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Keynote Address**

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Good afternoon. It is a very great pleasure for me to visit Purdue and learn more about its plans and achievements – and particularly about Purdue's Discovery Park. The early success of this remarkable center bodes well for the future strength of our country, which is what I am here to talk about this afternoon.

As advertised, I am going to talk about the Administration's *"American Competitiveness Initiative,"* parts of which have already been acted on by appropriations committees in the House and Senate, and has generally received positive and bi-partisan acclaim. But first I want to say a few words about America's competitive position in the world today. Many of you are aware that a number of reports, books, and commentators have expressed concern about that position, and I will try to explain why and what kinds of actions seem to be necessary to strengthen and sustain our competitiveness into the future.

But first I need to confirm in no uncertain terms that today and in the foreseeable future, the U.S. is and will be highly competitive and perform very well in the technology-based, globalized economy we expect will be a permanent feature of the 21st century. By nearly every measure, the U.S. leads the world in innovation and in the characteristics necessary for leadership in a technology-intensive economy.

With only 5% of the world's population, the U.S. employs nearly 30% of the world's scientists and engineers. GDP has grown steadily at an annual rate of about 3.5% per year (although in the recent past that rate has taken a hit because of the softening housing market, which is 6% of the economy). And technology intensive manufacturing has remained strong even as growing Asian production has eaten into Europe's market share. Inflation remains in check, unemployment is low, and the nation's productivity has continued to increase by about 3.4% on average during the past five years.

These positive economic indicators are consistent with large investments made by the federal government and private industry in research and development. The U.S. is by far the world's most generous sponsor of R&D, exceeding the R&D spending of the next largest economy, Japan, by more than half, and spending as much as the rest of the G-8 nations combined. Among large economies, only Japan spends a greater fraction of its GDP on R&D, at about 3.1% compared with our 2.7%

Moreover, the U.S. remains the most attractive country in the world for talented young scientists to start their research careers. Our universities rank among the best in the world. A recent study by Shanghai's Jiao Tong University shows that three quarters

of the top 50 universities in the world, and nearly half of the top 100 are in the U.S. (Purdue is among them.) Our strong intellectual property protection regime, emphasis on merit-based rewards for research performance, generous policies for sharing returns from intellectual property with the discoverers, strong venture capital community, and cultural receptivity to science and technology all combine to make our country extremely attractive to foreign investment. People from other countries are willing to invest not only their funds, but also to stake their own personal futures by coming to the U.S. and participate in our economy and way of life.

There is much more I could say about our current and probable future economic strength. But let me turn to some of the facts of the current world situation that make something like a "Competitiveness Initiative" advisable.

The most important fact by far is that finally some of the largest developing countries are adopting wiser government policies and economic practices that are permitting their economies to grow. This is a highly desirable development that we should welcome and not fear. It is good news for geopolitical stability and for the people in those countries – countries like China and India and Vietnam and some of the former Soviet bloc countries, including Russia. In each case liberalization of economic policies and attention to civil infrastructure – including the educational infrastructure as well as transportation, communication and energy systems – are creating conditions favorable to the creation of productive capacity, improved standards of living, and large new markets. The speed of these changes is astonishing. It is enabled by the new technologies that are transforming our own society, and particularly by information technology and its associated hardware. Cell phones are a good example of an innovation that leapfrogs the older telephone technology with one that is less capital intensive, requires less maintenance, and allows for more and better service. Developed countries have to overcome the burden of their legacy systems. Developing countries do not even have legacy systems.

To take advantage of the new technologies, however, developing countries need to educate their masses. Consequently they are investing heavily in education at every level, and in creating favorable conditions in their schools, colleges, and laboratories for attracting talented, technically oriented, men and women. Given our own dependence on talented immigrants from these same countries, the prospect of improving conditions in their homelands leads to concern that America's foreign talent will return in droves, or not to come at all to our universities and laboratories, leaving us to depend on the skills of our own citizens to continue to lead in the high technology economy of the future. And that has many people worried because many of our own brightest citizens have tended to opt for non-technical careers. Many more of those who might be interested in science or engineering are so poorly prepared in the basics that they fail to perform at a passing level when they take these subjects in college.

That, in a nutshell, is the concern. The deficiencies in our system of science and math education are well publicized. This Administration's *"No Child Left Behind"* initiative is designed to strengthen teaching and learning of the basics, mostly at the K-12 level. Not everyone needs to be an engineer or a scientist, but we do need a technically literate population to contribute to the technology-intensive economy of the 21st century.

There are other concerns, such as favorable tax incentives, or labor costs, or relaxed environmental regulations that entice U.S. companies to locate operations abroad. The question is, what are the most critical factors necessary to sustain our competitiveness, and to what extent is it at risk? Does the rapid progress of China, for example, threaten to weaken U.S. competitiveness and undermine our economy by draining away industry, trade, and expertise?

Speaking as a scientist, my first reaction to this worrisome scenario is to ask whether we can see signs of its impact in economic data. Given that our current position is so strong, can we predict when it might weaken, or how serious our condition might become in the likely future? I have become very interested in these questions during the past four years, and devoted a policy speech to them two years ago (at the April, 2004 Policy Forum of the American Association for the Advancement of Science. The speech is located on the OSTP website, www.ostp.gov).

My conclusion is that the data we have are certainly telling us that rapid change is taking place, particularly in China, but that we do not have adequate tools to quantify their significance for the future. Even the apparently simple question of whether we are producing too many or too few engineers or scientists in certain fields is very difficult to answer. Just because China is producing engineers at a prodigious rate does not necessarily imply that we need to increase our own production rate artificially. We ought to match graduation rates with job opportunities, if we can. Having just returned from that country, I am aware that China needs a large number of technically trained people to sustain their own economy. It is difficult to judge whether the number they are producing are too many or too few or in the right fields at the right level of expertise for their needs. Data on graduate student enrollments and rates of return of foreign graduate students to their home countries suggest that the U.S. remains very attractive to the best and brightest from other countries. I think the reports of impending storms appropriately emphasize the dangers of inaction, but are misleading as to the strength of our current competitive position and the rate it is changing. We should not fear the rising capabilities of China and India and other developing countries. We should welcome them as creating new partners, new markets, and new opportunities for our own economy.

And yet we must take seriously the weakness in the technical education we provide to our own citizens, and we must make it possible for our workforce to retrain itself continually as the conditions of their jobs evolve, and we must continue to encourage our industries to invest in the applied research and development that has enabled their current remarkable rates of productivity. And we must continue to support through federal funds the basic research that provides the foundation for future technologies. These are investments in our long term future competitiveness, and they are the main themes of the President's *"American Competitiveness Initiative."*

I credit many organizations for drawing these themes together into a coherent picture of needed actions. The President's *Council of Advisors on Science and Technology*, of which President Jischke is a member, produced reports beginning in 2002 on some of these themes, and the *Council on Competitiveness* released a report late in 2004 that linked them strongly to our future competitiveness. The most widely noticed report, published by the *National Academies of Science* in the summer of 2005, has the

dramatic title "*Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*," and a fiery red cover.

The publication describing the President's "*American Competitiveness Initiative*," launched in his State of the Union message last January, has a green cover. It differs from the "*Gathering Storm*" report in three major respects. First, while it accepts the general thrust of the "*Gathering Storm*" recommendations, it avoids the rather dramatic analysis of probable "stormy" events used to justify them. The sky is not falling on our economy, and the U.S. is in no imminent danger of losing its competitive position. The proposals in the ACI are not based on fear, but on optimism and confidence about the future.

Second, the ACI focuses on *long term strength* – on basic, not applied research, on early stage education, on creating business conditions that encourage long term private sector investments in R&D. It proposes to change immigration requirements to make it easier to retain highly trained foreign scientists and scholars, which could be construed as addressing a short term need, but America, the nation of immigrants, expects to benefit from talented and ambitious men and women from other countries for the indefinite future.

Finally, the ACI is about *priorities*, many of them among the recommendations in the series of reports I mentioned earlier. It specifies key agencies that support areas of science that are highly likely to have relevance to future technologies but have been underfunded relative to other areas (think physical science vs. biomedical science). The ACI proposes to double the funding of these key agencies over ten years. It also integrates key proposals for improving education into programs in the "*No Child Left Behind*" initiative, and adopts principles that stress educational best practices for teaching math and science. Many more details can be found in the green brochure on ACI, which can be downloaded from the website I mentioned earlier.

Where does Purdue's Discovery Park fit into this picture? That is easy. Discovery Park is an example of what makes the United States a leader in innovation *today*. It is producing new technologies, new companies, and new generations of entrepreneurs who are contributing *now* to the vitality of our economy. At the same time, Discovery Park provides an example of a successful model for the future economy that other universities and their regions can learn from. It brings together the public and the private sectors in that important zone where the federal role of long term basic research and the industrial role of short term applied research come together. By virtue of their experience and training, the personnel of Discovery Park can help parties in both sectors make wise investments in this difficult borderland. The most impressive thing to me about Discovery Park is not its promise for the future, but the fact it is functioning *today* as an important component of Indiana's 'ecology of innovation,' and is therefore contributing directly to America's economic strength.

Discovery Park does look to the future, of course. It brings a variety of talents and resources together in one place to nurture learning and creativity. Other similar centers, each with its own unique flavor, have sprung up all over the country. Developing countries, and developed countries too, are copying them in an attempt to

duplicate our success. I particularly like the educational outreach dimension of Discovery Park, which is a good example of one of the aims of the *American Competitiveness Initiative* to draw upon universities and industries to enrich the science and math learning experience in the schools. I knew a little about Purdue's Discovery Park before I arrived last night, but now that I know more, I can see that it fulfils the vision the ACI aims to realize throughout the nation. It is an enterprise of which Purdue can be proud, and I congratulate President Jischke and his colleagues and supporters on its success.

Thank you.