

“The Impact of Restricting Information Access on Science and Technology”

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“Scientific progress on a broad front results from the free play of free intellects, working on subjects of their own choice, in the manner dictated by their curiosity for exploration of the unknown.”

“Science the Endless Frontier,” Vannevar Bush, 1945

I. Background: These Are Not New Issues

The dynamic tension between the free exchange of ideas and the concern for their exploitation by those who would do us harm is a longstanding challenge. Following World War II, great advances in science and technology were fueled by significant investments by the federal government. Several times during these technological revolutions, concerns for security created impediments to the broad dissemination of research and several committees and panels investigated this. Much has been written on these discussions and we can benefit from the wisdom in these writings.¹

In the 1950s, colleges and universities were growing increasingly dependent on federal support for their research programs. In 1957, 84% of federal research funds were directed for military purposes.² Thus, concerns at the time surrounded the security restrictions on communications from federally funded research and those by private industry as well. In addition, the community questioned the balance in the U.S. science research portfolio caused by the lack of a federal rationale and emphasis on immediate practical results.³

A 1950 National Academy of Sciences report for the Department of State entitled *Science and Foreign Relations* stated: “The principal damage of unnecessary restrictions lies in the creation of a furtive atmosphere in which the flow of information necessary to progressive science is brought to a halt.”⁴

The space race and the Gemini and Apollo projects, brought upon by Sputnik, inspired a new generation of scientists and engineers who practiced “flash” drills at elementary

¹ See: Harold C. Relyea, *Silencing Science: National Security Controls and Scientific Communication* (Norwood, NJ: Ablex Publishing Corporation, 1994); Edward Teller, *Secrecy: The Road to Nowhere*, Technology Review, October 1981, pg. 12; *Striking a Balance: National Security and Scientific Freedom, First Discussions*, ed. Harold C. Relyea (Washington, D.C.: AAAS, 1985); Committee on Science, Engineering, and Public Policy (U.S.), Panel on Scientific Communication and National Security (Dale R. Corson, Chair), *Scientific Communication and National Security: A Report* (Washington, D.C.: National Academy Press, 1982).

² Harold C. Relyea, *Silencing Science: National Security Controls and Scientific Communication* (Norwood, NJ: Ablex Publishing Corporation, 1994), 13.

³ Ibid.

⁴ U.S. Department of State, *Science and Foreign Relations*, Washington, D.C., 1950.

school by crawling under their desks in case the explosion from an atomic bomb was seen. The cold war brought about heightened tensions regarding nuclear weaponry and delivery capabilities. After détente collapsed in 1979, national security controls affected professional conferences, visiting foreign scholars and study programs and courses available to students from certain countries.⁵ One conference, an American Vacuum Society meeting in 1980 on magnetic bubble memory devices, ran into export control restrictions and ultimately rescinded invitations to conferees from Hungary, Poland and the Soviet Union while other attendees were required to sign an agreement not to “re-export” information to named countries. That same year Russian scientists, including one working at the University of Texas, were prevented from traveling to an Institute of Electrical and Electronics Engineers and Optical Society of America conference on lasers, electro-optical systems and inertial confinement fusion due to the open display of technical equipment deemed sensitive.⁶

In 1981, the Department of State sought to restrict the access of a Hungarian engineer visiting Cornell University. After being informed that he would not be able to participate in private seminars or discussions and could not have access to preprints of papers they cancelled the visit. Also that year, MIT declined a \$250,000 contract from the Air Force because of federal control over the publication of research results. The presidents of these and other universities called for clarification that export control regulations “are not intended to limit academic exchanges arising from unclassified research and teaching.”⁷ Unfortunately there was no resolution of this issue and difficulties for international exchange persisted, with several startling actions by U.S. Customs officials in the name of protecting U.S. technology, including the confiscation of books and documents from departing academic visitors.

In 1985, Mikhael Gorbachev brought a reform movement, *perestroika*, and a new leadership having *glasnost*, or openness, as one of its fundamental principles. As the Soviet Union loosened its hold on Eastern Europe, democratic reforms flowed through the former Communist bloc culminating with the destruction of the Berlin Wall and free elections in Hungary, Czechoslovakia, Poland, and finally the new federation of former Soviet Republics. While the cold war ended, the national security laws restricting scientific and technological communication in the past remained on the books and would be used in other contexts against new enemies.⁸

Meanwhile, a new threat emerged as a trade war and technology race developed in the Pacific Rim. By the 1980s, concerns with the Japanese trade surplus and growing superiority in some commercial sectors elevated commercial interests to the same threshold as strategic concerns.⁹ In fact, since this period, U.S. economic health has

⁵ Relyea, 118.

⁶ Stephen H. Unger, “National Security and the Free Flow of Technical Information,” in *Striking a Balance: National Security and Scientific Freedom, First Discussions*, ed. Harold C. Relyea (Washington, D.C.: AAAS, 1985), 33-34.

⁷ Gina B. Kolata, “Attempts to Safeguard Technology Draw Fire,” *Science* 212 (1 May 1981): 523.

⁸ Relyea, 189-93.

⁹ Paul E. Gray, “Advantageous Liaisons,” *Issues in Science and Technology*, Spring 1990, National Academies Press, 40-46.

become an important consideration in security discussions. Export control laws, long a mechanism to control the transfer of goods having *military* applications, became a means to limit the export of goods or technologies having *commercial* value.¹⁰ This dual focus contributes to some of the difficulties experienced in university research administration today.

II. United States Leadership in Science and Technology

Today, the national and world economies, as well as our national security, increasingly are driven by science and technology.¹¹ Indeed, technological innovation has been responsible for more than 50 percent of the growth of the United States economy during the last 50 years, and this trend is continuing and accelerating in the age of knowledge-based economies.¹² The National Science Foundation (NSF) has found that “scientists and engineers contribute enormously to technological innovation and economic growth” despite their constituting less than five percent of the workforce. Most nations regard science and technology “as a key determinant of economic growth,”¹³ and consequently, the demand for scientists and engineers is projected to significantly exceed that for other occupations in this decade.¹⁴

The United States has a uniquely effective R&D system where universities are the dominant source of fundamental scientific and engineering research. The federal government funds university research projects selected through merit-based competitions in a marketplace of ideas. In addition to serving the purposes of the federal government, many of these results are moved into the private sector through entrepreneurship and licensing of patents. Each federal dollar serves the nation in two ways: it supports science and technology research while also educating the next generation of scientists and engineers. This close relationship between scientific research and education is a hallmark of U.S. leadership in science and technology. Germany and Russia struggle with a system of premier laboratories separated from their university structure.¹⁵ This separation hinders the innovation that arises from student-faculty interactions and

¹⁰ Export of military hardware and technical data is controlled by the International Traffic in Arms Regulations (ITAR) dating back to 1954 while the export of commodities of commercial interest (and the technical data related to their design, manufacture and utilization) is controlled by the Export Administration Regulations (EAR) from 1979.

¹¹ *Science and Engineering Indicators 2002* (Washington, D.C.: National Science Board, National Science Foundation, 2002), 0-8, 3-4, 3-10 to 3-11, and 6-5.

¹² There is a large literature on the close correlation between technological innovation and economic growth; current trends are regularly summarized in the *Science, Technology and Industry Outlook* published by the Organization for Economic Cooperation and Development. Much of this analysis draws on the pioneering work of Robert M. Solow, notably “A Contribution to the Theory of Economic Growth,” *Quarterly Journal of Economics* 70 (February 1956): 65-94, and “Technical Change and the Aggregate Production Function,” *Review of Economics and Statistics* 39 (August 1957): 312-20.

¹³ *Science and Engineering Indicators 2002*, 5-44.

¹⁴ *Ibid.*, 3-27.

¹⁵ Loren R. Graham, *Science in Russia and The Soviet Union: A Short History* (Cambridge: Cambridge University Press, 1993), 177.

diminishes the recruiting ability for science and technology research concerns in academia and industry.

Today, the nation's "international economic competitiveness ... depends on the U.S. labor force's innovation and productivity."¹⁶ However, NSF warns that "[s]cience is a global enterprise [and has been so] long before 'globalization'."¹⁷ To achieve that innovation and productivity, it is increasingly necessary to pursue national and international collaborations.¹⁸ The U.S. cannot educate students, undertake research, or produce technology for society in isolation from the rest of the world if it hopes to maintain its leadership in science and technology.

III. The U.S. Science and Technology Melting Pot

American leadership in the global science and technology enterprise has arisen in part from the continual influx of the world's best minds in science, engineering, and technology. Foreign students and scholars are critical to the vitality of American innovation. Many stay and contribute significantly to our economy and national research efforts. They provide much of the leadership and skilled workforce of our high tech sector. A recent trade magazine noted that the number of foreign-born CEOs in U.S. companies has nearly quadrupled since 1996, with CEOs from almost 100 foreign countries now leading American companies.¹⁹ Nearly 40 percent of U.S. engineering faculty are foreign-born,²⁰ and more than a third of U.S. Nobel laureates are foreign-born.²¹ Additionally, nearly half of the scientific and medical professionals at the National Institutes of Health are foreign nationals.²² Many others return to their native countries to influential leadership positions with an understanding and appreciation of American values. Their contributions to global security are immeasurable.

Startling trends warn us of impending problems. The National Science and Technology Council "has expressed concern about the nation's ability to meet its technical workforce needs and to maintain its international position in [science and engineering]."²³ Because the college-age population in the United States, Europe and Japan has steadily declined in the past two decades, major industrialized countries have sought foreign students to satisfy the demand for graduate students in science and engineering.²⁴ U.S. production of bachelor degrees in engineering, mathematics, computer sciences, and physical sciences has generally been declining since 1986.²⁵ Forty-one percent of engineering graduate

¹⁶ *Science and Engineering Indicators 2002*, 3-28.

¹⁷ *Ibid.*, 3-27 to 3-28.

¹⁸ *Ibid.*, 5-43 to 5-49.

¹⁹ David Lipschultz, "Bosses from Abroad," *Chief Executive* 174 (January 2002): .

²⁰ *Science and Engineering Indicators 1998* (Washington, D.C.: National Science Board, National Science Foundation, 1998), 2-20.

²¹ "Chronology of Nobel Prize winners in Physics, Chemistry, and Physiology or Medicine," *Nobel e-Museum – The Official Web Site of The Nobel Foundation*, (<http://www.nobel.se/index.html>).

²² Bernard Wysocki, Jr., "Foreign Scientists are being Stranded by War on Terror," *The Wall Street Journal*, 20 January 2002.

²³ *Indicators 2002*, 2-7.

²⁴ *Ibid.*, 2-7.

²⁵ *Ibid.*, 2-19.

students and thirty-nine percent of math and computer sciences graduate students in the United States are international.²⁶ Even though the decline of college-age students in the United States has begun to reverse and many efforts are being made at the K-12 level to encourage more U.S. students to take an interest in science and engineering, in the near term our nation's ability to maintain leadership in the science and engineering marketplace will depend on the increasing participation of under-represented minorities and women, *and* on sustaining the international student population.²⁷ It will become difficult to recruit both domestic and foreign talent to science and technology research if an atmosphere of secrecy and burdensome regulations prevail.

International Conferences and Collaborations

U.S. scientific and technological leadership is made possible by a creative environment fostered by international exchange and collaboration. High-level conferences, symposia, and collaborations provide the feedback, replication, and cooperation that are essential to the production of cutting-edge science and technology. Such interactions between leading American and foreign scientists and engineers have become pervasive in science today. Indeed, internationally co-authored papers now account for thirty-two percent of multi-authored papers.²⁸ Yet, this past October, almost 100 scientists were prevented from attending the World Space Congress in Houston due to visa delays.²⁹ The Chinese-American Frontiers of Science, the premier bi-national meeting of young scientists hosted by the U.S. National Academy of Science, had to be postponed due to visa impediments.³⁰ Distinguished foreign visitors and collaborators are being turned away from our institutions causing the disruption of invaluable research collaborations and exchanges.

The recent redefinition of criteria for the NSEERS (National Security Entry-Exit Registration System) program to include country of origin rather than citizenship have caused distinguished Canadian professors with world-renowned research programs to be treated as if they are criminals by being fingerprinted and photographed on both entry into and exit from the United States. The understandable refusal to travel to the U.S. as well as a solidarity movement by colleagues not personally affected will have a tremendously detrimental impact on U.S. research programs, conferences and international collaborations. The number of NSEERS countries has grown to twenty-five and may continue to expand.³¹

²⁶ Ibid., 2-27.

²⁷ Ibid., 2-16, 2-20 to 2-21, 2-25, 2-27.

²⁸ Ibid., 5-45.

²⁹ Wysocki, Jr., *Wall Street Journal*.

³⁰ Staff of the National Academies, telephone conversations, March 2003.

³¹ Javad Mostaghimi, "Impact of the American NSEERS Law on the North American Academy" (University of Toronto, unpublished white paper, 2003).

Increasingly, complex scientific challenges command large international facilities, national laboratories, and international collaborations. The use of Department of Energy (DOE) synchrotrons by international colleagues grew from 6% in 1990 to 40% today while the overall number of users grew from 1600 to 6000 per year.³² The D-Zero accelerator project, a world-class \$5 million-a-year operation located at the Fermi National Accelerator Laboratory, a DOE facility, is an example. Five hundred scientists from eighteen countries work on the accelerator. Visa problems have delayed and prevented some of the collaborators from entering, impairing the collaborations that fuel hardware and software advances. Left to grow unchecked, these problems will undoubtedly drive important interchanges and opportunities away from the U.S. to the detriment of our community, our security and our economy.

Cold-war Isolation?

After the release of the Corson report in 1982, then OSTP Director, George A. Keyworth II commented, “The last thing we want to do is ape the repressive Soviet model which stifles technological innovation through its obsession with secrecy.”³³ Clearly, there were many factors contributing to the decline of Soviet science and technology research during the cold war.³⁴ One key element, however, was the atmosphere of secrecy and repression in the scientific enterprise. Large, impersonal departments did not foster the kind of collegial interaction and breadth of research that American university departments do.³⁵ Evidence of Soviet isolation is found in any U.S. university’s list of international students and scholars from the former Soviet Union; at MIT their numbers were near zero until 1985, briefly rose into the single digits, then fell until 1991 where they climbed steadily to the dozens.³⁶ The self-imposed isolation of the Soviet Union during the cold war severely interfered with international exchanges, contributing to the utter collapse of Soviet science and technology and the mass exodus of talent. Significant numbers of Soviet scholars immigrated to Germany, Israel and the U.S. in the 1990s and the brain drain continues today³⁷ This isolation contributed to other problems such as the lack of a peer review system, a non-competitive research funding process, poor communication and collaboration between laboratories and a lack of awareness of breakthroughs in the West. We must prevent isolation of the U.S. from leading to a similarly disastrous scenario.

Although this may sound alarmist, the fact is that both Europe and Asia now graduate more PhDs in science and engineering than the U.S. does and also have world-class

³² Raymond Orbach, speech at Harvard Nanotechnology meeting April 10, 2003.

³³ Philip M. Boffey, “Security of U.S. Said to Be Hurt By Data Leaks,” *New York Times*, 1 October 1982.

³⁴ Loren Graham, *Science in Russia and the Soviet Union*, (Cambridge: Cambridge University Press, 1993).

³⁵ Thane Gustafson, “Why Doesn’t Soviet Science Do Better Than It Does?” in *The Social Context of Soviet Science*, eds. Linda L. Lubrano and Susan Gross Solomon (Boulder, CO: Westview Press, 1980), 31-67.

³⁶ Data obtained from the MIT Registrar’s report included in the Annual Reports to the President.

³⁷ See Graham, 2002.

research, especially in emerging fields like nanotechnology.³⁸ Moreover, Britain, Australia, and Canada have realized gains in foreign student enrollments in each of the past two years.³⁹ Foreign students and scholars have choices and the U.S. must compete to attract the world's brightest minds.

Particularly damaging are the now-common situations where students, scholars, or faculty already admitted to the U.S. and engaged in study and research, travel outside the U.S. (often for academic or serious personal reasons) and are unable to return. The cases are troubling, with research projects suspended, classes unattended, and (in some cases) family members and belongings stranded in the U.S. The enhanced scrutiny for returning visa holders seems a poor use of finite homeland security resources. If the U.S. does not promptly find a means to expedite visas for high quality students, scientists, and technologists, our nation will pay a heavy price that will be measured in the talent and opportunities that are lost to foreign competitors.

History seems destined to repeat itself. The stories today give us *déjà vu*, yet they are perhaps more compelling since our relationships with international colleagues are so much stronger twenty years after the "bubble memory" incident. These recent anonymous examples (from among many) illustrate the burden immigration problems are putting on universities:

- Dr. B has been coming to TechU for visits of varying lengths since 1993 as a guest of a faculty member and in conjunction with a large international project. Dr. B is a member of the Russian Academy of Science as well as the European Academy of Science, and is chair of a large Department in a top Russian University. He has been granted J visas on many occasions by the U.S. consulate in Moscow, so he is no stranger to their systems. Dr. B's J visa is stalled, despite the intervention of a U.S. Agency contact at the Moscow embassy. The project is on the brink of their definitive test, but the delay may prevent B's participation.
- An assistant professor of Electrical and Computer Engineering has been working at a U.S. University under an H1-B visa. He and his family (wife, a British citizen; two children, U.S. citizens) went to Egypt during the summer of 2002 to visit family. His wife and one child have returned to the U.S., while his return has been delayed, due to security clearance requirements. He applied for an H1-B1 non-immigrant visa at the U.S. consulate in Cairo, was twice interviewed by the consul and talked to the U.S. ambassador who could not expedite matters. The Dean of the College of Engineering was informed by the U.S. embassy in Cairo that a visa cannot be issued prior to obtaining the required clearance from Washington, D.C. The professor missed his scheduled fall class, and he is one of only three faculty members who can teach his course (and one is retired and the other is currently on an administrative assignment).

³⁸ The Strategic Task Force on International Student Access, *In America's Interest: Welcoming International Students* (NAFSA, Association of International Educators), 2003.

³⁹ *Ibid.*

- A faculty member with a J visa status went home to China in summer 2002, and in July he applied for a new visa to return to the U.S. He is still waiting for a decision on his application. When he did not return in time, his department arranged for someone to teach his class temporarily. Now, the department is planning to make the temporary assignment permanent, and will try to find another role for the J faculty member to fulfill, while he remains in China on the university payroll.

Immigration Issues

Two mechanisms to characterize and track international students and scholars deserve our utmost attention and care. The *Technology Alert List* (TAL), which triggers security reviews of foreign students and scholars, has recently been expanded to cover areas of study and research that appear to have no relevance to security, e.g., architecture, planning, housing, community development, environmental planning, landscape architecture and urban design, and to cover many others with tenuous links, e.g., civil engineering. Adding these areas of study to the TAL has created a debilitating backlog in cases and undermines the review process. A new mechanism should be put in place to ensure a continuing and intensive collaboration between the scientific community, and the government to narrow, focus and maintain the accuracy and efficiency of the TAL as guidance to consular officers.

The Student and Exchange Visitor Information System (SEVIS) can be a great improvement in security and record keeping. The ability to have a database of the information previously handled by cumbersome paper forms will be a great asset. The university community strongly supports the implementation of SEVIS and is working hard to deploy it. Unfortunately, however, the launch of SEVIS has been plagued by problems. Technical defects have had very serious consequences for students and scholars. Students and scholars erroneously flagged face immediate deportation. These technical flaws must be rectified immediately. SEVIS must also have the capacity to accept corrections arising from human error without creating unduly harsh consequences for the individuals or the universities. The system must be made robust and accurate before the community moves the estimated one million files into SEVIS to meet the August deadline.

These immigration issues indicate that the U.S. role as an intellectual magnet for the best and the brightest minds is precarious. Barriers to immigration and scientific visits could rapidly tip the scale and make other nations more attractive. It is in our nation's interest to bring in the best students and scholars by the most efficient and safest means.

IV. Openness in University Research

Science and engineering are fast-paced, interactive and collaborative enterprises that follow unpredictable paths and continually build on the work of others in unexpected ways. Nothing is more crucial to the progress of research than communication with colleagues and the cross-fertilization of ideas. This interchange occurs at all levels from students in neighboring laboratories to faculty attending international conferences. Brilliant advances often arise from an analogy drawn from a discussion with a colleague working in an entirely different field. The fallacious idea that research can be subdivided, cordoned off, or kept apart is deadly to our progress and our leadership. Research thrives on openness and suffers in isolation.

Today's Problems Demand Global Solutions

The recent worldwide epidemic of Severe Acute Respiratory Syndrome (SARS) highlights the global integration of society and our resulting interdependence. The World Health Organization (WHO)'s Global Outbreak Alert and Response Network coordinated an international effort uniting thirteen laboratories in ten countries to identify the cause of SARS. This international team makes use of the laboratories having significant experience in infectious diseases and high quality facilities to improve diagnoses and develop a treatment.⁴⁰ Clearly global exchange and international scientific collaboration and cooperation are critical to solving problems of this magnitude. Within a month, the collaboration identified a new pathogen, a member of the coronavirus family never before seen in humans, as the cause of SARS. "The pace of SARS research has been astounding," said Dr. David Heymann, Executive Director, WHO Communicable Diseases programmes. "Because of an extraordinary collaboration among laboratories from countries around the world, we now know with certainty what causes SARS."⁴¹ The spread of the disease and the delay in effective testing and treatment were exacerbated by the initial secrecy regarding the outbreak in China. An interim report on the SARS outbreak in Guangdong Province by a WHO team of experts recommends improved collaboration between virological laboratories in China to facilitate exchanges of results, specimens and reagents.⁴² The potential importance of "super-spreaders," source cases that, for reasons not yet understood, infect large numbers of people, shows how critical global communication, collaboration and response are to epidemics of this type. Clearly these and other aspects of health and homeland security require a worldwide approach.

The university research community responds effectively in times of national need. We have a strong history of public service and technological superiority has been a hallmark of our strategic might. While today MIT believes that we can best serve the nation by

⁴⁰ "WHO Coordinates International Effort to Identify and Treat SARS," World Health Organization press release, 17 March 2003 (<http://www.who.int/mediacentre/notes/2003/np4/en>).

⁴¹ Update 31 - Coronavirus never before seen in humans is the cause of SARS, Unprecedented collaboration identifies new pathogen in record time 16 April 2003, World Health Organization report (http://www.who.int/csr/sarsarchive/2003_04_16/en).

⁴² "Update 25 – Interim Report of WHO Team in China, Status of the Main SARS Outbreaks in Different Countries," World Health Organization report (http://www.who.int/csr/sarsarchive/2003_04_09/en).

pursuing open, unclassified research, the institute does provide mechanisms for faculty to participate in classified programs at other institutions⁴³.

As stated recently by MIT President Charles Vest: “As we respond to the reality of terrorism, we must not unintentionally disable the quality and rapid evolution of American science and technology, or of advanced education, by closing their various boundaries. For if we did, the irony is that over time this would achieve in substantial measure the objectives of those who disdain our society and would do us harm by disrupting our economy and quality of life.”⁴⁴

Restrictive Research Contracts Redux

The tumultuous years in the early eighties motivated much dialogue and many panels, committees and reports. In 1985, President Reagan recognized the critical importance to the nation of preserving the principle of openness while maintaining necessary national security. He promulgated National Security Directive 189 (NSDD-189), which reinforced a core principle for the conduct of basic and fundamental research at colleges and universities, primarily that there be no restrictions on the publication of research results. In so doing, NSDD-189 confirmed classification as the appropriate means to control federally sponsored university research with national security implications. Supported strongly by universities and sustained by every subsequent administration, NSDD-189 remains in effect today.⁴⁵

It is therefore both startling and disappointing to find restrictions placed on publication and the participation (or approval by the sponsor) of foreign students in unclassified research projects today. Two agreements from the same agency may contain different and inconsistent language. This clouds the government granting process and does little to serve the goals of national security and scientific and technical progress. It also leads to debilitating delays of months and years in contract negotiations. Some universities have begun to refuse research funding rather than accept such restrictions.⁴⁶ Of particular concern is the *ad hoc* nature of restrictive research contract clauses and the use of vague categories like “sensitive but unclassified.” MIT and the Council on Government Relations have maintained a list of examples of restrictive clauses found in research contracts⁴⁷.

⁴³ *In the Public Interest: Report of the MIT Ad Hoc Faculty Committee on Access to and Disclosure of Scientific Information*, Sheila Widnall, Chair, June 12, 2002, available at <http://web.mit.edu/faculty/>.

⁴⁴ Charles M. Vest, *Response and Responsibility: Balancing Security and Openness in Research and Education*, Report of the President for the Academic year 2001-2002. Available at: <http://web.mit.edu/president/communications/rpt01-02.html>.

⁴⁵ Statement by John Marburger, Joint NAS/CSIS Workshop on Openness and Security, 9 January 2003.

⁴⁶ Richard Monastersky, “Publish and Perish?” *Chronicle of Higher Education*, 11 October 2002; and Megan Twohey, “Colleges Fight New Restrictions on Use of Research,” *The Federal Paper* (20 January 2003): 3.

⁴⁷ Paul C. Powell, Julie T. Norris, and Robert B. Hardy, “Selected Troublesome/Unacceptable Clauses Related to Information Release and Foreign Nationals,” available at <http://mit.edu/osp/www>.

Despite the persistent nature of this issue in recent history, the current state of science and technology make openness even more pressing today. Three reasons that this is so are:

Science is increasingly interdisciplinary. Interdisciplinarity requires open communication and collaboration, new things arising from serendipitous interactions. Working in fields between traditional disciplines requires that barriers be broken down between disciplines, cultures, disciplinary arrogance; researchers need to learn each other's languages.

Science is fueling technology more rapidly than ever. The distance between fundamental breakthroughs and applications affecting society is growing smaller and technology transfer is becoming more rapid than ever. Note how quickly USB "memory sticks" have replaced CD burners as the backup medium of choice. The effective transition of technology to society requires openness and communication between universities, government laboratories, and industry.

US leadership in science and technology relies on close marriage between research and education. Research and education go hand in hand and are the most productive ways to produce new knowledge and to train new scientists. These, in turn, fuel our economy and quality of life. The close interplay between research and education requires open communication, formal and informal teaching settings, and the unencumbered participation of students in laboratories and research groups.

V. Conclusions

What are the impacts of restricting information access on science and technology today? I enumerate a few issues that I believe undermine our leadership in science and technology:

- The control of information restricts its dissemination domestically as well as internationally. This undermines our system of peer review, competitive proposal evaluation, and collaboration and removes the serendipitous discoveries arising from casual access. Openness must be preserved in research supported by industry as well as the government.
- The restrictions of research results discourage young people from pursuing research in heavily regulated fields. If the restrictions and processes to pursue research become too onerous, scientists will migrate to other work depriving us from the very talent we need to face these challenges. This could be particularly devastating if it diverts the talent pool from the areas of greatest need such as infectious disease or homeland security.
- Controls on information and international participation in research damage our relationships with allies. Science is an international language and scientists are great diplomats and great communicators. Once they begin to boycott U.S.

conferences or avoid sabbaticals in the U.S. due to the difficulties they face or in solidarity with those who face them, the nation will be gravely harmed.

- Restrictions on the dissemination of research results undermine the close synergy between research and education that make our system great and propel our leadership in innovation. The ability for students to access the latest breakthroughs in research is an important element in our pursuit of leading edge research with the best and brightest students.
- When restrictions are not carefully considered and weighed, absurd examples of government controls create an atmosphere of distrust or contempt within a community of researchers. These attitudes are difficult to mend and divert attention from the areas of greatest need.
- Hindering our ability to recruit the best and brightest international students and scholars harms our productivity and leadership in science and technology.

VI. Recommendations

Clearly the challenge we face of balancing our very real concerns for security with the need to protect our effective and innovative research environment calls for considered dialogue between policy makers and the scientific community. We should fortify the dialogue that has been carried on so ably for so many years. Recent statements by senior administration officials demonstrate an appreciation for these issues and a desire to engage the scientific community in this dialog.

At a recent keynote address to the Science and Technology Policy Colloquium hosted by the American Association for the Advancement of Science (AAAS), White House Office of Science and Technology Policy (OSTP) Director John Marburger, agreed SEVIS was in need of some work and offered a series of recommendations to correct the "visa situation," so as to keep the U.S. an attractive destination to visiting science and engineering personnel. The OSTP Director advised increasing involvement of the "expert communities within the federal government in providing guidance to the process"; eliminating duplicate operations among the screening processes; improving the "impact reporting among affected institutions"; bettering the knowledge "among all parties regarding how the visa system works"; and lastly, "a frame of mind within the technical and higher education communities that perhaps falls short of patience, but rises above hysteria."⁴⁸

At another venue, newly appointed Secretary of the Department of Homeland Security, Tom Ridge, addressed the AAU gathering of 62 university presidents. Mr. Ridge said that the effective implementation of SEVIS will depend upon making sure that the proper

⁴⁸ Andrew J. Hawkins, *Research community must have greater participation in student/scientist immigration issues, MIT's Crowley tells AAAS*, Washington FAX, April 14, 2003
<http://www.washingtonfax.com>

training is in place to use the system. While thanking the university presidents for their "hard work to deploy" SEVIS, he said that he understood their "legitimate concerns." "We know that your foreign students are indispensable to America's continued leadership in science and in medicine and in technology," he said. "And as we secure America from terrorists, we do not want to risk losing the next Enrico Fermi or Albert Einstein. We would be a far poorer nation in many, many ways." Mr. Ridge said the system must balance the privacy rights of students with national security needs.⁴⁹

I am hopeful that this understanding of the importance of protection our science and technology communities from ineffective restrictions will continue. Here are three suggestions for maintaining this momentum:

Institutionalize the Dialogue between Government and Universities. This important period in the development of new policies related to the Department of Homeland Security provides an excellent opportunity to establish an ongoing dialogue between government leaders and American universities on the issues of openness, science and technology. We must establish new mechanisms to foster collaborative engagement and workable, effective policy.

Ensure Openness in Research While Protecting National Security. The policy tone and standards must be set at the highest levels of the government. They should ensure that classification remains the primary means of control for federally financed university research. We should embrace the concepts such as "tall fences around narrow areas" from learned groups such as the Corson panel.⁵⁰ Reaffirming these principles would make government-funded research more effective, more efficient, less contentious and more successful.

Develop Clear and Effective Immigration Policies. The U. S. government should develop consistent, efficient and effective practices for reviewing and issuing visas to foreign students and scholars. We cannot afford to lose our ability to attract top students and scholars to the U.S.*

⁴⁹ *College leaders see security rules hampering research* George Archibald, The Washington Times , April 16, 2003, www.washingtontimes.com

⁵⁰ Committee on Science, Engineering, and Public Policy (U.S.), Panel on Scientific Communication and National Security (Dale R. Corson, Chair), *Scientific Communication and National Security: A Report* (Washington, D.C.: National Academy Press, 1982).

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