE)
Kathie Howell (AAE)	Tatiana Jevremovic (NE)
Rabi Mohtar (ABE)	Leah Jamieson (DOE)
Martin Okos (ABE)	Dale Harris (CEE)
Bob Hannemann (BME)	Chris Sahley (Science)
Jon Fricker (CE)	Robert Proctor (Psychology)
Osman Basaran (ChE)	Matt Sutton (Industrial Tech)
David Meyer (ECE)	Cathleen Barton (Intel)
Kamyar Haghighi (ENE)	Pat Galloway (Nielsen-Wurster)
Phil Wankat (ENE/IDE)	Tom Malott (Siemens, retired)
Barrett Caldwell (IE)	Joel Spira (Lutron)
Jose Tanchoco (IE)	Mark Johnson (ECE)
Sidney Moon (Education)	Carolyn Percifield (Advancement)
Teri Reed-Rhoads (ENE)	Marc Williams (AAE)