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**Position Statement on the FY 2010 Budget Request for the National Science Foundation (NSF)
Submitted by the ASME NSF Task Force**

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The National Science Foundation (NSF) Task Force of ASME's Technical Communities is pleased to comment on the NSF Fiscal Year (FY) 2010 budget request, in support of this year's proposed funding level of \$7.04 Billion for the NSF. Founded in 1880 as the American Society of Mechanical Engineers, ASME is a worldwide engineering society of over 127,000 members focused on technical, educational and research issues. It conducts one of the world's largest technical publishing operations, holds approximately 30 technical conferences and 200 professional development courses each year, and sets many industry and manufacturing standards.

NSF FY 2010 Budget Request Overview

With its dedication to broad-based, cross-cutting programs that push the frontiers of science and engineering, the NSF is critical in directing the nation's non-defense-related research and education. As recognized by the Administration and Congress, for the U.S. to remain globally competitive, prosperous, and secure, the nation must support "high-risk, potentially transformative investments" that "generate important discoveries and new technology, create and train a dynamic workforce, and spark the curiosity and creativity of millions." In accordance with this vision, the newly released President's Plan for Science and Innovation (hereto referred to as the President's Plan) would double NSF's funding relative to 2006 levels. To this end, ASME strongly endorses the NSF's "unique role in the scientific enterprise," which involves acquisition of knowledge and development of talent, whereby innovative research is fostered and a first-rate science and engineering workforce is cultivated. Such a paradigm stimulates economic growth, addresses critical national needs, and preserves our nation's position as a global leader.

The total FY2010 NSF budget request is \$7.04 Billion (B), representing a \$555 Million (M) or 8.5% increase over the \$6.5B appropriated for NSF in the FY2009 omnibus spending bill signed by President Obama in early March 2009. NSF also received an additional \$3.0B in the American Recovery and Reinvestment Act (ARRA) of 2009, which would increase the total FY2009 total appropriation to \$9.5B. Because the ARRA funding is a one-time infusion of funds, it is counted separately, and not as part of the FY2009 estimate.

Research and Related Activities (RRA) comprises the major portion of the total NSF request at \$5,733M, with a 10.6% increase over the FY2009 estimate. After an overall 6.7% increase in FY2009, all of NSF's research directorates again receive notable increases in FY2010. These increases should help the Directorates to recover from the post-2004 NSF budget cuts and to reach all-time highs in inflation-adjusted funding. The resources for the Engineering Directorate (**ENG**) increase by 10.3% over the current year estimate to \$765M, of which \$133M is budgeted (through mandate) for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs that **ENG** administers for all of NSF.

ENG consists of the following disciplinary-area divisions: Chemical, Bioengineering, Environmental, and Transport Systems (CBET), up 9.6% to \$160M; Civil, Mechanical and Manufacturing Innovation (CMMI), up 9.6% to \$192M; Electrical, Communications and Cyber Systems (ECCS), up 9.6% to \$96M;

Industrial Innovation and Partnerships (IIP), up 10.5% to \$156M; Emerging Frontiers in Research and Innovation (EFRI), up 9.6% to \$29M; and Engineering Education and Centers (EEC), up 12.4% to \$132M.

A share of the **ENG** budget (allocated from the constituent divisions) will continue to support research and education efforts related to broad, Foundation-wide investments. The following activities receive increases: National Nanotechnology Initiative (up 5.7% to \$148M); Science and Engineering Beyond Moore's Law (up 233% to \$10M); and Networking and Information Technology R&D (up 14.5% to \$23.7M — \$14M of which is Cyber-enabled Discovery and Innovation). Funding for the Climate Change Science Program (\$1.0M) remains at the same level.

The Administration's FY2010 budget also expands significantly the following three NSF programs: Faculty Early Career Development (up 11.6% to \$203.8M); Graduate Research Fellowships (up 6% to \$122M), and Advanced Technological Education (up 24% to \$64M). Additionally, the Administration is devoting \$92M for a Foundation-wide effort to fund potentially transformative research, and to increase the overall Climate Change Education Program.

The ASME NSF Task Force Position

Affirmation and Endorsement

The ASME NSF Task Force highly endorses NSF's crucial function in guiding the basic research and integrated education that keeps America at the vanguard of science, engineering, and technology. NSF possesses an exceptional record of comprehensive and flexible support of a breadth of research, from 'curiosity-driven' science to targeted initiatives. This achievement has been made possible via strict adherence to the independent peer-review process for merit-based awards. The increases proposed under the President's Plan, and previously under the America COMPETES Act, should allow NSF to properly sustain and expand these efforts and commitments, advancing discovery and learning, spurring innovation, and honing the nation's competitive edge.

The FY 2010 Budget Request represents an 8.5% increase over the FY 2009 estimate. Almost all of the total \$555M increase for NSF is in R&D funding, totaling \$5.7B, a gain of \$550 million or 10.6% over the FY2009 estimate. After the increases provided in both ARRA and the FY2009 omnibus bill, this request would bring R&D investment to an all-time high in inflation-adjusted dollars, permitting the research directorates to get back on track after the budget cuts that occurred after 2004. Adequate investment in fundamental science and engineering research, that involves both established and emerging areas, is essential in recognizing and nurturing innovation, in preparing the next generation of scientific talent and leaders, and in producing the products, processes, and services that improve health, living conditions, environmental quality, energy conservation, and national security for all Americans.

Overall, the Task Force also supports and commends activities within **ENG**. NSF's support of "emerging fields, high-risk ideas, interdisciplinary collaborations, and research that pushes and even transforms the very frontiers of knowledge" is exemplified within **ENG**. Examples of successes emanating from **ENG** include the development of algorithms that combine systems control, computer vision, and imaging processing, to track objects in dynamically changing environments to improve the usefulness of brain scans, image-guided therapy, and virtual colonoscopy. **ENG's** researchers have created a new optical "metamaterial," with a negative index of refraction, made of alternating layers of different semiconductors, to bend light backwards. The metamaterial has applications for chemical threat sensors, communications equipment, and medical diagnostics. **ENG** has also funded pioneering work on using thin microwave antennas to ablate locally cancerous tissue—shrinking or eliminating tumors—without seriously damaging the healthy tissue and limiting radiation exposure.

NSF leads the U.S. nanotechnology research effort, and **ENG** is the focal point within NSF for this key national research endeavor. ASME has strongly supported the National Nanotechnology Initiative (NNI) since its inception as an NSF **investment area** in FY 2000. Increased funding amounts are requested for research at the fundamental level, as well as in environmental, health, and safety aspects. Within the total NSF-wide investment for NNI, **ENG**'s contribution will increase by 5.7% to a total of \$148M.

Finally, ASME continues to support NSF's vision to "explore the frontiers of scientific knowledge and extend the reach of engineering by encouraging, identifying, and funding the best ideas and most promising people." Thus, ASME commends the President's expansion of the Faculty Early Career Development, the Graduate Research Fellowships, and the Advanced Technological Education programs. Funding for the Faculty Early Career Development (CAREER) awards, which support exceptionally promising college and university junior faculty who are most likely to become the academic leaders of the 21st century, will increase 11.6% to \$203.8M. The FY 2010 Request provides \$245.2M for NSF's three flagship graduate fellowship and traineeship programs: \$122.0M for the Graduate Research Fellowship (GRF) program, \$66.9M for the Integrative Graduate Education and Research Traineeship (IGERT) Program, and \$54.3M for the Graduate STEM Fellowships in K-12 Education program. This funding will enable NSF to support an estimated 5,250 graduate students. NSF also supports the Research Experiences for Undergraduates program (REU) at \$67.7M, the Research Experiences for Teachers program (RET) at \$5.7M, and the Research in Undergraduate Institutions program (RUI) at \$35.2M. In addition, NSF continues to broaden participation in science and engineering. This includes efforts to reach all states and regions, e.g. the Experimental Program to Stimulate Competitive Research (EPSCoR), which increases 10.6% to \$147.1M, as well as efforts that focus on underrepresented groups. The program ADVANCE, which funds transformative efforts to address the systemic barriers to women's full participation in academic science and engineering, is budgeted at \$21.0M, a 1.1% increase. Finally, in coordination with the Department of Education, NSF will continue funding for the Math and Science Partnership program (at a 4.6% decrease to \$58.2M), aimed at improving K-12 science, technology, engineering, and mathematics (STEM) education and teaching.

Questions and Concerns

ASME's key questions and concerns arising from the FY2010 budget request center on:

- the need for sustainable funding for NSF
- low funding success rates for new grants, and low funding levels for existing grants,
- funding ranking for **ENG** with respect to other Directorates within NSF;
- increased funding for non-priority-area core disciplinary research within **ENG**.

NSF is the only federal agency devoted "to the support of basic research and education across all fields of science and engineering." While comprising only a small percentage of the total federal budget for R&D, NSF provides 21% of the federal support given to academic institutions for basic research overall, or 45% when medical research supported by the NIH is excluded. Moreover, while NSF does not directly support medical research, its investments do provide the technologies in diagnosis, medicine, pharmaceutical manufacturing, and drug delivery that are essential for the medical sciences and related industries. Given recent appropriations provided to NSF in FY2009 and the Recovery Act, the ASME NSF Task Force extols Congress and the Administration for their recognition of the unique role that NSF plays in the scientific enterprise, and encourages them to provide sustainable funding for NSF in FY2010 for the future welfare of our nation.

Although the funding success rate for research grants at NSF has increased over the past few years, it is still well below the 30% level of the late 1990s, predicted at 22% for FY2010 agency wide. The FY2009 funding success rate is estimated to be 29%—evinced that without the one-time ARRA, the number of excellent, meritorious proposals far exceeds the available funding for new programs. Nonetheless, even maintaining current grant size and duration is not enough. An extended period of constant grant sizes has

diminished buying power, and thus the ability to adequately support research and student development. Note that the bulk of the grants are budgeted for graduate student stipend and tuition. The projected average annualized award size for research grants for NSF FY2010 is \$154.6K, for a duration of 3.0 years. Noteworthy, **ENG** has the second lowest estimated funding success rate for research grants of the directorates at a projected 18% for FY2010. Moreover, **ENG** also has the lowest average annualized award size and project duration for research grants of the directorates at \$114K for a duration of 3.0 years, far below the overall NSF average given above. By way of reference, the National Institutes of Health's (NIH) projection for the annualized average size of competitive research project grants (RPGs) for FY2010 is \$399.5K with an average project duration of 3.8 years, at a 20% funding success rate.

ENG is the single largest source of federal funding for university-based, fundamental engineering research – providing 45% of the total federal support in this area. However, **ENG** (less SBIR/STTR) is still only fifth in total funding (at \$632.0M) of the six Directorates within NSF, despite receiving an increase of ~10% in the FY2010 request. Our Nation's long-standing global prominence in technological innovation may be at risk, if such investments in basic engineering research and education are constrained by lack of federal funding in engineering.

Encouragingly, the 10.6% growth in RRA allows for the support of 950 additional research grants NSF-wide. For **ENG**, 240 additional grants are anticipated for unsolicited fundamental research proposals for individual investigators and small group activities. Although we are moving in the right direction, the total funding for non-priority-area core disciplinary research (from which new priority areas and even new disciplines are often conceived) within **ENG** should still be examined. Funding for broad, Directorate-wide priority areas (Climate Change Technology and Science programs, Networking and Information Technology Research and Development, and National Nanotechnology Initiative) and the SBIR/STTR program within **ENG** constitute a full 43% of the budget request for **ENG**. The Task Force does not advocate for the redistribution of monies from **investment priority-areas** into non-priority core areas, but rather provide significant increases for completely flexible core funds in order to develop the creative and novel ideas that feed the comprehensive fundamental Science, Engineering, and Technology knowledge base, which serves to advance this nation's health, prosperity, and welfare, and security.

Closure

The ASME NSF Task Force urges Congress to support the Administration's request at a minimum of \$7.04B for FY 2010, and enthusiastically supports the National Science Foundation's leadership in projecting the nation's basic research and development vision. We commend Congress and the Administration for their recent support for NSF in the Recovery Act and the FY2009 omnibus bill, which included significant increases that will help stimulate our economy with the fruits born from science and technology. However, sustained yearly increases in the NSF's budget are needed in both core disciplinary research and integrated education. Increasing award duration would foster a more stable and productive environment for learning and discovery. Longer timetables would also provide researchers with opportunities to provide expanded education and research experiences to students. We encourage Congress to provide these needed resources for NSF in FY2010.

ASME International is a non-profit technical and educational organization with over 127,000 members worldwide. The Society's members work in all sectors of the economy, including industry, academia, and government. This position statement represents the views of the NSF Task Force of ASME's Technical Communities and is not necessarily a position of ASME as a whole.