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EXECUTIVE SUMMARY

Foreign-born scientists and engineers (S&Es) have long played a prominent role in U.S. technological and scientific advancement and are a critical part of the science and engineering (S&E) labor force in corporations, universities, and research centers nationwide. However, long-standing structural flaws in the U.S. visa system and the unintended consequences of security procedures instituted since September 11, 2001, may be causing an increasing number of S&Es to forgo coming to the United States, thereby depriving the nation of a critical supply of human talent. Yet attracting this talent is a key factor in maintaining the nation's economic competitiveness and preeminence in science.

Among the findings in this report:

- The foreign-born comprised 11.1 percent of the U.S. population as a whole in 2000, but accounted for 16.6 percent of all S&Es in the United States.
- Foreign-born S&Es represented 38 percent of all S&Es in the United States with a doctorate and 29 percent of those with a master's degree in 2000. The foreign-born share of all doctorate holders amounted to 51 percent among engineers and 45 percent among life scientists, physical scientists, and mathematical and computer scientists.
- The foreign-born accounted for 42.2 percent of all physical scientists and 38.6 percent of all life scientists in educational & health services in 2000, as well as 26.2 percent of all physical scientists in manufacturing.
- About 33.1 percent of all foreign-born S&Es in the United States in 2000 were from India or China, two of the countries most affected by post-9/11 visa policies.
- The number of non-immigrant visas issued by the State Department (which are the primary means by which foreign-born S&Es enter the United States) fell by 35.7 percent From FY 2001 to FY 2002, including declines of 33.7 percent in H-1B visas for highly skilled professionals and 26.5 percent in F-1 student visas.
- According to the Government Accountability Office, in 2003 it took an average of 67 days for foreign consulates to receive a response from federal agencies on requests for security checks on visa applicants whose work involved access to technologies designated as "sensitive" to U.S. national security.
- Lengthy processing delays often have nothing to do with the amount of time it takes to actually perform a security check on the applicant. Rather, cases get "stuck" or lost at one or more of the many agencies involved in the process, all of which have different databases and computer systems.

INTRODUCTION

Immigrants in the United States have always played a prominent role in the technological and scientific advancement of the nation. In the 19th century, Scottish-born Alexander Graham Bell invented the telephone and Croatian-born Nikola Tesla developed the alternating current system of electricity that literally lights the world today. In the early and mid 20th century, Italian-born Enrico Fermi produced the first controlled nuclear chain reaction and German-born Albert Einstein revolutionized physics with his Theories of Relativity. Between 1901 and 1991, 44 of the 100 Nobel Prizes awarded to researchers in the United States were won by the foreign-born or their children. In 2000 alone, Austrian-born Eric R. Kandel of Columbia University was awarded the Nobel Prize in Medicine, German-born Herbert Kroemer of the University of California at Santa Barbara won the Nobel Prize in Physics, and New Zealand-born Alan G. MacDiarmid of the University of Pennsylvania received the Nobel Prize in Chemistry.[1]

The foreign-born are not only prominent among the most famous scientists in the United States. They also are indispensable to the U.S. science and engineering (S&E) workforce as a whole, with 1.2 million foreign-born scientists and engineers (S&Es) accounting for almost 17 percent of all workers in S&E occupations. Moreover, the foreign-born comprise nearly 38 percent of all S&Es in the United States with a doctorate. The research and development divisions of U.S. corporations continue to develop new technologies and remain internationally competitive in part because immigration provides them with the best talent in the world. On university campuses throughout the country, high-achieving foreign-born students and faculty are essential to many science departments. As long as the U.S. secondary and higher education systems are not producing native-born students in the sciences in sufficient numbers to meet national needs, foreign-born S&Es will remain vital if the nation is to retain its leadership in technical fields.

Despite the critical role played by foreign-born S&Es in the workplace and academia, the United States is in danger of losing a significant share of this important pool of talent. In the security conscious post-9/11 era, the U.S. government has developed procedures for entry into the United States that are so complicated and time consuming that many of the world's brightest S&Es cannot enter in a timely fashion to conduct research or pursue studies. As a result, major research projects are delayed and investments are wasted when lengthy processing of visa applications prevents key personnel from entering the country for many months. Even worse, in the face of these delays, many prospective U.S.-bound S&Es are seeking a growing number of opportunities in countries where they are far less likely to confront these problems. Consider these examples:

- The UCLA Medical Center lost a Pakistani pediatric heart surgeon for seven months while he was stranded abroad awaiting his visa. The doctor, Faiz Bhora, had ten years of U.S. medical training, but was subjected to a lengthy and ultimately fruitless investigation of his background.[2]

- At the University of Texas at Austin, Dennis Eremin, a Russian physicist who had been in Texas for five years, left the United States to get married. Afterward, he had to wait ten months to get a visa to reenter the country and complete his Ph.D. program.[3]

- An engineer who had worked in the United States for 4 years applied for a renewal of his L-1 visa in Jakarta. The delay in processing his request led the company to transfer him to an overseas office, and to move projects abroad in order to complete them.

- Nobel Laureate Robert C. Richardson describes how Patriot Act restrictions on the handling of pathogens by foreign nationals reduced from 38 to 2 the number of researchers at Cornell University working on projects to better understand the sorts of pathogens that terrorists might use as biological weapons.[4]

These delays are occurring because background checks and other screening procedures implemented af-

ter 9/11 are slow and inefficient. There is near-universal agreement that heightened security measures have a vital role to play in U.S. immigration and visa policies. However, new screening procedures must be targeted at individuals who pose the greatest risk and U.S. consulates must receive adequate staffing and training to effectively implement these measures. Under current visa policies, background checks are conducted on a greater number of visa applicants and consular officials more frequently request Security Advisory Opinions (that is, official clearance from various federal agencies to process an application), but this is often because of confusion over regulations or the lack of clear guidance on how to implement them. In addition, the Technology Alert List (TAL) – a list of technologies deemed sensitive to U.S. national security – has been expanded to include almost every possible field of study in science and engineering. Foreign-born S&Es who work in any of the fields on the list are subjected to additional background checks and processing delays when they apply for visas.

Slow processing of visa applications affects all persons intending to enter the United States, including tourists, business travelers, and visiting artists and entertainers. But delays affecting foreign-born S&Es are particularly crucial given the growing importance to the scientific establishment of international exchanges and collaborative projects among nations. Restrictions on the entry of foreign S&Es into the country, therefore, have serious long-term consequences for U.S. research and development capabilities. In addition, some researchers report that international students are increasingly choosing to study in Asian and European nations in order to avoid the United States and its restrictive visa rules.[5]

Beyond delays and inefficiencies in visa processing, U.S. immigration policies are based on the implicit assumption that there is no need to actively recruit foreign-born S&Es because the United States is their only possible destination. This is a dangerously flawed assumption. There is broad recognition of the fact that both U.S. economic growth and U.S. national security depend in large part on maintaining a competitive edge in science and technology.[6] It is also well known that global competition for S&E talent has increased rapidly over the last decade as major industrial countries such as China, South Korea, and the nations of the European Union create more incentives for their best and brightest professionals to remain at home, or to return home after studying abroad.[7] Yet U.S. immigration policy continues to offer foreign S&Es wishing to come to the United States a confusing and ad hoc mixture of temporary visas. There are relatively few opportunities for permanent immigration designed specifically for high-skilled workers. As the National Science Board points out, "in light of the growing international competition for high-skill students and professionals in S&E, the United States needs visa and immigration policies that provide a clearly understood and straightforward set of options for foreign S&E students and workers."[8]

In an era of increasing global competition the United States can ill afford to relinquish its leadership in scientific and technological fields that create jobs, improve healthcare, increase worker productivity, and enhance national security.

In an era of increasing global competition the United States can ill afford to relinquish its leadership in scientific and technological fields that create jobs, improve healthcare, increase worker productivity, and enhance national security. The United States traditionally has enjoyed a competitive advantage in science given its world-class systems of universities, government laboratories, and corporate research capability. But other nations are developing new scientific capabilities that are starting to erode this advantage. Immigration policy is one factor within U.S. control that can be used to maintain the nation's preeminence in science. Many scientists around the world continue to view the United States as a beacon of intellectual and political freedom and as a powerhouse of scientific accomplishment. The question today is whether U.S. immigration policies bolster and sustain the U.S. tradition of innovation in science and technology or create an obstacle course that deprives the country of a precious asset – human talent.

Figure 1

FOREIGN-BORN PORTION OF SCIENTISTS AND ENGINEERS BY OCCUPATIONAL CATEGORIES: 2000

	Total	Native born	Foreign born	% of FB S&Es in U.S. 10+ years
Computer Scientists	3,010,546	81.8%	18.2%	47.7%
Mathematical Scientists	152,091	88.4%	11.6%	64.1%
Architects, Surveyors, and Cartographers	229,277	87.4%	12.6%	70.1%
Engineers	1,704,862	83.6%	16.4%	67.1%
Drafters and Engineering Technicians	730,378	88.8%	11.2%	69.4%
Life Scientists	217,308	76.7%	23.3%	41.7%
Physical Scientists	361,486	75.3%	24.7%	49.3%
Social Scientists and related	341,983	90.2%	9.8%	63.9%
Science Technicians	282,736	87.2%	12.8%	54.1%
All Scientists and Engineers	7,030,667	83.4%	16.6%	55.2%

NOTE: These figures include foreign-born scientists and engineers in all education levels. The percentage of foreign-born in these categories increases with education level.

FOREIGN-BORN SCIENTISTS AND ENGINEERS PLAY KEY ROLES IN THE U.S. WORKFORCE

Nearly 1 in 5 Scientists and Engineers in the U.S. is Foreign-Born

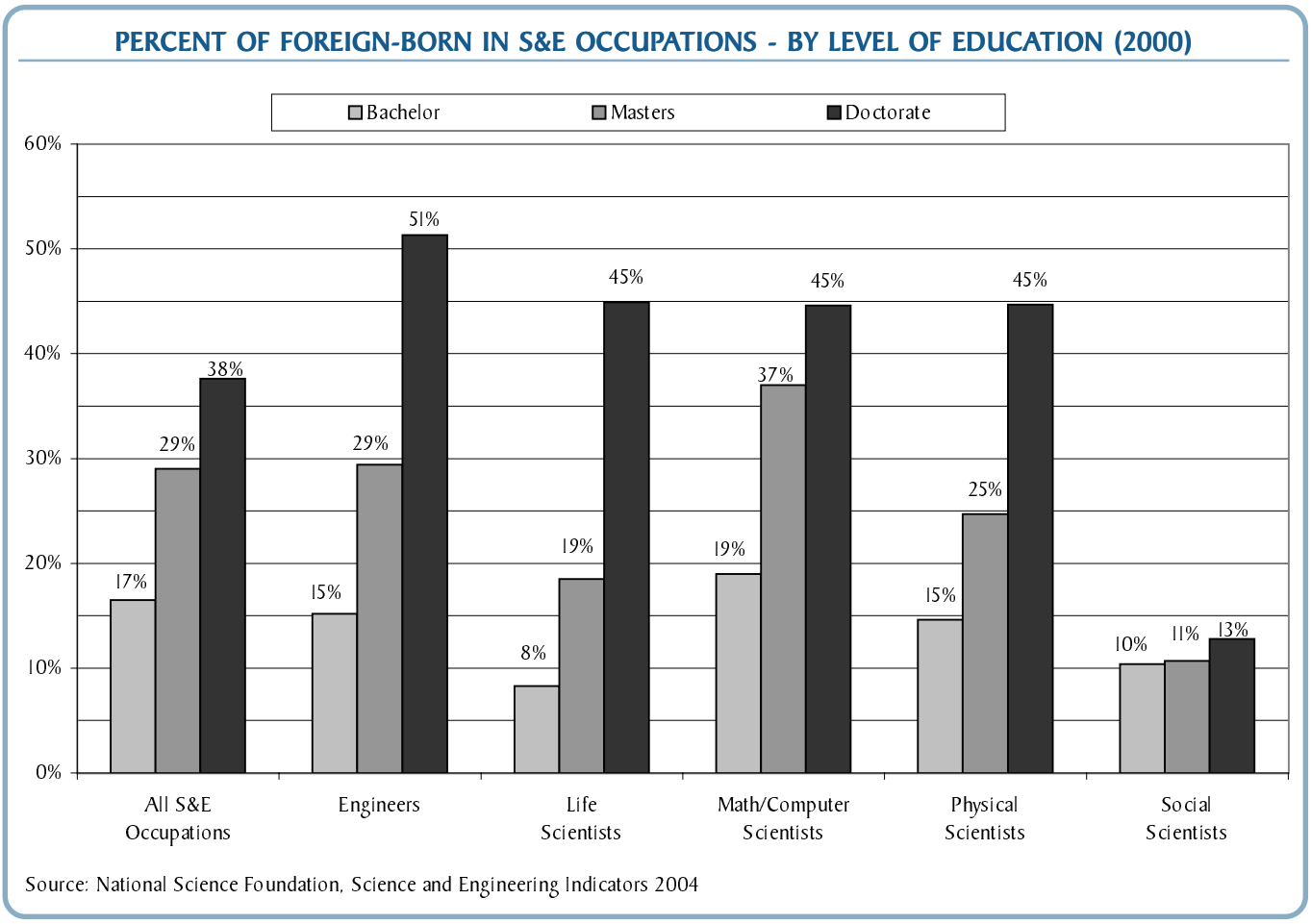
Foreign-born professionals have long been an integral part of the S&E workforce in a wide range of occupations. According to data from the 2000 Census, the foreign-born comprised 11.1 percent of the U.S. population as a whole in 2000, but accounted for 16.6 percent of the 7 million S&Es in the United States (see Figure 1). The foreign-born presence was most pronounced among physical scientists (24.7 percent of whom were foreign-born) and life scientists (23.3 percent of whom were foreign-born). Moreover, between one-half and two-thirds of foreign-born S&Es (depending upon occupation) had entered the United States more than 10 years before.

This statistical portrait of a diverse and long-established foreign-born S&E workforce stands in marked contrast to popular stereotypes. For instance, the current debate over H-1B visas for highly skilled foreign professionals is frequently marred by the misconception that the beleaguered computer industry has been flooded with foreign workers who entered the United States on H-1Bs during the high-tech boom of the 1990s. In fact, only 18.2 percent of U.S. computer scientists were foreign-born in 2000, and roughly half of those had entered the country before 1991.[9]

Foreign-Born S&Es Are Among the Most Highly Educated Professionals

Although foreign-born S&Es are not numerically dominant in any S&E occupation, their contribution to the S&E labor force is amplified by the fact that they are highly represented among the most educated professionals in their fields. According to the National Science Board, in 2000 the foreign-born comprised 38 percent of all S&Es in the United States with a doctorate and 29 percent of those with a master's degree, compared to 17 percent of those with only a bachelor's degree (see Figure 2). The foreign-born are more prominent still in the most highly educated echelons of particular S&E occupations. The foreign-born share of all doctorate holders amounted to 51 percent among engineers and 45 percent among life scientists, physical scientists, and mathematical and computer scientists. Foreign-born doctorate holders also play a key role in training future generations of both native and foreign-born S&Es. Among all U.S. doctorate holders employed at academic institutions in 2001, the foreign-born accounted for 39 percent in computer sciences, 35 percent in engineering, 28 percent in mathematics, 23 percent in physical sciences, and 20 percent in life sciences.[10]

Figure 2



Source: National Science Foundation, Science and Engineering Indicators 2004

Foreign-Born S&Es Are Vital to Many Industries

In addition to being among the most educated members of the S&E labor force, foreign-born S&Es are also a critical component of the workforce in particular industries. Overall, the industries that relied most on foreign-born S&Es in 2000 were the educational and health category (where the foreign-born comprised 18.8 percent of all S&Es - Figure 3a) and the professional and scientific category (where the foreign-born constituted 18.4 percent of all S&Es - Figure 3b). However, these statistics do not fully capture the importance to certain industries of foreign-born S&Es in specific occupations. For instance, the foreign-born accounted for 42.2 percent of all physical scientists in educational & health services and 26.2 percent in manufacturing. The foreign-born represented 38.6 percent of all life scientists in educational & health services (Figure 3a) and 28.9 percent in professional & scientific services (Figure 3b). As these statistics illustrate, U.S. visa and immigration policies that affect foreign-born S&Es also affect the productivity and competitiveness of the U.S. industries in which they most commonly work.

Figure 3a

PRESENCE OF FOREIGN-BORN SCIENTISTS AND ENGINEERS BY OCCUPATION AND INDUSTRIAL CATEGORY: 2000

	Information	Finance[1]	Educational & Health[2]	Arts & Entertainment[3]	Other Services[4]	Public Administration	Total
Computer Scientists	18.5	18.5	13.5	11.4	12.8	8.5	18.2
Mathematical Scientists	11.9	14.9	14.9	12.2	9.6	8.0	11.6
Architects, Surveyors, and Cartographers	15.5	10.3	19.6	9.0	4.3	5.6	12.6
Engineers	18.4	18.4	19.2	18.7	15.1	13.7	16.4
Drafters and Engineering Technicians	9.1	9.6	15.1	8.5	15.0	4.7	11.2
Life Scientists	27.5	12.8	38.6	5.0	11.5	5.8	23.3
Physical Scientists	18.7	16.7	42.2	10.2	23.3	9.8	24.7
Social Scientists and related	8.7	27.8	7.2	6.6	12.0	8.7	9.8
Science Technicians	9.1	7.9	20.1	5.5	11.1	5.9	12.8
Total (all occupations)	17.3%	18.3%	18.8%	10.2%	13.3%	9.0%	16.6%

i.e. immigrants are 18.5% of computer scientists in the information industry

[1] Includes insurance, real estate, and rental and leasing
[2] Includes social services
[3] Includes recreation, accommodation, and food
[4] Other services except public administration

Figure 3b

PRESENCE OF FOREIGN-BORN SCIENTISTS AND ENGINEERS BY OCCUPATION AND INDUSTRIAL CATEGORY: 2000

	Agriculture[1]	Construction	Professional & Scientific[2]	Manufacturing	Wholesale trade	Retail trade	Transportation[3]	Total
Computer Scientists	14.5	9.6	21.8	18.6	16.2	17.5	15.0	18.2
Mathematical Scientists	2.9	8.8	14.9	12.0	17.2	10.7	6.3	11.6
Architects, Surveyors, & Cartographers	2.8	14.6	13.0	12.0	30.2	8.2	13.4	12.6
Engineers	10.3	16.1	16.9	16.8	17.6	18.5	12.6	16.4
Drafters and Engineering Technicians	4.4	9.0	9.6	13.7	13.8	12.3	8.8	11.2
Life Scientists	3.3	9.6	28.9	23.5	6.8	4.2	3.8	23.3
Physical Scientists	11.4	12.2	20.8	26.2	21.3	20.4	9.1	24.7
Social Scientists and related	4.5	5.2	10.8	13.5	16.3	8.3	12.2	9.8
Science Technicians	9.6	11.9	14.8	11.2	10.5	20.9	4.6	12.8
Total (all occupations)	8.8%	13.4%	18.4%	16.9%	16.0%	17.0%	12.0%	16.6%

i.e. immigrants are 14.5% of computer scientists in the agriculture industry

[1] Includes forestry, fishing and hunting, and mining
[2] Incudes management, administrative, & waste mgmt.
[3] Includes warehousing and utilities

One-Third of Foreign-Born S&Es Come From India and China

Although foreign-born S&Es in the United States come from countries all over the world, about 33.1 percent are from either India or China (see Figure 4). India is by far the leading source of computer scientists (accounting for 24.1 percent of all foreign-born computer scientists), while China is the leading source of both foreign-born life scientists (29 percent) and foreign-born physical scientists (25.2 percent). These country distinctions are important because the post-9/11 visa policies and security requirements which have had the greatest impact on foreign-born S&Es also have had the greatest impact on the nationals of particular countries, particularly China.

Figure 4

REPRESENTATION OF SELECTED COUNTRIES AMONG FOREIGN-BORN SCIENCE AND ENGINEERING WORKERS: 2000

	India	China/Taiwan Hong Kong	Vietnam	Former USSR	Philippines	Mexico	Canada	Other countries
Computer Scientists	24.1%	16.6%	5.1%	7.0%	4.4%	2.6%	2.8%	37.4%
Mathematical Scientists	10.5%	21.3%	4.1%	2.8%	6.3%	2.3%	5.9%	46.9%
Architects, Surveyors, and Cartographers	6.3%	10.0%	1.7%	2.1%	5.7%	6.8%	5.7%	61.8%
Engineers	12.4%	15.8%	6.9%	3.6%	4.9%	3.2%	3.8%	49.5%
Drafters and Engineering Technicians	4.4%	5.4%	14.7%	4.1%	9.7%	12.1%	2.9%	46.7%
Life Scientists	11.3%	29.0%	1.3%	4.9%	2.3%	2.3%	4.1%	44.8%
Physical Scientists	11.9%	25.2%	2.8%	6.1%	4.2%	1.3%	3.4%	45.0%
Social Scientists and related	7.1%	8.1%	1.5%	2.8%	3.7%	3.0%	7.3%	66.3%
Science Technicians	7.2%	15.1%	4.9%	2.9%	7.4%	11.9%	2.9%	47.7%
Total	16.7%	16.4%	5.7%	5.4%	4.9%	3.7%	3.4%	43.8%

Note: Based on leading countries of foreign-born S&E workers

THE IMPACT OF U.S. VISA POLICIES ON FOREIGN-BORN SCIENTISTS AND ENGINEERS

Confusion and Inconsistency in Temporary Visas

U.S. visa policies have a major impact on foreign-born S&Es, particularly those who were born abroad and came to the United States for their higher education (usually on student visas) or who received their higher education abroad and came to the United States for employment (as either temporary workers or permanent immigrants). Less clear is the impact of visa policies on S&Es who were born abroad but entered the United States as children together with their parents, usually through family reunification channels. Typically, these S&Es are legal permanent residents and received all or much of their education (including elementary school) in the United States.

With the exception of those who entered as children, most foreign-born S&Es come to the United States as "non-immigrants" with a temporary status. However, S&Es from abroad must choose from a confusing array of non-immigrant visas which permit individuals to enter the country for purposes of pleasure, study, business, training and temporary employment. Although none of the available visas is specific to S&Es, the ones most commonly utilized by foreign-born S&Es are:

B-1: Visitors for business (including participation in scientific, educational, professional or business conventions, conferences or seminars) for periods up to 90 days.

F: Full-time academic students in colleges, universities, seminaries, conservatories, academic high schools, and other academic institutions.

H-1B: Temporary professional workers employed in a specialty occupation.

J-1: A student, scholar, trainee, teacher, professor, research assistant, specialist or leader in a field of specialized knowledge or skill who is entering to participate in an approved training program.

L: Intra-company transferees of high-level managers or employees with specialized knowledge for multinational companies with a related entity in the United States.

O -1: Individuals of extraordinary ability in the sciences, arts, education, business, or athletics.

Regardless of whether they were educated abroad or in the United States on a student visa, foreign S&Es who have academic credentials in their professions most commonly enter the country on H-1B visas. The H-1B visa is an employer-sponsored, employer-specific visa category

In addition to the confusing non-immigrant visa categories, U.S. immigration law does not offer a clearly defined or efficient path to permanent residence –a "green card" – for foreign-born S&Es working or studying in the United States.

that can be used only if a U.S. employer petitions the government for approval to employ a foreign worker. The H-1B category requires the employer to make a series of attestations to protect U.S. workers, including a requirement that the employer pay the foreign worker the prevailing wage for the job the worker will perform. These attestations, coupled with the costs both in processing time as well as legal and filing fees, discourage a U.S. employer from hiring a foreign worker unless the employer determines that the worker is needed. Thus, foreign S&Es may remain in the country only if a specific U.S. employer wants and needs them. However, even if employers want to hire foreign S&Es, many are unable to do so because of annual numerical limitations on how many H-1B visas can be issued. In fiscal year (FY) 2004, the annual limit on H-1Bs reverted back to the 65,000 cap originally imposed by Congress in 1990. As a result, the cap was reached in April of 2004 and no additional H-1B visas can be issued until the new fiscal year begins in October 2004. Because a cue has been forming since April, it is highly likely that the H-1B visa numbers will run out very quickly in FY 2005, making it impossible for many employers to hire foreign S&Es because there are no available H-1B visa numbers.

While some universities use the H-1B professional worker category for students and scholars in paid positions within the university, most students come to the United States with either an F or a J visa to pursue an undergraduate or graduate program. A longstanding requirement of both these visa categories is that the applicant demonstrate "residence in a foreign country he has no intention of abandoning." In other words, prospective students must prove that they do not plan to immigrate permanently to the United States. Given the uncertainty that is common among students about what options to pursue after a four-year undergraduate or lengthy graduate-level program, proving this intent before the program even begins is very difficult. If a consular officer is not satisfied that an applicant for a student visa will, in fact, return home, a visa can legitimately be denied. The "residence abroad" requirement is routinely used to deny student visas to students who may otherwise be qualified (i.e. they have been admitted into fully accredited academic programs, they can pay the tuition, etc.). This requirement is counterproductive, particularly for S&E students who may well become ensconced in research that will benefit from their continued participation after the completion of a degree.

Those F and J students who do succeed in meeting the residence abroad requirement and come to the United States to study may later change their minds about leaving. Once here, a student can apply to change to H-1B status, which allows for "dual intent." This permits the applicant to hold two intents simultaneously: a current plan to remain temporarily in the United States and, at the same time, a future option to seek permanent status in the United States if it is available. For a number of years, the H-1B category also had a foreign residence requirement, but dual intent was codified in 1990 after many H-1B applications were denied because applicants were unable to maintain a residence abroad. The statutory requirement of a residence abroad for foreign students creates confusion and unfairness in the visa application process at U.S. consulates overseas and does nothing to improve the caliber of students coming to the United States. Consular officers should be charged with determining whether a student is *bona fide* in terms of objective factors, such as whether the student has the appropriate credentials and adequate resources to cover the costs of the educational program, and whether the academic institution is fully accredited.

No Clear Path to Permanent Residence

In addition to the confusing non-immigrant visa categories, U.S. immigration law does not offer a clearly defined or efficient path to Lawful Permanent Residence (LPR) – a "green card" – for foreign-born S&Es working or studying in the United States. This is unfortunate given the degree to which non-immigrant S&Es replenish and expand the S&E labor force of the United States by be-

coming permanent residents. In most years, well over half of the foreign-born S&Es who are granted permanent residence had a prior non-immigrant status (see Figure 5). An even larger majority of mathematical and computer scientists (77.4 percent) and natural scientists (77.7 percent) who acquired permanent residence during the 1990s had a prior non-immigrant status (see Figure 6). As these statistics illustrate, visa policies not only impact a temporary workforce, but have long-term implications for the S&E labor force of the United States as a whole.

Figure 5

SCIENTISTS AND ENGINEERS ADJUSTING FROM NONIMMIGRANT STATUS

	Total Grants of LPR Status	Percent Adjusting from Nonimmigrant Status
1990	13,473	42.2%
1991	14,860	48.3%
1992	23,695	64.2%
1993	24,230	67.8%
1994	17,934	63.0%
1995	14,688	55.7%
1996	20,202	63.5%
1997	17,822	66.4%
1998	14,904	58.2%
1999	10,527	36.4%
2000	21,540	60.4%
Total	193,875	58.9%

Note: Includes adjustees from refugee status

Figure 6

PERCENT OF LPR GRANTS TO PERSONS ADJUSTING FROM NONIMMIGRANT STATUS: 1990-2000

Architects	14.8%
Engineers, surveyors and mapping scientists	57.2%
Mathematical and computer scientists	77.4%
Natural scientists	77.7%
Social scientists and urban planners	28.3%

Note: Includes adjustees from refugee status

However, foreign-born S&Es seeking permanent residence confront U.S. immigration laws that are incredibly complex and confusing, an application process that is slow and cumbersome, and outcomes that are unpredictable. As the National Science Board has observed, relatively few paths to permanent residence are designed specifically for high-skilled professionals, and the pathways by which high-skilled immigrants move from temporary to permanent status must be navigated by the individual applicant rather than being promoted by the design of U.S. immigration law.[11] U.S. immigration policies tend to be an *ad hoc* series of responses to often conflicting economic and political demands of the moment, rather than a straightforward set of immigration options which not only make life easier for immigrants themselves, but also serve to maintain the U.S. competitive edge in science and technology.

Once foreign-born S&Es begin self-navigating the U.S. immigration system, they face a bureaucracy mired in delays, backlogs, and the inconsistent adjudication of cases. The process of applying for permanent residence in the United States usually requires a foreign worker to first obtain an offer of permanent employment from a U.S. employer. The worker must then seek permission to accept the offer through a multi-layered process that involves proving to the Department of Labor (DOL) that the foreign worker will not displace any U.S. workers, then proving to the Bureau of Citizenship and Immigration Services (BCIS) at the Department of Homeland Security that the worker is admissible to the United States. It is not uncommon for applicants to wait anywhere from two to five years, and often longer, for the final issuance of a permanent immigrant visa. During these lengthy processing delays their temporary visas must be maintained. This is often impossible because the visas expire and cannot be extended beyond a set number of years. A select group of highly skilled workers of extraordinary ability or whose field of study benefits U.S. "national interests" can apply for permanent residence without first obtaining an offer of permanent employment or seeking permission from the Department of Labor. But this process is also fraught with bureaucratic difficulties, including unreasonable requirements to prove that applicants will work in their fields of expertise, and rigid rules on issues like prevailing wage standards that fail to recognize the difference in wage levels between non-profit and for-profit research centers.

There is growing evidence from the scientific community that U.S. immigration policies are impeding ongoing research collaborations, discouraging or preventing outstanding researchers and scientists from entering the country, and jeopardizing U.S. preeminence in science and technology fields.

Security Procedures Lead to Unintended Visa Processing Delays and Confusion

Beyond the long-standing structural flaws in the U.S. visa system, foreign-born S&Es – and therefore the U.S. companies, research centers, and universities that depend on them – have been hit hard by poorly conceived and poorly implemented security requirements put in place since 9/11. In May of 2004, the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine joined 22 other national education, science, and engineering organizations in issuing a public statement that newly established visa policies and procedures to bolster security have "led to a number of unintended consequences detrimental to science, higher education, and the nation."[12] The statement reflects the growing evidence from the scientific community that U.S. immigration policies are impeding ongoing research collaborations, discouraging or preventing outstanding researchers and scientists from entering the country, and jeopardizing U.S. preeminence in science and technology fields.[13] At the heart of these problems is an immigration policy that lacks consistent, efficient and effective practices for reviewing and issuing visas to foreign students and scholars.

The federal government acknowledges the rise in processing delays and backlogs that has resulted from these new visa policies. According to a February 2004 report from the U.S. Government Accountability Office (GAO), the exact amount of time it takes for a foreign science student or scholar to obtain a visa is not known. However, the processing time is increased considerably if a consular officer decides that an applicant must undergo an additional security check. Specifically, the officer must decide whether to request a Security Advisory Opinion (SAO); that is, an opinion from various federal agencies on whether or not to issue a visa to the applicant. Although SAOs are requested for a number of reasons, the most common with regard to foreign-born S&Es is that the applicant's background or proposed activity in the United States may involve access to technologies on the Technology Alert List (TAL).[14]

The TAL, which was originally designed during the Cold War, is a long list of scientific fields and technologies designated by the federal government as "sensitive" for national security purposes. In August 2002 the TAL was vastly expanded to include areas of study and research with little apparent relevance to security, such as architecture, housing, community development, environmental planning, landscape architecture, and urban design. The expanded list also includes the fields of chemical engineering, biomedical engineering and biotechnology, which are so broadly defined as to include almost every technology or skill associated with chemistry, biochemistry, immunology, microbiology, pharmacology, or genetic engineering, to name just a few.

Consular officers who request an SAO for a visa applicant based on possible access to a technology listed on the TAL do so through a process known as Visas Mantis. Guidance to consular officers included in the TAL specifically states that the Visas Mantis process is not to be applied if the applicant's background or work involves information available in the public domain or academic courses. However, as the GAO report notes, consular officers have complained that this guidance is unclear and have expressed a desire for more easily understandable definitions and explanations of some scientific terms. These findings lend credence to the growing belief among scientists and immigration practitioners that many officers are not adequately prepared to make judgment calls in the "zero tolerance" environment that has prevailed since 9/11 and are erring on the side of caution by initiating security checks on any applicant with a scientific or research background.[15]

In October 2001 President Bush issued Homeland Security Directive #2, "Combating Terrorism Through

Immigration Policies", which expressed concerns about "sensitive areas of study." A week later the Administration's Office of Science and Technology Policy announced its intention to create a new Interagency Panel on Advancing Science and Security (IPASS), which would provide another level of review for all specialized visas, including student visas. Although the program has yet to be finalized, according to the Department of State, the proposed IPASS process is meant to "increase the involvement of U.S. Government scientific experts to work with intelligence, counterintelligence, and law enforcement representatives to advise the Department on science related visa applications, beginning with students and visiting scholars."[16] The Administration originally suggested that IPASS might help reduce the backlog of visa applications, however, it appears more likely that the process will be added to existing review systems rather than replacing them.[17] While there is some hope that the involvement of IPASS experts could help focus security checks on S&E visa applicants who truly pose a threat to the United States, many scientists and educators are concerned that if IPASS is implemented incorrectly it could increase the number of delayed visa applications and further impede teaching and research.

The lengthy delays in visa processing that result from a Visas Mantis security check are widespread and significant. In just the three-month period between April and June of 2003, the GAO found that 2,888 visa applications from science students and scholars were subjected to a Visas Mantis security check. In a random sample of 71 of these cases, the GAO found that it took an average of 67 days for consular officers just to get a response from federal agencies on the security checks. In a review of the Visas Mantis cases submitted from the consular post in Chennai, India, in FY 2003, the GAO found that 58 percent took more than 120 days to process from the date the visa application was filed to the date a response was received, while 25 percent of cases took between 60 and 120 days to process. Among the Visas Mantis cases submitted from Moscow in FY 2003, about 21 percent took between 60 and 120 days to process, and 10 percent took more than 120 days to process.[18]

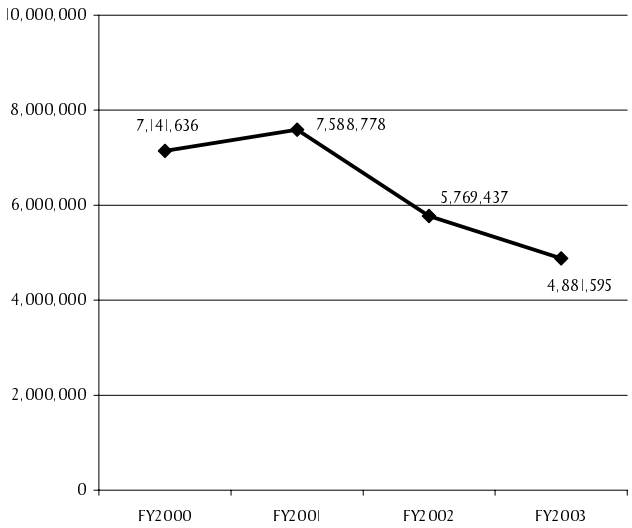
Many of these delays have nothing to do with the amount of time it takes to actually perform a security check on the applicant. Rather, cases get "stuck" or lost at one or more of the many agencies involved in the process, all of which have different databases and computer systems. A consulate that initiates a Visas Mantis request has no way of knowing if the State Department has received the request. The State Department has no way of knowing if the FBI has received the case. Furthermore, the FBI has no way of knowing if the results of a security check have been forwarded back to the consular post. In the majority of cases reviewed by the GAO, it took two weeks or longer just for the State Department to notify the post that it could issue the visa. Even more troubling, the GAO investigation revealed that some 700 Visas Mantis cases sent from Beijing never reached the FBI for the security check and were lost. Officials at the consulate were unsure how the cases got lost, but indicated that it had taken about a month to discover the problem and again provide the FBI with the cases.[19]

The delays in sending requests for security checks and receiving the results are further compounded by the additional time it takes to schedule a visa interview and actually issue the visa to the applicant. At the post in Chennai, India, the wait time for an interview averaged 3 to 4 weeks, but took as long 12 weeks during the summer of FY 2003. These kinds of lengthy delays are common and often the result of insufficient space or staffing resources at consular posts. Since August of 2003 the number of interviews that consular posts must schedule has increased dramatically due to a new regulation that requires personal interviews of all visa applicants.[20]

In addition to the delays associated with getting a visa approved in the first place, scientists and scholars already working in the United States on H, L, or O visas can no longer have their visas re-issued while they are in the country.[21] Previously, individuals with these visas who were granted permission to remain in the United States for additional time could simply send their passports to the State Department to receive a new visa stamp reflecting the visa's new validity period. However, beginning on July 16, 2004, anyone in this situation who wants

Figure 7

NONIMMIGRANT VISAS ISSUED FY2000 - FY2003



to depart the United States will require a new visa to reenter and must submit a new visa application at a U.S. Embassy or Consulate abroad. As a result, scientists and scholars working in the United States on these visas who wish to participate in international conferences outside of the country may face the daunting prospect of having to repeat the visa application process they successfully completed once before.

TRENDS IN VISA PROCESSING

Closing the Door: Visas Have Fallen Since 9/11

Far fewer foreign-born persons have entered the United States on non-immigrant visas since 9/11. From FY 2001 to FY 2002, the number of non-immigrant visas issued by the State Department declined by 35.7 percent, from roughly 7.6 million to 4.9 million (see Figure 7). Although the State Department does not categorize non-immigrant visas by the occupation of the visa holder, this decline undoubtedly includes many foreign-born S&Es given that non-immigrant visas are the primary mechanism by which they come to this country.

Professional and Student Visas Decline Sharply

A better indication of how foreign-born S&Es have been affected by the decline in visas is to focus on those visas used primarily by professionals and students, as opposed to those used mainly by tourists, diplomatic personnel, and others. The decline in the number of these visas largely matches the decline in non-immigrant visas overall. For instance, F-1 visas for students fell by 26.5 percent and H-1Bs for highly skilled professionals by 33.7 percent from FY2000 to FY2003 (see Figure 8).

Figure 8

NONIMMIGRANT VISAS ISSUED FY2000-FY2003 BY SELECTED STUDENT AND PROFESSIONAL EMPLOYMENT-RELATED VISA TYPES

	FY2001	FY2002	FY2003	Percent Change 2001-2003	Numeric Change 2001-2003
B-1	84,201	75,642	60,892	-27.7%	-23,309
F-1	293,357	234,322	215,694	-26.5%	-77,663
H-1B	161,643	118,352	107,196	-33.7%	-54,447
J-1	261,769	253,841	253,865	-3.0%	-7,904
L-1	59,384	57,721	57,245	-3.6%	-2,139
O-1	6,666	6,026	6,126	-8.1%	-540
All Student/Professional Employment Related*	867,020	745,904	701,018	-19.1%	-166,002
Total Nonimmigrant Visas Issued	7,588,778	5,769,437	4,881,595	-35.7%	-2,707,183

**Equals the sum of the preceding visas*

S&E graduate programs at colleges and universities around the country have been particularly hard hit. A 2003 survey of all physics graduate programs in the United States by the American Institute of Physics revealed that "two-thirds of the Ph.D.-granting departments, and almost half of the Masters departments, report that they have accepted foreign students who were unable to attend because of visa difficulties." Overall, roughly "20 percent of admitted foreign students were at least initially prevented from attending in the fall of 2002." As a result, many departments reported that they were forced to fill teaching assistant positions with undergraduate physics students or graduate students from other departments. Moreover, some graduate courses were cancelled due to low enrollment and some research assistant positions left unfilled. The majority of departments reported that students from China were most affected by visa problems.[22] Similarly, a 2004 survey of the nation's top chemistry departments by the American Chemical Society found that 74 percent of departments reported that "at least one student accepted at their institution in 2003 has been unable to join the chemistry department because of visa delays or denials." In addition, 71 percent reported that "foreign students already enrolled at their institutions have had trouble reentering the U.S. when they leave for business trips or vacations." About 52 percent reported that students from China were impacted the most by visa delays and denials.[23]

Figure 9

CHANGE IN NONIMMIGRANT VISAS ISSUED: FY2001-FY2003

	All Countries	India	China
B-1	-27.7%	-22.3%	-20.9%
F-1	-26.5%	-20.6%	-35.9%
H-1B	-33.7%	-43.0%	-38.2%
J-1	-3.0%	-9.8%	-28.0%
L-1	-3.6%	52.2%	0.6%

Visitors from China and India Decline

The decline in non-immigrant visa issuance has had a particularly strong impact on Chinese and Indian nationals (see Figure 9). China significantly outpaces the overall drop in every visa category except B-1. In large part, this is due to the fact that foreign-born S&Es from China are concentrated precisely in two areas, life and physical sciences, that are most likely to involve sensitive technologies as defined by the TAL. To a lesser extent, India also has experienced relatively high declines in visas issued. In addition, persons from both China and India are reported to be experiencing a marked increase in the number of security checks based on their potential access to sensitive technology in the United States.[24] Political conditions in nations such as China and India do indeed necessitate careful security screening of visa applicants who are nationals of these countries. However, the importance of these nations in providing the United States with S&Es demands that such security screening be effective and efficient, and that it be conducted by a sufficiently large and adequately funded consular staff that is trained specifically to evaluate the visa applications of S&Es.

The visa difficulties encountered by Chinese S&Es have had wide-ranging effects on the S&E establishment in the United States. For instance, in 2003 the National Academy of Sciences had to postpone a meeting with the Chinese Academy of Sciences because of problems that Chinese scientists were confronting in getting visas. As a result, the National Academies decided to hold any future conferences with foreign academies outside of the United States. The same year, roughly 70 percent of the Chinese exhibitors scheduled to attend the chemical industry's Informex trade show in New Orleans were denied visas to enter the United States.[25]

CONCLUSION

Recent years will be remembered as a watershed era in the history of international migration to the United States in which a growing need for highly skilled workers, particularly S&Es, met with an increased need to secure U.S. borders and more carefully regulate the flow of all immigrants and foreign visitors. National security concerns notwithstanding, a nearly 20 percent decline in non-immigrant visas granted to professionals and students raises serious concerns about whether new visa policies are diminishing U.S. access to the best talent, especially given that non-immigrant visa status often is a gateway to legal permanent residence for many foreign-born researchers and scientists in the United States.

The U.S. need for foreign-born S&Es stems in part from explosive growth and rapid change in many technological and scientific fields which demand a critical mass of expertise to remain competitive. But it is also due in part to the relatively low rate at which native-born students are entering and graduating from scientific degree programs in U.S. universities. The United States has been fortunate in its ability to recruit skilled foreign-born professionals to fill positions that the native-born workforce is unable to fill. In the information age, the United States must make a much greater national investment in K-12 math and science education and the promotion of scientific careers among the native-born. The quality of science instruction must be improved, as noted by Nobel Prize-winning physicist Robert C. Richardson, and students should be educated about the many rewards of a scientific career.[26]

Yet even if the United States were to increase the number of native-born students choosing S&E careers, the current need for workers cannot wait for new streams of university graduates years or decades from now. U.S. corporations and universities must have access to needed talent today in the face of growing international competition. The programs of study and work that currently exist at universities, corporations and research centers could not easily weather a sudden decline in the number of new workers and students on whom they depend.

As a result, the United States must keep its doors open to scholars and workers in S&E occupations, even at a time of heightened security. Policymakers concerned with maintaining an open flow of S&Es while still addressing national security concerns might consider allowing S&Es who are already here to renew their non-immigrant visas in the United States rather than requiring them to go abroad to do so. New policies that place greater value on foreign students, especially in S&E fields, could include elimination of the residence abroad requirement and implementation of dual intent for foreign students. Moreover, a visa category specifically designed for credentialed scientists and engineers, whether educated in the United States or abroad, and not subject to the H-1B numerical limitations currently imposed on all professional workers might be in order. The U.S. government should invest in security screening procedures that eliminate unnecessary delays, with high priority given to S&Es already engaged in important work that benefits the United States. Although more stringent security measures are clearly necessary in the post-9/11 world, these measures must be carefully tailored to meet actual security needs and backed up by the resources necessary to implement them effectively and efficiently. The U.S. government can enhance national security while still recognizing that immigration policy is a vital tool in successfully competing for foreign talent and keeping the United States at the top of the list as a desired destination for S&Es from all over the world.

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