

## **(Re) Designing the College of Engineering at the University of Wisconsin-Madison for 2010 and Beyond**

### **Abstract**

Life in engineering colleges and schools will be different in 2010 and beyond. While we have been responsive to, and the subject of, events and forces requiring change in the past, it appears that now a variety of factors will truly change the way that engineering education is carried in the United States in the future (*cf.* The Engineer of 2020: Visions of Engineering in the New Century and Retooling.) The key questions for us then become “How will the faculty, staff, and students of the College of Engineering (COE) of the University of Wisconsin-Madison respond to current challenges such as changes in demographics, scarce resources and globalization?” and “Will the college make the optimum use of the available people, skills, and resources to not only meet these challenges, but at the same time, become an even more exciting and welcoming place to work and learn? Will the COE become an environment where not just students, but faculty and staff also are inspired to keep learning? Or alternatively, will the people in the college be subject to events apparently outside of their own control?”

Our taskforce has been engaged in both thought and action on how to assist the UW-Madison COE in meeting these challenges, AND, as importantly, in improving as a university-based engineering community. Our approach to (re)design of the COE for 2010 and beyond is and has been centered on two realities: First, while the administration of the college sees many forces on the horizon that will affect the activities of everyone in the college, individuals in the college may not be convinced or aware of the urgency or need for response. Second, without everyone’s participation and contribution, no change to the institution, particularly of the magnitude required, will be successful.

The purpose of this paper is to share what we have learned to date and our plan to move forward from here. For example, the initial college-wide forum illustrated that the faculty and staff were very concerned about the future of the college and the possible changes that would occur. At the same time, however, they did not articulate how they perceived that the college would actually change. In response, we are providing opportunities for study and discussion of the forces driving change, assuming that this will move the conversation to ideas that are helpful when thinking about how to redesign the college.

### **Introduction**

Impending changes are presenting engineering schools across the country and around the globe with new challenges. Our task force at the UW-Madison COE has been engaged in efforts to assist the college in meeting these challenges. Some of these challenges are specific to the UW-Madison College of Engineering. Many of them, however, are universal. Our hope is that in discussing the path(s) that we are following, we can broaden the conversation beyond a single campus. We do not want to mislead anyone: we do not claim to have the answers, and we certainly have many unanswered questions, however, we believe that a national dialogue is required if engineering education is to meet the challenges of the 21<sup>st</sup> century.

## Formation of the Task Force and The EELI Retreat

The National Academy of Engineering, and the Center for the Advancement of Scholarship in Engineering Education (CASEE) held the first of the Engineering Education Leadership Institute(s) (EELI) from July 11-15, 2005 in San Jose, California. Eight engineering schools participated in the event (Olin, Georgia Tech, Howard University, Iowa State University, North Carolina A&T, Penn State, Purdue, University of Washington, and the University of Wisconsin-Madison.) According to the organizers, “The EELI curriculum focused on developing leadership skills in the areas of change management, creativity, and diversity with explicit attention to the application of these skills to the leadership and development of faculty, administrative staff, and students. Our goal was to assist engineering education leaders in enhancing their knowledge and skills in areas required for achieving the visions of the NAE report, *The Engineer of 2020*.”<sup>1</sup> In addition, each of the eight schools was required to identify three challenges faced by their school. Prior to attending the retreat, each of the teams was to have developed a plan for addressing these challenges or a project to pursue.

The EELI retreat was a remarkably effective means for the development of our task force, in part because of the ideas presented at the retreat, but also because of the opportunity to spend extensive time together in deliberation about our college. Without this, it is unlikely that any initiative at the college level involving the seven of us would have occurred at all. All of the members of the Task Force knew of each other prior to the EELI retreat, and several of us had worked together in the past. It was not until the EELI retreat, however, that we began to picture how it is that we might function as a team, particularly given that the team consisted of 3 members of the college administration, and 4 faculty, two of whom are department chairs. The retreat rapidly led us to realize that we all had high hopes for our college, and any differences that we might have were less important than our common goal to assist in improving the college. The retreat also provided an opportunity to determine if there was sufficient commitment, including time and money, to engage in a deliberate activity of redesign of the college.

At the conclusion of the EELI retreat, we established a goal of culture change in the UW-Madison College of Engineering to align the culture and behavior with the needs of “The Engineer of 2020”. A plan of action involving 8 steps was also developed at the retreat:

1. Formalize the implementation task force
2. Frame and communicate CoE Vision 2010
- 3. Assess faculty and staff aspirations for CoE**
4. Identify changes needed and develop action plans
5. Define and populate core teams
- 6. Empower faculty and staff to make needed changes**
- 7. Create a structure that encourages and supports culture transformation**
8. Assess progress and make course corrections.

From our perspective, the real challenges in the list shown above are 3, 6, and 7, because we envisioned that 3 and 6 involve engaging faculty and staff in ways that are not currently being done, and 7 because we did not know what the structure was that would encourage and support culture transformation. We left the EELI with plans to meet weekly to work on planning and implementation, and to determine how it is that we might deal with these three steps.

Literally as we left the EELI retreat, Barbara Waugh, co-founder of World eInclusion of HP gave us a copy of her book, *Soul of the Computer*, and gently suggested it might provide a diversion on our flights home.<sup>2</sup> In *Soul of the Computer*, Barbara describes her transition from radical activist to corporate executive and explains how she has come to see those two roles as remarkably similar. In her years at Hewlett Packard, a corporation she warily joined as a temporary way to pay the bills, Barb has effected countless institutional changes, ranging from new human resources policies on domestic partner benefits to corporate-wide changes in mission shifts. For example, she describes how initially the vision of HP labs becoming “the World’s Best Industrial Research Lab” was “not big enough” One day a colleague stopped by Barbara’s office to comment “Being the best industrial research lab *in* the world doesn’t do it for me. But I’d get up in the morning to be best *for* the world.” It was with that minor “tweak” that the vision for the lab began to generate sufficient enthusiasm to truly have an impact on the culture in the lab. As we studied this book on the flight home and in the days following our return, as a group we realized that there were real possibilities for our organization also.

### Three Questions

At the EELI, and at our initial meetings back in Madison, we began to realize that we were confronting three questions central to institutional change in a world of changing demographics, scarce resources, and globalization. We’ll state these questions briefly here, and then discuss each in more detail below. First, will we participate in and lead the changes that will happen in the College of Engineering or will outside forces end up determining our culture and work environment? Second, how do we engage the entire college community, including faculty, staff and students, in the process? And third, what specifically will the college do? Put another way, we must first decide whether to take charge of our future, then engage our colleagues, and finally commit to the difficult work of reshaping our institution.

### Engineering and Society

Before we describe details of how we approaching change in the college, it is appropriate to describe two additional influences that we are heeding. *Retooling: An Historian Confronts Technological Change* by Rosalind Williams is another book that has shaped our thinking.<sup>3</sup> A key point of the book is that technology and society are not independent, and yet, if engineering is to be relevant in solving current problems confronting society, engineering must change. This idea resonates with our thoughts about our own college: we have a sense that our work and the work of the students that graduate from here could and should be more applicable to social problems and issues. In other words, we believe that an appropriate engineering education is a liberal education, as defined by William Cronin.<sup>4</sup> His list of ten qualities that allow for identification of “liberally educated people” is shown below. The question, however, is how do we promote this in our program so that our students are fully prepared to participate in solutions to critical social problems and issues.

1. They listen and they hear.
2. They read and they understand.
3. They can talk with anyone.

4. They can write clearly and persuasively and movingly.
5. They can solve a wide variety of puzzles and problems.
6. They respect rigor not so much for its own sake but as a way of seeking truth.
7. They practice humility, tolerance, and self-criticism.
8. They understand how to get things done in the world.
9. They nurture and empower the people around them.
10. They follow E.M. Forster's injunction from *Howards End*: "Only connect..."

## **Impending Changes in Engineering**

The question of what engineering will become is also critical to directing transformation in the college. *The Engineer of 2020* and *Educating the Engineer of 2020*, both suggest that engineering in the future will be more global, more interdisciplinary, more interconnected than ever before. These ideas have become central in driving the direction for change in the college.

## **Choosing Our Destiny**

In answer to the first question of whether we will control change or allow change to control us, the Task Force early on decided that being in control of the college's destiny was far preferable to the alternative of simply waiting for global changes to shape our future. Clearly, in some respects the changes around us are outside of our control – the shifting demographics of the country and the world are a reality. The economic forces that are resulting in decreasing state support for public universities are not likely to be reversed by any one institution. And we would likely not want to undo globalization even were such a reversal within our power to achieve. And yet the members of the Task Force and our colleagues are unwilling to sit idly by and watch a brave new world reshape our lives and our work. We would much prefer to retain some measure of control over the future of engineering education and our roles in it. This should hardly be surprising – engineers are, above all, problem solvers, trained in and comfortable with tackling difficult challenges.

## **Engaging Our Colleagues**

Leadership is a tricky thing – it requires a balance of finding a vision that is compelling enough to inspire colleagues to join in and yet flexible enough to allow those colleagues to feel that they have helped shape the vision. As we have described, our Task Force continues to benefit from the ideas of Barbara Waugh on leadership, in particular in such areas as having the "Courage to Listen" and in the tools for change she advocates. For example, we began this effort in September with an All-College Meeting at which we shared what we had learned and developed at the summer retreat, including our proposal for a new vision for the college:

- A College of Engineering that offers greatly increased cross-disciplinary / cross-department research and education – an increasingly collaborative community of scholars
- Administrative infrastructure and reward system that support this opportunity

*A college that is more than the sum of its parts*

At this meeting, in a facilitated discussion, we asked attendees to discuss and relate to us what they thought would be driving change in the college in 2010, and how their individual role in the

college would change as a result. In response, we received ideas on how to fix the “problem.” For example, it was widely agreed that we needed to figure out a way to get more support from the state legislature. While this idea has merit, this response was characteristic of what was discussed. The group preferred to discuss solutions, rather than identifying the drivers for change. Nevertheless, reviews of the meeting were generally positive.

The next step in our plan involved determining faculty, staff and student aspirations for the COE. We started this via a series of listening sessions, to which students, faculty, and staff were invited. Each listening session opened with a brief overview from the All-College meeting on the drivers for change in engineering education. Attendees were then asked to respond to three questions (though the conversation was allowed to proceed as attendees chose).

1. Describe your job, role or place in CoE in the year 2010. How will it be different from what it is now? What changes will have occurred? If you do not plan to be here, please answer for those that follow you.
2. What will cause the changes you described? What are the most important drivers for change in engineering education and in engineering itself?
3. What effect will these drivers have on the CoE as a whole?

A total of roughly five-dozen members of the college community attended the listening sessions, and another half dozen who were unable to attend a session provided comments to members of the Task Force via email or telephone. Discussions were also initiated in various college committees. Attendees at the listening sessions included faculty, academic staff, classified staff, and students, though the mix varied in each session.

The comments in the listening sessions covered a wide range of topics, including curricular design and flexibility, advising, merit and other reward/recognition systems, tenure procedures, communication of expectations, support for young families, student recruitment and retention, and more.

Attendees believed that drivers for change will certainly include budget, changes to the student body, and the size of the faculty. Global pressures will be a factor as well, whether through relocated jobs or through increased competition or both. The rate of change in higher education and in the culture around us also seems to be increasing. Some attendees felt that in addition to these broad changes, their own jobs will be changing significantly in the next five years, though this perspective came more often from staff than from faculty. Faculty noted that they will potentially be more involved in financing the college, either through fundraising efforts or through increased research efforts. Increasing discussions of the “relevance” of engineering will force change as well, according to attendees, which may pose a challenge to engineers trained as problem solvers rather than problem framers. The lack of a clear impetus (a la the Cold War or Sputnik and the Space Race) presents a challenge to those who may want to direct change. And finally, all of the drivers noted above will affect who is drawn to engineering (and who isn't).

To summarize and communicate the outcome of these listening sessions, the Task Force consolidated the changes described by attendees into three broad categories: Environment, Interaction, and People.

#### Environment

- Leadership, incentives, and flexibility must exist for students, faculty, and staff to participate in experimentation, change, and choice.
- Faculty and staff must provide an education that prepares our students to enter the world as it will be, not as it was.
- Faculty, staff and students need to be able to work effectively in an environment where diversity is the norm rather than the exception.

#### Interaction

- Cross-disciplinary research and education will be the norm, but only if the infrastructure exists to support them.
- Interaction across groups (faculty, staff, students, departments, etc.) will help build community and encourage further cross-disciplinary collaborations.

#### People

- Professional development for faculty and staff will enable them to keep pace with changes in the college, the profession, and the world, and thus serve students well.

### **Next Step: Action or Something Else?**

After the listening sessions, debate in the Task Force focused on the next steps. One possibility was that we take what we had learned and start making changes. There were many good ideas expressed at the listening sessions and the college committee meetings that, if implemented, would likely improve the college.

Our approach, however, after considerable discussion, has been different. First, we have not had a culture that is used to providing input like we are requesting now. So it was clear that we had not finished the task of engaging faculty, staff and students from the college in this process. Second, it was also clear that we had not communicated the process we were following, or how it was that we would be evaluating how we were doing. We were not sure if faculty, staff, or students trusted us, or believed that we were committed to the process we were using. To remedy this, the Task Force developed a set of Guiding Principles and Operating Principles, shown below:

#### ***Guiding Principles***

*Priority will be given to changes that enhance the CoE*

- Excellence in education and scholarship
- Flexibility and diversity
- Connectivity and sense of community
- Creativity and inventiveness

*And make the college more than the sum of its parts*

## ***Operating Principles***

*In implementing changes, CoE leaders will*

- Identify a process for implementing change
- Rely on the Task Force to gather data and solicit feedback throughout the process
- Communicate with faculty, staff, and students concerning relevant issues and data
- Implement changes that support the vision and goals
- Communicate changes in the process
- Focus on what is possible and most beneficial to change.

As shown, we hope that these principles will communicate what we believe in and what we will use to guide our changes, and secondly, that we will operate in a way that actions, in fact, support the rhetoric. These principles were communicated at a second All-College meeting. In addition, we will be soliciting additional feedback at the next set of listening sessions.

## **Informed Decisions: Working Groups**

Coincident with listening and learning what the college community, it was also clear that we could not implement changes prior to study of a number of different issues. For example, suppose it was decided that in an era of limited resources, particular areas of research would be supported and strengthened. The next question then becomes how to choose the areas to support. A set of metrics that measure what it is that we value is necessary so that we have some reasonable means of comparing and evaluating different alternatives.

To provide this information, several working groups have been formed. In addition to a working group on metrics, working groups have been formed to provide information related to alternative revenue sources, and to propose principles for deploying administrative support services.

Once these working groups have completed their tasks, and the college has had time to digest and discuss the findings, another set of working groups will be established to develop specific implementation plans for changes in the College of Engineering.

## **Committing to a New Future**

We have moved from a small but enthusiastic Task Force of seven of us who attended last summer's retreat, to a set of six working groups, each tackling a different piece of the challenge of 2010.

We are also starting a new set of listening sessions, this time with the objective being to identify the aspirations of the members of the college community. We are asking the college community to identify their hopes and dreams for the college. Barbara Waugh sums it up very well:

How I thought it was, if you were great, like Martin Luther King, Jr., you had a dream. Since I wasn't great, I figured I had no dream, and the best I could do was follow someone else's. Now I believe it works like this: It's having the dream that

makes you great. It's the dream that produces the greatness. It's the dream that draws others around us and attracts the resources it takes to accomplish the dream.

## Summary

A Task Force at the UW-Madison College of Engineering has been energetically engaged in assisting the college in redesign to meet the challenges of 2010 and beyond. The Task Force has developed a plan for improvement that depends on active engagement by members of the college community. This process has been started by communicating, listening and studying with the community to learn about our identity, and what it is that we value.

While the UW COE remains in many ways homogenous, there is a tremendous diversity of reasons for believing that change is worthwhile. For some, it's a desire to continue to compete successfully (for students, for funding, for prestige). For others, it's a desire to find new challenges in a career. For still others, it's a nagging sense that we can do better, and that we need to stretch if we are going to reach our full potential.

The Task Force has faced numerous challenges in the apparent dichotomy that exists between efforts to fully engage the community in study and conversation about the challenges facing the college and how those challenges might be addressed, and the need to show progress. A listening process such as we are following tends to result in uncertainty. We frequently hear from the community that we need to set more direction for the change. Yet we have to balance this with listening to ideas that come from the community. We would not change the original eight point plan of action, however, it is likely that we would emphasize more the fact this plan of action is not sequential; instead it is iterative as a result of feedback from the community.

So far in this redesign process, there is also as yet no firm agreement on what specific actions the college should take. Should our enrollment go up or down? Is it more important to hire faculty or staff? Is it more efficient to centralize support services or personalize them? Should our departments' curricula become more similar to one another or more diverse? What's the optimal class size? Should we place more emphasis on bringing in research dollars or on solidifying the legislature's support? Are the best employees entrepreneurs or collaborators? Clearly, the answers to these questions will not be simple, but the asking of them is essential. As we have described, however, the starting point for our activities has not been in examination of curriculum or research areas or even hiring decisions, instead it has been in examining ourselves and attempting to determine the identity of the institution. In other words, our identity is not defined by our curriculum or our research areas, instead it is about the culture and the fundamental philosophy that drives the activities of the college.

Acknowledgments – The Task Force would like to thank the National Academy of Engineering and CASEE for initiating the EELI. The EELI served as a required catalyst for us to get started.

## References:

1) *The Engineer of 2020: Visions of Engineering in the New Century*, National Academy of Engineering, 2004.

2) Waugh, B and Forrest, M., *The Soul in the Computer: The Story of a Corporate Revolutionary*, Hewlett Packard, 2005.

3) Williams, Rosalind, *Retooling: A Historian Confronts Technological Change*, MIT Press, 2002.

4) Cronin, William, "Only Connect.. . : The Goals of a Liberal Education," *The American Scholar*, (Autumn, 1998), p.73-80.