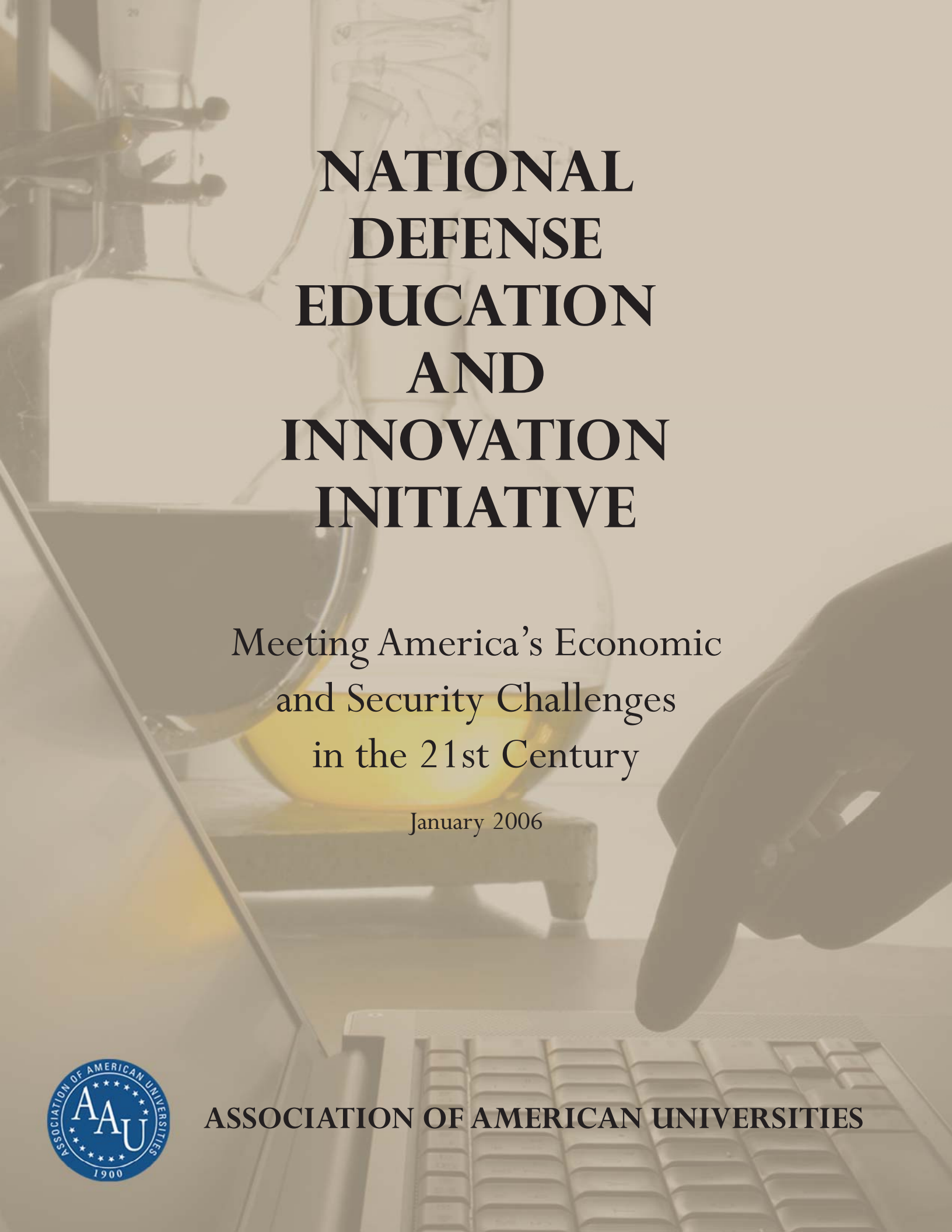

NATIONAL DEFENSE EDUCATION AND INNOVATION INITIATIVE

Meeting America's Economic and Security Challenges in the 21st Century

January 2006

ASSOCIATION OF AMERICAN UNIVERSITIES

ASSOCIATION OF AMERICAN UNIVERSITIES

The **Association of American Universities** (AAU), founded in 1900, is an association of 60 leading U.S. public and private research universities and two top Canadian universities. While AAU universities comprise only about 1.5 percent of all U.S. colleges and universities, they educate annually over one million (approximately nine percent) of the nation's undergraduates and over 450,000 (approximately 20 percent) of the nation's graduate and professional students.

AAU universities award just over one-half of all U.S. doctoral degrees and 55 percent of all Ph.D.s in sciences and engineering. AAU members perform nearly 60 percent of the university research funded by the federal government. The federal investment in research at AAU universities totaled nearly $13 billion in FY2002.

AAU provides a forum for the development and implementation of institutional and national policies promoting strong programs in university research and scholarship and undergraduate, graduate, and professional education. It supports its members' advocacy of national policies in these areas.

Brandeis University
Brown University
California Institute of Technology
Carnegie Mellon University
Case Western Reserve University
Columbia University
Cornell University
Duke University
Emory University
Harvard University
Indiana University
Iowa State University
The Johns Hopkins University
Massachusetts Institute of Technology
McGill University
Michigan State University
New York University
Northwestern University
The Ohio State University
The Pennsylvania State University
Princeton University
Purdue University
Rice University
Rutgers, The State University of New Jersey
Stanford University
Stony Brook University-
State University of New York
Syracuse University
Texas A&M University
Tulane University
University at Buffalo, The State University of New York
The University of Arizona
University of California, Berkeley
University of California, Davis
University of California, Irvine
University of California, Los Angeles
University of California, San Diego
University of California, Santa Barbara
University of Chicago
University of Colorado at Boulder
University of Florida
University of Illinois at Urbana-Champaign
University of Iowa
University of Kansas
University of Maryland, College Park
University of Michigan
University of Minnesota, Twin Cities
University of Missouri, Columbia
University of Nebraska-Lincoln
University of North Carolina at Chapel Hill
University of Oregon
University of Pennsylvania
University of Pittsburgh
University of Rochester
University of Southern California
University of Texas at Austin
University of Toronto
University of Virginia
University of Washington
University of Wisconsin-Madison
Vanderbilt University
Washington University in St. Louis
Yale University

NATIONAL DEFENSE EDUCATION AND INNOVATION INITIATIVE

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January 2006

ASSOCIATION OF AMERICAN UNIVERSITIES

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"[T]he inadequacies of our systems of research and education pose a greater threat to U.S. national security over the next quarter century than any potential conventional war that we might imagine."

— Hart-Rudman Commission on National Security, Road Map for National Security: Imperative for Change, 2001.

INTRODUCTION

Introduction

The United States has exercised global leadership in economic and security matters for more than 50 years, and the American people have experienced extraordinary security and economic progress as a result.

But in this still-young century, the nation faces new challenges to both our security and our prosperity: the danger to our national and homeland security posed by terrorism, the increasing competitive pressure from the growing economies of Asia and elsewhere, and the threat to our economic and national security posed by dependence on Middle East oil. These challenges demand a dramatic, creative response.

[T]HE BURDEN OF MEETING THESE CHALLENGES IS NOT GOVERNMENT'S ALONE . . . RESEARCH UNIVERSITIES AND HIGHER EDUCATION IN GENERAL HAVE KEY ROLES TO PLAY.

Yet they come at a time when the continuous innovation that has been the hallmark of America's economic success and military prowess is threatened at its very foundation. Serious problems in our educational system and a weakening federal commitment to research in the physical sciences and engineering are eroding the nation's innovative edge, with increasingly evident and alarming results.

Nearly 50 years ago, faced with similar challenges following the launch of Sputnik by the Soviet Union, America responded by enacting the National Defense Education Act and by multiplying the nation's investment in university-based research. The Association of American Universities (AAU) believes that today's challenges demand a comparable response.

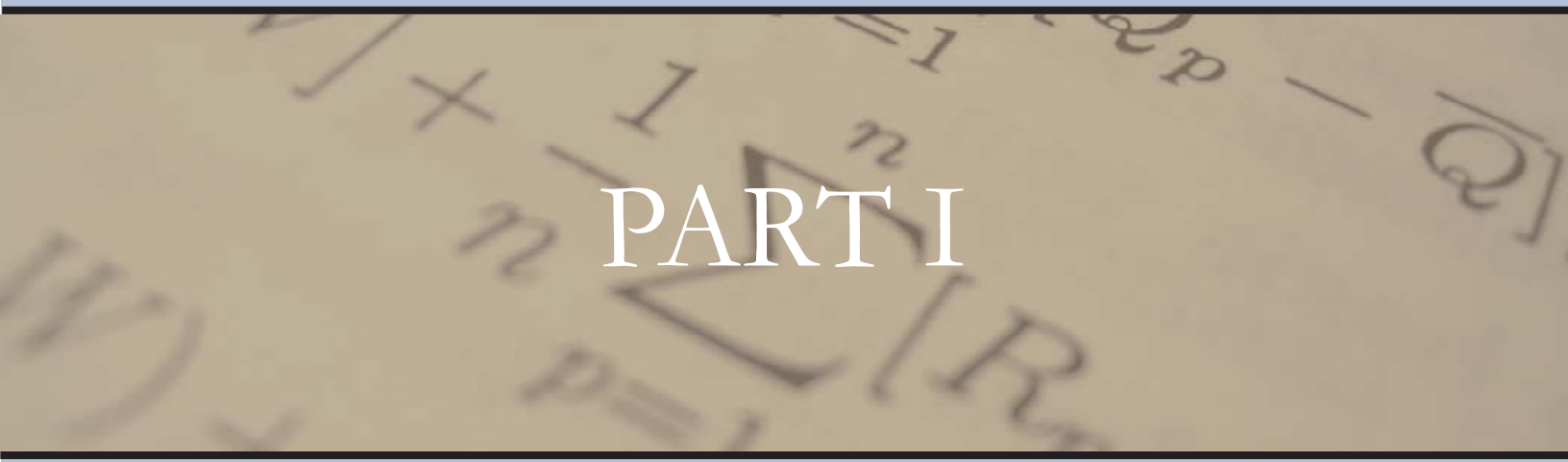
In that spirit, AAU calls on the Administration, Congress, and academia, with the help of the business sector, to implement a 21st Century National Defense Education and Innovation Initiative aimed at meeting the economic and security challenges we will face over the next half-century. Government and America's universities and colleges should implement this initiative now, so that it can be fully in place by 2008 – the 50th anniversary of the National Defense Education Act (NDEA) of 1958.

The Initiative springs from a belief among AAU universities that the burden of meeting these challenges is not government's alone and that research universities and higher education have key roles to play. It therefore calls for action and resources – and change – not only from government but also from the nation's colleges and universities. It also reflects a strong belief that, if we take the right actions, America can maintain its global leadership and that we can ensure our national and economic security for the 21st Century.

This report is in three parts. The first highlights the most significant recommendations contained in the Initiative. The second is a narrative that lays out the challenges, historical background, and a broad description of the Initiative. The third section of the report provides a detailed list of recommendations.

"One thing is certain. Our competitors will not wait for us to come to our senses - they will continue to fuel the changes in education and infrastructure required to spark innovation."

— Craig Barrett
CEO, Intel Corporation
Wall Street Journal
March 4, 2004



PART I

National Defense Education and Innovation Initiative:

Meeting America's Economic and Security Challenges in the 21st Century

HIGHLIGHTS

Objectives of the Initiative

- Enhance America's research capacity in order to sustain scientific and technical innovation.
- Cultivate American talent to enhance the nation's math, science, engineering, and foreign language expertise.
- Continue to attract and retain the best and brightest international students, scientists, engineers, and scholars.

Key Recommendations for Universities and Colleges

Enhance Research and Innovation

- Strengthen the connections between campus-based research and undergraduate education.
- Establish interdisciplinary research and education initiatives that create new combinations of faculty, postdocs, and graduate and undergraduate students to address emerging national challenges.
- Provide top young scientists and engineers – postdoctoral fellows (postdocs) and junior faculty – with independent research opportunities and funding to encourage novel thinking and research.

Cultivate American Talent

- Identify and promote best practices and programs in undergraduate STEM (science, technology, engineering, and mathematics) and foreign language education, especially those that address college freshman attrition and under-representation of minorities and women in STEM fields.
- Continue reexamination of doctoral education, particularly in STEM and language disciplines, to develop ways to shorten time to degree, improve completion rates, and broaden the scope of Ph.D. education.
- Continue to establish and build on professional science masters programs that meet specific science and technical managerial workforce needs identified by the federal government, business, and industry.
- Provide more university research experiences for those training to be K-12 math and science teachers, and for current teachers.
- Create accelerated teacher certification programs for individuals with STEM, foreign language, or area studies expertise.
- Create and sustain stronger partnerships with school districts, state departments of education, and business that focus on training and retraining K-12 teachers to fill the current teacher skills and knowledge gaps in STEM and foreign language education.

Attract and Retain Foreign Talent

- Continue to work with Congress and the Administration to combat the misperception that international students, scholars, scientists, and engineers are no longer welcome in the U.S.
- Continue to work with the Departments of State and Homeland Security to improve the visa process so that bona fide international students, scholars, scientists, and engineers can enter the U.S. in a secure, timely, and efficient manner.

National Defense Education and Innovation Initiative:

Meeting America's Economic and Security Challenges in the 21st Century

Key Recommendations for Government

Enhance Research and Innovation

- Increase federal investment in basic research supported by the NSF, NASA, and the Departments of Energy, Defense, Homeland Security, and Commerce by 10 percent annually for the next seven years placing particular emphasis upon growing federal support for the physical sciences and engineering. Grow investment thereafter to continue driving innovation.

- Sustain basic medical science funding at historical rates of growth to preserve the biomedical research capacity made possible by the recent doubling of the National Institutes of Health (NIH) budget.

- Strengthen federal support for research infrastructure by reinvigorating competitive facilities and equipment programs at NIH and the National Science Foundation (NSF), adequately funding the Department of Energy's 20-year facilities plan, and examining policy changes to strengthen federal support for scientific infrastructure at universities.

Cultivate American Talent

- Increase by 5,000 the number of graduate fellowships and traineeships supported by existing programs at federal science and education agencies, including NSF, NIH, National Aeronautics and Space Administration (NASA), and the Departments of Defense (DOD), Homeland Security (DHS), Energy (DOE), and Education.

- Create a graduate fellowship and traineeship program in the DOE Office of Science that supports 1,000 students annually and that generates talent to help achieve energy self-sufficiency and to enhance the nation's scientific enterprise.

- Expand the DOD National Defense Education Program, which provides scholarships and fellowships to students in critical fields of science, mathematics, and engineering in return for a commitment of national service after their studies.

- Increase federal need-based student aid, especially Pell Grants, to make college possible for the neediest students.

- Build on the Administration's National Security Language Initiative by expanding federal foreign language, area studies, and study abroad programs.

- Revive the NDEA K-12 teacher skills summer workshops to help teachers of math, science, and foreign languages improve their teaching skills and meet teaching standards.

- Improve education research and K-12 education by creating: 1) a competitively awarded extramural grant program in the Institute of Education Sciences at the Department of Education that funds high-quality research on K-12 education and 2) a new graduate fellowship program that supports 500 students per year pursuing Ph.D.s in math and science education.

- Establish a new mentoring and tutoring program in which college students earn a stipend for tutoring K-12 students in STEM and foreign language coursework.

Attract and Retain Foreign Talent

- Reform immigration policies to create clear pathways to permanent residency and U.S. citizenship for top international students who earn U.S. degrees, as well as outstanding scientists and engineers in the U.S. on exchange or work visas.

- Ensure that government policies and contracting practices do not discriminate against or curtail participation by international students and scientists in the conduct of unclassified fundamental research.

"Investing in science (including math and science education) is the most important strategic investment we make in continued American leadership economically and militarily."

— Newt Gingrich,
Winning the Future
2005

PART II

Challenges to America's Security and Prosperity

In the years since World War II, the United States has overcome numerous threats to its security and its economic leadership. Today, the nation faces new challenges that in some ways are unprecedented. Like the threats of the past, they are not insurmountable. But there should be no mistaking their seriousness.

In the arena of national security, America and its allies face enemies – both hostile governments and a stateless enemy organized across geopolitical borders – that not only threaten us with traditional warfare but also seek the ability to undertake biological, chemical, and nuclear attacks.

This threat is rooted in ideological and cultural differences. Yet our nation lacks the level of language and cultural knowledge needed to confront successfully those who threaten us.

Our nation also faces threats to its continued prosperity and global economic leadership. We face a long-term energy crisis, and we face growing competition from other nations – such as China and India – that are investing strategically in their manufacturing capabilities, expanding into service industries, and, most significantly, building state-of-the art research institutes and universities to foster innovation and compete directly for the world's top students and researchers.[1]

For more than 50 years, America's unique propensity for innovation has spurred long-term economic growth that created a thriving middle class and a steadily rising standard of living. Innovation has also made America's men and women in uniform the best-equipped and most effective in the world. As the Department of Defense has faced increasingly complex military challenges, it has relied on science and technology as a force multiplier.

But this nation's continued leadership is not a birthright. Our ability to overcome these challenges depends on the innovative capabilities that have driven America's progress in the past. However, the foundation upon which these capabilities have stood is threatened by serious problems in our educational system; decreasing incentives for students to study critical scientific, engineering, and language fields; and insufficient funding for research, particularly basic research in the physical sciences and engineering.

AMERICA'S UNIQUE PROPENSITY FOR INNOVATION HAS SPURRED LONG-TERM ECONOMIC GROWTH . . . AND . . . MADE AMERICA'S MEN AND WOMEN IN UNIFORM THE BEST-EQUIPPED AND MOST EFFECTIVE IN THE WORLD.

The evidence of these problems is clear in both our own looming deficiencies and in the growing innovative capabilities of other nations. For example:

- Federal basic research funding in the physical sciences and engineering has been essentially flat (Figure I), and has declined as a percentage of Gross Domestic Product over the past 30 years.[2]

- The performance of American students in math and science declines as they reach higher grades and is significantly below that of many of our international competitors.[3]

- Asia and Europe are expanding their capacity to educate and train scientists and engineers, thereby increasing competition for the best and brightest students. Both have surpassed the U.S. in the number of science and engineering (S & E) doctoral degrees awarded (Figure II).

- U.S. students are far less likely to earn undergraduate science or engineering degrees than those in other countries. In a list compiled by the NSF, the U.S. ranked 16th out of 17 countries in the share of science and engineering degrees among all degrees awarded (Figure III).

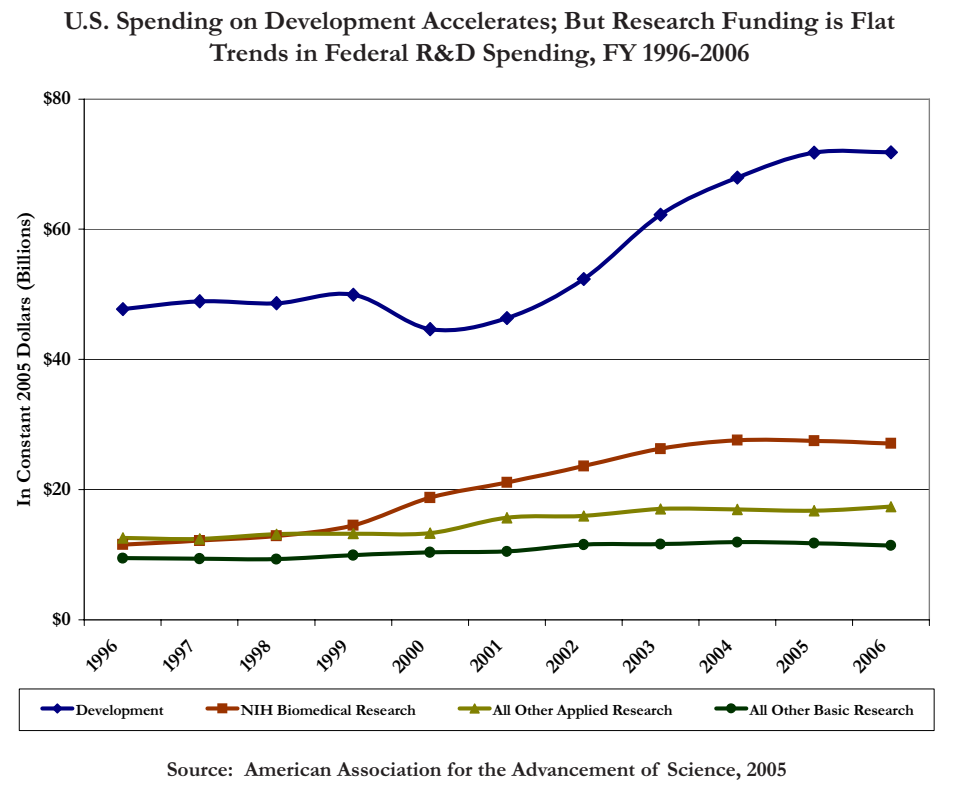


Figure I

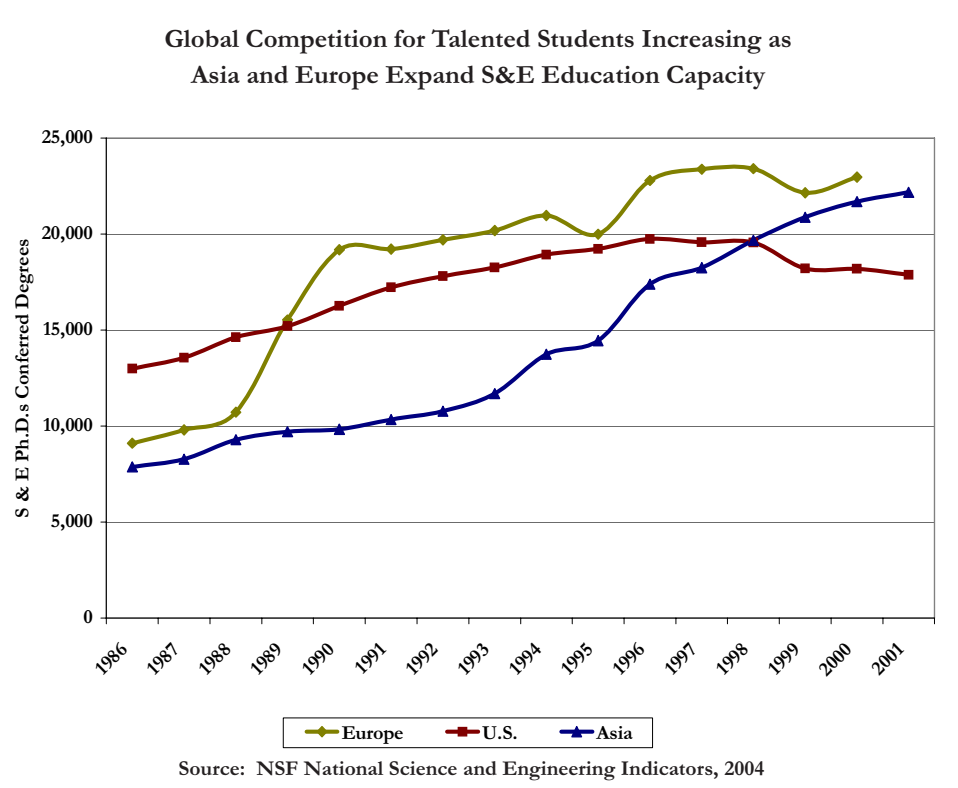


Figure II

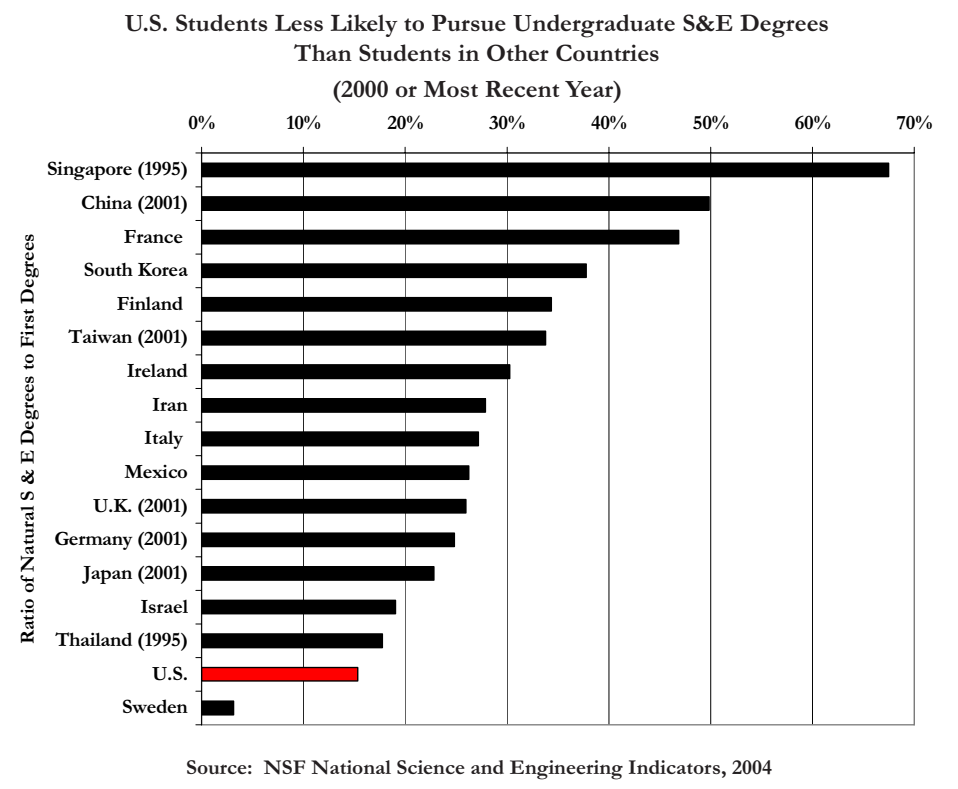


Figure III

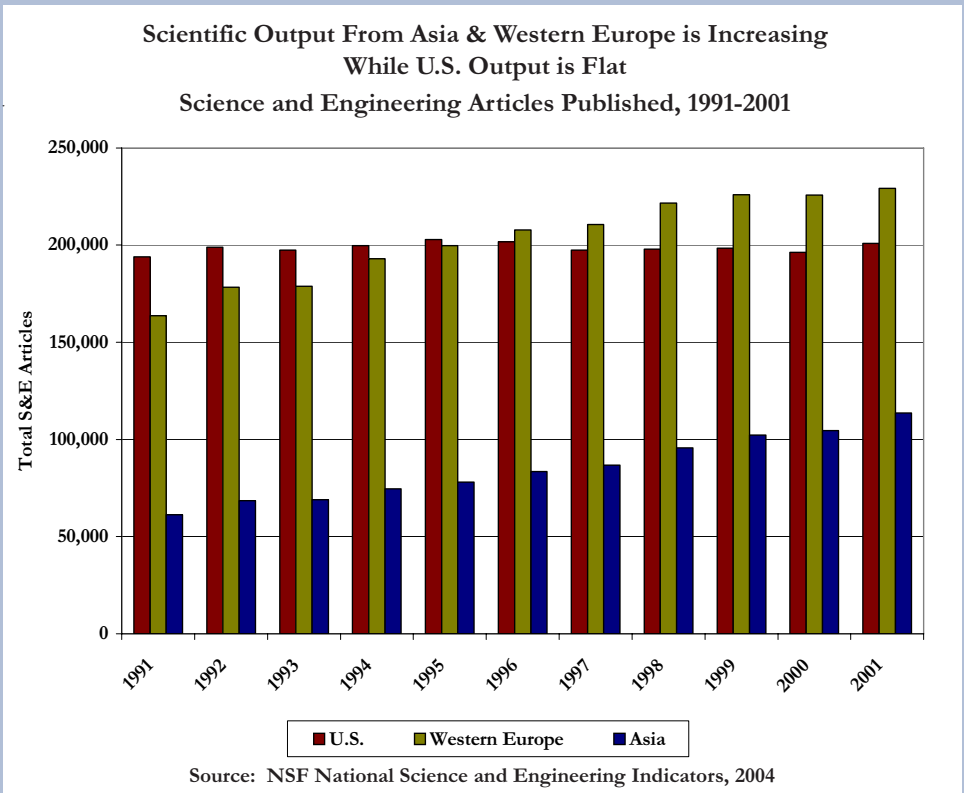


Figure IV

- Western Europe has surpassed the U.S. in the number of published articles and Asia is rapidly gaining (Figure IV).

- The number of patent applications filed in this country by those in Asia has skyrocketed by 759 percent from 1989-2001[4], signaling that the world is beginning to catch up in this important benchmark of innovation.

- More than 65 federal agencies, ranging from the Central Intelligence Agency to the Peace Corps, annually need to fill 34,000 positions requiring foreign language skills – a requirement that is often unmet or filled only through outside contractors.[5]

To be sure, it is in America's interest that countries as large and important as China and India contribute more to the world's scientific and technological know-how and that they have growing economies committed to free markets. America's strength does not lie in the weakness of others. Indeed, we benefit from the innovations of others, just as the rest of the world has benefited from our innovations.

The problem is not the strength of other nations but rather maintaining America's own historic strengths. Numerous business and scientific leaders and national organizations have raised concerns about the nation's ability to meet increasing

competition in world markets, reduce our energy dependency, and ensure the well-trained scientific and technical workforce that is essential to innovation.

"RISING ABOVE THE GATHERING STORM" . . . AND [OTHER] SIGNIFICANT REPORTS . . . HAVE SOUNDED THE ALARM AND RECOMMENDED WAYS TO ADDRESS THE EROSION OF AMERICAN LEADERSHIP.

"Rising Above the Gathering Storm," the landmark report by the National Academies, and significant reports by the Council on Competitiveness, the Business Roundtable, the National Association of Manufacturers, the Center for Strategic and International Studies, the Task Force on the Future of American Innovation, and other national organizations, have sounded the alarm and recommended ways to address the erosion of American leadership.[6] Some of the recommendations in this paper have appeared in one or more of these previous reports. *New York Times* columnist Thomas L. Friedman's best-selling book, The World is Flat, among others, has given attention to these reports and raised public consciousness of the urgency of these issues.

These individuals and organizations have created a consensus as to the problem and, to an extraordinary degree, the solution. They agree that the principal ways to secure our nation's economic prosperity and military capability are to strengthen our educational system and revamp and re-energize the structures for innovation that have served us so well for the past half-century. The concern is clear: If we remain on our present course, our nation will not be able to produce the well-trained scientific and technical workforce necessary to meet increasing competition in world markets.

The educational and research systems that have undergirded our prosperity and well-being over the past 50 years now require renewed attention and investment. That is the overarching objective of the National Defense Education and Innovation Initiative.

Cultivating Talent From the U.S.

In recent years, American students' capacity to pursue scientific and technical degrees has declined. U.S. 4th graders score well among nations in math and science testing but they fall near the bottom by 12th grade.[7] This weakness also shows up at the post-secondary level. In 1966, American-born students earned 77 percent of science and engineering (S&E) Ph.D.s awarded in the U.S, while foreign-born students earned 23 percent. In 2000, the comparable numbers had dropped to 61 percent for U.S.-born students and risen to 39 percent for those from abroad.[8]

U.S. universities have a problem with attrition of science and math students – too many of those who begin their undergraduate studies with the intention of majoring in the sciences or math leave these fields for others.[9] If this trend continues, by the year 2010 the share of the world's science and engineering Ph.D.s produced by the U.S. will fall to approximately 15 percent, with China overtaking the U.S. in S&E doctoral production and the European Union producing nearly twice as many S&E Ph.D.s as the U.S.[10]

For the past 30 years, the U.S. has compensated for the tendency of American students to avoid science careers by attracting top students from abroad. In the past, these students have augmented the number of U.S. students. Today, augmentation has become dependency.

The nation cannot be assured that the flow of foreign students will continue. Even if it does, we still face a national security workforce crisis in which these foreign-born students are of little help. U.S. citizens are needed to fill security-related positions in the defense industry, the military, the national laboratories, the Departments of Defense and Homeland Security, the intelligence agencies, and other federal agencies.

Nearly one-third of the civilian STEM employees in the Department of Defense are eligible to retire right now.[11] In seven years, that percentage will more than double, with nearly 70 percent eligible to retire. Moreover, at least 13,000 DOD laboratory scientists are projected to retire within the next decade.[12] Similar retirements are expected at the Department of Energy and NASA.[13] This demographic crisis comes at a time when national demand for STEM employees in both the public and private sectors is projected to rise 10 percent by 2010.[14]

Defense industry organizations, including the National Defense Industrial Association and the Aerospace Industries Association, report the same trend among their member businesses and express concern about the increasing need for scientists and engineers who are U.S. citizens and can receive security clearances.

The Department of Defense is so alarmed about its workforce pipeline that it has launched its own National Defense Education Act initiative to educate, train, recruit, and retain U.S. citizens in skills and disciplines needed to fulfill its national security mission.[15] These include not only science and engineering but also cultural and foreign language studies.

It is also important to focus on the under-representation of minorities and women in STEM fields. We must find more effective ways to attract minorities and women to science and engineering careers. We cannot afford to allow this rich and underutilized reservoir of American talent to go untapped.

WE MUST FIND MORE EFFECTIVE WAYS TO ATTRACT MINORITIES AND WOMEN TO SCIENCE AND ENGINEERING CAREERS.

Attracting the Best Talent From Abroad

America is fortunate that our colleges and universities have been historically the most desired destination for international students, scientists, and scholars. But because an insufficient number of American students have chosen STEM-related careers, our nation has become overly dependent upon talent from abroad. Nevertheless, while developing U.S. talent will help restore a proper balance between U.S. and international talent – and is the primary focus of this Initiative – it is essential that America continue to attract and retain the best and brightest from around the world.

The supply of high-quality talent from abroad is at risk, however. Following the September 11, 2001 attacks, restrictive immigration procedures and onerous proposed export control rules have convinced many international students that they are no longer welcome here. Universities abroad have begun to compete for them effectively. In recent years, the U.S. has seen a decline in the number of international students applying for and enrolling in American graduate programs.[16]

We must do more to ensure that we continue to attract the most talented students, and we must do more to encourage them to remain here after graduation. Likewise, we need to continue to attract and retain the best scientists and engineers from around the world. One of the most important ways of accomplishing these goals is to enact policies that ease the path of these graduates and professionals to permanent residency and U.S. citizenship.

This combination – insufficient numbers of American students prepared for STEM careers and fewer international students studying and then remaining to work in the United States – represents an ominous trend that has significant implications for America's competitiveness.

AN EFFECTIVE AMERICAN RESPONSE TO THESE CHALLENGES MUST EMPLOY THE TEACHING AND RESEARCH CAPACITIES OF OUR NATION'S UNIVERSITIES AND COLLEGES.

Meeting the Challenges

To meet these challenges, we urge the Administration, Congress, business, and academia to develop and implement a 21st-Century National Defense Education and Innovation Initiative aimed at meeting the economic and security challenges we will face over the next half-century. We must begin now, and by no later than 2008 – the 50th anniversary of the National Defense Education Act of 1958 – we should have in place a national education and research strategy that helps ensure our nation's defense, energy and homeland security, and continued economic competitiveness.

An effective American response to these challenges must employ the teaching and research capacities of our nation's universities and colleges. It is important not only that the partnership between the federal government and universities be strengthened but also that universities reexamine the way they educate students for careers in the sciences and engineering and careers that demand expertise in foreign languages and cultures. This effort will require a thorough evaluation of both undergraduate and graduate programs by institutions, individually and collectively.

To maintain our leadership amidst intensifying global economic competition, we must make the best use of talented and innovative individuals, including scientists, engineers, linguists, and cultural experts. The same is true for winning the war on terrorism. The nation must cultivate young talent and orient national economic, political, and educational systems to offer the greatest opportunities to the most gifted American and international students.

We succeeded with this model in the second half of the 20th century. Other nations have learned from America's success and now aim to emulate and improve upon our example. Our response must be to bolster the systems that support our scientific and technological strengths, and to ensure that Americans are engaged globally through foreign language and cultural competence.

From Our Past, a Successful Model for Our Future: Sputnik and the NDEA

The appearance in the sky of an orbiting Russian satellite on October 4, 1957 shocked Americans into the realization that U.S. scientific and educational leadership could not be assumed. To compete successfully against a formidable adversary, we would have to give education and research a central role in building American strength, and government initiatives would be essential to that process. A national education and research strategy emerged virtually overnight. That model is strikingly relevant to today's circumstances.

The education portion of this strategy was embodied in the enactment by Congress of the National Defense Education Act (NDEA) of 1958. The NDEA addressed four major educational deficiencies. To address science education in grades K-12, the NDEA created new programs to support the development of modern curricula in science and math and to upgrade the quality of science teaching by funding training institutes for science teachers. Recognizing that more Ph.D.s were needed to staff industrial and federal laboratories and to supply faculty to meet the surge of college enrollment, the NDEA created new graduate fellowships to encourage development and expansion of Ph.D. programs in all disciplines. To help ensure access to college for all who wanted to attend, the measure provided for low-interest student loans to undergraduate and graduate students with financial need. Finally, to ensure a workforce capable of dealing with global economic, diplomatic, and military challenges, the NDEA authorized the creation of foreign language and area studies centers to improve the nation's knowledge of languages and cultures not commonly taught, as well as institutes to train elementary and secondary foreign language teachers.

Simultaneously, in 1958 the government began to increase significantly its support of scientific research, creating both the National Aeronautics and Space Administration (NASA) and the Advanced Research Project Agency – now known as DARPA – within the Department of Defense. Between 1957 and 1961, the federal investment in research and development more than doubled, and total government outlays for basic research at the National Science Foundation and other agencies tripled.[17] Much of this investment went into laboratories at U.S. universities, which were viewed as partners with the federal government in carrying out research vital to the nation's economic well-being and national security. The output of discovery from this investment was extraordinary, and it helped to create an unrivaled basic research enterprise. As one indicator of this, the number of U.S. Nobel prize winners in science quadrupled in the second half of the 20th century.

Likewise, the impact of NDEA was widespread and long-lasting. Implementation of the Act improved the knowledge and skills of a generation of K-12 teachers, brought many universities actively into K-12 science education, and helped the nation produce needed professors to educate the expanding number of college students. It also provided the

research and training base for languages and regional studies that were critical to the U.S. during the Cold War.

Many of today's leaders – in business, academia, and government – benefited directly from the educational opportunities provided through the NDEA and the corresponding increased investments in research. A number of the NDEA's core elements remain in some form across federal agencies, including the NSF and DOD graduate research fellowship programs, the Title VI international education programs at the Department of Education, and the Perkins Loan program, formerly the National Defense Student Loan Program. But as security threats and economic conditions have changed over the years, the national commitment to the NDEA programs has waned. Despite these important remaining elements, the NDEA as a comprehensive strategy no longer exists.

IRONICALLY, THE GREATEST SCIENTIFIC AND NATIONAL SECURITY SIGNIFICANCE OF SPUTNIK WAS AMERICA'S RESPONSE TO IT.

At the same time, the government's commitment to basic research in the physical sciences and engineering has weakened. While some have cited increases in research and development in the private sector as well as government, the fact is that those increases have been devoted largely to development, not to basic research that leads to groundbreaking discoveries.

The success of the NDEA of 1958 in responding to a major test of America's leadership still speaks to us despite the passage of time and the different challenges – and challengers – we face today. What gives this half-century-old law contemporary relevance is that Congress and the Administration understood the central role of education and research in meeting the overriding problems of their day and addressed them comprehensively. America's colleges and universities, in turn, responded quickly to the challenges, as well as to the opportunities offered to them.

Ironically, the greatest scientific and national security significance of Sputnik was America's response to it. Now is the time to apply the lessons of the post-Sputnik experience to America's contemporary challenges.

A New National Strategy – A National Defense Education and Innovation Initiative for the 21st Century

The member universities of AAU believe that the NDEA and the simultaneously strengthened federal commitment to basic research provide a model, in part in substance and wholly in spirit, for engaging today's talented young people in the challenges that lie ahead. Such an initiative will require the participation of colleges and universities, businesses, and federal and state governments.

In Part I of this paper can be found the highlights of the National Defense Education and Innovation Initiative, a set of key recommendations for both the federal government and universities, which must be partners in this endeavor. Part III, which follows this section, provides a detailed list of the proposals that make up the Initiative.

Elements critical to the federal role include:

- Robust support of basic research, much of which is performed at America's research universities, through competitive grants awarded by the Departments of Defense, Energy, and Homeland Security, NSF, NIH, and NASA;

- Developing significant new incentives aimed at producing the scientists, engineers, mathematicians, linguists, international experts, and technically skilled workforce needed to preserve our economic and national security; and

- Ensuring scientific openness and the free flow of ideas, policies, and people that encourage the brightest in the world to study and work in the U.S.

Meanwhile, universities and colleges have an important role in the following:

- Producing the quality talent America needs in government, business, education, and the military;

- Generating new ideas, knowledge, and technology through the conduct of research and scholarship;

- Enhancing undergraduate, graduate, postdoctoral, and teacher education programs; and

- Partnering with business and federal, state, and local governments to improve the U.S. education system at all levels.

The Role of Business

The federal government and universities have a historic relationship in addressing national security and economic challenges through education and research. However, businesses and the business community also have critical roles to play in helping to strengthen our nation's education and research systems. They can contribute significantly by:

- Continuing their individual and collective efforts to educate the public and state and federal decision-makers about the challenges to American competitiveness and security and the need for this type of initiative;

- Identifying and communicating workforce education and training needs and helping to create opportunities to address those needs through partnerships with educational and philanthropic institutions, the federal government, and local and state governments; and

- Increasing participation in partnerships to address the education and research challenges facing our nation.

"As the global center of gravity shifts from West to East…American students must be at the forefront of our engagement with countries like China and India, Iraq, and Afghanistan. To prepare young Americans to understand the peoples who will help define the 21st century, nothing is more important than our ability to converse in their native tongues."

— Secretary of State Condoleezza Rice, January 5, 2006

PART III

Following is an agenda of university and government actions that can make important contributions to this national education and innovation initiative. It expands upon the highlights contained in Part 1of this report. Some of these proposals have been put forward by other organizations as well. We hope that these ideas will receive serious consideration, and we look forward to the emergence of further ideas.

Recommendations for Enhancing Our Research Capacity to Sustain Innovation

Universities and Colleges:

- Strengthen the connection between campus-based research and undergraduate education, including expansion of undergraduate research opportunities.
- Establish interdisciplinary research and education initiatives that create new combinations of faculty, postdocs, and graduate and undergraduate students to address emerging national challenges.
- Provide top young scientists and engineers – postdocs and junior faculty – with independent research opportunities and funding to encourage novel thinking and research.

Federal Government:

- Increase federal investment in basic research supported by the NSF, NASA, and the Departments of Energy, Defense, Homeland Security, and Commerce by 10 percent annually for the next seven years placing particular emphasis upon growing federal support for the physical sciences and engineering. Grow investment thereafter to continue driving innovation.
- Sustain basic medical science funding at historical rates of growth to preserve the biomedical research capacity made possible by the recent doubling of the NIH budget.
- Strengthen federal support for research infrastructure by reinvigorating competitive facilities and equipment programs at NIH and the National Science Foundation (NSF), adequately funding the Department of Energy's 20-year facilities plan, and examining policy changes to strengthen federal support for scientific infrastructure at universities.
- Improve education research and K-12 education by creating: 1) a competitively awarded extramural grant program in the Institute of Education Sciences at the Department of Education that funds high-quality research on K-12 education and 2) a new graduate fellowship program that supports 500 students per year pursuing Ph.D.s in math and science education.
- Create new sources of competitive research funding at federal science agencies targeted toward exceptionally promising young scientists.
- Provide incentives in federal research grants for scientists and engineers to involve more undergraduates in research.

Recommendations for Cultivating American Talent to Enhance the Nation's Math, Science, Engineering, and Foreign Language Expertise

Increasing the Number and Quality of American Math, Science, Engineering, and Foreign Language and Area Studies Graduates

Universities and Colleges:

- Identify and promote best practices and programs in undergraduate STEM and foreign language education, especially those that address college freshman attrition and under-representation of minorities and women in STEM fields.
- Continue reexamination of doctoral education, particularly in STEM and language disciplines, to develop ways to shorten time to degree, improve completion rates, and broaden the scope of Ph.D. education to better prepare students for a wide range of careers.
- Continue to establish and build on professional science masters programs, such as those supported by the Alfred P. Sloan Foundation, that meet specific science and technical managerial workforce needs identified by the federal government, business, and industry.[18]
- Develop academic personnel policies and provide institutional resources to enable more women to pursue challenging STEM careers in academia while meeting family responsibilities.
- Identify and promote best practices in articulation agreements between community colleges and four-year institutions, especially in STEM and foreign language and area studies disciplines.
- Increase participation in study-abroad programs and enhance the capacity of those programs to prepare students to operate effectively in a global environment.

Federal Government:

- Increase by 5,000 the number of graduate fellowships and traineeships supported by existing programs at federal science and education agencies, including NSF, NIH, NASA, and the Departments of Defense, Energy, Homeland Security, and Education.
- Create a graduate fellowship and traineeship program in the DOE Office of Science that supports 1,000 students annually and that generates talent to help achieve energy self-sufficiency and to enhance the nation's scientific enterprise.
- Expand the Department of Defense National Defense Education Program, which provides scholarships and fellowships to students in critical fields of science, mathematics, and engineering in return for a commitment of national service after their studies.[19]
- Increase federal need-based student aid funding, especially the Pell Grant program, to make college possible for the neediest students.

- Build on the Administration's National Security Language Initiative by expanding federal foreign language, area studies, and study abroad programs, including the Title VI international education and Fulbright-Hays overseas programs at the Department of Education; the foreign language and cultural programs at the National Endowment for the Humanities; the Fulbright, Gilman Scholarships, and Title VIII programs at the Department of State; and the National Security Education Program and National Flagship Language Initiative at the Department of Defense.

- Create an institutional grant program to establish or build on professional science masters programs that are designed to meet scientific and technical managerial skill sets identified by the federal government and industry.

Improving the Quality of K-12 Math, Science, Engineering, and Foreign Language Education

Universities and Colleges:

- Provide more university research experiences for those training to be K-12 math and science teachers, and for current teachers.

- Create accelerated teacher certification programs for individuals with expertise in STEM and foreign language and area studies disciplines.

- Create and sustain stronger partnerships with school districts, state departments of education, and businesses that focus on training and retraining K-12 teachers to fill the current teacher skills and knowledge gaps in STEM and foreign language education.

- Improve the integration of teacher education programs into core academic programs to achieve the optimal balance between preparation in how to teach and preparation in the content area to be taught.

- Strengthen education research by encouraging the application of new quantitative and qualitative methods, with a focus on measuring student learning and evaluating education policies and practices.

Federal Government:

- Revive the NDEA K-12 teacher skills summer workshops to help teachers of math, science, and foreign languages improve their teaching skills and meet teaching standards.

- Establish a new mentoring and tutoring program in which college students earn a stipend for tutoring K-12 students in STEM and foreign language coursework.

- Develop a new national program aimed at encouraging students, especially underrepresented minorities and women, to pursue educational pathways that lead to scientific and engineering careers.

- Commission the National Academies to develop recommendations for improved K-12 teaching of science, math, and foreign languages.

Recommendations for Attracting and Retaining the Best and Brightest International Students, Scientists, Engineers, and Scholars

Universities and Colleges:

- Continue to work with Congress and the Administration to combat the misperception that international students, scholars, scientists, and engineers are no longer welcome in the U.S.
- Continue to work with the Departments of State and Homeland Security to improve the visa process so that bona fide international students, scholars, scientists, and engineers can enter the U.S. in a secure, timely, and efficient manner.
- Partner with the federal government, business and industry, and philanthropic organizations to offer incentives to top international graduate students, scientists, engineers, and scholars to study and work in American universities and colleges.

Federal Government:

- Ensure that government policies and contracting practices do not discriminate against or curtail participation by international students and scientists in the conduct of unclassified fundamental research.
- Reform immigration policies to create clear pathways to permanent residency and U.S. citizenship for top international students who earn U.S. degrees, as well as outstanding scientists and engineers in the U.S. on exchange or work visas.
- Continue to improve the visa issuance and screening processes and policies to make them more efficient, including timely extensions and renewals for those in education and research.
- Amend Section 214(b) of the Immigration and Nationality Act of 1952 to place greater emphasis on student visa applicants' intent and financial means to complete a course of study in the United States, instead of their ability to demonstrate evidence of a residence and employment in their home country and their intent to return home.

Recommended Next Steps

In order to ensure the enactment of this Initiative by the 50th anniversary of the NDEA, we must build broad public support for improving STEM and foreign language education and encourage more U.S. students to pursue these critical fields. We must also renew our nation's commitment to investing in basic research critical to innovation and new technologies. To accomplish this, AAU recommends the following:

- Building on the December 6, 2005, National Summit on Competitiveness, the White House should convene a second national summit to bring together Members of Congress and leaders of business, industry, and education to build a consensus around the elements of a National Defense Education and Innovation Initiative for the 21st Century.[20] These groups together should then seek to craft practical solutions based on these elements.

- The White House Office of Science and Technology Policy should ask the National Academies to convene senior officials in science and education agencies to: 1) inventory and evaluate existing STEM and foreign language and area studies education programs; 2) identify inefficiencies and make recommendations for strengthening existing federal programs; and 3) identify ways to improve coordination of existing programs and resources.

". . . if trends in U.S. research and education continue, our nation will squander its economic leadership, and the result will be a lower standard of living for the American people. . . . The good news is that America is able to meet these challenges from a position of economic strength."

— Statement of National Summit on Competitiveness: Investing in Innovation, December 2005

CONCLUSION

Conclusion: A Uniquely American Response

AAU member universities are encouraged by other organizations and individuals who have come forward with ideas to meet the challenges facing our nation. The time to act is now. We as a nation must commit to specific solutions.

Orienting American society to the challenges that lie ahead will not be an easy task. It will take serious commitments of university resources and significant federal expenditures. However, as numerous business organizations have pointed out, these are investments that will produce reliable returns that benefit our society. For any of the major actors – universities, business, and government – to look to others to solve these problems without looking first to themselves is to invite failure. American society has never operated by command. Ours is a culture of self-initiative and problem solving. Our greatest successes have been the product of competitive effort accompanied by collaboration. In this way we have met great national challenges that were beyond the reach of any single individual or sector of society.

OUR GREATEST SUCCESSES HAVE BEEN THE PRODUCT OF COMPETITIVE EFFORT ACCOMPANIED BY COLLABORATION.

As an organization of research universities, AAU believes it must focus on its responsibilities to contribute to American competitiveness and security by doing better what only we can do, namely improve education and research. The recommendations AAU offers specifically outline the contributions universities can and should make. We believe that government and business also have important responsibilities. We stand prepared to do our part. We will work with the federal government, business, and the nonprofit sector to maintain and enhance America's leadership position in the world.

It is our hope that this paper, along with the recent reports issued by a host of business, academic, and other organizations, will convince the Administration, Congress, and the American people that our national and economic security – indeed our global leadership – depend on education and innovation. Both of these objectives rely on a new national commitment in the form of a National Defense Education and Innovation Initiative for the 21st Century.

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Acknowledgements

We wish to acknowledge the several excellent reports that have appeared over the past year concerning the economic and security challenges that the nation faces and the recommendations contained in those reports. Our report provides recommendations from the perspective of the Association of American Universities that we think should be considered by the federal government, by business and industry, and by our research universities in order to meet these challenges. It is our intention to work with other organizations and with the Administration and Congress to implement measures that draw on these recommendations. We believe they are extremely important to our long-term economic and national security.

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Nils Hasselmo, President
Association of American Universities

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