"The Future of the American Research University"

James J. Duderstadt

University of Illinois – Urbana Champaign
March 17, 2011

Opening Remarks

Happy St. Patrick's Day…although I understand I'm four days late, after your "alternative" St. Pat's Day celebration. Although my last name doesn't sound very Irish, my grandmother's name was McCleary, so that is close enough!!!

It seems like every decade I have a date with the University of Illinois:

1987: UIUC Chancellor search
1999: Henry Lecture: "A Society of Learning"
2010: UIUC Graduate School Address

But these are command performances, since I view your institution as one of the great research universities in the world–ranking among public universities along with U Wisconsin-Madison and U. Michigan in the Big Ten, UC-Berkeley and UCLA in the West, and U North Carolina-Chapel Hill and U Virginia in the East. In fact you are almost certainly among the top 10 public research universities in the world.

Hence it is not only a real pleasure but, indeed, a great privilege to be invited back to your campus every decade or so!!!

Today I will be speaking about the future of the American research university. (By the way, I always forget the proper order, UIUC or UICU, so I'll just refer to your campus by its historical name, the University of Illinois. Actually my discussion will only concern the nation's "flagship" public research universities such as you folks anyway.)

Here I will make remarks from a number of viewpoints:

Chair, Policy and Global Affairs Division, National Research Council
(National Academies of Science, Engineering, and Medicine)

Brookings Senior Fellow:

Economic Development of Great Lakes
National Energy Policy (Innovation Hubs)
Midwest Master Plan

Glion Colloquium (Global Sustainability)

Lots of other stuff: chair of National Science Board, DOE Advisory Committee on Nuclear Energy, Intelligence Science Board,

National Academy Committee on the Future of the American Research University (requested by Congress)

SETTING THE STAGE: PRESIDENT OBAMA'S SOTU 2011 ADDRESS

"The world has changed. In a single generation, revolutions in technology have transformed the way we live, work and do business. Today, just about any company can set up shop, hire workers, and sell their products wherever there's an Internet connection.

Nations like China and India realized that with some changes of their own, they could compete in this new world. And so they started educating their children earlier and longer, with greater emphasis on math and science. They're investing in research and new technologies.

"The competition for jobs is real. But this shouldn't discourage us. It should challenge us. Remember America still has the largest, most prosperous economy in the world. No country has more successful companies, or grants more patents to inventors and entrepreneurs. We're the home to the world's best colleges and universities, where more students come to study than any place on Earth.

"The future is ours to win. But to get there, we can't just stand still. As Robert Kennedy told us, "The future is not a gift. It is an achievement." Sustaining the American Dream has never been about standing pat. It has required each generation to sacrifice, and struggle, and meet the demands of a new age. And now it's our turn. We know what it takes to compete for the jobs and industries of our time.

We need to out-innovate, out-educate, and out-build the rest of the world."

President Obama, 2011 State of the Union Address

Through investing in innovation we create the jobs of the future; through investing in education we prepare our citizens to fill these jobs; and through building the infrastructure for a knowledge-based economy, we will assure prosperity and security for our nation.

Economists estimate that 40 to 60 percent of economic growth each year is due to research and development activity, particularly in American universities. Another 20 percent of the increased resources each year are based upon the rising skill levels of our population. In other words, 60 to 80 percent is really dependent upon higher education in terms of research and development and skills of the labor force.

In a recent survey, when asked to identify the one federal policy that could most increase the long-term economic growth rate, economists put further investment in education and research at the top of the list.

It is this reality of the hyper-competitive, global, knowledge-driven economy of the 21st Century that is stimulating the powerful forces that will reshape the nature of our society and that pose such a formidable challenge to our nation and our states and cities.

Recall again President Obama's challenge to out-innovate, out-educating, and out-build the rest of the world. Key to the achievement of all three of these goals is the American research university, which through its research creates the new knowledge key to innovation; through its educational programs, particularly at the graduate and professional level, it creates the knowledge workers and entrepreneurs capable of applying innovation to create economic value; and through its development and deployment of advanced infrastructure such as information and communications technology, it provides the foundation for the knowledge economy.

Today this critical importance of this key asset in achieving economic prosperity and security is widely understood, as evidenced by the efforts currently being made by many nations to create and sustain research universities of world-class quality.

U.S. research universities continue to dominate international rankings:

Times Higher Education: 8 of top 10, 26 of top 50 are US.
QS: 6 of 10, 22 of 50
Shanghai Jaio Tong: 8 of 10, 38 of 50

Yet while the United States still maintains strong leadership in the quality and capacity of its research university system, there are growing concerns about the vulnerability of this key asset in the face of shifting public priorities. While American research universities continue to provide the nation with global leadership in research, advanced education, and knowledge-intensive services such as health care, technology transfer, and innovation, this leadership is threatened by rising competition from abroad, by stagnant support of advanced education and research in key strategic areas such as science and engineering, and by the complacency and resistance to change of the academy.

Recently members of the United States Congress have asked the National Academies to conduct a thorough study of the state of the nation's research university.

As stated in their letter:

> "America's research universities are admired throughout the world, and they have contributed immeasurably to our social and economic well-being. Our universities, to an extent unparalleled in other countries, are our nation's primary source of long-term scientific, engineering, and medical research. "
>
> "We are concerned that they are at risk.
>
> "Hence we are writing to ask the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine to assembly a distinguished group of individuals to assess the competitive position of American research universities, both public and private, and to respond to the following question:
>
> > "What are the top ten actions that Congress, state governments, research universities, and others can take to maintain the excellence in research and doctoral education needed to help the United States compete, prosper, and achieve national goals for health, energy, the environment, and security in the global community of the 21st Century."

THE BRAVE NEW WORLD FACING RESEARCH UNIVERSITIES

CHALLENGE 1: BETWEEN A ROCK AND A HARD PLACE

I begin with the following premise:

> Today our world has entered a period of rapid and profound economic, social, and political transformation driven by a hypercompetitive global economy that depends upon the creation and application of new knowledge and hence upon educated people and their ideas.

Yet achieving the imperatives of a knowledge-driven global economy requires resolving several seemly incompatible challenges:

1. It has become increasingly apparent that the strength, prosperity, and welfare of a nation in a global knowledge economy will demand a highly educated citizenry enabled by development of a strong system of tertiary education.

2. It will also require institutions with the ability to discover new knowledge, develop innovative applications of these discoveries, and transfer them into the marketplace through entrepreneurial activities.

3. Yet it must do achieve these goals while facing pressures to reduce the relative burden on taxpayers who face other public spending priorities such as health care, retirement, and national security.

The Europeans term this challenge as being caught between "massification" (broadening college attainment to much of the population), "league tables" ("achieving prominence in various higher education rankings of academic quality", and tax relief…

In this country we might rephrase this as facing the competing demands of a workforce requiring a dramatic increase in college degree attainment, building and sustaining world-class colleges and universities, and coping with the shifting priorities of an aging baby boomer population that seeks retirement security, health care, safety from crime and terrorism, and tax relief.

Clearly these priorities and challenges are tightly interwoven.

For example, while increasing the attainment of college degrees in a population helps to build a world-class workforce, this by itself DOES NOT CREATE JOBS. In a knowledge-driven global economy, new jobs are created by new knowledge, and this requires world-class research, technological innovation, and entrepreneurial skills.

Clearly these imperatives require strong public and private investment. Yet in the wake of the Great Recession, state after state has experienced tax revenue declines that have triggered deep budget cuts to public colleges and universities in the range of 20% to 50% or higher. These deep cuts of public support fall on top of two decades of eroding tax support of public universities as the states have struggled with the burdens and priorities of aging populations.

(An aside here: This decline in public support was nothing new for my university, the University of Michigan, located as it is in the Rust Belt close to Detroit and the collapsing American automobile industry. Over the past 30 years we have seen our public support decline from 70% of our operating budget to less than 6%. As university president I used to explain that during this period we had evolved from a state-supported to a state-assisted to a state-related to a state-located university. In fact, with campuses in Europe and Asia, we remain today only a state-molested institution.)

It is worth noting here that the nation's leading public university, the University of California has been high particularly hard hit by serious cuts in state appropriations leading to salary decreases, payless furlough days, and ramping up employee contributions to retirement and health care plans. Last year it was announced that the UC pension fund is now underfunded by over $20 B, which will require over $700 M/y of annual investments for years to come–roughly what the UC campuses spend on instruction!

For private universities, endowments heavily dependent upon long-term, ill-liquid assets have taken big hits (30% or greater) causing temporary declines in operating revenues for the wealthiest institutions. At last count, Harvard lost almost $14 billion of its endowment, with comparable losses at other prominent private universities such as Yale and Stanford. Note that at Harvard and Yale, roughly 60% of the support of core academic programs comes from endowment!!! Last week's Chronicle of Higher Education notes that 3-year (4.2%), 5-year (3%), and 10-year returns (3.5%) remain below levels needed to fund long-term plans for standard spending, inflation, and expenses!

At the same time, the tuition, room and board charges of private universities are now bumping up against market ceilings as they have surged past $50,000/year (and even higher for professional schools).

My own hunch is that these financial challenges are not due to the usual ebb and flows characterizing a cyclic economy but rather a consequence of the fact that our current system of supporting American higher education is no longer sustainable, particularly in view of the increasing needs of our society.

CHALLENGE 2: RAISING THE BAR FOR EDUCATION

Today, a college degree has become a necessity for most careers, and graduate education is desirable for an increasing number. In the knowledge economy, the key asset driving corporate value is no longer physical capital or unskilled labor. Instead it is intellectual and human capital. This increasingly utilitarian view of higher education is reflected in public policy. The National Governors Association notes that "The driving force behind the 21st Century economy is knowledge, and developing human capital is the best way to ensure prosperity."

Education is becoming a powerful political force. Just as the space race of the 1960s stimulated major investments in research and education, there are early signs that the skills race of the 21st Century may soon be recognized as the dominant domestic policy issue facing our nation. But there is an important difference here. The space race galvanized public concern and concentrated national attention on educating "the best and brightest," the academically elite of our society. The skills race of the 21st Century will value instead the skills and knowledge of our entire workforce as a key to economic prosperity, national security, and social well-being.

While public surveys still suggest strong support of higher education, numerous studies sponsored by government, business, foundations, the National Academies, and the higher education community have suggested that the past attainments of American higher education may have led our nation to unwarranted complacency about its future.

The United States currently ranks 10th among OECD nations with on 39% of 25-to-34 year olds having an associate degree or higher (although it ranks 5th for 25-to-65 year olds) and almost last in college completion rates, particularly when the fastest growing component of our population comes from minority groups (particularly Latinos) with the lowest participation in higher education. Less than 40% of Americans earn a two- or four-year college degree, and much of the adult

population in the U.S. has never taken a single college class, then most of our citizens are falling behind. They are vastly underserved by traditional colleges and universities. To fully develop our nation's human capital, new means of knowledge access must be made available.

There is clear evidence of an increasing stratification of access to (and success in) quality higher education based on socioeconomic status. Students from the highest income quartile are ten times more likely to graduate with college degrees than those from the lowest quartile!

Furthermore, many question today whether our colleges and universities are achieving acceptable student learning outcomes (including critical thinking ability, moral reasoning, communication skills, and quantitative literacy).

CHALLENGE 3: CHANGING DEMOGRAPHICS

Aging populations, out-migration, and shrinking workforces are seriously challenging the productivity of developed economies throughout Europe and Asia. Yet here the United States stands apart because of another important demographic trend: immigration. As it has been so many times in its past, America is once again becoming a highly diverse nation of immigrants, benefiting immensely from their energy, talents, and hope. In fact, over the past decade, immigration from Latin America and Asia contributed 53% of the growth in the United States population.

Immigration is expected to drive continued growth in the U.S. population from 300 million today to over 450 million by 2050, augmenting our aging population and stimulating productivity with new and young workers. Such population mobility is also rapidly changing the ethnic character of our nation. Yet even without immigration the minority population in the United States will continue to grow for decades to come, rising to 42% by 2050. Minorities now comprise 40% of the Millennial generation of students now entering our colleges.

By any measure, we are evolving rapidly into a truly multicultural society with a remarkable cultural, racial, and ethnic diversity. This demographic revolution is taking place within the context of the continuing globalization of the world's economy and society that requires Americans to interact with people from every country of the world. The increasing diversity of the American population with respect to race, ethnicity, and national origin is one of our greatest strengths, since such diversity contributes to our capacity to innovate and relate to a highly diverse global economy.

But here American higher education faces a serious challenge, since the minorities comprising the most rapidly growing components of our population have traditionally had the lowest levels of college attainment. For example, the percentage attaining baccalaureate degrees for African Americans at 19% and Hispanics at 13% lags far behind those of Whites at 33% and Asian Americans at 52%), a consequence of inadequate K-12 preparation, poverty, and discrimination (Chronicle, 2010). Our colleges and universities will not only have to dedicate a much greater effort but also develop new paradigms capable of serving rapidly growing ethnic minorities still burdened with inadequate K-12 preparation, impoverished backgrounds, and discrimination.

CHALLENGE 4: MARKETS VS. PUBLIC POLICY

These economic, geopolitical, and demographic factors are stimulating powerful market forces that are likely to drive a massive restructuring of the higher education enterprise, similar to that experienced by other economic sectors such as banking, transportation, communications, and energy.

It also seems clear that the financial model that has dominated American higher education for the past several decades is beginning to fray. Traditionally, this has involved a partnership among states, the federal government, and private citizens (the marketplace).

In the past the states have shouldered the lion's share of the costs of public higher education through subsidies, which keep tuition low for students; the federal government has taken on the role of providing need-based aid and loan subsidies. Students and parents (and to a much lesser extent donors) pick up the rest of the tab. Yet today tuition and fees charged for private universities (and an increasingly number of public universities) have hit the wall ($40,000 for tuition and $50,000 total). The tuitions at public universities are also rising rapidly. For example at both U California and U Michigan instate residents pay $12,000 a year, while out-of-state students pay private tuition levels at $36,000 a year! We have both moved into the $50,000/year club for tuition, room and board!!!

This system has become vulnerable as the states face the increasing Medicaid obligations of a growing and aging uninsured population, made even more difficult by the state tax-cutting frenzy during the boom period of the late 1990s. This is likely to worsen as a larger percentage of young people and working adults seek higher education while the tax-paying population ages and health care costs continue to escalate. A recent Brookings Institution study concluded:

"The traditional model of higher education finance in the U.S. with large state subsidies to public higher education and modest means-tested grants and loans from the federal government is becoming increasingly untenable." (It is worth noting that a co-author of this study, Peter Orzag, was the recent director of the U.S. Office of Management and Budget.)

But there is another issue here. We are moving toward a revenue-driven, market-responsive higher education system because there is no way that our current tax system can support the degree of universal access to postsecondary education required by knowledge-driven economies in the face of other compelling social priorities (particularly the needs of the aging). This is amplified by an accelerating influence of the market on higher education and a growing willingness on the part of political leaders to use market forces as a means of restructuring higher education in order to increase the impact of the competition. Put another way, market forces are rapidly overwhelming public policy and public investment in determining the future course of higher education.

Yet the increasing dominance of market forces over public policy raises important challenges. Whether a deliberate or involuntary response to the tightening fiscal constraints and changing priorities for public funds, the long standing recognition that higher education is a public good, benefiting all of our society, is eroding. Both the American public and its elected leaders increasingly view higher education as a private benefit that should be paid for by those who benefit most directly, namely the students. Without the constraints of public policy, earned and empowered by public investments, market forces could so dominate and reshape the higher education enterprise that many of the most important values and traditions of the university could fall by the wayside, including its public purpose.

CHALLENGE 5: AUTONOMY AND ACCOUNTABILITY

Clearly in such a rapidly changing environment, agility and adaptability become important attributes of successful institutions. Yet the governance and leadership of most institutions are far more inclined to protect the past than prepare for the future. Most public university governing boards view their role as one of oversight to ensure public or political accountability rather than as stewardship to protect and enhance the university so that it is capable of serving both present and future generations.

In many states even as relative government support has declined, the effort to regulate universities and hold them accountable has increased. Although some of

this is rationalized by the sub-optimal activities of a relatively small number of institutions, it is perhaps also evidence of governments attempting to retain control over the sector through regulation even as their financial control waned. While it is certainly true that cost-containment and accountability are important issues, it is also the case that most public universities can rightly argue that the main problem for them is that they are overregulated and underfunded.

Bob Birgeneau, Chancellor of UC-Berkeley, points out that today the single largest shareholder of the University of California has become the federal government, through both student financial aid and research grants. In fact, the taxpayers of California have dropped to the bottom of their support. If you ran the numbers, I'll bet you would find the same thing for UIUC!!! In fact, you might even face the dilemma of the University of Michigan, in which today we find ourselves controlled (indeed, micromanaged) by our smallest shareholder, the State of Michigan, which now provides only 4% of our operating budget.

Yet I certainly would not recommend that we redefine ourselves as "federal public universities" since my experience with the recent Spellings Commission provided strong evidence of the dangers of focusing primarily upon the "a" words in determining higher education policy: Access, Affordability, and Accountability!!! Just recall the opening statement in our report:

> "American higher education has become what, in the business world would be called a mature enterprise: increasingly risk-averse, at times self-satisfied, and unduly expensive. It is an enterprise that has yet to address the fundamental issues of how academic programs and institutions must be transformed to serve the changing educational needs of a knowledge economy. It has yet to successfully confront the impact of globalization, rapidly evolving technologies, an increasingly diverse and aging population, and an evolving marketplace characterized by new needs and new paradigms."

More specifically, the Commission raised two areas of particular concern about American higher education: social justice and global competitiveness.

> Too few Americans prepare for, participate in, and complete higher education. Notwithstanding the nation's egalitarian principles, there is ample evidence that qualified young people from families of modest means are far less likely to go to college than their affluent peers with similar qualifications. America's higher-education financing system is increasingly dysfunctional. Government subsidies are declining; tuition is

> rising; and cost per student is increasing faster than inflation or family income.
>
> Furthermore, at a time when the United States needs to be increasing the quality of learning outcomes and the economic value of a college education, there are disturbing signs that suggest higher education is moving in the opposite direction. Numerous recent studies suggest that today's American college students are not really learning what they need to learn (Bok, 2006).

The Bush administration, which launched the Spellings Commission, did little to respond to its recommendations. In sharp contrast, the Obama administration has not only set out bold goals for the nation that address many of these concerns, such as the President's challenge to raise college attainment by 25% to raise the nation to the world's leader by 2020 while providing at least one year of college for every American, It has also launched a number of important initiatives and programs to address these concerns such as the restructuring of federal financial aid in the Reconciliation Health and Education Act of 2009, the Race to the Top and Early Learning programs, a dramatic expansion of the Pell Grant program.

THE NATIONAL ACADEMIES COMMISSION ON RESEARCH UNIVERSITIES

Let's return once again to the request from Congress:

> "We are concerned that they are at risk.
>
> Hence we are writing to ask the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine to assembly a distinguished group of individuals to assess the competitive position of American research universities, both public and private, and to respond to the following question:
>
> What are the top ten actions that Congress, state governments, research universities, and others can take to maintain the excellence in research and doctoral education needed to help the United States compete, prosper, and achieve national goals for health, energy, the environment, and security in the global community of the 21st Century."

An ad hoc committee has been formed to respond to this request.

Chad Holliday, *Committee Chair*, Chairman of the Board, Bank of America, and Chairman and CEO, E.I. du Pont de Nemours and Company (DuPont) (retired) [NAE]
Peter Agre, University Professor and Director, Johns Hopkins Malaria Research Institute, Department of Molecular Microbiology and Immunology, Bloomberg School of Public Health, Johns Hopkins University [NAS/IOM]
Enriqueta Bond, President, Burroughs Wellcome Fund (retired) [IOM]
C.W. Paul Chu, T. L. L. Temple Chair of Science and Professor of Physics, University of Houston, and Former President, Hong Kong University of Science and Technology [NAS]*
Francisco Cigarroa, Chancellor, The University of Texas System [IOM]
James Duderstadt, President Emeritus and University Professor of Science and Engineering, University of Michigan [NAE]
Ronald Ehrenberg, Irving M. Ives Professor of Industrial and Labor Relations and Economics, and Director, Cornell Higher Education Research Institute, Cornell University
William Frist, Distinguished University Professor, Owen Graduate School of Management,
Vanderbilt University, and US Senator (retired)
William Green, Chairman and CEO, Accenture

John Hennessy, President and Bing Presidential Professor, Stanford University [NAS/NAE]
Walter Massey, President Emeritus, Morehouse College, and Chairman, Bank of America (retired)
Burton McMurtry, Founding Partner, TVI
Ernest Moniz, Cecil and Ida Green Professor of Physics and Engineering Systems, Director of the Energy Initiative, and Director of the Laboratory for Energy and the Environment at the MIT Department of Physics, Massachusetts Institute of Technology
Heather Monroe-Blum, Principal, Vice-Chancellor, and Senior Officer of the University, and Professor in the Department of Epidemiology, Biostatistics and Occupational Health, McGill University
Cherry Murray, Dean, Harvard School of Engineering and Applied Sciences, John A. and Elizabeth S. Armstrong Professor of Engineering and Applied Sciences, and Professor of Physics, Harvard University [NAS/NAE]
Hunter Rawlings, President Emeritus and Professor of Classical History, Cornell University
John Reed, Chairman, New York Stock Exchange (retired), and Chairman and CEO, Citigroup (retired)
Teresa Sullivan, Provost, Executive Vice President for Academic Affairs, and Professor of Sociology, University of Michigan, and President-Elect, University of Virginia
Sidney Taurel, Chairman and CEO, Eli Lilly & Company (retired)
Laura D'Andrea Tyson, S. K. and Angela Chan Chair in Global Management, Haas School of Business, University of California Berkeley
Padmasree Warrior, Chief Technology Officer, Cisco Systems

The study committee has, in carrying out its work, focused on:

- Research and doctoral programs carried out by research universities and associated medical centers;
- Basic and applied research in research universities, along with collaborative research programs with other components of the research enterprise (e.g., national and federal laboratories, federally-funded research and development centers, and corporate research laboratories);
- Fields of study and research that are critical to helping the United States compete, prosper, and achieve national goals for health, energy, the environment, and security, with a focus on science, engineering, and medicine.

HOW TO BEGIN: A SWOT ANALYSIS

We began last fall with a SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats):

- Strengths:
  - National Priorities Requiring Research Universities
    - Security (Defense, Terrorism)
    - Economic Prosperity
    - Public Health
    - Preservation and Transmission of Culture
    - Citizens for a Democratic Society
    - Enlightened Criticism
  - Unique Contributions of Research Universities
    - New knowledge (basic and applied R&D)
    - Scholars, scientists, researchers ("*universitas magisterium et scholarium*")
    - Knowledge-intensive professionals (engineers, doctors, teachers, etc.)
    - Knowledge-intensive services (clinical care, innovation, entrepreneurism)
    - Knowledge/culture repositories (libraries, museums, theaters)
    - Social criticism, leadership

- Threats
  - Globalization
  - Human capital (changing demographics)
  - Financial sustainability (particularly of flagship public universities)
  - Technological change
  - Public/political awareness
  - Challenges to academic freedom and integrity
  - Lack of a national strategy

- Weaknesses
  - Obsolete financial models
  - Obsolete public policies (both federal and state)
  - Inadequate alignment with U.S. priorities
  - Mission creep
  - Institutional competition ("winner take all", cost driver)
  - STEM pipeline
  - Obsolete governance, management, leadership
  - Inadequate capacity for change
  - Changing professoriate
  - Obsolete doctoral/postdoc training (feudal system)

Opportunities
- Use crisis to stimulate change
- Develop new financial models for 21st Century
- Restructure graduate education ("Flexner Report" for the PhD)
- Rebalance competition and cooperation
- Redefine core mission ("core-in-cloud")
- Explore new paradigms (e.g., global, open-source, ecology)

In briefing our committee last fall, Senator Lamar Alexander suggested we separate our recommendations into those that were cost-free, and those that would require substantial investment (although recognizing these might not occur for a number of years). Although it is still early in its studies, some of the major issues and possible recommendations that have been raised by those testifying before our committee include:

COST-FREE RECOMMENDATIONS

1. (Vannevar Bush Redux: A New National Research Policy) Develop a new national policy for sustaining and deploying the assets of the nation's research universities to address national needs, analogous to earlier major federal initiatives (e.g., Land-Grant Acts, the government-university-industry research partnership, the National Defense Education Act). Include a Quadrennial Review process in this policy.

2. (Restructure Sponsored Research Policies) The current framework for sponsored research support should be radically restructured:
   - The highest priority is providing stable, predictable funding (at whatever level) to allow universities to plan and make appropriate commitments.
   - Conduct only sponsored research that is fully funded (from the federal government, industry, and foundations)
   - Simplify process, removing unnecessary regulations and administrative burdens
   - Avoid earmarks (both universities seeking them and Congress providing them) ("Don't ask; don't take!")

3. (Restructure Post-Graduate Education) Graduate and post-doc education should be radically restructured.
   - Dramatically reduce attrition rates and time to degree.
   - Align graduate and postdoc programs with market needs.

Augment traditional training with skills necessary for broader employment.

Shift from RAs and TAs to fellowships and traineeships as the dominant support for graduate education, with participation by all federal agencies and businesses dependent upon advanced degrees (perhaps supported by placing a SBIR-like "tax" on each federal agency).

Graduate programs in critical areas should be restructured to become more attractive and supportive to outstanding undergraduates, particularly from underrepresented minority populations (e.g., eliminate feudal culture, provide commitments of multiple year support)

4. (Provide Public Universities with the Necessary Agility and Autonomy) At a time when the nation has become ever more dependent upon research universities, many states are threatening both the quality and capacity of their public research universities through inadequate funding and intrusive regulation and governance. Since many of these institutions are not only critical national assets but also predominantly federally supported institutions (through federal student financial aid research grants), the states should be cautioned that if they are no longer able or willing to support their research universities at world-class quality, they should take steps to provide them with sufficient autonomy and agility to sustain their unique role in addressing both state and national interests.

5. (Strategies for Addressing Human Capital Needs and Changing Demographics)

Implement policies at the federal, state, and university level to encourage, provide access, and achieve success for underrepresented minority populations .

Adopt open immigration policies for high-skill students (similar to Canada).

Commit research universities to reconnect with entire education ecosystem.

Focusing intellectual resources on improving K-12 (e.g., U-Teach).

Working closely with community colleges and regional universities.

Link research university with minority-serving institutions.

6. (Efficiency and Productivity) The nation's research universities should commit new efforts to streamline activities, increasing efficiency and productivity, while focusing their considerable capacity to address the urgent needs of

the nation, particular in the areas critical to an innovation-driven economy and the creation of 21st century jobs. Included might be efforts such as:

- Moving to year-round operation.
- Broader engagement with education ecosystem (K-12, CC, CU, etc.).
- Reducing attrition rates and times to degrees (e.g., 3 y BA, 5 y PhD).
- Better aligning degree programs with national needs and employment opportunities (particularly at the graduate level).
- Redefining "tenure" to protect academic freedom rather than career-long employment. (Although this is the "third rail".)
- Developing new models for faculty retirement and junior faculty development.
- Developing both metrics and best practices to evaluate efficiency and productivity.

7. (Public Education Campaign) The American public has little understanding of the role played by world-class research universities in both creating new knowledge (and stimulating innovation critical to economic prosperity and national security) and in training those capable of generating knowledge and innovation (graduate education). Higher education needs to launch a major marketing effort to educate the public (and body politic) about unique character and importance of research universities to national goals such as economic prosperity, public health, and national security.
   - Caution universities to avoid public relations activities that distract public attention from the core value and impact of their academic programs (e.g., promoting fund-raising prowess or intercollegiate athletics rather than public purpose and impact).
   - Although this will involve activities at the institution level, a strong and coherent message will likely require coordination from national organizations (e.g., AAU, APLU, ACE).

INVESTMENT RECOMMENDATIONS

1. (Restructure Research University Financing) Current financial models for most American research universities are unsustainable and must be restructured. While efficiency, streamlining, cost reductions, and productivity enhancement are all necessary, eventually the nation must address the dramatic decline in research university revenues through investments at all levels–federal government (particularly for graduate

education), states, private sector, and students (tuition). As any business knows all too well, relying entirely on cost-cutting and productivity enhancement without attention to the top revenue line growth eventually leads to oblivion!

2. (Matching Grants for Faculty Renewal) To rebuild and sustain the faculties of research universities in key strategic areas during a period of serious financial stress, the federal government should launch a program of matching grants to establish endowments for research faculty positions. Each faculty chair would be supported by a $3 million endowment, consisting of a $1 million grant from the federal government distributed through a competitive process based on research excellence and graduate student productivity, and a required $2 million match from private, state, or institutional resources. A total federal program of $1 billion/year would establish 1,000 new chairs each year, contributing significantly to the research and graduate education capacity of America's research universities.

3. (Federal Government Becomes Primary Sponsor of Graduate Education) The federal government should become the primary patron for graduate work in key disciplines, just as it did for research in the years following WWII. The majority of this support should be in the form of multiple-year graduate fellowships (transportable) and traineeships (program based) provided by each federal agency (both research and mission-directed) dependent upon advanced degrees (MS/PhD).

4. (A National Learning, Research, and Innovation Network) Use advanced cyberinfrastructure (in the broadest sense) to connect together the nation's research universities, national laboratories, federal agencies, and industry, thereby creating the world's most powerful knowledge resource. Note this would not only involving ultra-high speed connectivity both among and within organizations, but also coordinated data centers, clouds, personnel, and supporting policies. It would take advantage of rapidly changing paradigms (IT services as a utility, open knowledge paradigms such as digital libraries and open courseware, and data-intensive research). It would enable both collaboration AND competition (e.g., bringing competitive forces into the classroom), by connecting both fundamental research, technological innovation, academic programs, faculty and students, federal and industry scientists and engineers to create new opportunities for collaboration and eliminating redundancy, while linking these extraordinary resources to both the private and public sector as well as to the world. It would also provide even more incentive to move to an

open access policy for ALL federally-sponsored research, representing a profound upgrade in "knowledge bandwidth" in additional to network bandwidth.

5. (Invest in New Paradigms for Transformational and Translational Research and Innovation) Increase investments in new research paradigms that better link together research universities, national laboratories, and industry to enable the transfer of both fundamental and applied research with technological innovation, commercialization, and deployment to address national priorities (e.g., ARPA-like structures, regional innovation hubs, and translational research organizations). Clusters of these initiatives should be launched at scale and adequately funded from multiple sources (federal, state, industry, universities).

A Final Warning

During the summer of 2005, the National Academy of Sciences, the National Academy of Engineering and the Institute of Medicine undertook a study of America's evolving competitiveness in the global economy. The Executive Summary of the original report began, "The United States takes deserved pride in the vitality of its economy, which forms the foundation of our high quality of life, our national security, and our hope that our children and grandchildren will inherit ever greater opportunities." But the report concluded that, "Without a renewed effort to bolster the foundations of our competitiveness, we can expect to lose our privileged position." The report paints a daunting outlook for America if it were to continue on the perilous path it has been following in recent decades with regard to sustained competitiveness.

So where *does* America stand today relative to its position of five years ago when the *Gathering Storm* report was prepared? The unanimous view of the committee members participating in the preparation of the updated report is that our nation's outlook has worsened. While progress has been made in certain areas, the latitude to fix the problems being confronted has been severely diminished by the growth of the national debt over this period from $8 trillion to $13 trillion. Yet many other nations *have* been markedly progressing, thereby affecting America's relative ability to compete effectively for new factories, research laboratories, administrative centers—and *jobs*.

The *Gathering Storm* Committee's overall conclusion is that in spite of the efforts of both those in government and the private sector, the outlook for America to compete for quality jobs has further deteriorated over the past five years.

The *Gathering Storm* increasingly appears to be a Category 5!

THE NEED FOR A NATIONAL STRATEGY

Most nations are developing bold strategies to address–or at least cope with–the ongoing challenges of meeting workforce needs while elevating their universities to world-class status, although local cultures, traditions, and politics shape their particular approach.

Because of our origin as a federation of independent colonies (and then states), the United States continues to rely on a highly decentralized market-driven approach, consistent with the constitutional role that the states play in higher education and the autonomy of private institutions, with little strategic direction from the federal government. In fact, the United States is essentially the only developed nation without a national strategy for higher education in general and for research universities in particular. Of course our nation does have a well-organized national research system, based on competitive grants from federal agencies. But the budgets and control of our public research universities, which conduct most of the research and produce most of graduates of advanced degree programs, are at the state level, with only minimal influence by policies of the federal government.

Today, more than ever, the United States needs to develop a national strategy for sustaining (and perhaps expanding) a system of world-class research universities. Actually we have done this before, a century ago, with the Land-Grant Acts that provided the revenues from the sale of federal lands to the states to build the public universities that have provided educational opportunities to the working class and conducted both the basic and applied research to address key national priorities such as agriculture and industry. The federal government stepped in once again after WWII to create a partnership between the research universities and federal agencies through a peer-reviewed competitive grant system.

Yet since that time, for almost four decades, the nation really has had no agenda for higher education in America. Little wonder that at times we appear to be drifting aimlessly, with changing social priorities putting at great risk the very institutions that earlier generations built and supported so strongly as key to the future of a great nation. Today we need a new national strategy to sustain and enhance the quality of the nation's research universities.

The nation's research universities remain strong–indeed, world-class–although they are currently threatened by many forces–the economic challenges faced by the nation and the states, the emergence of global competitors, changing demographics, rapidly evolving technologies, as well as complacency, inadequate investment, and the absence of a bold national strategy.

Yet a time of crisis can also stimulate a call to action for the nation's research universities. It is in this spirit of joining with the federal government, the states, business and industry, and the public that America's research universities should commit themselves to a renewed commitment to restoring American leadership.