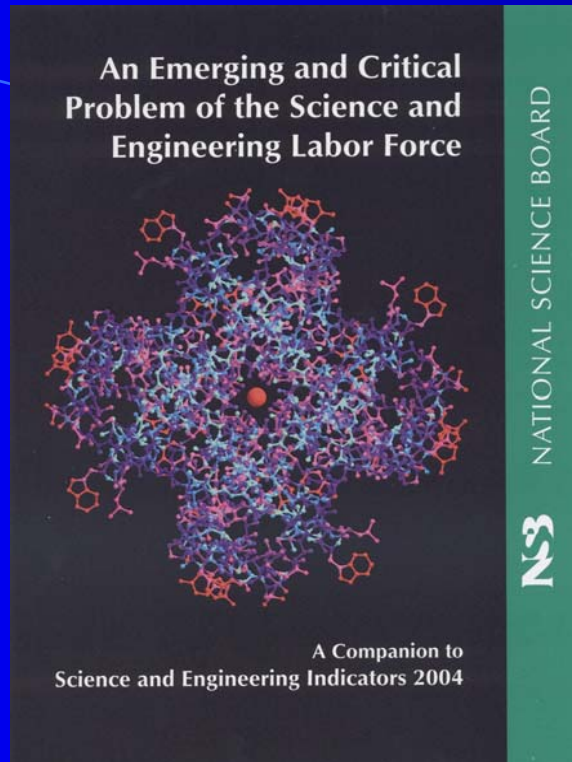


# ***An Emerging and Critical Problem of The Science and Engineering Workforce***



## **The National Science Board**

**Dr. Michael P. Crosby**

*NSB Executive Officer & NSB Office Director*

***A briefing to the:  
Congressional Research and Development Caucus  
July 15, 2004  
Rayburn House Office Building, Washington, DC***

# About the National Science Board

**National Science Board was established by the NSF Act of 1950:**

**“...to promote the progress of science; to advance the national health, prosperity, and welfare; and secure the national defense.”**

**The National Science Board provides:**

- **Oversight and policy-making** for NSF, and
- **Advice to the President and the Congress** on matters of national science and engineering policy.

# NSB is Concerned by Long-Term Trends Threatening the Future of Our Science and Engineering Workforce

- NSB identified several trends that suggest long-term concerns:
  - Science and engineering jobs in U.S. have **grown faster** than overall workforce.
  - **Increasing dependence** of the U.S. science and engineering workforce on foreign-born talent.
  - **Intensifying global competition** for science and engineering talent.
  - The U.S. science and engineering workforce is **aging**.
  - **Lack of growth** in the number of **bachelor's degrees** earned by U.S. citizens in natural science and engineering fields.
  - Growing share of **underrepresented minorities** and flat college age population.

## Annual Growth Rates: 1980-2000

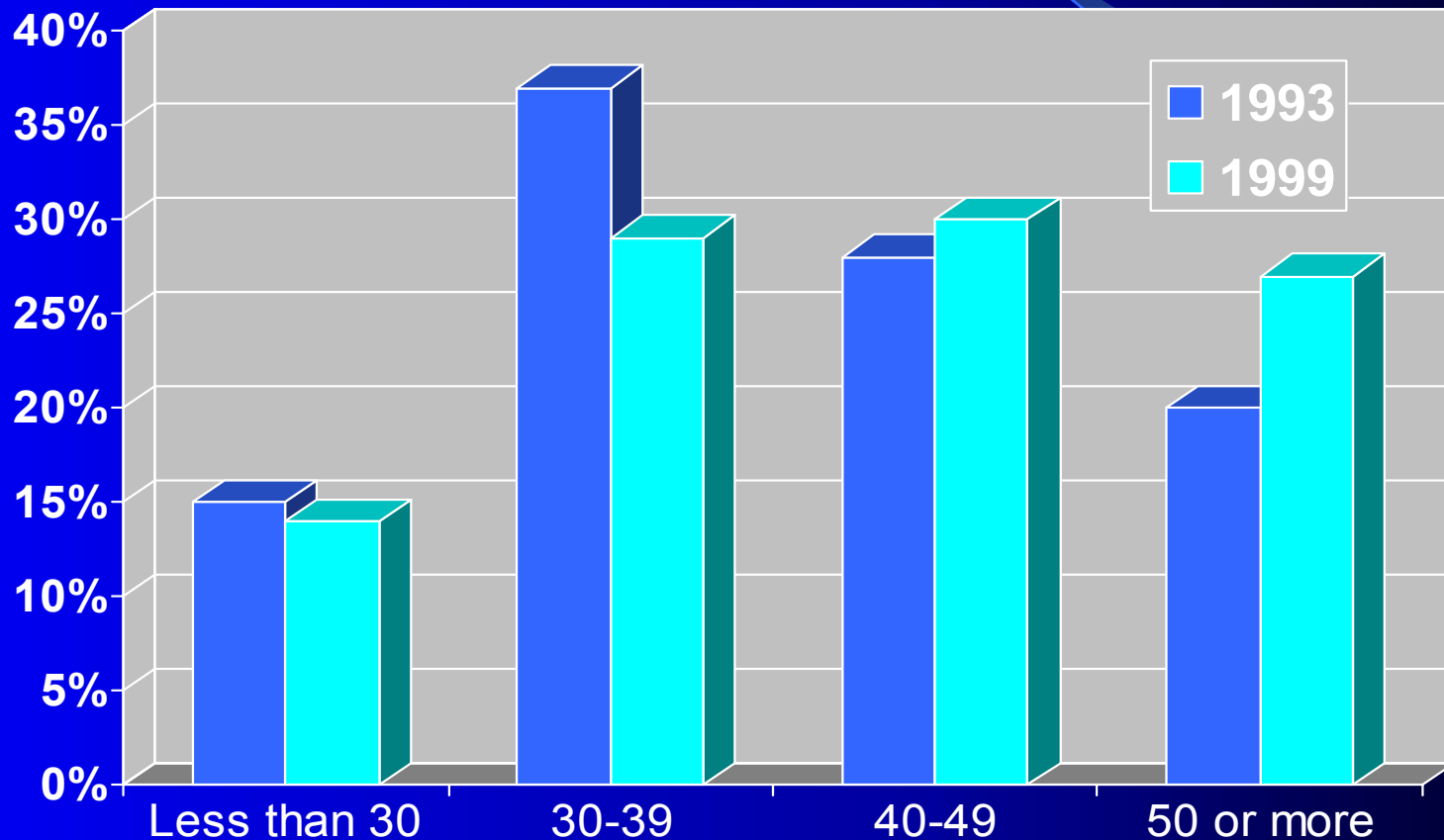
● Total civilian labor force		1.1%
	<u>S&amp;E</u>	<u>ENG</u>
● S&E or ENG Occupations	4.9%	3.3%
● -- excluding math/computer	3.3%	
<hr/>		
● Bachelor's degree production	1.4%	0.1%*
● Master's degree production	2.0%	2.4%
● Doctoral degree production	1.9%	3.9%

\* 1980-1990 1.0% 1990-2000: -0.8%

Source: NSF/SRS tabulation of U.S. Census 1980-2000 PUMS

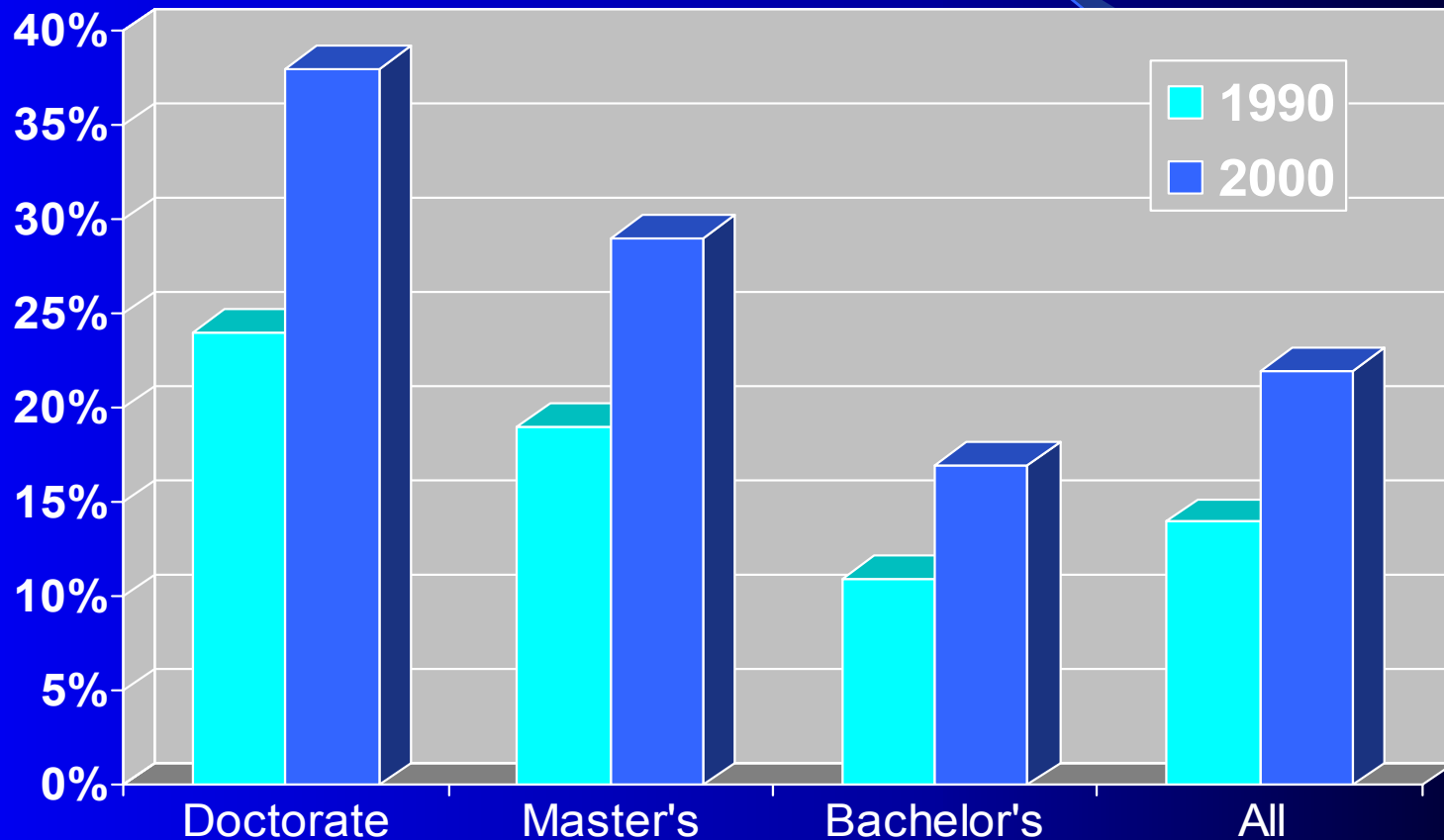


# Science and Engineering Occupations' Labor Force Aged in the 1990s



Source: *Science and Engineering Indicators 2002*, Appendix Tables 3-34 and 3-35, pages A3-102 and A3-108.

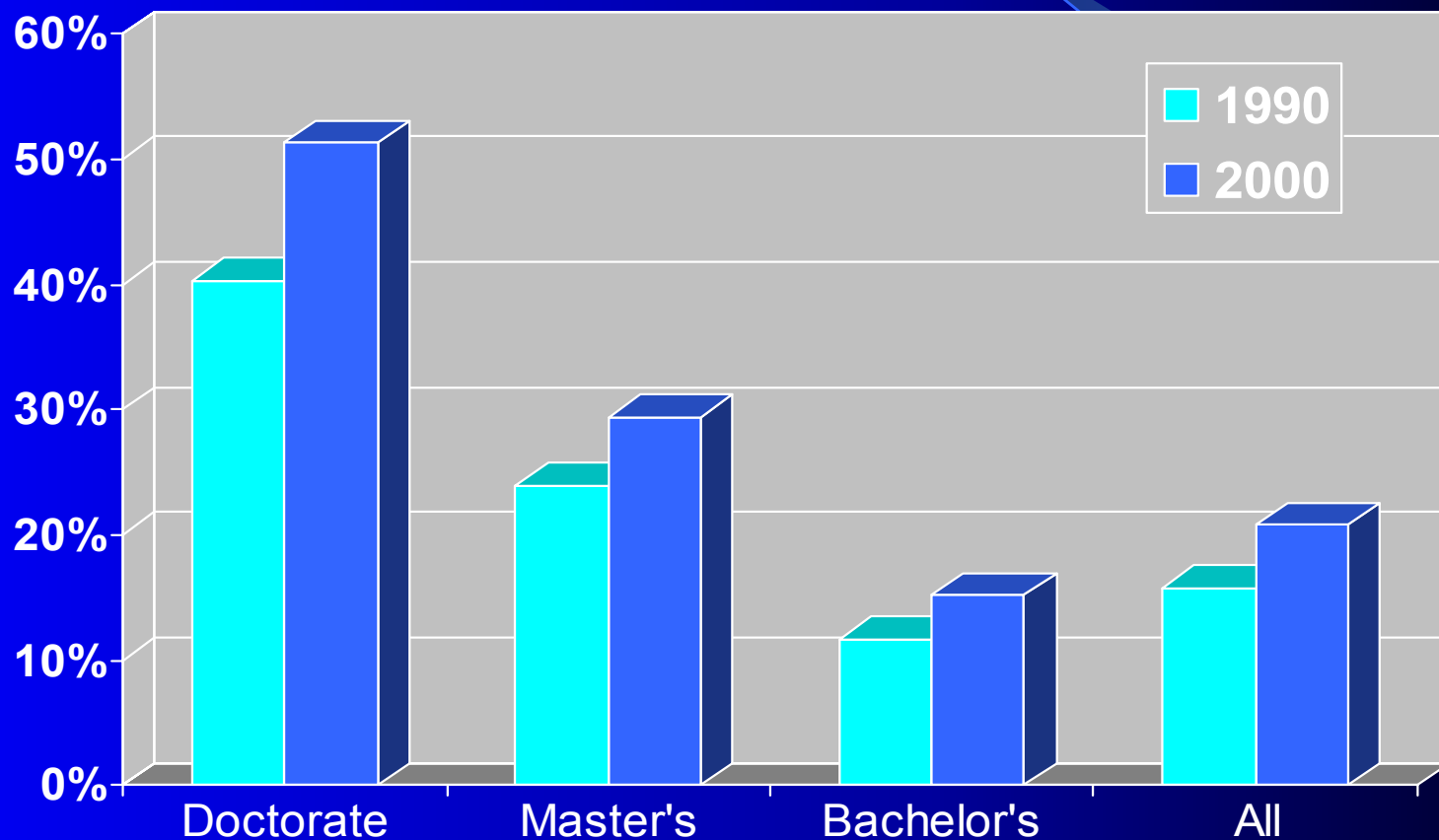
# Foreign-Born Workers Account for an Increasing Share of the U.S. Science and Engineering Workforce



Source: U.S. Bureau of the Census, 5 percent public use microdata system files, 1990 and 2000.

Note: Data exclude postsecondary teachers.

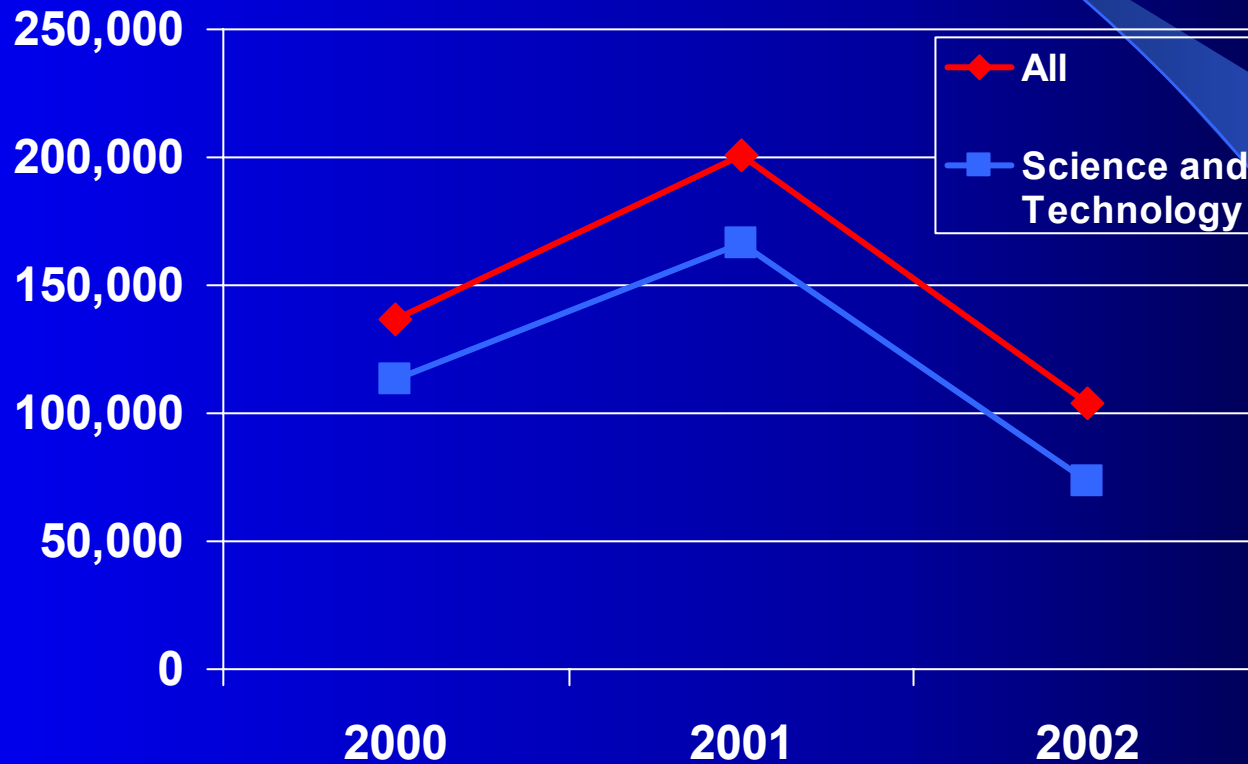
# Foreign-Born Workers are an Increasing Share of the U.S. Engineering Workforce



Source: U.S. Bureau of the Census, 5 percent public use microdata system files, 1990 and 2000.

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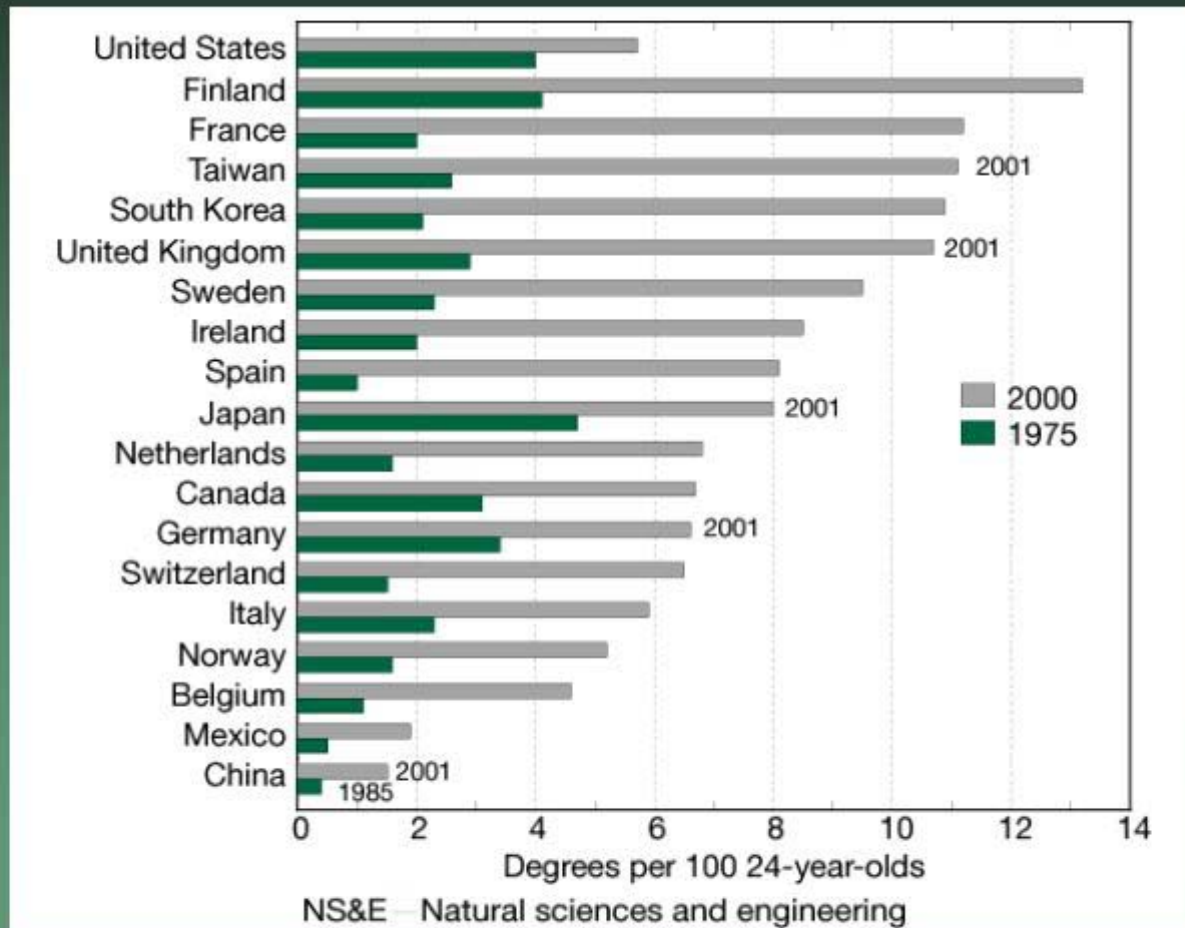
# H-1B Visas Dropped Sharply in 2002



Source: Department of Homeland Security, Office of Immigration Statistics.

# US dropped from 3rd to 15th

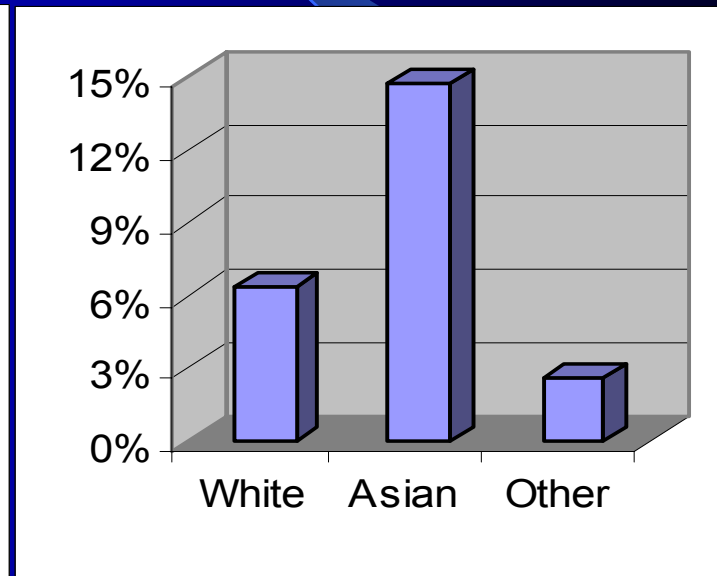
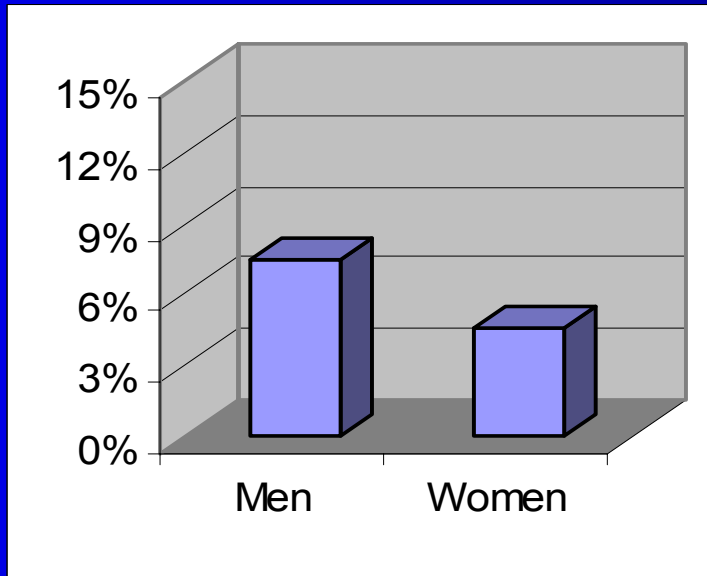
Ratio of first university NS&E degrees to 24-year-old population, by selected country/economy:  
1975 and 2000 or most recent year



SOURCE: National Science Board, *Science and Engineering Indicators-2004*

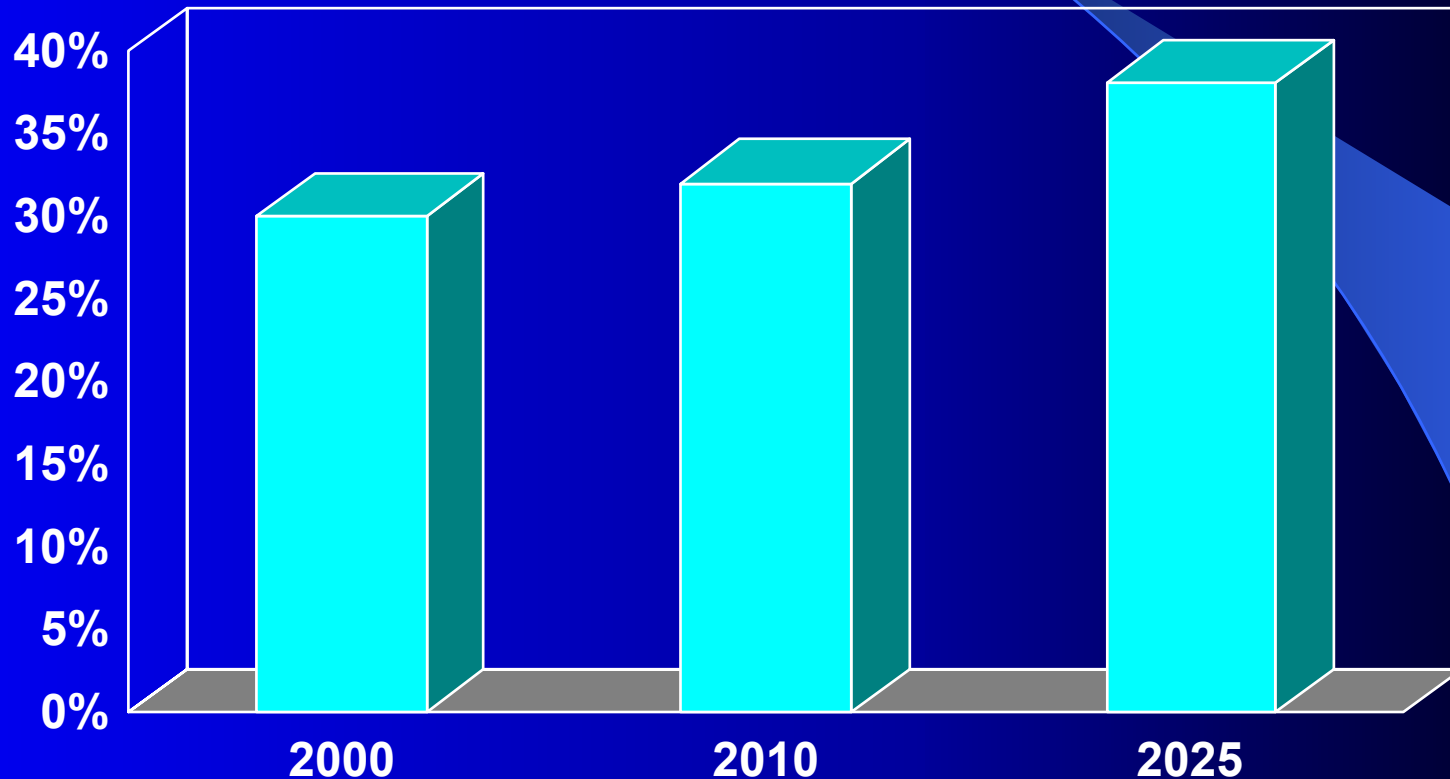


# Women and Underrepresented Minorities Are Less Likely to Earn Bachelor's Degrees in Natural Science and Engineering



Source: *Science and Engineering Indicators 2002*, Text Table 2-9, page 2-23.

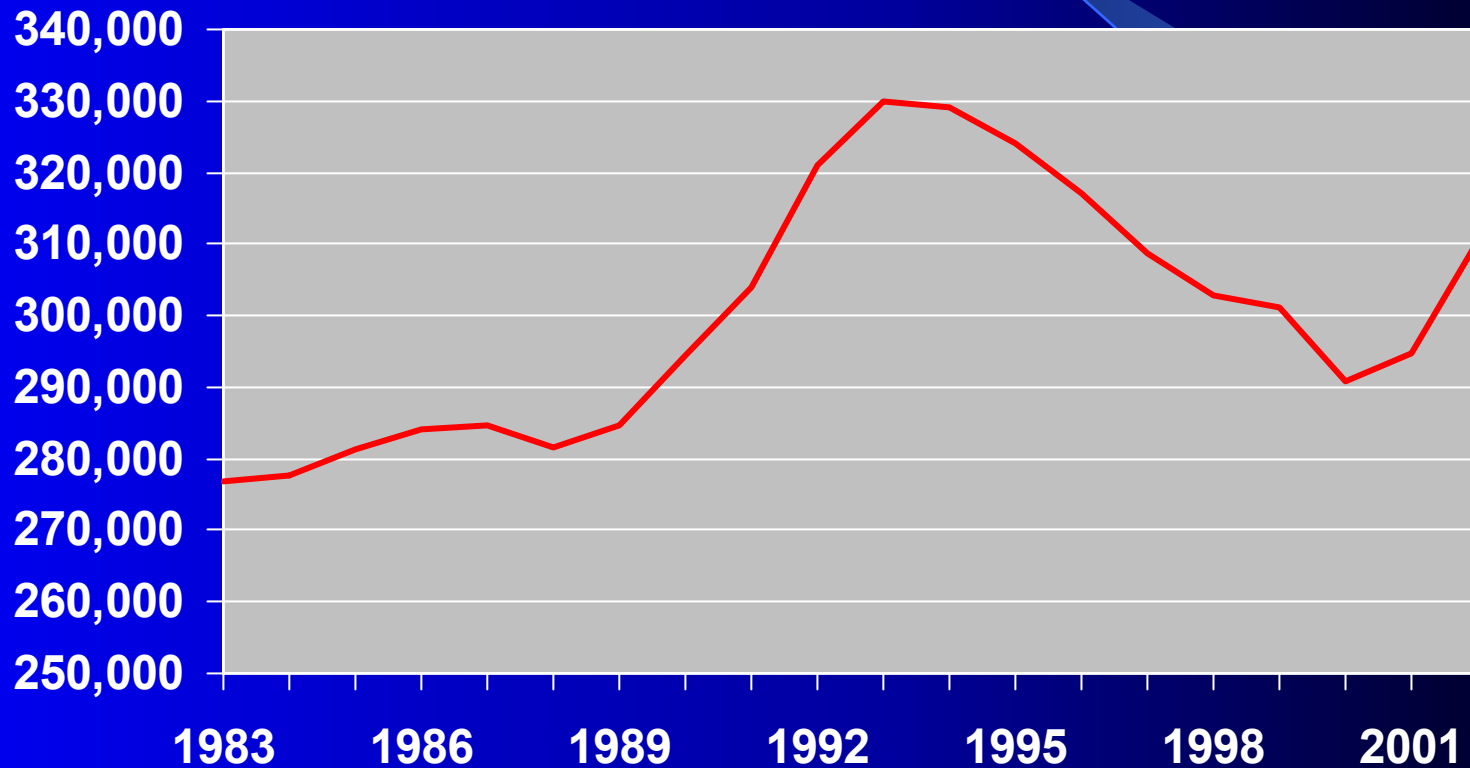
# Groups Now Underrepresented in Science & Engineering will Account for an Increasing Share of the College-Age Population



Source: U.S. Bureau of the Census, Population Division, *Projections of the Resident Population by Age, Sex, Race and Hispanic Origin: 1999 to 2100*

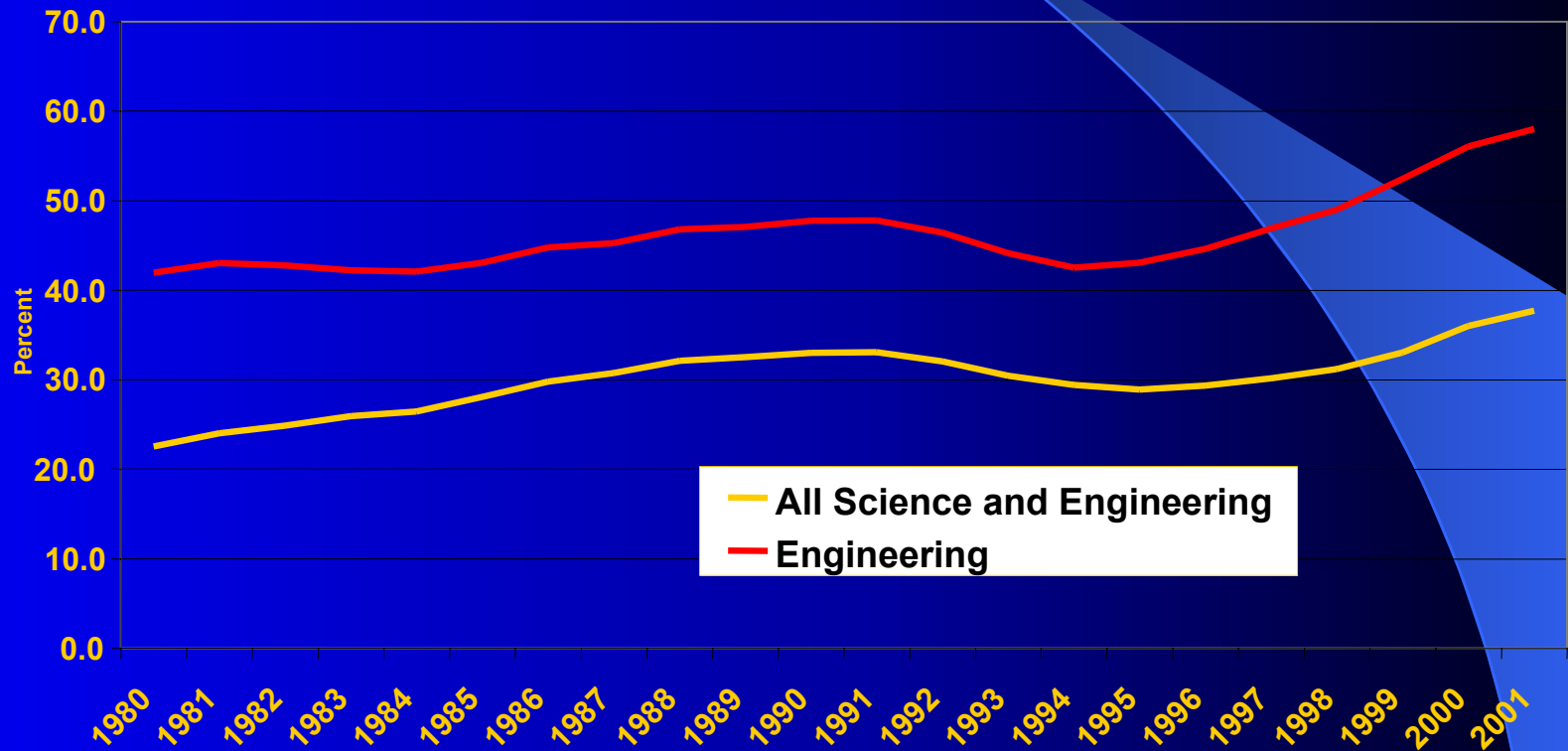
Note: Populations for 2010 and 2025 are projected.

# The Number of U.S. Citizens Enrolled in Graduate Study Fell During the Late 1990s



Source: Lori Thurgood, "Graduate Enrollment in Science and Engineering Fields Reaches New Peak; First-Time Enrollment of Foreign Students Declines," NSF InfoBrief 04-326, June 2004, Table 3.

# Foreign Students as a proportion of Full-time Graduate Enrollment



# Advanced Education: Findings

- **Opportunity costs to US graduate students in S&E are high** relative to other career paths and costs to international students.
- Universities should provide a **broader range of education and training options** to prepare advanced students for opportunities in the job market.

# Advanced Education Recommendation:

- Federal support for research and graduate and postdoctoral education should respond to the **real economic needs of students** and promote a **wider range of educational options** responsive to national skill needs.

# NSB Recommends Expanding Knowledge of the Science and Engineering Workforce System

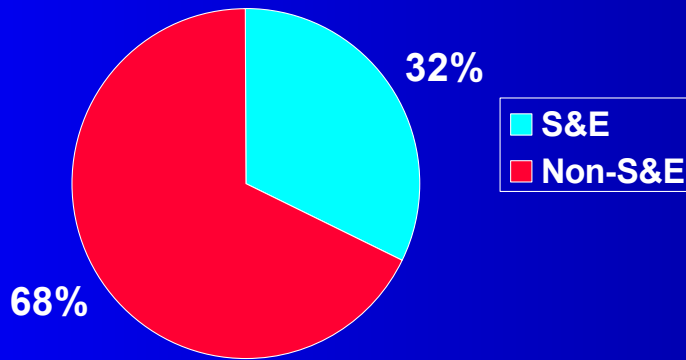
- Existing data sources are not **sensitive, extensive or timely** enough to capture **current state or future dynamics** of the science and engineering workforce.
- NSB emphasizes the importance of **counseling and guidance** on educational pathways to S&E careers.

# NSB Recommendation: Build a Better Base of Information

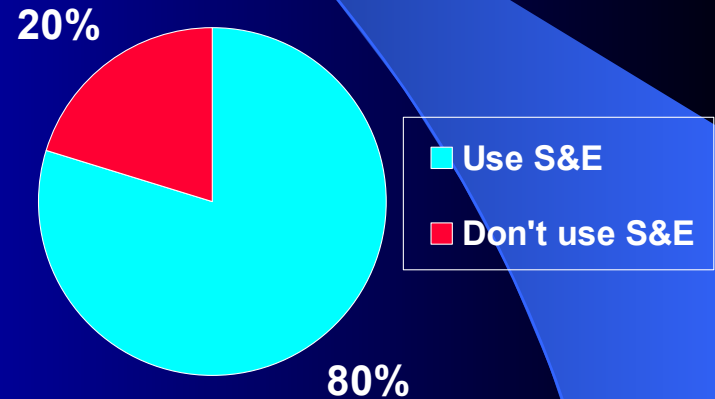
- NSB's *Realizing America's Potential* report recommended that the **Federal government** should lead a national effort to build a base of information on:
  - **Status of the science and engineering workforce.**
  - **Science and engineering skill needs and utilization** (e.g., metrics for identifying supply/demand mismatches, especially in areas of likely national need).
  - **Strategies that attract high ability students and professionals to S&E careers.**

# NSB Defines the Science and Engineering Workforce Broadly

## Occupations of S&E Workers



## Use of S&E Skills in Occupations



Source: *Science and Engineering Indicators 2002* Appendix Table 3-2, Page A3-5.

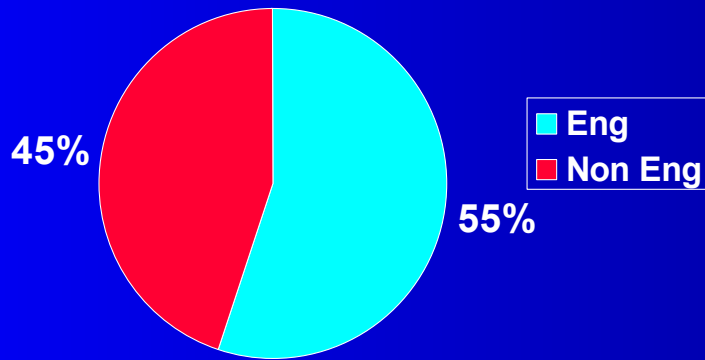
Note: SESTAT definitions of "S&E" and "Non-S&E" occupations.

Source: Calculated from *Science and Engineering Indicators 2002* Text Tables 3-1, 3-2, pages 3-6, 3-7.

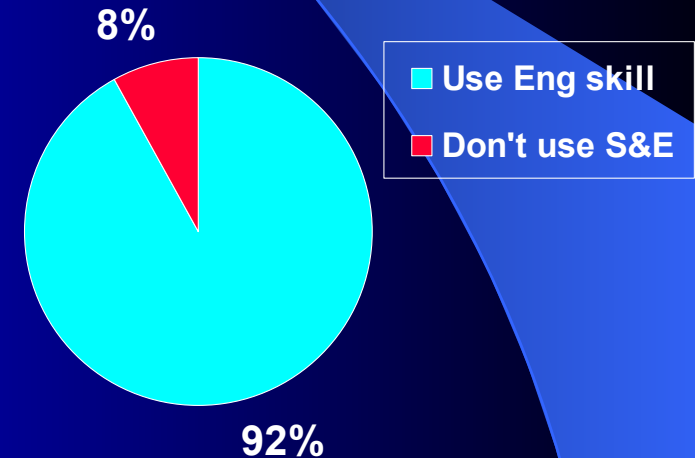
Note: "Use S&E skills" includes all those in SESTAT-defined "S&E" jobs and those in SESTAT-defined "Non-S&E" jobs who "closely" or "somewhat" use S&E skills in those jobs.

# NSB Defines the Engineering Workforce Broadly

## Occupations of Engineers



## Use of Engineering Skills in Occupations



Source: *Science and Engineering Indicators 2004* Note: SESTAT definitions of "Eng" and "Non-Eng" occupations.

Source: Calculated from *Science and Engineering Indicators 2004*  
Note: "Use S&E skills" includes all those in SESTAT-defined "Eng" jobs and those in SESTAT-defined "Non-Eng" jobs who "closely" or "somewhat" use Eng skills in those jobs.

# **NSB Recommendation: Understand Global S&E Dynamics**

- **The Federal Government should substantially raise its investment in research that advances the state of knowledge on international S&E workforce dynamics.**
- **Data to support this goal will require collaboration across US and international agencies.**

# Engagement With the International Workforce: Recommendation

- The **current reexamination** of visa and immigration policies must recognize that **engagement** with the international science and engineering workforce is essential.

# Realizing America's Potential

- **Trends**: No immediate crisis is apparent, but long term trends are **disturbing**.
- **Global leadership**: **All stakeholders must act now** to retain the US advantage in human resources for S&E, given the long-term lead time required to build global leadership.
- **Global workforce**: Both **domestic and international talent are needed** to continually renew the US workforce.
- **The Federal role**: The Federal government is uniquely qualified to **coordinate activities at the national and global levels** to benefit the national workforce.

# What Will It Take for U.S. to Maintain Global Leadership?

- It is necessary to take steps to **maintain U.S. leadership** in innovation and discovery at a time of increasing globalization of science and engineering:
  - Increase the participation of **all** U.S. citizens in science and engineering careers.
  - Maintain the opportunities for **foreign-born** to pursue U.S. education and employment in science and engineering.

