It is a pleasure to be here and join you in congratulating these inductees into the Alabama Engineering Hall of Fame. Georgia Tech is very proud to have a half-dozen of our alumni represented in the Alabama Engineering Hall of Fame, including James Thompson, Mark Smith, Eugene Gwaltney, F. Brooks Moore, Paul Taylor, and Dean Emeritus Robert Barfield of the University of Alabama, who did all three of his degrees at Georgia Tech. We’re grateful for the opportunities Alabama has given them to excel, because in addition to reflecting well on the State of Alabama, their accomplishments also reflect well on Georgia Tech.

It goes the other direction, too. Among those we honor tonight is Allen Franklin of the Georgia Power Company -- Alabama native and alumnus of the University of Alabama, who has contributed so much to Georgia in the course of his outstanding career. And we are grateful to Alabama for sharing his talents with us.

In the process of honoring outstanding contributors and contributions to engineering, you are also drawing attention to the significance of engineering to the well-being of Alabama. And that is very important.

The future of a technology-based economy rests squarely on the shoulders of engineers, and engineers are counting on universities like Auburn, Alabama, South Alabama and even Georgia Tech to prepare them for that responsibility. So I’d like to take a few minutes this evening to talk with you about the future of engineering education.

I have to admit right up front that higher education has traditionally been a stick-in-the-mud. We don’t like change, and we have often been left standing in the starting blocks, still listening for the starter’s gun while private industry was rounding the first turn.

Our present literature is still dominated by the culture of the large corporation. But out there in the cut-throat competition of a global economy, that bureaucratic, vertical hierarchy has given way to a nimbler, more horizontal, entrepreneurial structure. Future engineers will need to be prepared to work in a new economy that is quite different from what most of our university faculty know and understand.

What’s more, our own structure in education continues to replicate that same old pyramid the corporate world has abandoned. We proceed vertically within the academic disciplines rather than horizontally across them.

We also tend to make education decisions that serve our internal institutional needs, rather than the industries that hire our students. Our focus on building up our research programs has meant that we seldom hire faculty based on their knowledge of engineering practice and ability to teach it. In the short-term we may not notice the effect, but in the long run there is a danger that engineering education will become irrelevant to the external constituencies it exists to serve.

We also face new competition. While we traditional universities try to convince students to pack up and move to our campuses, virtual universities make physical location irrelevant by offering students the option of pursuing their education from any place they choose.
These are some of the realities that led management consultant Peter Drucker to predict that universities are headed the way of the dinosaur. In a *Forbes* magazine interview two years ago, he stated that “30 years from now, the big university campuses will be relics.”

The good news is that we’ve still got 28 years to prove him wrong. And engineering education clearly has the opportunity to do so. Because at the same time that Mr. Drucker is contemplating our demise, the new economy that is springing up around us is knocking on our doors, demanding more college graduates in engineering and technology. Engineering jobs are predicted to increase by 46 percent over the next ten years, with the largest surge in computer engineering and related areas.

So, how does engineering education need to change to be as vibrant in this new economy as it was in the industrial age? What should the well-rounded engineer of the 21st century look like, and how do we re-engineer engineering education so that we are able to produce one?

The first thing we must recognize is that the end of the cold war and the rapid emergence of a global economy were powerful forces that caused industry to make drastic changes just to survive. Large government programs and entire segments of our economy literally disappeared. New products and services emerged using alternative technologies and skill sets. Entrepreneurs, start-up businesses and venture capitalists took over the tasks of producing jobs and creating wealth. The industrial ideal is no longer standardization, but continuous improvisation. Industry has been changed forever by these experiences, and it expects engineering education to respond to its new needs.

The new entrepreneurial culture that is springing up outside the gates of our universities represents the kind of exciting frontier that will attract our best students. When I was an undergraduate at Georgia Tech three decades ago, students used to discuss which large corporation they would work for and what the pension plan looked like. Today, our students envision themselves as entrepreneurs running a successful start-up company, or at least working for a lively young company that is growing by leaps and bounds.

Further, all of today’s industries, not just the new start-ups, are looking for engineers who think like entrepreneurs. An effective engineer in this new economy needs more than an academic understanding of the concepts of design. The larger context of engineering practice now encompasses elements of human endeavor, including political pressures, ethics, business management, communication, leadership and the need to find honest compromises within economic and time constraints.

Engineers must not only be technically competent, but also effective team members, flexible in their attitudes toward work assignments, adaptable, creative in problem-solving, perceptive about the global economy, and able to communicate their ideas to management, labor and the public. Producing a Renaissance engineer who is adept in all of the components of this broader definition is the crux of our educational process.

I was really pleased earlier this month to hear the vice president of a high-tech company say that the Georgia Tech students he hired were good communicators, confident, and able to see the big picture. These are traits that today’s companies value.
To prepare our students to practice in this entrepreneurial culture, we need to link our engineering programs with programs in other disciplines like computing science and business management that will give them the broader range of skills that they will need.

We also need to recognize that the new technologies emerging at the economy’s cutting edge often combine traditional academic disciplines. At Georgia Tech, the newest school in our College of Engineering is biomedical engineering. It is not only a marriage of two disciplines – engineering and medicine – that traditionally functioned separately. It is also a joint department between Georgia Tech, a public institution, and Emory University, a private institution. It is the first joint public-private university department in Georgia, possibly in the United States.

Each of us brings our strengths to the partnership. Georgia Tech brings our expertise in engineering; Emory brings the resources of a major medical school. Together we are educating students to serve health care’s newest frontier. And in the process we are pioneering a model of cooperation in higher education.

Another new frontier that crosses disciplines is sustainable technology. Engineers are beginning to find that a seat is reserved for them at the public policy table. As the Kyoto Global Climate Conference demonstrated last year, political solutions to problems like global warming are very difficult. They inevitably call for somebody to make a sacrifice, and no one wants to volunteer. Sustainable technology can step into the breach and help to reconcile the conflict between economic development and environmental preservation without short-changing either one.

This new field not only cuts across all engineering curricula, but it also requires a grounding in public policy and social responsibility. And it needs rapid development and incorporation into our educational programs.

In addition to closer cooperation among disciplines, engineering education also needs to do a better job of keeping a finger on the pulse of private industry. Fortunately, events have conspired to give us the opportunity to live by the words of that old Protestant hymn “Just a Closer Walk with Thee,” and bring engineering education closer to the real world of private industry. The shift in university research away from reliance on federal support and toward industry sponsorship, is helping to create a focus on the teaching of engineering practice. We need to take advantage of this opportunity to inject the realities of practice in the educational experiences we offer our students.

If we incorporate practice-oriented problems into our engineering courses, they will have a higher degree of relevance. If we expect our faculty to engage in reasonable levels of consulting, they will bring a practicing perspective to the classroom. If we encourage our students to participate in cooperative programs that alternate study and work, they will gain firsthand experience in the practice of engineering.

Another place where we are still in the starting gate while industry is rounding the first turn is in our use of technology. Technology is our subject matter, but we need to do a better job of using it to teach our students. The use of computers has been pervasive on university campuses for more than a decade, but we have been slow to understand the potential and ramifications of networking and the Internet for teaching.

The creation of the Boeing 777 was a stunning demonstration of the power of information technology in a global economy. This airplane has 132,500 uniquely engineered parts that were designed and manufactured in 12 different nations. In the United States alone, 487 suppliers created parts for it. But no full-scale model of the...
plane was ever assembled to make sure all of these disparate parts would fit. It was simply built and flown, and that in record time.

The design of the parts was coordinated across company lines and national boundaries with through the use of compatible software on networked computers. The parts and systems were pre-assembled and checked as solid images on workstation display screens, eliminating the need for a model. This is the kind of electronic teamwork with which our students must learn to be comfortable.

Technology can also help us to be creative in meeting the increasing demand for technical education. The university campus offers important advantages that virtual universities can never duplicate – hands-on lab work, mentoring of students by faculty, and camaraderie among students that builds interpersonal skills. But at the same time, we must make fuller use of technology in the way we deliver education, from wiring our campuses, to creating on-line course material, to offering distance learning classes. Our challenge is to combine the power of information technology as a teaching tool with the strengths of a firsthand campus experience.

Choosing which new technologies to implement and deciding how to go about it calls for a meeting of the minds among those who have a stake in it. I believe that we in engineering education need to seek the advice not only of computer experts but also of private industry, so that we make decisions about technology that are not only good investments and but also prepare our students for practice in the workplace.

In his book Academic Strategy, George Keller says that universities must produce “new management wine in old academic bottles.” For engineering education, that will require new methods of teaching and learning that incorporate technology; new relationships among academic disciplines and with industry; a new understanding of our broader social responsibilities; and a new degree of nimbleness in recognizing and responding to change in the world around us.

It will not be simple or easy. We face a tough climb up a mountain that does not have an obvious path to the peak. But it must be done. Dramatic as the changes of the recent past may seem, they are likely to be small compared to what lies ahead. If universities are to live to prove Peter Drucker wrong, then we must work deliberately to create an educational milieu that anticipates a future of rapid change and unpredictability, and equips our students with the flexibility and adaptability they need to take it in stride.

If anyone is able to do that, it ought to be engineers. We’ve always had something of that entrepreneurial spirit in our mindset, going back more than a century to our roots in the industrial revolution. Our goal has always been to look for practical, useful solutions and figure out how to get things done. And if we can put that knack for resourcefulness to work in the re-engineering of engineering education, then universities will be an active force that drives our economy forward 30 years from now and beyond.