STI OUTLOOK 2002 - COUNTRY RESPONOSE TO POLICY QUESTIONNAIRE

UNITED STATES

1. General framework and trends in science, technology, and industry policy

New Executive leadership in the U.S. began in January 2001. President Bush has underscored the need to make government more result-oriented and accountable; this emphasis is reflected in the President's budget requests for FY 2002 and FY 2003. The economic downturn, exacerbated by the terrorist attack on September 11, 2001 has also affected nearly every aspect of government policy and budgeting.

Nevertheless, the general framework and policy direction for science and technology (S&T) policy remains basically unchanged. The U.S. intends to maintain leadership across the frontiers of scientific knowledge and to use science and technology to support national security and the nation's long-term economic growth, improve the health and welfare of its citizens, and protect environmental quality.

The President's budget requests to Congress in both FY 2002 and FY 2003 provide for overall increases in the Federal research and development (R&D) investment. In FY 2002, Federal R&D reached an historic USD 103 billion, up from USD 91 billion in FY 2001. The largest increases are in defense and the life sciences. Federal funding for basic research remains strong and emphasises areas that will contribute to U.S. scientific strength and national interests in the long-term. These areas include mathematics, information technology, nanotechnology, and biotechnology.

However, Federal R&D funding for some fields of sciences and engineering is flat or lower than in previous years when adjusted for inflation. Some fields experienced funding cuts. To improve the accountability and effectiveness of government spending, the President's budget requests funding level adjustments based on management and performance of R&D programs. The FY 2003 budget proposal introduces a "management scorecard" that evaluates the effectiveness of Federal agencies and their programs in five categories: human capital, competitive sourcing, e-government, financial management, and the integration of budget and performance are used to rate program effectiveness. Implementation of the Government Performance and Results Act of 1993, which requires Federal agencies to submit to Congress multi-year strategic plans, annual performance plans, and annual performance reports, also backs this call for a more result-oriented and accountable government.

In addition, the Administration aims to curb the increasing number and costs of Congressional earmarks (which are location-specific spending designated in budget appropriations bills) for Federal R&D as a means to further the use of competitive, merit-based research. For example, the number of Congressional earmarks for the National Aeronautics and Space Administration rose from about 20 in FY 1997 to over 120 in FY 2002, or from less than USD 100 million to over USD 500 million. The Administration also aims to shift R&D priorities within government departments and agencies, as well as reducing Federal program support for industry R&D and innovation. It has recommended elimination or cuts in funding for the Advanced Technology Partnership, the Technology Opportunities Program, and the Manufacturing

Extension Partnership in the FY 2002 and FY 2003 budget proposals. Congress provided funding appropriations for these programs in FY 2002 and would likely continue support in FY 2003.

The September 11, 2001 terrorist attacks prompted an emergency request for Federal counter-terrorism R&D under the FY 2002 budget. The U.S. Congress approved an additional budget of USD 1.5 billion to fight bioterrorism and bolster homeland defense. All agencies with R&D responsibilities received additional funding. The largest increases went to the Department of Defense (addition of USD 118 million to USD 353 million), Department of Energy (addition of USD 126 million to reach USD 196 million), and the Department of Health and Human Services (addition of USD 335 million to reach USD 451 million). Nearly 40% of the increase for the Department of Health and Human Services went to the Centers for Disease Control and Prevention to support response to bioterrorism, and the rest was for the National Institutes of Health.

Source: "Budget of the United States Government, Fiscal Year 2003" at http://www.whitehouse.gov/omb/budget/fy2003/bud09.html; "Budget of the United States Government, Fiscal Year 2002" at http://w3.access.gpo.gov/usbudget/fy2002/maindown.html; and "Congressional Action on R&D in the FY 2002 Budget" at http://www.aaas.org/spp/dspp/rd/ca02tbla.htm; and

2. Public sector research and public research organisations

2.1. Policy changes and background/rationale related to public sector R&D

U.S. policy related to public sector R&D is largely unchanged under the new Executive leadership, although there have been increases and decreases in different areas of the Federal R&D budget. The Federal role in research is critical for the national S&T enterprise, particularly in areas that are high risk and require long-term investment to produce future high payoffs to society or that are unlikely to be funded by the private sector. Federal R&D is also critical for unique, costly, cutting-edge research facilities and instrumentation and for academic research that, as a primary purpose, support education in science and engineering. The Federal system for allocating R&D funds is an incremental process that results in final allocation decisions based on inputs from a range of stakeholders, including the science and engineering community. Nearly all Federal R&D is subject to annual appropriation decisions by the President and the U.S. Congress.

A significant increase in Federal R&D for defense occurred in FY 2002, in addition to the continuing expansion of Federal R&D for the life sciences. However, Federal R&D in most other areas, such as mathematics and the physical sciences such as chemistry, physics, and astronomy, received only moderate increases; for some, the level of funding is flat or reduced after adjustment for inflation.

The Administration emphasises improvement in the management and performance of all Federal programs, including those in R&D. Administration efforts in this regard include reductions of Congressional earmarks for R&D in the President's budget proposals for FY 2002 and FY 2003. In FY 2002, Congressional earmarks for R&D reached a total of USD 1.5 billion. The Department of Agriculture (USDA) receives the largest amount of all earmarks for R&D (25%), the Department of Defense (DOD) is second (23%) and the National Aeronautics and Space Administration (NASA) is third (16%). The Federal program receiving the largest earmark for R&D is the Agricultural Research Service of USDA (USD 257 million in FY 2002, or 17% of all Congressional earmarks for R&D). The Army has the second largest amount of earmarks (USD 120 million), followed by the Co-operative State Research, Education, and Extension Service (CSREES) of USDA (USD 107 million), and the Aero-Space Technology Research (USD 83 million) and Academic Programs (USD 67 million) of NASA.

The Administration aims to reduce the number and amount of Congressional earmarks, which are location-specific spending items designated in appropriations bills, as a way to further promote competitive and merit-based research. The President's FY 2003 budget requests elimination of funding for over 400 USDA earmarks and recommends similar cuts for other government agencies.

The President's FY 2003 budget proposal also makes explicit that funding for Federal R&D programs be determined by their performance. In this connection, the FY 2003 budget proposal introduces a "management scorecard" to rate the effectiveness of Federal agencies and their programs. The scorecard covers five categories: human capital, competitive sourcing, e-government, financial management, and the integration of budget and performance.

The President's FY 2002 proposal cited the National Weather Service, the National Science Foundation (NSF), and the Women, Infants and Children's Program of USDA as having proven effectiveness, and recommended increases in their budgets. NSF, in particular, received the only passing score for financial management among the Federal agencies and programs rated in the President's FY 2003 budget proposal. The NSF budget would total USD 5 billion in FY 2003, an increase of 5%. Excluding NSF's non-R&D education activities, NSF R&D would be USD 3.7 billion, a boost of 3.6% or USD 129 million.

The call for improved government management and performance is consistent with the Government Performance and Results Act (GPRA) of 1993 and the drive to develop better mechanisms for co-ordination of the Federal R&D budget that originated in the late 1980s. GPRA was enacted to improve the effectiveness, efficiency, and public accountability of public programs and to aid government decision-makers and Congress in assessing the performance of public programs. Under the Act, agencies have to develop multiyear strategic plans, annual performance plans, and annual performance reports to measure the progress of programs toward achieving their goals and explain why performance goals were not met. Agencies were to submit their first strategic plans to Congress in September 1997, their first performance plans in the spring of 1998, and the first performance reports in March 2000. The focus on results, that is outputs and outcomes of programs, rather than inputs is a new approach for both Federal agencies and the Congress, and criteria for definitively characterising goals, measures, and standards as "results-oriented" are still being developed. Thus, most agencies have collected data on program goals, costs, and result, but not all have successfully completed all GPRA requirements.

On the volume and shifts in funding allocation, Federal support for R&D continued to expand in FY 2001 and FY 2002, and selected high-priority areas in defense and health R&D received substantial increases. Defense and health R&D together make up more than three-quarters of the entire Federal R&D portfolio, and their shares are growing as Federal R&D remains flat or falls in other areas such as the physical sciences, mathematics, and engineering. The Federal R&D for FY 2002 was also boosted by emergency funds requested by the Administration and approved by Congress to fight bioterrorism and bolster homeland defense following the terrorist attacks on September 11, 2001.

Total Federal support for R&D in FY 2001 reached USD 91.3 billion, an increase of USD 8 billion from USD 83.3 billion in FY 2000. Increases went largely to DOD and the National Institutes of Health (NIH). Although there were increases in R&D funding for most agencies, some received increases less than the rate of inflation and others sustained cuts in their R&D programs.

FY 2002 Federal spending on R&D is estimated at USD 103.2 billion, breaking the USD 100 billion mark for the first time. Significant increases appear in allocations to DOD and NIH. Funding for DOD represents a significant boost for the first time in many years. Federal R&D for defense grew by USD 8.2 billion in the FY 2002 budget to reach USD 53.8 billion. Federal R&D funding for NIH in FY 2002 increased by USD 2.8 billion over the previous fiscal year to reach USD 22.5 billion, the largest annual funding boost in NIH history.

Non-defense R&D totaled USD 45.62 billion in FY 2001, or an increase of USD 4.72 billion or 11.5%, over FY 2000. Estimated FY 2002 allocation is USD 49.37 billion, reflecting an 8.2% rise from FY 2001. Most of this growth is due to substantial increases in Federal R&D for NIH, which has grown about 14% per year since FY 2000. Non-defense R&D excluding NIH only grew only 9% between FY 2000 and FY 2001 to reach USD 25.9 billion and an estimated rise of 3.7% between FY 2001 and FY 2002 to reach USD 26.8 billion.

Defense R&D expanded in FY 2001 and FY 2002. Defense R&D includes R&D under DOD and other Federal agencies, although DOD conducts the bulk (more than 90%) of this work. Defense R&D was USD 45.6 billion in FY 2001, an increase of 7.2% over FY 2000. Defense R&D for FY 2002 is USD 53.8 billion, an 11.7% increase over FY 2001. The “Science and Technology” portion of DOD’s budget (including basic and applied research plus exploratory technology development) reached USD 8.9 billion in FY 2001, up from USD 8.7 billion in FY 2000. This portion of R&D grew by nearly 10.6% to an estimated USD 9.9 billion in FY 2002.

Basic research continues to be a high priority for the Federal government. In FY 2001, Federal funding for basic research reached USD 21.3 billion, up 11.5% from USD 19.1 billion in FY 2000. Federal support for basic research in FY 2002 is USD 23.5 billion, an increase of 10.3% from the previous year. The increases went mostly to the life sciences and medical research funded by NIH. The total NIH budget in FY 2001 was USD 19.7 billion, a 10.6%, or USD 1.9 billion increase over FY 2000. Of this sum, USD 11.6 billion went to basic research, or 54% of total Federal support for basic research. The total NIH budget increased further in FY 2002 to reach an estimated USD 22.5 billion. This is a 14.1% increase from the previous year. Of this sum, USD 13.2 billion went to basic research, or 56% of total Federal support for basic research.

Federal support for applied research and development also increased in FY 2001 and FY 2002. Applied research received USD 21.9 billion in Federal support in FY 2001 and increased by 9.6% to USD 24.1 billion in FY 2002.

The President announced his FY 2003 budget request on February 4, 2002. Several trends in Federal R&D funding continue, including substantial increases for DOD and NIH and the Administration’s goal to further improve government management and performance.

The total request for the FY 2003 budget for Federal R&D is a record USD 111.8 billion or an 8.3% rise over FY 2002. Proposed increases for DOD (USD 5.4 billion) and NIH (USD 3.9 billion) account for more than half of the overall Federal R&D increase of USD 8.6 billion over FY 2002. The latter reflects the Administration’s commitment to double funding for NIH from the 1998 level within five years. Much of the emergency spending on homeland security will also continue in FY 2003. The budget request for the mathematical sciences included a substantial 20% increase to USD 182 million to support multidisciplinary R&D. Proposed increases in research would also go high priority areas that are supported by multiple agencies: the war on terrorism, networking and information technology (IT), nanotechnology, and climate change.

For other Federal R&D funding agencies, there are no clear patterns among the increases and decreases in the Administration’s budget request for agency portfolios. Declines for some departments and agencies also reflect a return to more normal funding levels as the FY 2002 budget is inflated by emergency appropriations for counter-terrorism following the September 11, 2001 terrorist attacks.

In FY 2003, DOD would receive its second largest dollar boost in history for its R&D to USD 54.6 billion, an increase of USD 5.4 billion or 10.9% after a record increase of nearly USD 7 billion in FY 2002. Since most of the increase would go to development of weapon systems in the military services, basic and applied research would remain flat.

General science R&D would go up by 2.6% largely due to a funding boost for NSF and its programs, as well as the transfer of three programs from other missions to the NSF portfolio. These are the Sea Grant Program of the Department of Commerce's National Oceanographic and Atmospheric Administration (NOAA), the Toxic Substances Hydrology Program of the Department of the Interior's U.S. Geological Service, and the Environmental Education Program of the Environmental Protection Agency (EPA).

Also, three major multi-agency initiatives would receive increases in the FY 2003 budget. Funding of the Nanoscale Science, Engineering, and Technology Initiative would climb another USD 100 million (or 17.3%) to USD 679 million in FY 2003. The budget for the Networking and Information Technology R&D initiative under NSF would increase by 2.5% to USD 1.9 billion. The U.S. Global Change Research Program budget would climb 5% to USD 1.8 billion.

On the non-defense R&D budget, the FY 2003 budget proposal continues trends in the two previous fiscal years. The non-defense R&D budget of USD 53.2 billion would be a 7.8% rise from FY 2002. It includes USD 26.5 billion, or a 17.4% growth, for NIH R&D and USD 26.7 billion, or a 0.4% drop, in non-NIH R&D. Nearly the entire increase goes to DOD and NIH, leaving all other discretionary programs, including R&D programs outside NIH and DOD, with flat or declining funding overall.

Defense R&D would rise further in the proposed FY 2003 budget. The President's request of USD 58.5 billion is an 8.8% increase over FY 2002. The Science and Technology portion of DOD's R&D under the proposed budget is USD 9.7 billion or 2% lower than in FY 2002. Much of the growth would be in other areas of R&D conducted by DOD.

For basic research, the FY 2003 budget requests an 8.5% or USD 2 billion increase for a total of USD 25.5 billion. This would be an all-time high. As in the three previous fiscal years, more than half of all Federal support for basic research (USD 14.5 billion or 57%) goes to NIH. However, NIH basic research would increase only by 9.7%, less than its overall R&D increase, because of a new emphasis in FY 2003 on applied research on cancer and bioterrorism. Most agencies would see their basic research funding increase modestly in the FY 2003 budget. Requests for applied research and development also increased in the FY 2003 budget proposal. For applied research, it is up 9.2% from FY 2002 to reach USD 26.3 billion. Funding for development is up 8.9% from FY 2002 to reach USD 55.5 billion or an increase of 28.4% from FY 2001.

On initiatives for enhancement and effective use of public research infrastructure, NSF adopted new guidelines for setting priorities for major research facilities in November, 2001. NSF is also implementing a Large Facilities Project Management and Oversight Plan to improve the process for reviewing and approving large projects and to increase oversight of its projects. All current and future large projects will be subject to these new guidelines and oversight. NSF does not directly operate the large facilities that it supports. NSF primarily makes awards to universities and non-profits to construct, manage, and operate large projects. Other major agency sponsors of the national research infrastructure are the Department of Energy (DOE), NIH, and NASA.

The President's FY 2003 budget calls for enhancement of infrastructure capabilities in astronomy, earthquake research, and the environment. The budget proposes initiating construction of the international Atacama Large Millimeter Array telescope in Chile and the Earthscope projects across the United States. The Atacama Large Millimeter Array will be the world's most sensitive, highest resolution, millimeter-wavelength telescope. Earthscope will provide several instruments – some portable – to investigate the structure and evolution of the North American continent and the physical processes controlling earthquake and volcanic eruptions. The 2003 budget also provides funding to test at least two sites of the National Ecological Observatory Network, which will provide an integrated network of regional environmental research observatories. A second proposal under the budget is to improve priority setting and the visibility of the selection process for large facility projects. Also, for the first time, funding for early-stage planning and development of potential new and large facility projects is provided in a budget proposal from the Executive branch.

Source: "Budget of the United States Government, Fiscal Year 2003" at http://www.whitehouse.gov/omb/budget/fy2003/budget.html; "Congressional Action on R&D in the FY 2002 Budget" at www.aaas.org/spp/dspp/rd/ca02tbla.htm; "Preliminary Analysis of R&D in the FY 2003 Budget" prepared by the American Association for the Advancement of Science (AAAS). The full document can be found at http://www.aaas.org/spp/dspp/rd/prel03p.pdf; National Science Board, "Guidelines for Setting Priority for Major Research Facilities," January 17, 2002 at http://www.nsf.gov/nsb/documents/2001/nsb01204/nsb01204.pdf; National Science Board, "The Scientific Allocation of Scientific Resources," March 30, 2001 at

http://www.nsf.gov/nsb/documents/2001/nsb0139/nsb0139.pdf; Managing for Results: Analytic Challenges in Measuring Performance. GAO/HEHS/GGO-97-138. May 1997 at http://www.gao.gov; Effectively Implementing the Government Performance Results Act: Executive Guide. GA/GGD-96-118. June 1996.

2.2. Initiatives to reform the organisation and governance of universities and public research organisations

The Federal government supports academic research largely through the mechanism of competitively awarded grants. From time to time, aspects of this mechanism are reviewed. For example, the National Science Foundation is currently reviewing the size and duration of its awards to answer the following questions: Is the award size appropriate for scientific productivity? Does the average duration of awards divert resources from the conduct of research to the drafting of proposals to assure continued funding?

To improve the organisation of the Federal R&D portfolio, the President's FY 2002 budget recommended a concentration of all Federal R&D for basic research under NSF. Thus, it proposes the transfer of the Sea Grant Program under NOAA, the Toxic Substances Hydrology Program of the Department of the Interior's U.S. Geological Service, and the EPA's Environmental Education Program to NSF.

Finally, the Administration aims to cut Congressional R&D earmarks, or location-specific spending designated in a Congressional appropriations bill, as a means to encourage more merit-based competition in R&D funding. For example, the FY 2003 budget requests a doubling of competitive research grants in the USDA National Research Initiative from USD 120 million to USD 240 million, but cuts earmarked Special Research Grants from USD 103 million to USD 7 million. For NASA, too, the FY 2003 budget request eliminates most R&D earmarks added on to the budget in FY 2002. Congressional action to approve the final budget appropriations will likely, as in previous years, retain many of these earmarks.

Source: Data drawn from "Preliminary Analysis of R&D in the FY 2003 Budget" prepared by the American Association for the Advancement of Science (AAAS). The full document can be found at http://www.aaas.org/spp/dspp/rd/prel03p.pdf; *and* "Managing for Results: Analytic Challenges in Measuring Performance." GAO/HEHS/GGD-97-138. May 1997 at http://www.gao.gov/.

3. Government support for private sector R&D and innovation

Industry R&D in the U.S. grew steadily in the second half of the 1990s at an annual rate of 10% per year. By 2000, industry R&D reached USD 202 billion, slightly more than double the U.S. Federal R&D budget. However, economic slowdown and a recession in the past two years have reduced industry R&D investments. Although industry continues to target most funds to development activities, the greatest percentage increase has been in basic research. Basic research made up 9% of industry R&D, applied research was 20.1%, and development was 70.9% in 2000.

Today, achieving Federal goals for sustaining U.S. leadership in science and technology demands partnerships and cooperation with other sectors, including private industry. A variety of legislation and government department and agency programs promote the transfer of publicly funded research in universities and public research laboratories to the private sector and encourage industry R&D investment. However, these Federal efforts are relatively limited in size and scope and focus primarily on areas where risks are high, market funding is not available, or Federal investment might produce potential future high payoffs for society.

Source: National Science Board, "The Scientific Allocation of Scientific Resources," March 30, 2001 at http://www.nsf.gov/nsb/documents/2001/nsb0139/nsb0139.pdf; "R&D innovation in industry" at http://www.iriinc.org/web/Publications/aaas.htm

3.1. Changes to enhance the effectiveness of policy instruments used to provide public support for private sector R&D and innovation

There have been no major policy changes, although the President's FY 2002 and FY 2003 budget proposals have called for shifts in some program funding across government departments and agencies. For example, the President's FY 2003 budget requests a USD 70 million increase for the National Institute of Standards and Technology (NIST) under the Department of Commerce (DOC). This would raise the NIST budget to total of USD 402 million. However, funds are shifted from the NIST Advanced Technology Program (ATP) and the Manufacturing Extension Program (MEP) to other areas, such as funding to make a new Advanced Measurement Laboratory operational.

U.S. Government departments and agencies sponsor a broad range of R&D to support their mission. While Federal scientists and engineers at public research laboratories carry out some of these R&D activities, U.S. Government departments and agencies also award R&D grants or contracts to scientists and engineers in industry, as well as universities, non-profit organisations, and unaffiliated professionals. Whether R&D is carried in public research laboratories, other public sector institutions, or the private sector, research proposals are generally peer-reviewed, merit-based, and open to competition.

Industry can obtain transfers of R&D results produced with Federal support at universities and public research laboratories. The Stevenson-Wydler Technology Innovation Act allows Federal laboratories to enter into Co-operative Research and Development Agreements (CRADAs) with industry. The Bayh-Dole Patents and Trademark Act encourages industry to invest in the development and commercialisation of inventions that result from public funds. Both Acts were passed in 1980 and have been amended several times subsequently.

As for Federal department and agency programs that target private-sector R&D and innovation, most are relatively small. The general thrust of these programs is to provide financial support or assistance to explore the feasibility of an innovation concept, fund principal R&D, link innovators to science and technology experts, promote co-operation among industry, academia, and government, disseminate information about technology and standards. Industry takes the lead in setting priorities for R&D and innovation and in funding commercial application of technology in products and processes. Examples include the ATP (which funds high-risk innovation projects), MEP (which helps firms to find solutions to business and technical problems through nation wide network of centers and manufacturing experts), and the Small Business Innovation Research (SBIR) program (which funds feasibility and pre-commercialisation R&D for innovation projects). Also, the Office of Technology Competitiveness at DOC works with industry to identify critical issues, conduct, and disseminate leading edge research analysis.

The debate to make permanent the Research and Experimental Tax Credit continues. The President's FY 2003 budget proposal seeks to make this R&D credit permanent. This R&D tax credit was first introduced in 1981. Repeated attempts to make it permanent have failed, winning only Congressional approval for multi-year extensions. Under the current scheme, firms receive a 20% tax credit for incremental R&D expenditures in excess of a calculated base amount.

Source: "About ATP" at http://www.atp.nist.gov/atp/about.htm; "Office of Technology Competitiveness" at http://www.ta.doc.gov/TechComp/default.htm; "SBIR"at http://www.eng.nsf.gov/sbir/; "Budget of the United States Government, Fiscal Year 2003" at http://www.whitehouse.gov/omb/budget/fy2003/budget.html; and "Manufacturing Extension Partnership" at http://www.mep.nist.gov/index2.html.

3.2. Changes in the balance and/or priority of public support of business R&D and innovation

There has been no major change in the balance and/or priority of public support of business R&D and innovation, although there are shifts in the funding level of some government programs.

The vast majority of Federal R&D funds do not go to support business R&D and innovation. Federal funds focus on R&D that supports the mission of government departments and agencies and research that is high-risk and not supported by the market, but which has potential future high payoffs for society. However, the Federal government encourages industry to transfer technology produced with public funds or to invest in their development and commercialisation and does this through enabling legislation and a number of government technology and innovation assistance programs.

The U.S. Government supports public-private partnerships and collaborations with universities and industry to promote national science and technology initiatives. Nanotechnology, clean coal technology, and fuel-cell technology are the latest Federal R&D initiatives. The National Nanotechnology Initiative is a collaborative research and education enterprise that involves 10 Federal departments and agencies. In FY 2001, Congress approved USD 422 million to support nanoscale science, engineering, and technology, and the budget rose to roughly USD 604 million in FY 2002. The Clean Coal Research Initiative proposed in the President's FY 2003 budget request would receive USD 326 million. The FreedomCAR Initiative replaces the Partnership for a New Generation of Vehicles (PNGV) to develop advanced fuel cell technology. The President's FY 2003 budget request asks for USD 150 million to launch this initiative. Information technology and biotechnology continue to receive strong Federal R&D support.

For small- and medium-sized enterprises (SMEs), the Federal government provides assistance for business R&D and innovation through a variety of programs across government departments and agencies. These programs include ATP, MEP, and the Technology Opportunities Program (TOP) in the DOC. (TOP awards grants for model projects to demonstrate innovative uses of network technology.) SMEs are eligible to participate in all these programs and compete for grants.

The SBIR and Small Business Technology Transfer (SBTT) programs target SMEs. SBIR was reauthorized by Congress to continue until 2008. Funding comes from the R&D budget of 10 Federal agencies that have extramural R&D over USD 100 million. Each agency provides funding that equals to

2.5% of their extramural R&D budget. SBTT was reauthorized by Congress to operate until 2009. Funding comes from Federal agencies with extramural R&D over USD 1 billion. The contribution from each agency is 0.15% of their annual extramural R&D budget – and will rise to 0.3% in 2004.

Each agency manages its own SBIR and SBTT programs. Grants are made to small businesses to explore feasibility of innovation concepts and undertake principal research for products and processes that support the mission of the funding agency. For example, the SBIR program of the Department of Education focuses on technology innovation research that aids teaching and learning, while the SBIR program under NIH supports health-related innovation research. All grants are competitive and merit-based and usually go to support research that is high-risk or not funded by the market. Neither SBIR nor SBTT fund commercial application of R&D.

The SBIR and STTR programs differ in two major ways. First, under SBIR, the Principal Investigator must have his/her primary employment with the small business concern at the time of award and for the duration of the project period. Under STTR, primary employment is not stipulated. Second, STTR requires research partners at universities and other non-profit research institutions to have a formal collaborative relationship with the small business concern. At least 40% of the STTR research project is to be conducted by the small business concern and at least 30% of the work is to be conducted by the single, "partnering" research institution.

Also, the Bayh-Dole Patents and Trademark Act gives preferential treatment to small businesses in the licensing of technologies that result from public funds.

Source: "Technologies Opportunities Program" at http://www.ntia.doc.gov/otiahome/top/grants/grants.htm; "Small Business Innovation Research and Small Business Technology Transfer" at http://sbir.er.doe.gov/sbir/

4. Enhancing collaboration and networking among innovating organisations

4.1. Initiatives to promote collaboration and networking among innovating organisations

Clean coal research, nanotechnology, and fuel-cell technology are the latest of Federal R&D initiatives. These R&D initiatives support high-priority policy concerns that are the responsibility of multiple U.S. government departments and agencies.

As in previous Federal R&D initiatives, such as networking, IT, and biotechnology, Federal R&D provides for funding to support collaboration and networking among public and private sector organisations through a variety of agency programs. Some of these programs involve collaborative research, such as the FreedomCAR initiative between DOE and the U.S. Council for Automotive Research to develop advanced fuel cell technology. Other programs, such as those under NIST, assist industry to identify private and public sector partners to form R&D consortia or link them to scientists and engineers in NIST laboratories.

There have been no major new initiatives to strengthen regional/local innovation systems. Many Federal R&D (and science, math and technology education) programs work in collaboration with State and local governments, as well as industry and non-profit organisations. The NSF Experimental Program to Stimulate Competitive Research (EPSCoR) program targets university researchers in States that are historically under-represented in Federal R&D funding. The goal is to make these States more competitive in research on a national level. Similar to this is the Experimental Program to Stimulate Competitive Technology (EPSCoT) program of the Department of Commerce. EPSCoT also target States that are historically under-represented in Federal R&D funding, but its focus is on technology deployment targeting industry. MEP involves State and local funding and participation in the building and operation of its nation wide network of MEP centers and manufacturing experts.

Source: “FreedomCAR replaces Partnership for a New Generation of Vehicles” at http://www.doe.gov/HQPress/releases02/janpr/pr02001.htm; “Office of Technology Competitiveness” at http://www.ta.doc.gov/TechComp/default.htm; and “EPSCoR” at http://www.her.nsf.gov/epscor/about/start.cfm;”EPSCoT” at http://www.ta.doc.gov/epscot/FAQS.htm

4.2. Initiatives to promote stronger industry-science relations

There has been no major change in policy or regulation to promote industry-science relations.

The Stevenson-Wydler Technology Innovation Act and the Bayh-Dole Patents and Trademark Act provide the legal basis for the transfer of technology produced with public support at public research laboratories and universities to industry and for collaboration between industry scientists and engineers with their counterparts in Federal laboratories and universities.

The U.S. Government places no restrictions on the mobility of Federal scientists and engineers to move from one sector to another. However, as Federal employees, they cannot participate in the creation of spin offs or take equity in technology-based firms that emerge from public research.

Neither does the U.S. Government generally participate directly in the establishment or development of venture capital funds and/or second stage financing for the support of new technology-based firms or spin offs from public research. One exception is In-Q-Tel, a “venture catalyst” non-profit, private and independent company created in September 1999 by the Central Intelligence Agency. In-Q-Tel invests in the development and delivery of next generation information technologies that address the critical needs of the agency, and will become commercially available and supported.

Source: “Co-operative Research and Development Agreement” at http://www.nist.gov; and “In-Q-Tel” at http://www.in-q-tel.com

5. S&T Human Resources

5.1. Policy initiatives in response to real or perceived shortages of scientists and engineers

The U.S. needs a growing number of scientists and engineers to maintain leadership across the frontiers of science, and apply scientific and technological advances to support the nation’s long-term economic growth, improve the health and welfare of the citizens, and protect the environment.

There is some concern that not enough U.S. citizens are pursuing graduate studies in science and engineering. Instead, the U.S. may need to increasingly rely on foreign high-technology skilled professionals who are in the U.S. on temporary, non-immigrant worker visas. Enrolment of U.S. students in graduate level science and engineering programs today is 9% lower than in 1993. During the same period, enrolment of foreign students on temporary visas in U.S. colleges and universities increased by 3%.

The NSF reports that the number of science and engineering doctorates awarded in the U.S. is an annual average of roughly 26,000 in the 10-year period between 1991 and 2000. U.S. citizens make up about 59% of this number and 38% goes to non-U.S. citizens. (Citizenship for the remaining 3% is not known.)

Among the non-U.S. citizens, 21% have permanent visas in the U.S. and 78% holds temporary visas. (Citizenship of the remaining 1% is unknown.)

A breakdown of science and engineering doctorates obtained between 1991 and 2000 in the U.S. by major field shows that U.S. citizens are the clear majority only in Psychology (87% vs. 7% for non-U.S. citizens) and the Social Sciences (59% vs. 34% for non-U.S. citizens). Non-U.S. citizens have a slight lead (55% of all degrees awarded) in all engineering fields from chemistry to mechanical, civil, electrical, and materials/metallurgy.

In the Sciences, U.S. citizens received 64% of all degrees awarded, 32% went to non-U.S. citizens. However, U.S. citizens have a lead only in the Physical Sciences (57% vs. 42% for non-U.S. citizens), Earth, Atmospheric, and Ocean Sciences (62% vs. 34% for non-U.S. citizens), and the Biological Sciences (66% vs. 32% for non-U.S. citizens). Non-U.S. citizens received a greater share of the doctoral degrees in Mathematics (51% vs. 46% for U.S. citizens), Computer Sciences (48% vs. 47% for U.S. citizens), and Agricultural Sciences (50% vs. 47% for U.S. citizens). The number of non-U.S. doctoral degree recipients in the Biological sciences has been growing, as much as 14% in one year and 10% in several other years. In comparison, the number of U.S. doctoral degree recipients has been growing at less than 2% on average during this 10-year period.

The majority of non-U.S. citizens who received doctorate degrees between 1991 and 2000 stayed in the U.S. after completing their studies to pursue postdoctoral research or employment in academia, industry or other sectors. Among those with permanent U.S. visas, 56% of all with science and engineering doctoral degrees remained in the U.S. For those with temporary visas, 48% stayed in the U.S. Thus, the average for all non-U.S. citizens is 52%.

A breakdown by fields shows that the average for all non-U.S. citizens is 54% in Engineering and 51% for all Sciences. Within the Physical Sciences, 58% stayed in the U.S.; in Mathematics, it was 56.5%; in the Computer Sciences, it was 63.5%; in the Biological Sciences, it was 57.5%. More non-U.S. citizens chose to pursue postgraduate research or work outside the U.S. only in the Earth, Atmospheric, Ocean Sciences (52.5%), Agricultural Sciences (67.5%), Psychology (57%), and Social Sciences (61%).

Source: Science and Engineering Doctorate Awards: 2000. NSF 02-305 at http://www.nsf.gov/sbe/srs/nsf02305/start.htm

5.2. Changes in training and education programmes for scientists and engineers

Support for education and training includes most activities funded through the Education and Human Resource budget function, as well as those programs funded through the Research and Related Activities function that accomplish education and training objectives through the tie to research programs. Pre-kindergarten through secondary level (or "K-12" education as it is known in the U.S.) has traditionally received the largest share of funding (about 60%), undergraduate level receives about 23%, graduate and post-doctoral level gets approximately 15%, and other education and training support, such as public education, receives about 3% of all funds committed to education and training.

Education programs under NSF are designed to improve the human resource base of science and engineering in the U.S. and to increase the participation of scientists and engineers from groups that are traditionally under-represented in advanced levels of science, mathematics, and engineering. Much of NSF's support is associated with the Federal interagency effort to improve science, mathematics, engineering, and technology education.

NSF programs at the undergraduate level include (1) the Advanced Technology Education projects which focus on technician education at the undergraduate and secondary levels in advanced technology fields; (2) the Comprehensive Undergraduate Education Reform which supports institution-wide reforms of undergraduate science, engineering, and mathematics education; (3) the Alliance for Minority Participation which supports comprehensive approaches to increase the quality and quantity of underrepresented populations to earn science and engineering undergraduate degrees; and (4) the Engineering Education Coalition which stimulates innovative and comprehensive approaches for systemic reform of undergraduate engineering education and aim to increase the retention of students.

NSF programs at the graduate level include (1) Graduate Fellowships and Minority Graduate Fellowships which are awarded across all science, mathematics, and engineering disciplines to provide student support in critical areas of current and anticipated national priority; (2) Graduate Research Traineeships which are awarded competitively to institutions to provide student support in critical areas of current and anticipated national priority; (3) Research Training Groups to foster multidisciplinary, research-based training and education at the graduate level, and (4) Postgraduate Study and Research Fellowships which are sponsored in specific research disciplines. Also, the Graduate Teaching Fellowships were recently launched to produce professionals who work at the K-12 and undergraduate level.

The FY 2002 budget increases funding to NSF to attract more of the most promising U.S. students to pursue careers in science and engineering. It provided for increases in annual stipends for NSF Graduate Research Fellowships and Graduate Teaching Fellowships and increased funding for the Integrated Graduate Education and Traineeship Programs. The FY 2003 budget requests further increase in NSF graduate fellowship and traineeship annual stipends to USD 25,000. There are also increases in support for international postdoctoral fellows and for industry-based fellowships for graduate students and postdoctoral fellows.

In addition, the President's Math and Science Partnerships initiative was launched in 2001 to provide funds for States to join with institutions of higher education to strengthen mathematics and science education in K-12 levels. The FY 2002 budget gave USD 160 million to this initiative, and the FY 2002 budget proposal seeks to boost funding to USD 200 million. However, funding has declined for most other education and human resource programs.

Source: "Education and Training" at http://www.nsf.gov/bfa/bud/fy1997/97et2.htm; "Budget of the United States Government, Fiscal Year 2002" at http://w3.access.gpo.gov/usbudget/fy2002/maindown.html

5.3. Policy changes related to the international migration and mobility of S&T personnel

The terrorist attacks on the U.S. in September 2001 prompted a more stringent enforcement of immigration controls. However, U.S. policies, in general, do not explicitly promote or circumscribe international migration and mobility of scientific and high-skilled personnel, including foreign students, researchers, and skilled workers; neither do U.S. policies promote return migration of expatriate students, researchers, and skilled scientists and engineers. Tens of thousands of individuals from around the world come to the U.S. each year for undergraduate and graduate level training as well as short- and long-term professional visits, such as fellowships, sabbaticals, and participation in scientific workshops and seminars.

Foreign high-tech skilled workers can apply for permanent or temporary visas to maintain residence and employment in the United States. The H1-B category, a temporary work visa for high-skilled workers is the most common temporary visa used by skilled professionals from foreign countries for employment in the United States. In response to strong industry demand for skilled professionals to work in the information technology sector, the American Competitiveness in the 21st Century Act of 2000 increases the number of H1-B visas granted each year from 65,000 to 195,000 for FY 2001, 2002, and 2003. Also, for the first time, those to be employed by universities, non-profit research institutions, and government research institutions were exempted from the annual ceiling.

Source: "American Competitiveness in the Twenty-First Century Act of 2000" at http://thomas.loc.gov

6. International Co-operation and Globalisation

6.1. Initiatives to promote international co-operation in science, technology and innovation

International linkages in science and technology are an important part of the U.S. science and technology policy. In 2000, the National Science Board stated that "Our participation in international S&E [science and engineering] collaborations and partnerships is increasingly important as a means of keeping abreast of important new insights and discoveries in science and engineering."

The U.S. recognises that the scientific enterprise is a transboundary one. Researchers seek the best collaborators they can find regardless of national boundaries. Many scientific queries also require international collaborations to bring together the appropriate scientific data, materials, equipment, and tools, and to share costs. In addition, international R&D co-operation contributes to the spread of the ethos of free inquiry, knowledge to improve the health and economic well being of societies, and international goodwill.

Today, about 60% of the entire U.S. R&D investment comes from the private sector. Leaving this aside, the bulk of support for U.S. researchers, particularly in basic research, comes from Federal R&D programs, as well as Federal R&D allocations to NSF, DOD, DOE, and NIH. Most funds are given directly to U.S.-based scientists on the merit of their proposals. Some Federal programs explicitly include international co-operation. For example, the Co-operative Science Program between NSF and the Korean Science and Engineering Foundation (KOSEF) seeks to increase the level of co-operation between the U.S. and Korea.

Agency funds for international co-operation also support their domestic R&D missions, aid the agency in its operations, or meet other government missions, such as humanitarian assistance and disaster relief. However, mission-oriented S&T support is difficult to track because these funds are not tagged and identified separately within the Federal budget.

Finally, the U.S. negotiates and signs formal and informal agreements to co-operate in international S&T. Most of these agreements involve binational co-operation between the U.S. and a foreign country, and some support multinational R&D. The subjects of these agreements range broadly over the areas of science and technology targeted. However, some international S&T agreements are never fully implemented because of a lack of funds from one or more of the signatories.

Source: National Science Board. Science and Engineering Indicators 2000. National Science Foundation, 2000 at http://www.nsf.gov/sbe/srs/seind00/start.htm; and Caroline Wagner, Allison Yezril, and Scott Hassell, International Cooperation in Research and Development: An Update to an Inventory on U.S. Government Spending, MR-1248-OSTP, RAND, 2000 at http://www.rand.org/publications/MR/MR1248/

6.2. Policies and programmes to foster international collaboration in research and development

The U.S. Government supports and participates in international S&T activities. Between 5% and 6% of the Federal R&D budget annually funds international co-operative S&T. These activities range from largescale multinational "megascience" projects, such as the International Space Station, to small grants to fund research experiments conducted by individual U.S. scientists with counterparts in other countries. International S&T activities also include assistance projects, such as those helping to develop a pest-resistant strain of wheat for Central American farms, monitoring of the global atmosphere, or seeking the causes of disease.

In addition to spending on international R&D, the U.S. Government also supports activities that have a scientific or technological component and that involve international co-ordination or co-operation. These activities include weather tracking, mapping, seismic detection, and space and defense operations.

In most instances, the U.S. Government funds international S&T activities to build scientific capabilities that are central to scientific or national interests or to meet mission-specific requirements. In many cases, international activities are not budgeted separately or in a manner that can be easily discerned or tracked.

Source: National Science Board. Science and Engineering Indicators 2000. National Science Foundation, 2000 at http://www.nsf.gov/sbe/srs/seind00/start.htm; and Caroline Wagner, Allison Yezril, and Scott Hassell, International Co-operation in Research and Development: An Update to an Inventory on U.S. Government Spending, MR-1248-OSTP, RAND, 2000 at http://www.rand.org/publications/MR/MR1248/

6.3. Initiatives to attract foreign direct investment into local high-tech industries and R&D activities

The U.S. Government does not have special measures to enhance foreign firm access to U.S. technology programs. Foreign firms are free to obtain licenses for technologies in the U.S. Only technologies that are classified or subject to export controls for national security reasons are not accessible to foreign firms. The majority of publicly funded technology programs are focused on U.S. firms but a few are open to participation from foreign firms. The Foreign Guest Research Program at NIST offers scientists from around the world the opportunity to work with NIST scientists and access NIST laboratories. These foreign guest researchers may come from universities, industry, or non-profit organisations. Funding for them may come from their home institutions, a bilateral program with the U.S., international organisations, or support for direct scientist-to-scientist collaboration.

The U.S. Government also does not have special measures to enhance U.S. industry access to foreign/international technology programs. U.S. firms are largely free to enter into industry R&D collaborations with foreign partners inside and outside the United States. Private sector international R&D is increasing. There is a growing number of formal co-operative agreements or alliances between firms. Overseas R&D activities performed under contract and through overseas subsidiaries of U.S. firms have also increased, and the number of U.S. industry R&D laboratories located abroad is rising. At the same time, many foreign firms have established R&D centers in the United States. The majority of strategic alliances are between U.S.-owned firms based in the United States and their subsidiaries overseas and between U.S-owned firms and their Japanese- and European-owned counterparts. The multinational character of many U.S. and foreign businesses makes it difficult to distinguish their national origin or to clearly designate them as "U.S." or "foreign." Most of these relationships focus on a few high-technology areas, most notably IT and biotechnology.

Source: National Science Board. Science and Engineering Indicators 2000. National Science Foundation, 2000 at http://www.nsf.gov/sbe/srs/seind00/start.htm; and "National Institute of Standards and Technology" at http://www.nist.gov

Policies and programs to encourage or support international industrial R&D alliances, especially among SMEs.

The U.S. Government does not actively fund international R&D alliances in the private sector. Only a few bilateral agreements support industrial R&D co-operation between U.S. and foreign companies. NIST maintains a number of memoranda of understanding, mutual recognition agreements, and other international agreements with foreign countries for co-operation in setting measurements and standards in many fields of science and engineering. International industrial R&D alliances between U.S. and foreign businesses U.S. businesses rely mainly on businesses to set their own priorities and fund their co-operative activities.

Source: "National Institute of Standards and Technology" at http://www.nist.gov; "International Agreements" at http://www.nist.gov/oiaa/intragre.htm

7. Industry-related policies

7.1. Globalisation

The U.S. Government actively supports and promotes competitive free trade through its participation in international bodies such as the World Trade Organisation and contribution to international development assistance through bilateral channels and multilateral organisations. Many U.S. government departments and agencies collect data and conduct research on the international competitiveness of U.S. firms as well as the competitiveness of industries in many foreign countries, and making such information publicly available.

However, there are few special programs or initiatives dedicated to helping U.S. industry to globalise or enhance their competitiveness in world markets. One example is the Office of International Technology (OIT) in the Department of Commerce. OIT works with individuals and foreign governments to advance policies and initiatives that advance U.S. technology leadership in the global economy, expand U.S. high tech business opportunities overseas, and enhance U.S. economic prosperity.

Most other programs, such as those under NIST, work to strengthen U.S. global competitiveness by working with industry to develop technologies, measurement methods, and standards or identify industry, university, and government partners for R&D and innovation. Moreover, it is industry, rather than government, which takes the lead in setting R&D priorities and in commercialization of technologies and innovations.

Source: "National Institute of Standards and Technology" at http://www.nist.gov

7.2. Manufacturing

None.

7.3. Services

None.

7.4. Intangible Investment

None.

7.5. Corporate Responsibility

Tax incentives encourage U.S. corporations to make charitable contributions to support education, protection of the environment, public health, and other activities to improve citizen welfare and strengthen communities across the country. The Department of Energy operates the Voluntary Reporting of Greenhouse Gases Program. The program, created by the Energy Policy Act of 1992, provides a means for organizations and individuals who have reduced their greenhouse gas emissions to record their accomplishment and to share their ideas for action. The Administration's Clear Skies and Global Climate Change Initiatives, announced on February 14, 2002 as the U.S. approach to reducing greenhouse gas emissions, give emissions trading credits to corporate participants in the Voluntary Greenhouse Gas Reporting Program that can show real emissions reductions. The credits can be used in a domestic "cap and trade" program.

Following the collapse of Enron, the Administration announced a 10-point plan on March 7, 2002 to improve corporate responsibility. The plan would require corporate chief executives to vouch personally for their company's financial statements and would impose broad new responsibilities on executives and accountants. Executives who receive large salaries and bonuses after issuing misleading financial statements would be required to surrender their wealth if accounting fraud was later uncovered. Accounting firms would face greater government scrutiny, including new prohibitions on mixing accounting functions with consulting and other services if such work compromises the independent of the audit. The plan would also create an independent regulatory board that would establish professional conduct and competence standards, monitor accountants, and punish industry officials.

Source: "About the Voluntary Reporting of Greenhouse Gases Program" at http://www.eia.doe.gov/oiaf/1605/2nd_broc.html; "President Bush Announces Clear Skies and Global Climate Change Initiatives" at http://www.whitehouse.gov/infocus/environment/; and "President Outlines Plan to Improve Corporate Responsibility" at http://www.whitehouse.gov/news/releases/2002/03/20020307-3.html