AIR WAR COLLEGE

AIR UNIVERSITY

SCIENCE AND TECHNOLOGY INTELLECTUAL CAPITAL, A CRITICAL US ASSET

by

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Contents

Biography

Colonel Smith is a student at Air War College. She holds a bachelor's degree in Soviet Area Studies from the United States Air Force Academy, and a master's degree in Maintenance Management from the Air Force Institute of Technology. Her operational assignments include various aircraft maintenance positions at Griffiss, Kunsan, McChord, and Tinker Air Force bases. She has also held staff assignments doing research at the Air Force Logistics Management Agency, managing aircraft maintenance contracts for Air Education and Training Command, and serving on Headquarters Air Force as a Legislative Liaison to the United States House of Representatives.

Colonel Smith deployed in support of Operation IRAQI FREEDOM, standing up the strategic airlift maintenance capability at Balad, Iraq. She also deployed Headquarters European Command in support of Operation Enduring Freedom. Colonel Smith commanded the 62d Logistics Support Squadron, the 62d Maintenance Squadron, the 332d Expeditionary Aircraft Maintenance Squadron, and was the Deputy Commander of the 552d Maintenance Group.

Introduction

The potential for losing intellectual dominance in science and technology is a major threat to the ability of the US to maintain national security and economic superiority. The US must ensure it exercises the best possible options to grow, attract and maintain enough qualified individuals to stay ahead of all adversaries. In addition to expanding the base of technology-educated individuals, the threats to the intellectual capital base must be countered in order to secure US ability to deter actions of adversaries. The primary measure of intellectual capital development is the number of undergraduate and graduate degrees earned in science, technology, engineering and mathematics (STEM). It is imperative for the US to focus now on doing what is necessary to maintain educational excellence and post-education opportunities to ensure the US knowledge base in science and technology will remain the strongest in the world.

This paper will examine many aspects influencing the future of US intellectual capital. The first chapter will present the strategic importance of growing, attracting, and retaining graduate-level STEM professionals. This includes first, second and third order effects of having or, conversely, losing US intellectual capacity. Chapter two addresses current trends and specifically addresses the importance of benefiting from foreign-born students and workers. This chapter includes statistics regarding graduate degrees granted in the US to both US citizens and non-US citizens. Chapter three presents initiatives to ensure the US will have a robust technology-educated core in future years. Finally, chapter four lays out potential impacts. It specifically addresses the ability for the US to stay at the cutting edge of innovation and the correlation of maintaining STEM intellectual capacity to countering or deterring technically advanced threats.

The exponential growth of technology combined with rapid globalization point to a future which requires the US to have an advantage in science and technology intellectual capital. Without this resource, the US will be at a disadvantage in many areas, including national security and economic stability. To best prepare for future threats, the US needs to keep priority on growing, attracting and maintaining graduate-level technical capacity.

CHAPTER 1: The Importance of STEM Intellectual Capital

A loss of leadership in S&T could hurt the U.S. economy, living standards, and national security.

- Titus Galema and James Hosek

US Competitiveness in Science and Technology, 2008

The United States earned and has maintained the pre-eminent place on the world's science and technology stage due to a robust higher education system and a pervasive culture of innovation. This advantage contributed to successes in all sectors, and is a perishable resource worthy of attention and preservation. Exponential growth in technological change combined with rapid globalization increases the criticality of the US creating, recruiting, and maintaining science and technology intellectual capital.

Intellectual capital is the compilation of individuals with education and prowess in science & technology who use those talents to benefit the nation. This definition includes both American-born individuals and immigrants. Historically, the technological and scientific knowledge needed for US national security has not been a function of only domestic scientific talent.[1] While the Manhattan project was overseen by a General and chief scientist who were both US-born and educated, over half the key scientists involved were foreign-born. [2] The two scientists most responsible for the hydrogen bomb were born and educated abroad, one from Hungary the other from what is now the Ukraine.[3] Similarly, when the "space race" began with the Soviet Union launching Sputnik 1, the US responded by recruiting Wehrner von Braun, born in Poland. He became known as the "father of the U.S. space program."[4] These examples illustrate that throughout American history, when faced with a threat, the US found the requisite talent wherever available. This has been, in breadth and depth, a uniquely American approach and one that has created diversity and strength in many fields. As part of an effort to maintain and increase intellectual capital, the US must continue to seek, recruit and retain foreign immigrants with science and engineering capability.

Retaining or increasing the advantage of dominant intellectual capacity in science and technology is critical to the US staying at the forefront of innovation and has potential second- and third-order economic, political, military and social effects. Potential first order effects include producing new forms of energy, responding to diseases, protecting the environment, stimulating further interest and excitement in students to study science and technology, sparking the next technological revolution, and enhancing security.[5] Currently, the US is the leader in many of these areas, and a change in that position could alter the world's economic, social and security balance. Possible second order effects of STEM capability include innovation, economic growth, military superiority, and the ability to detect and counter threats. All of these elements support the broad US national strategy of promoting peace and prosperity. Third order effects could include global social changes which alter the balance of power. All of these effects are amplified by globalization.

As an example, the National Academy of Engineering published an in-depth analysis of the impact of globalization on the impact of technical advance. In part, it stated that "the United States must develop the necessary human, financial, physical, regulatory and institutional infrastructures to compare more advantageously with other nations in attracting the technical, managerial, and financial resources of globally active private corporations or individuals."[6] In a globalized world, there is additional opportunity for individuals world-wide to gain expertise and there is increased opportunity for them to use it in a variety of locations for a variety of motivations. The location where a person earns a degree may have less influence on where they will work in the future. Likewise, in a globalized world, the place where a highly-educated worker lives will be less limiting on whose interest they are supporting. This illustrates the importance of growing and recruiting individual intellectual capital working specifically in the interest of the US.

One specific second order effect of intellectual capital superiority is the national security activity of deterrence. Deterrence is rooted in influencing adversary leadership decisions away from a course of action deleterious to the US. This endeavor requires an understanding of actions an adversary is capable of taking, including threats based on emerging technologies. A decreasing US science and technology intellectual base is likely to decrease the US ability to deter these threats. More simply stated, brain power itself provides deterrence capability. If the adversary knows the US has the intellectual ability to understand and counter threats, the chance of achieving the effect they desire decreases. This change in the adversary's decision equation deters them from acting. Likewise, existing weapons are a key component of the US deterrent posture and those weapons also require individuals with the intellectual capability to keep them viable. A current example covers one estimate that the Pentagon is at risk of running out of scientists to operate and upgrade the nation's arsenal of intercontinental nuclear and conventional missiles.[7]

As technology advances exponentially, risk increases due to dependence on vulnerable major networks such as the electrical grid and the internet. Not only are more aspects of human endeavor relying heavily on these networks, but as time goes on, the US is losing the necessary knowledge base required to revert to previous ways of doing business in a crisis. This increased dependence on high-value systems is a compelling reason why maintaining a robust pool of people with critical STEM knowledge is critical to successfully deter adversaries.

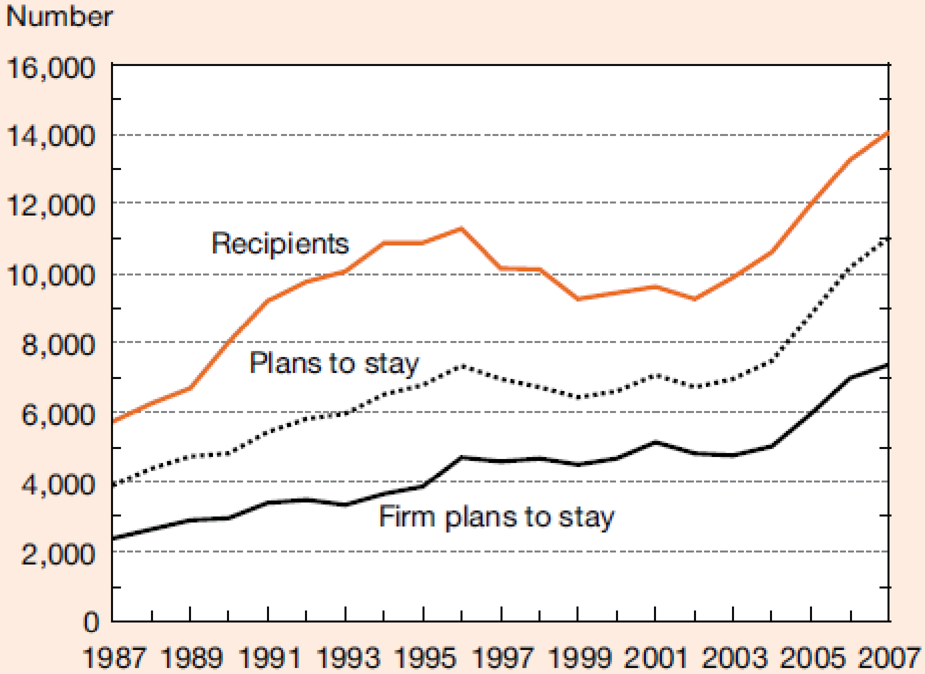
If the US does not take actions necessary to stay at least even, if not ahead, in science and technology, there will be significant and very negative impacts. No other single nation currently covers the spectrum of science and technology accomplished in the US, but this does not make the US invulnerable. The globalized world requires that the US be at least on-par with all potential adversaries in every technology field so not even one adversary can get an advantage by an outpacing advance in one area. If an adversary were to develop an advantage in a technology beyond what the US could deter or counter, that would cause a change in the balance of world power. For this reason, the US must stay even or ahead in all areas, or be prepared to exist in a world where the US is not the number one power.

CHAPTER 2: Current Status and Trends

The number of university degrees a nation awards in sciences and engineering (S&E) is an indicator of a nation's capacity to innovate in that arena. The S&E graduate enrollment in the US declined in the latter half of the 1990s, but has increased steadily since 1999. The most recent data, published by the National Science Foundation in 2010, shows that most technical fields, except computer sciences, increased the number of bachelor's degrees awarded in 2007.[8] Although it is difficult to determine the specific number of degrees required to keep an advantage, a positive trend is promising and far better than the alternative.

Students in the US on temporary visas earned only 4% of the technical bachelor's degrees awarded in 2007, but foreign students make up a much higher proportion of the master's and doctoral degree recipients. In 2007, foreign students earned 24% of S&E master's degrees and 33% of doctoral degrees, bringing the total number of doctorates earned by foreign students to 13,700, a new peak.[9] This large number of degrees earned by foreign students on temporary visas indicates the importance for the US to intervene and encourage these students to stay in the US, and work for US interests. John Smart, preeminent scholar on the future of technology, and founder of the Acceleration Studies Foundation,[10] points to the US culture of innovation and the ability to do valuable research as advantages foreign students see for studying in the US.[11] The next step must be recruiting and retaining individuals in the high-skill work force. Foreign-born intellectual capital is a critical asset. The US has depended on the diversity, competition and personal drive contributed by foreign students both during their education and afterwards in the highly-skilled work force. Fortunately, through the year 2007, this trend is positive, as is the trend of foreign-born graduates who intend to stay in the US after graduation, illustrated below.

Figure 2-21
Plans of foreign recipients of U.S. S&E doctorates to stay in United States: 1987–2007



NOTES: Degree recipients include permanent and temporary residents. See appendix table 2-31 for plans to stay by field of study and place of origin in 4-year increments.

SOURCE: National Science Foundation, Division of Science Resources Statistics, Survey of Earned Doctorates, special tabulations (2009).

Science and Engineering Indicators 2010

The US is still the destination of the largest number of foreign students, but the numbers are trending in a negative direction. US share in 2000 was 25% but in 2006 it had fallen to 20%. UK, Germany and France are the other top destinations.[12] This is a trend worthy of close attention, because attracting foreign students is a primary way of recruiting foreign talent for the long-term. Historically, graduate level science and technology programs in US universities have been the world's benchmark. This acknowledged excellence, combined with the US culture of innovation, made degrees from US universities very attractive to both US-born and international students. The secondary effect of attracting foreign students to US universities is that many of the international students have historically remained in the US after graduation, increasing intellectual resources available to US educational institutions, private companies, and government institutions.

Increased competition from other countries expanding their recruitment efforts is not the only threat to the US attracting foreign students. Several trends threaten to decrease the US advantage in attracting foreign talent between now and 2035. First, US security concerns have increased greatly since the terrorist attacks of 9/11 and as a result visa procedures are more daunting, including those for foreign students and for foreign graduates of US universities who wish to stay in the US to work. Second, at the same time that US policies are making it more difficult for foreigners to stay, improving conditions in many competitor nations are making it more attractive for foreigners educated in the US to return home. The knee-jerk reaction to 9/11, which tightened visa policies, created a 2-year decline in foreign students. This trend reversed with foreign science and engineering graduate students in US institutions increasing in the fall of 2006.[13]. The number of student and exchange-visitor visas issued in 2006 was higher than ever before, and the sum of the other high-skill-related visa categories was near the 2001 high, suggesting a continuing attractiveness of the US to those with advanced education. [14] This improvement bodes well for recovery in the areas of recruitment and retention of intellectual but the dip must be heeded as a warning of how easily the trend can be reversed. The foiled terrorist attack on a Northwest Airlines flight to Detroit on Christmas Day 2009, has reemphasized national attention back to visas for foreigners, and US policy makers must understand that any tightening of visa restrictions may seem to provide short-term improvements in security, but could result in long-term decrease in capability to deter the very threats we are bracing against.

Finally, the pervasive interconnectedness or "flattening"[15] of the world, is a trend that has made it more possible and palatable for foreign-born graduates who do stay in the US to still commit all or part of their efforts to interests in their countries of origin rather than using them to benefit the US. The US must develop a strategic plan now to continue to ensure adequate science and technology skills for 2035 and beyond.

Capitalizing on Foreign Graduates

Attracting foreign students is only the first step in securing foreign-born intellectual capital for the US. Obtaining student visas is not the only issue. After graduation, many foreign graduates have difficulty obtaining visas to stay in the US. In a study of approaches to strengthen scientific technology, Colonel Walter Juzukonis pointed out that the US provides fast-track citizenship for foreign nationals who serve in the US military and proposes a similar fast-track approach for foreign nationals who have earned Doctorate degrees in fields we need to bolster.[16]

Historically the US has capitalized on the advantage of benefiting from "brain drain." This phenomenon occurs when highly skilled immigrants contribute educational and economic gains to a country that hosts them for extended periods or permanently.[17] The "brain drain" from foreign countries is created by a lack of opportunity for individuals to be innovative in their home countries. The US provides attractive opportunities, in a culture of innovation, and the “brain drain” for other nations in turn becomes a "brain surge" for the US. A 2006 report of Brazilian, Chinese and Italian students studying in the US showed that social responsibility and perceived opportunities in their home countries were strong factors in their decision regarding staying in the US or returning to their country of origin.[18] The US can increase the potential for foreign graduates to stay in the US by providing incentives that outweigh individuals' desire to return to their home countries. Investing resources and creativity in influencing these decisions will provide payback if it means the US retains STEM-educated, innovative individuals.

In today's environment, the US must recognize and prepare for multiple levels of external threats. Easy access to information increases the possibility of high-tech threats being wielded by not only nation states, but also groups and individuals. Some see this as an impetus for tighter restrictions on visas and naturalization policy. Ironically, these same policies make it more difficult to expand the pool of individuals with technology and science skills needed to counter those threats. National policy makers must work these issues aggressively, and recognize that keeping science- and technology-educated individuals out of the US is a prescription for increased external threats and decreased US capability to deter or counter them.[19]

T. A. Frank, an Irvine Fellow at the New America Foundation, proposes one way to regain our dominance in the tech sector would be to get more of the brightest people in the world to move here. He contends that because roughly a quarter of technology and engineering start-ups in the United States have founders who were born abroad, it would benefit the US to encourage more talent to come to, and stay in the US. Frank supports a plan whereby any student with an advanced degree in science, technology, engineering or math should be offered a reasonable chance at permanent residency in the United States, with the requirement of employment in that field. A bill presented by Republican Senator John Cornyn in 2007 would have removed caps on employment-based green cards for workers with advanced degrees. This did not get passed. Arlen Specter presented a similar bill which also did not pass. The aim should be to prevent an exodus of the people educated in the US. Some think this policy will hurt low-income Americans. Historically, this is not true, because an increase in high-skill workers tends to create additional jobs, not take them. "[20]

CHAPTER 3: Existing Initiatives

There are many initiatives in work to encourage the future of technological expertise. Great examples already exist of politicians and educators focusing on this important venture. President Obama made STEM education a national priority by putting emphasis on science and technology early in his first term. Even prior to President Obama putting the national spotlight on STEM education, initiatives already were underway at lower levels in the US. Examples exist in efforts of interest groups, states, and individual politicians.

Even before inauguration, President Obama recognized that science and technology need to be reinvigorated. [21] The President made an early announcement that physicist John Holdren would serve as assistant to the president for science and technology and director of the White House Office of Science and Technology Policy. In addition to putting priority on filling this key position, President Obama started talking publicly about improving education in STEM areas. In his own remarks to the National Academy of Sciences, President Obama quoted Abraham Lincoln's statement regarding his creation of the National Academy of Sciences to add "the fuel of interest to the fire of genius in the discovery of new and useful things."[22] In his own words, President Obama stated "Science is more essential for our prosperity, our security, our health, our environment, and our quality of life than it has ever been before."[23] In his remarks, he committed to use polices and incentives to exceed the level of US research and development achieved at the height of the space race. He also committed to improve education in math and science. The President pointed out that in high school more than 20 percent of students in math and more than 60 percent of students in chemistry and physics are taught by teachers without expertise in those fields. He created an incentive for states making commitments to math and science education to compete for additional funds. Further, in response to the the US trailing other nations in creating scientists and engineers, he set a goal for America to have the highest proportion of college graduates in the world by 2020. He also pledged to triple the number of National Science Foundation graduate research fellowships.[24] The tone of his entire speech was one of a commitment to reinvigorate the nation's commitment to science and technology in order to stay competitive academically, and economically.

President Obama is doing more than just talking about improving technology education, he included substantial funding in the proposed FY 2011 Budget specifically targeted at creating the next generation of scientists and engineers who can help drive economic growth in the coming decades. The Budget provides $300 million in new grants to States to develop and implement instructional practices and improve teaching and learning in science and math. The Investing in Innovation Fund totals $500 million and includes $150 million for competitive grants for school districts, nonprofits, and other organizations to test, validate, and scale promising strategies to improve teaching and accelerate student learning in STEM subjects. The Budget also directs the Department of Education to work with the National Science Foundation and other Federal agencies to identify the most effective interventions that can help States, schools, and teachers improve STEM outcomes.[25] Setting the goal for 2020, and providing funding for initiatives show the administration’s dedication to the future of science and technology brain power. These are all good concepts but only become of value if implemented. The current fiscal crisis in the US puts all such programs at risk and the political environment may not be conducive for supporting such expenditures for both fiscal and nationalistic reasons. The arguments for S&T education must be maintained and must strongly illustrate the long term advantages of increasing the current STEM capabilities.

The administration is not alone in attempting to reinvigorate science and technology education. In 2005 a coalition of US 15 business-oriented organizations, named Tapping America's Potential (TAP), set a challenge to double America's graduates with bachelor's degrees in science, technology, engineering and mathematics from 200,000 to 400,000 by 2015. The number increased each year through 2006, but not by enough to meet the goal. Falling short of the target may not be statistically relevant because the target was chosen based on professional judgment of members of business, rather than calculated against needs of the nation. However, the fact that business leaders are giving the issue specific attention is a positive indicator that experts understand the importance of intellectual capital.

Colorado provides one outstanding example of a state-level project to invigorate technology education. Four institutions, the Metropolitan State College of Denver, Colorado School of Mines, Community College of Denver, and Cherry Creek School District, have formed an unprecedented alliance called the Colorado Academy for the Development of STEM-related Careers (Colorado ADSC). It is designed to position the state as a leader in STEM education and to ensure that its students, from kindergarten through graduate level, connected to cutting edge innovation. Colorado's Governor Bill Ritter, has embraced and supported ADSC's vision. The initial focus will be on aerospace, providing education, scholarships, internships, career guidance and mentoring to students desiring skills needed to build aerospace careers. Colorado ADSC will provide educational certifications and specialized training that connect its targeted learning communities from kindergarten to PhDs to ensure job readiness and career enhancement.

Colorado ADSC will also collaborate with Colorado Workforce Centers, which will facilitate training and assist in job placement."[26] This program could be used as a model for other states and, if leveraged properly, could educate and inspire a whole generation of US students.

Individual politicians have also recognized the importance of STEM education. Republican Congressman Randy Forbes (VA-04) obtained a National Science Foundation grant of $989,747 for Virginia State University to target minority students with the intent to increase the pool of STEM students. In the US, this segment of the population has been under-represented in the STEM fields and tapping into that resource is another potential method to increase the intellectual capital for the future. The money will fund a three year study aimed at improving test scores for minority students in STEM fields. Forbes hopes the study can become an education model, and said it "is about more than just advancing test scores and equality in education; it is about economic advancement and ensuring that the United States retains its edge in the math, science and technology fields--a critically important requirement in today's global economy."[27] While the intent is good and should be supported, it does have the scent of “pork” politics so proper argumentations need to accompany such proposals to defend them in the political arena.

The issues of creating and maintaining intellectual capital are complex and require a multi-faceted approach. The initiatives listed above merely provide examples of methods which could yield benefits. Globalization increases competition for intellectual capital and makes it critical for all levels of US government, business, and education to find innovative, effective ways to encourage STEM education, and attract and retain STEM-educated researchers and workers.

CHAPTER 4: Implications for Deterrence in 2035

All indications are that technology will continue to develop at an increasing rate and that globalization will continue to "flatten" the world. The world of 2035 will benefit from positive technology innovations which improve health care, information availability, energy sources, and human performance. The technologies which will make these improvements possible will also offer adversaries opportunities to use them for negative purposes. As always, US national security in 2035 will depend upon the ability to deter adversaries. Intellectual capital in STEM professions, whether residing in US- or foreign-born individuals is the foundation of any deterrence. STEM knowledge is an enabler for deterrence.

Deterrence is dependent upon a potential adversary determining that an action on their part will wither fail to get the result they seek or will create an intolerably high cost or risk.[28] The US relies on deterrence as a major element of national security strategy and to keep it viable must stay aware of developing technological advances. This can only be accomplished if the US harnesses the capabilities of individuals who can understand and competitively operate in the fields of nuclear weaponry, cyber warfare, chemistry, molecular biology, nano technology, directed energy and the space domain. In addition to understanding evolving technologies, the US must maintain existing deterrence options, like nuclear and conventional weapons, while developing new offensive and defensive weapons. Deterrence are crucially dependent on science and technology.

Space as a Case Study: US May Not Have Advantage in 2035

There are many areas of concern for deterrence in the year 2035. Primary among these are threats in cyber, nuclear, biological, directed energy, nano and space technology. The space domain provides a valuable example as a critical area in which the US must be prepared to deter threats into the future. It is also a good example of an area which produces second-order effects because it is an industry which drives economic growth. According to *The Space Report 2009*, "it is unclear whether the U.S. education system can drive growth in the number of new skilled science and technology graduates, especially those with advanced degrees, needed to replace veteran U.S. space workers who are retiring."[29] The number of bachelor's degrees awarded in "space critical" fields dropped by 8% between 1986 and 2006.[30] These specific degree areas are Earth and atmospheric sciences; mathematics and computer science; and engineering.

These trends do not bode well for the future of the space industry nor national security interests in the space domain. The demand for key space industry occupations is projected to grow over the next 10 years, and unless the number of space critical graduates increases, or the US is able to recruit foreign talent, jobs will go unfilled.[31] "The key to maintaining US technology preeminence is to encourage and develop skilled scientists and engineers who strengthen the space industry.[32] The US space industry is just one example of a domain in which the US may not maintain intellectual dominance through 2035.[33] Each area of potential threat must be evaluated individually with space providing just one clear example of the criticality of maintaining intellectual dominance.

CONCLUSION

Maintaining the advantage in science and technology intellectual capital is critical to the future of US security. Current trends are positive and initiatives are in work to grow, attract and maintain enough qualified individuals to stay ahead of adversaries. However, the past decade has shown that these trends are vulnerable to sudden change. The tightening of visa processes after 9/11 demonstrated that the inflow of foreign students and experts can reduce very quickly. Although the intended consequence of keeping terrorists out is vital, the federal government must also recognize the ramifications of decreasing the source of technical expertise. In the near-term it is likely that the US will continue to rely on foreign-born individuals to maintain the science and technology advantage. If the US chooses to reduce historic dependence on foreign-born brain power, there must be a corresponding increase in home-grown expertise. The most robust pool of individuals can be amassed by a combination of attracting foreign-born students and experts and increasing US born presence in the highly educated technology arena.

President Obama has expressed the issue of improving science and technology education as a matter of national importance, and proposed substantial funding in the proposed FY11 Budget. Industry, state, and local initiatives are also in place to provide educational opportunities to increase the number of US-born students earning technology degrees. Adjusting visa and immigration laws to enable the US to attract and retain even more talent from other nations will reduce the threat of the US falling behind in capability to lead innovation in science and technology. This lead is crucial to deterring adversaries, whether they are nation states, non-state actors, or individuals.

If the US does not maintain the lead in critical technologies like nuclear weaponry, biological warfare, nano technology, cyber warfare, directed energy and space technology, it is likely that one or more adversaries will take advantage of areas of weakness. Current deterrence depends on the adversary believing the US has the capability to deter and will to take decisive action. The capability is created by those with understanding of cutting-edge technology. If an adversary did not think the US could act decisively, they would be more likely to take offensive action. A cyber-attack could interfere with almost any US data system, and could potentially disrupt most US military operations. A space attack could eliminate access to the Global Positioning System which, at a minimum, would make navigation nearly impossible, and disrupt banking world wide. A biological attack could eradicate a vast portion of the US population. Each of these are examples of events that, undeterred and un-countered, could change the balance of power and threaten the American way of life. Current intellectual capacity makes deterrence viable and supports development of methods to recover if one of these attacks did occur. Without qualified scientists and engineers, the US could not replace or establish a work-around for GPS after a space attack. Likewise, vaccinations and antidotes would not be possible to counter or minimize the impact of a biological attack. These are just two examples of a plethora of possible threats if the US does not maintain intellectual superiority.

The US enjoys its position as the one remaining super power in large part due to its broad-spectrum of intellectual expertise in technology fields. In his February 2010 State of the Union address, President Obama stated that the US is not going to be "number 2." Maintaining the position as "number 1" means more than maintaining national security. As the leader of technology development, the US also gets to set policy. This has world-wide implications for areas like human genome mapping, nuclear weaponry, and biological warfare. As the leader in these areas, the US can best influence international treaties, bans, and agreements. Intellectual capital is a critical national security resource which cannot be regained rapidly if it is allowed to deteriorate. Keeping the advantage is a wise investment in the future.

ENDNOTES

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[6] Lee, National Interests in an Age of Global Technology, 5.
[7] Kelley, "Report: U.S. Missile Science Slumping."
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[20] Frank, Green Cards for Grads, A7-8.
[21] Leshner, A Wake-Up Call for Science Education, A11.
[22] Obama, Remarks at the National Academy of Sciences, 1.
[23] Ibid., 2.
[24] Ibid.
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