



The Manufacturing Council

WASHINGTON, D.C. 20230

Subcommittee on U.S. Competitiveness Focus: R&D – Innovation, Technology, Process, and Advancement of Knowledge

Subcommittee Report

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Vision

A policy framework that fosters R&D -- innovation, technology, process, and advancement of knowledge that will enable U.S. manufacturers to lead the way in the 21st century

Background

With the global economy continuing to break down traditional national barriers to markets and technology, the advantages of the U.S. being the world's largest economy is slowly dissipating.

To remain competitive and renew and sustain manufacturing, the U.S. must continue to lead the world in support of research and development.

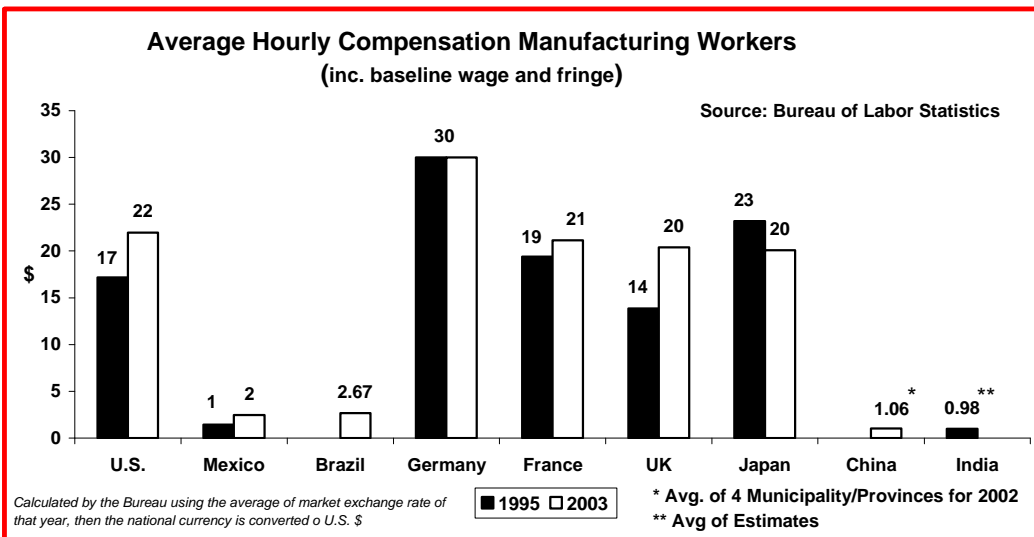
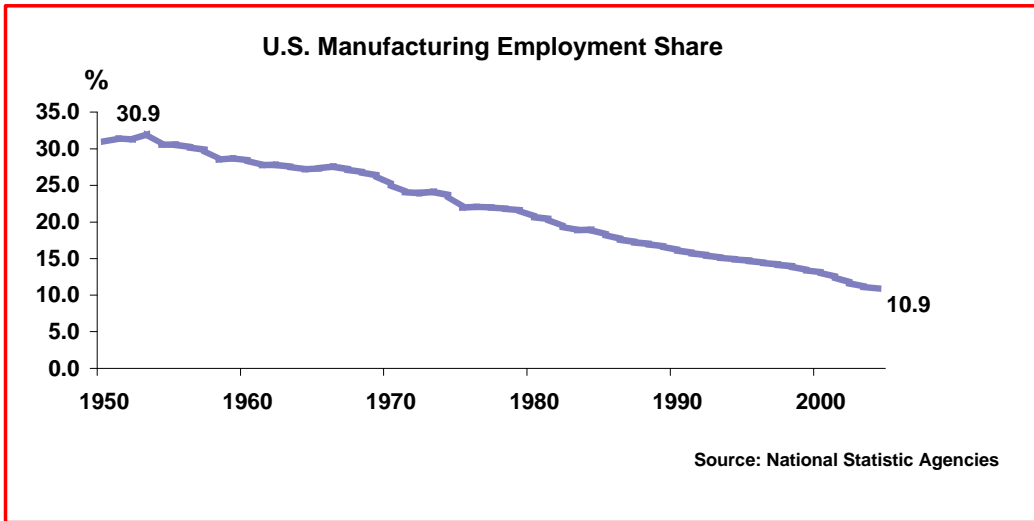
A climate that fosters R&D, including innovation, technology, process, and advancement of knowledge will be a key ingredient to maintain a global competitive advantage for U.S. manufacturers. R&D takes place in both product and manufacturing and we must have both to succeed.

Key Findings:

- The U.S. manufacturing sector accounts for 14% of GDP in 2001
- The U.S. government investment in R&D has dropped from 1.92% GDP in 1964 to 0.78% GDP in 2003
- Total U.S. Industry has increased its R&D as a percentage of GDP from 0.6% in 1964 to 1.5% in 2003
- U.S. technical training in science and engineering is approximately 31.8% of total annual graduates compared to 66.2% and 59.4% in Japan and China, respectively

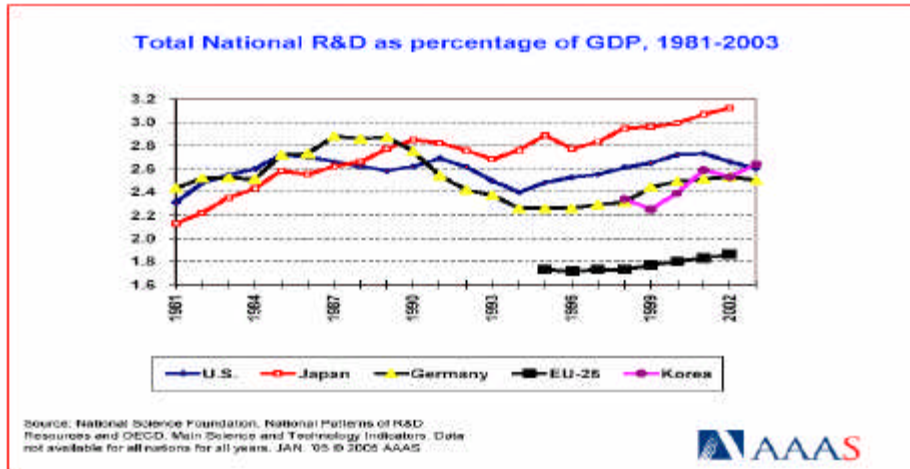
The Administration and Congress should take actions that create policies and incentives to encourage R&D, including innovation and new technology applications. Government support of R&D is vital to sustain and encourage manufacturing in the U.S. The fostering of innovation not only enables U.S. manufacturers to remain competitive, but it is a key to rising productivity and enabling start-up companies. Concurrently, while promoting R&D, we must continue efforts to reduce manufacturing costs that are uncompetitive with other countries such as health care, tort reform, tax reforms and other initiatives. The balance of this paper will address R&D only, but we cannot diminish the importance of other ongoing factors affecting the manufacturing sector.

U.S. Manufacturing Employment Share Declines



- In 2003, manufacturing's employment share was 11%, down approximately 66% from 30.9% in 1950. The U.S. needs to increase its R&D investment to mitigate and offset this decline in manufacturing jobs and protect higher paying jobs.
- To offset the significant global labor cost difference, the U.S. needs to push new technology to replace lost jobs with higher technical jobs.

R&D Investment – A Critical Component in Sustaining Manufacturing in the U.S.



Manufacturing is one of the primary engines of wealth generation in America, contributing over \$1.5 trillion in annual output and accounting for 14% of our GDP. R&D has been the driving force behind U.S. manufacturing competitiveness. R&D (innovation, technology, process, and advancement of knowledge) will be a key factor in determining America's economic success through the 21st Century.

The U.S. still has technological leadership in many measures:

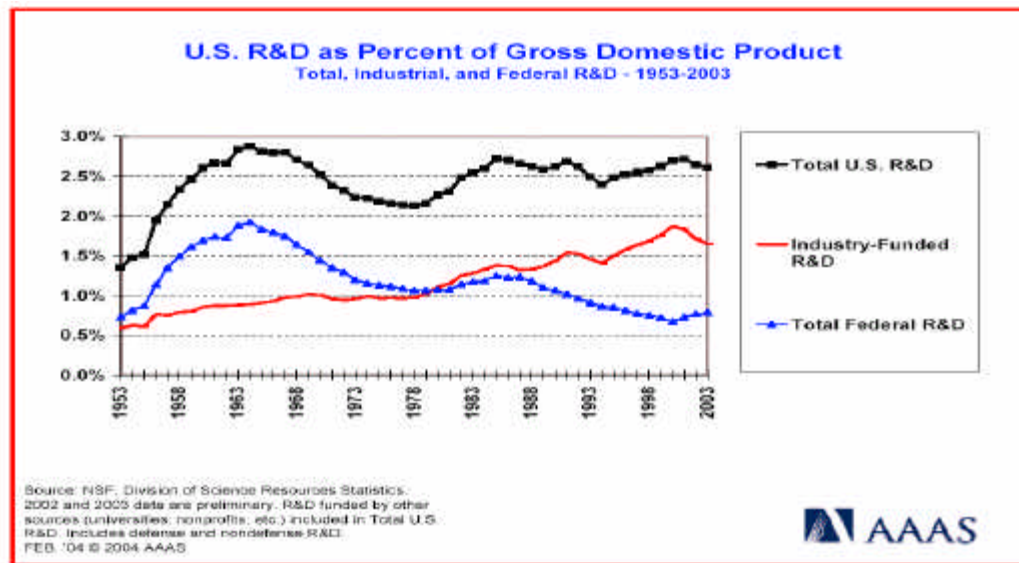
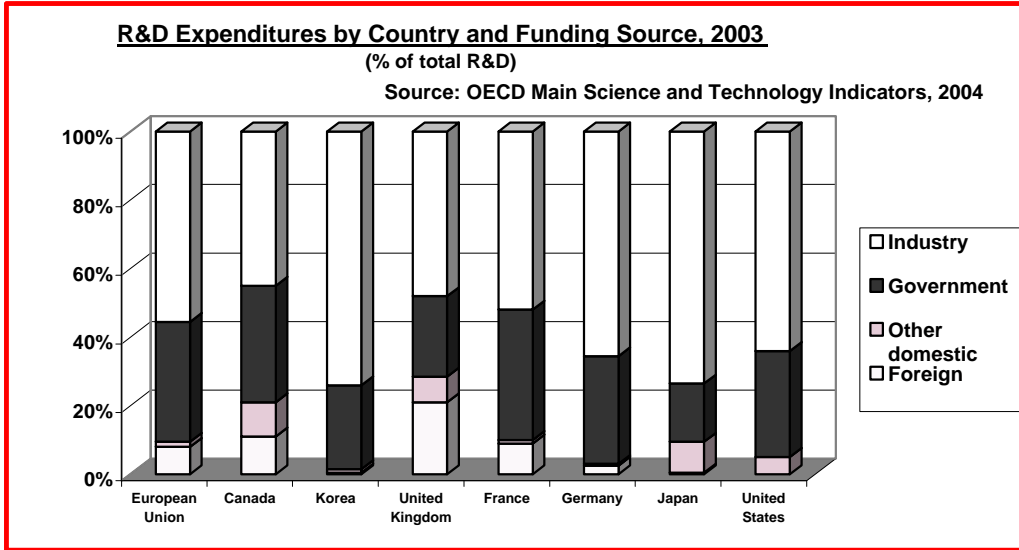
- Percentage of GDP invested in R&D
- Productivity
- Number of educated researchers

However, current trends in research investment and workforce development indicate that the U.S. must take action to maintain its competitiveness in R&D for the future. Furthermore, these trends also indicate that the United States is in jeopardy of trailing other nations in terms of capacity for technological innovation and capability of the technical workforce. To obtain the economic benefits of advances for Americans, the U.S. must maintain the capacity for technological innovation and capacity of technical workforce to attract the best and brightest talent from within and abroad.

Expanded support for R&D in industry, including increased government-industry partnership, would strengthen the ability of the U.S. Manufacturing sector to support National Security initiatives.

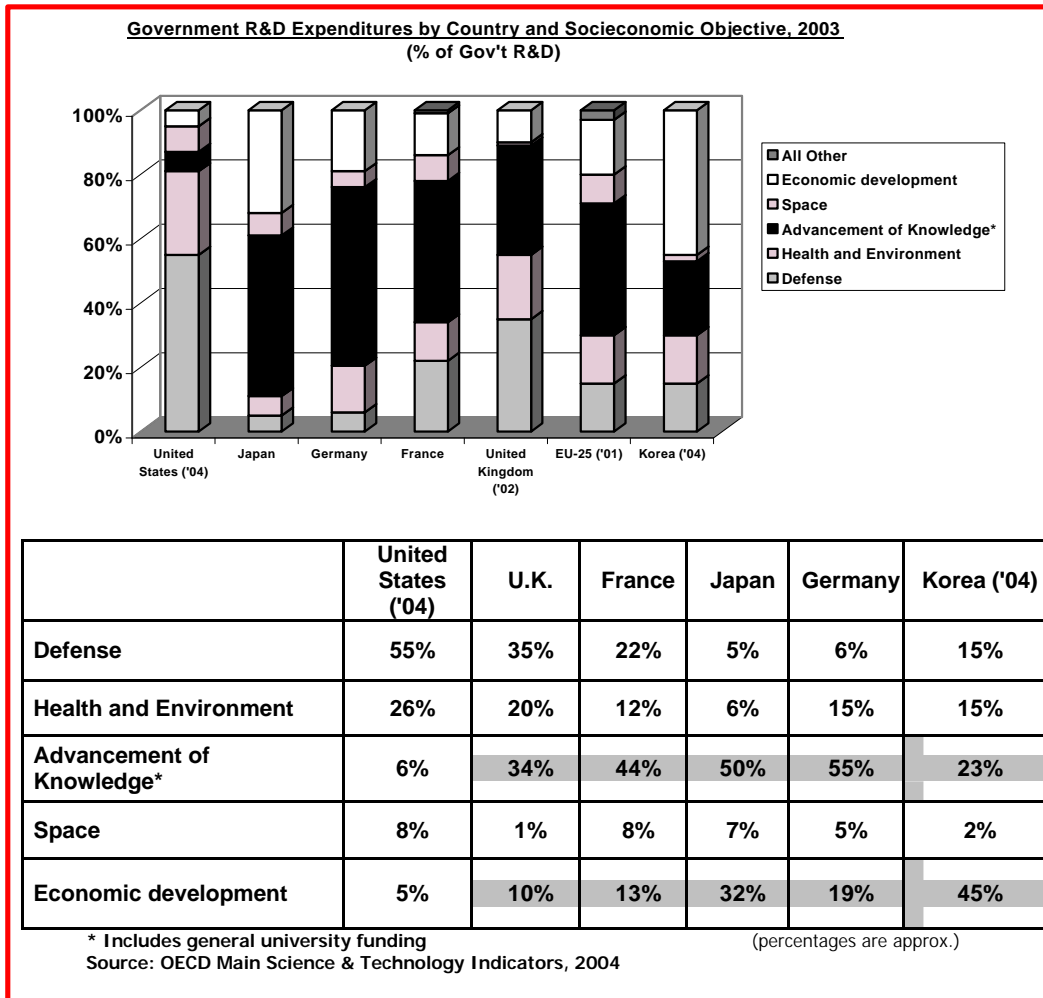
Competitive challenges from the global economy have placed unprecedented pressures on our nation's manufacturing sector. Today, the market drives the location of investment based on growth opportunities. The U.S., as a mature market, has relied on R&D innovation to maintain its competitive stature. Ongoing, the U.S. must strengthen its R&D capability and sustainability in all aspects of manufacturing in order to continue to compete as other markets catch up.

Private Industry Contributes to Majority of National R&D Investment



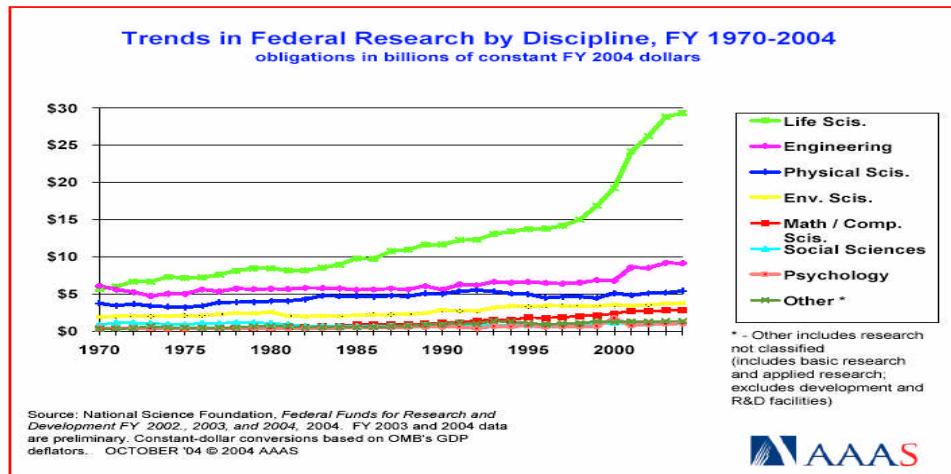
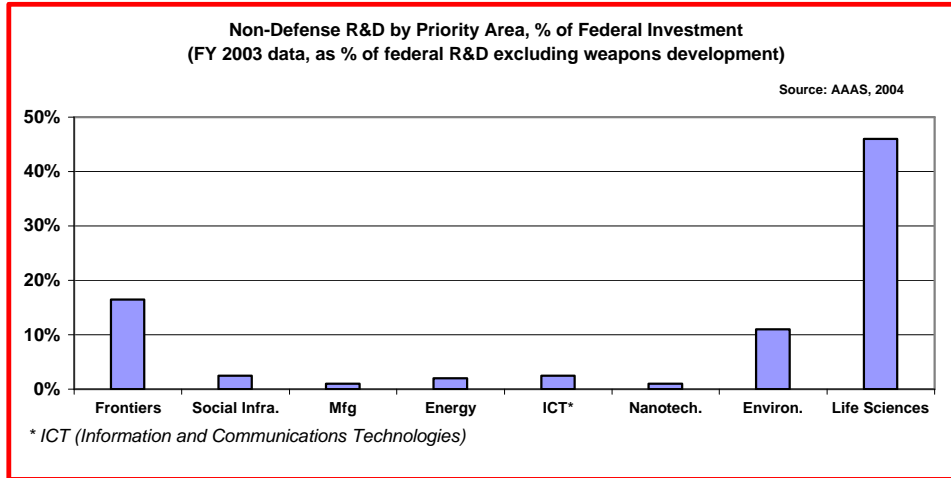
- In 2003, the federal portion of R&D was 0.78% of GDP, compared to 1.92% in 1964. Private industry has taken on a greater burden and now accounts for two-thirds of the national investment in R&D.
- While increasing R&D dollars to the 1964 GDP levels is unrealistic, investing in R&D at a rate comparable to GDP growth is critical to maintaining a competitive advantage.

U.S. Focus is on Defense while Other Countries Invest in Advancement of Knowledge – Key Business Driver



- Even though the U.S. government can claim the highest absolute level of R&D investment in the world, the priority of the expenditures (55%) of the U.S. has been dedicated to national defense. Other competitive countries focus on advancement of knowledge and economic development.
- Although total U.S. R&D expenditure is higher, the percentage provided as a key enabler towards advancing knowledge and technology is small relative to investments made by other countries. U.K., France, Japan, Germany, and Korea invest 23% to 55% in innovation knowledge and technology and these investments have become key enablers of business to expand and grow globally.

Present U.S. R&D Priority Trends



- Beyond defense development, the priority of the U.S. R&D expenditures has been devoted to life sciences.
- Federal funding for physical sciences and engineering has been flat for the last two decades and decreasing as a share of GDP.
- Science and technology is the cornerstone of America productivity. It creates jobs and drives economic growth; therefore, additional investment in this area will be required.

Conclusions

Looking forward, we must promote actions in the Administration and Congress that prioritize policies and initiatives which will encourage **R&D (including innovation, technology, process, and advancement of knowledge) - - the primary building block for ongoing U.S. manufacturing competitiveness.**

Support for U.S. R&D investment will encourage global competitiveness and promote industry and government collaboration. Historically, we can see how these collaborative efforts have sewn the seeds for major manufacturing and commercial product initiatives - examples include commercial applications from the space program, the building blocks of the internet that were established through collaborative research efforts, and supercomputing capabilities that could not have progressed with industry funding alone.

History has also shown that the U.S. needs to constantly replenish manufacturing jobs in our economy through significant attention to R&D. Without this investment, U.S. labor costs become less competitive constricting our ability to create and maintain high paying jobs.

Both government and business should seek an American competitive advantage by putting greater emphasis on investment in innovation, technology, and advancement of knowledge. In the present environment, these are not a priority. In order for U.S. businesses and industry to compete globally, and for our manufacturing economy to avoid sacrificing long-term viability, government must encourage further R&D investment.

Recommendations

The following are key building blocks, some of which have been identified in the *Manufacturing in America* report, which must be addressed:

Short Term Actions (1-3 years):

- **Promote initiatives that encourage small business development and accelerate capital investments**
 - Provide increased funding for federal science programs and the Manufacturing Extension Partnership Program
 - Pursue effective tax policies that encourage investment and business expansion
- **Advocate the need for a permanent extension and expansion of expiring U.S. R&D tax credits by year-end 2005.**
 - Establish a supportive work plan to promote manufacturing and innovation through expanded Research and Development initiatives and partnerships
 - Identify areas of focus for key manufacturing and process improvements that can be accelerated through effective public-private partnerships (see Attachment 1)
- **Support patent reform initiatives to promote and protect innovation.**
 - Improve the quality and streamline the timing needed for patents granted by the U.S. Patent and Trademark Office (see Attachment 2 for Number of Patents Granted by Country)
 - Reform patent litigation to address rising costs
 - Reduce the cost and complexity of filing patents internationally
- **Prioritize Funding and Upgrade Worker Skills and Innovation Through Technology Applications**
 - Champion medium and long-term strategy for expanding availability of science and engineering talent (see Attachment 3 for percentage of graduate degrees in Science, Math and Engineering by Country)
 - Universities and Partnerships
 - Manufacturing/Apprenticeship Program
 - Elementary/Middle/High School Program
- **Promote innovation and process improvement in U.S. health care initiatives to improve manufacturing competitiveness.**
 - Global competition must be met through innovation and new technology applications both within the plant walls and in external cost elements - - health care is the single most important external cost element for manufacturers - - significantly above other countries because of their respective national health care policies. Health care cost reductions are as important to overall manufacturing competitiveness as any other cost element
 - Lessons learned in applying technology must be spread to health care to drive costs to affordable levels. Champion accelerated efforts to reduce costs through:
 - Inter-operability and quality reporting metrics
 - Electronic medical records
 - E-prescribing

Long Term Actions (3-5 years):

Champion the vision for U.S. support of R&D initiatives and implement an action plan that returns spending that is consistent with the rate of growth of U.S. economy.

We recognize the government's role as an effective research and development partner, as well as to establish a supporting environment for industry to expand their R&D initiatives, will help solidify the foundation for innovation in the 21st century. The role of R&D – innovation, new technologies, process and advancement of knowledge in establishing U.S. manufacturing leadership is critical as we continue to compete.

U.S. Manufacturing Council R&D in Manufacturing

U.S. Manufacturing Council

- A more intent focus in government on manufacturing and competitiveness
- The need for economic growth, both domestic and in international markets
- "Keeping our side of the street clean" by addressing domestic cost issues
- Ensuring a level playing field by cracking down on unfair trade practices

Existing Organizations that Support R&D in Manufacturing*

AIAG (Automotive Industry Action Group) - reduce cost and complexity within the automotive supply chain and to improve speed-to-market, product quality, employee health-and-safety and the environment. <http://www2.aiag.org/> **Ford Contact:** Mary Foster (MFOSTER@ford.com); Linda Plawecki, Ford Executive Loan (lplawecki@aiag.org)

DAPCEP (Detroit Area Pre-College Engineering Program) - dedicated to increasing the number of historically under-represented minority students (African-American, Hispanic-American and Native-American) who are motivated and prepared academically to pursue careers in engineering, science and mathematics-related fields. <http://www.dapcep.org/>

FIRST (For Inspiration and Recognition of Science and Technology) - designs accessible, innovative programs to build self-confidence, knowledge and life skills while motivating young people to pursue opportunities in science, technology and engineering. <http://www.usfirst.org/>

Focus Hope – use intelligent and practical action to fight racism, poverty and injustice.

Achievements include:

- A food program for eligible mothers, children, and senior citizens,
- Education and training in manufacturing, engineering, and information technology,
- Arts programs to increase understanding of different cultures,
- Children's day care and education,
- A manufacturing operation that gives students hands-on work experience
- Conference facilities
- Volunteer and outreach initiatives

<http://www.focushope.edu/>

Ford-MIT Alliance - intended to initiate projects and programs that would not otherwise take place, with specific emphasis on issues that are important to Ford, to build upon MIT's existing research and strengths, and to provide insight, impact, and value to Ford. <http://oceanides.srl.ford.com/epss/MIT.htm>

LEED (Leadership in Energy and Environmental Design)

- Define "green building" by establishing a common standard of measurement
- Promote integrated, whole-building design practices
- Recognize environmental leadership in the building industry
- Stimulate green competition
- Raise consumer awareness of green building benefits
- Transform the building market

<http://www.usgbc.org/LEED/>

MAPI (Machinery and Allied Products Institute) - dedicated to furthering the interest of capital investment in the best interests of the manufacturing sector. <http://www.mapi.net/>

NACFAM (National Council for Advanced Manufacturing) - increase the effectiveness of the high-level policy dialogue between industry, government and other stakeholders in the issue areas of Tax Policy, Structural Cost Reduction, Supply Chain Integration, Trade Policy, Energy Issues, Technology and Innovation, and Workforce Education and Training. <http://www.nacfam.org/> **Ford Contacts:** Nick Broggi (NBROGGI@ford.com) & Patricia Deneszczuk (PDENESZC@ford.com)

NAE (National Academy of Engineering) - promote the technological welfare of the nation by marshaling the knowledge and insights of eminent members of the engineering profession. <http://www.nae.edu/>

NAM (National Association of Manufacturers) - enhance the competitiveness of manufacturers by shaping a legislative and regulatory environment conducive to U.S. economic growth and to increase understanding among policymakers, the media and the general public about the vital role of manufacturing to America's economic future and living standards. <http://www.nam.org/>

NFIB (National Federation of Independent Business) - impact public policy at the state and federal level and be a key business resource for small and independent business in America. <http://www.nfib.com/>

NGMTI (Next Generation Manufacturing Technology Initiative) - accelerate the development and implementation of breakthrough manufacturing technologies in support of the transformation of the defense industrial base and the global economic competitiveness of U.S.-based manufacturing. <http://www.ngmti.org/>

NIST (National Institute of Standards and Technology) – develop and promote measurement, standards, and technology to enhance productivity, facilitate trade, and improve the quality of life. <http://www.nist.gov/>

NSBE (National Society of Black Engineer) - increase the number of culturally responsible Black engineers who excel academically, succeed professionally and positively impact the community. <http://www.nsbe.org/>

SAE (Society of Automotive Engineers)

- Dedicated to advancing mobility technology to better serve humanity
- Improved processes and systems for mobility product life cycles with a focus on total life cycle
- Fosters innovation, creativity, timely response to change, social responsibility, and user satisfaction with a focus on a better natural environment for the benefit of future generations.

<http://www.sae.org/>

SBA (Small Business Administration) – Maintain and strengthen the nation's economy by aiding, counseling, assisting and protecting the interests of small businesses and by helping families and businesses recover from national disasters. <http://www.sba.gov/>

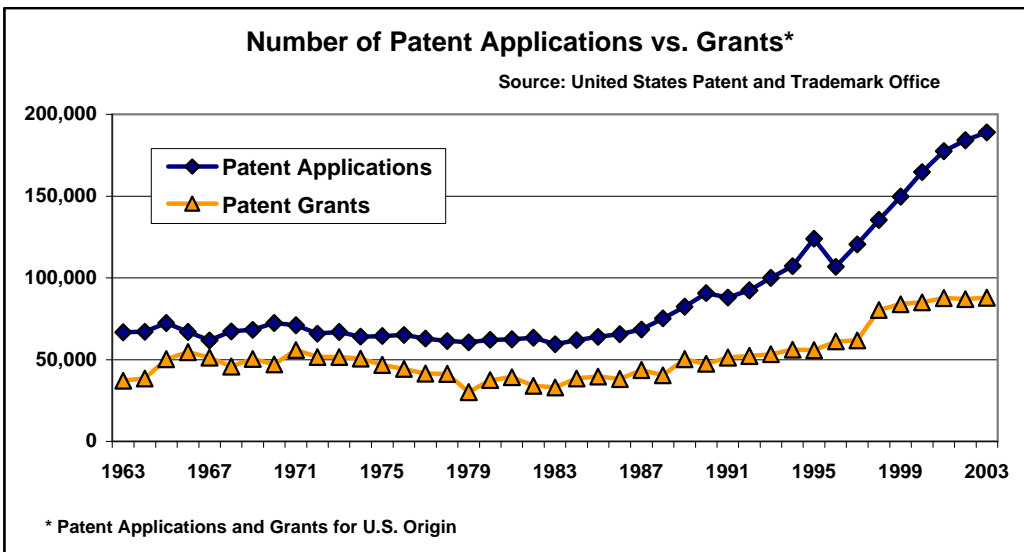
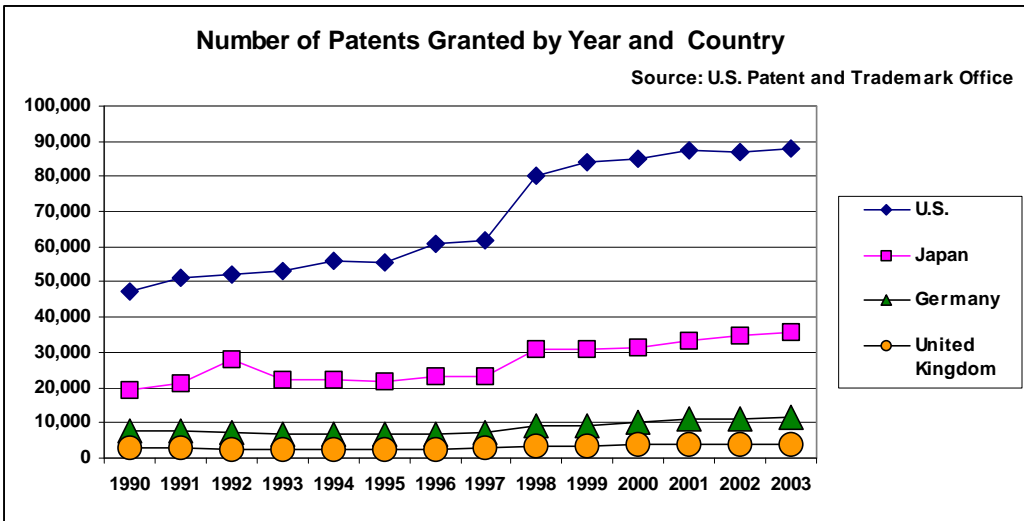
SME (Society of Manufacturing Engineers) - world's leading resource *Where Manufacturing Comes Together* - both people and information - to advance manufacturing knowledge. Innovation, productivity, flexibility, and continuous improvement are keys to gaining a sustainable competitive advantage. <http://www.sme.org/>

SHPE (Society of Hispanic Professional Engineers) - form a national organization of professional engineers to serve as role models in the Hispanic community. <http://www.shpe.org/>

USCAR - umbrella organization of DaimlerChrysler, Ford and General Motors, which was formed in 1992 to further strengthen the technology base of the domestic auto industry through cooperative research. <http://www.uscar.org/>

* This list is not inclusive of all organizations supporting R&D

U.S. Leads in Number of Patents Granted per Year -- Keeping Up with Applications Poses a Major Challenge



- Patent filings in the U.S. are at an all-time high – more than 188,000 a year. In 2003, only half of the patents filed were granted as patents. The U.S. manufacturing sector accounts for more than 90 percent of all U.S. patents registered annually
- This results in a backlog of pending patents, longer waiting times for patents to issue and quality of the patents slipping in some key sectors and technology. Ultimately, this obstacle in the patent system could delay new products and services that could hurt job creation, productivity and slow economic growth

**Percentage of Bachelor Degrees Awarded
in Science and Engineering by Country**

