

## INTEGRATIVE ACTIVITIES

**\$263,000,000**

The FY 2008 Budget Request for Integrative Activities (IA) is \$263.0 million, an increase of \$31.63 million, or 13.7 percent, above the FY 2007 Request of \$231.37 million. The Experimental Program to Stimulate Competitive Research (EPSCoR) has been transferred from Education and Human Resources to Integrative Activities. This move places EPSCoR within the NSF Office of the Director in order to maximize cross-directorate interaction and to ensure continued integration with the research and education directorates.

### Integrative Activities Funding<sup>1</sup> (Dollars in Millions)

|                        | FY 2006<br>Actual | FY 2007<br>Request | FY 2008<br>Request | Change over<br>FY 2007 Request |         |
|------------------------|-------------------|--------------------|--------------------|--------------------------------|---------|
|                        |                   |                    |                    | Amount                         | Percent |
| Integrative Activities | \$233.30          | \$231.37           | \$263.00           | \$31.63                        | 13.7%   |

<sup>1</sup>Includes funding for EPSCoR for all years shown for comparability. EPSCoR has been transferred from Education and Human Resources to Integrative Activities.

## RELEVANCE

Integrative Activities supports emerging, cross-disciplinary research and education, recognizing the importance of integrative efforts to the future of science and engineering. IA is a source of federal funding for the acquisition and development of research instrumentation at U.S. academic institutions. Also supported are a number of integrative research and education centers and programs that enhance NSF research investments in discovery and workforce development.

Funds requested and appropriated to IA are managed by a variety of organizations within NSF, which provides the flexibility to broaden support for emerging, cross-disciplinary research programs and activities. For example, the Science and Technology Centers program currently funds 17 centers that are managed cooperatively by six NSF directorates/offices and the Office of Integrative Activities.

Another example is EPSCoR. In FY 2006 NSF leadership requested a workshop addressing the future of the EPSCoR Program. As a result of that workshop a report was prepared and submitted: *EPSCoR 2020: Expanding State Participation in Research in the 21<sup>st</sup> Century – A New Vision for the Experimental Program to Stimulate Competitive Research (EPSCoR)*. One of the main issues arising from the workshop was the need to find a mechanism within NSF that would ensure that EPSCoR goals are integrated into the performance of all NSF directorates. The report went on to state that “EPSCoR should be relocated within the Office of the Director where its ‘research’ focus and cross-directorate interactions will be maximized and integrated with the Research Directorates.” Thus, funding for EPSCoR is moved from the Directorate for Education and Human Resources to IA within the Office of the Director. IA is able to coordinate and manage efforts throughout the Foundation. The relocation will allow the EPSCoR program greater leverage for improving the research infrastructure, planning complex research agendas, and developing scientific and engineering talent for the 21<sup>st</sup> century.

**Integrative Activities Funding by Program**

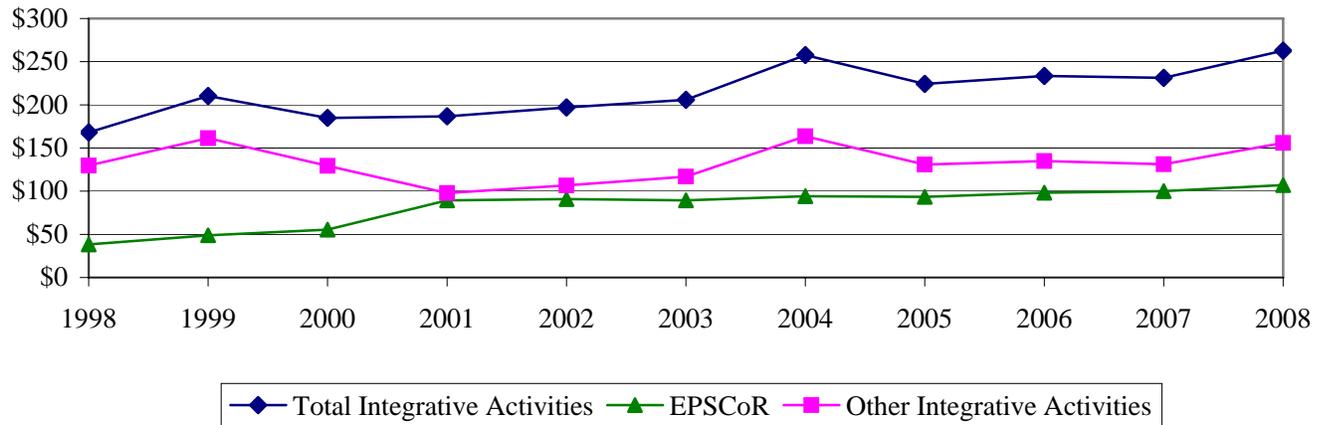
(Dollars in Millions)

|  | FY 2006         | FY 2007         | FY 2008         | FY 2007 Request |              |
|--|-----------------|-----------------|-----------------|-----------------|--------------|
|  | Actual          | Request         | Request         | Amount          | Percent      |
| EPSCoR <sup>1</sup>                            | \$98.22         | \$100.00        | \$107.00        | \$7.00          | 7.0%         |
| Major Research Instrumentation                 | 88.39           | 90.00           | 114.44          | 24.44           | 27.2%        |
| Partnerships for Innovation                    | 9.34            | 9.19            | 9.19            | -               | -            |
| Science and Technology Centers                 | 12.41           | 0.90            | 0.90            | -               | -            |
| Science and Technology Policy Institute/RaDiUS | 4.28            | 4.28            | 4.47            | 0.19            | 4.4%         |
| Science of Learning Centers                    | 20.66           | 27.00           | 27.00           | -               | -            |
| <b>Total, Integrative Activities</b>           | <b>\$233.30</b> | <b>\$231.37</b> | <b>\$263.00</b> | <b>\$31.63</b>  | <b>13.7%</b> |

Totals may not add due to rounding.

<sup>1</sup>Includes funding for EPSCoR for all years shown for comparability. EPSCoR has been transferred from Education and Human Resources to Integrated Activities.

**Integrative Activities Funding  
(Dollars in Millions)**



**Summary of Major Changes in Agency-Wide Investments**

(Dollars in Millions)

**FY 2007 Request, IA.....\$231.37**

Discovery Research for Innovation

Experimental Program to Stimulate Competitive Research +\$7.00

EPSCoR has been transferred from Education and Human Resources to IA. The FY 2008 Budget Request for EPSCoR is \$107.0 million, an increase of \$7.0 million, or 7.0 percent, over the FY 2007 Request of \$100.0 million. The increase will be used to co-fund research and education proposals that are merit reviewed throughout NSF and that are submitted by eligible institutions within EPSCoR jurisdictions.

Transformational Facilities and Infrastructure

Major Research Instrumentation (MRI) +\$24.44

With an increase of \$24.44 million, or 27.2 percent, over the FY 2007 Request of \$90.00 million, funding for MRI is \$114.44 million for FY 2008. This growth allows the MRI program to initiate greater support for acquisition and development of mid-size instruments as recommended in the recent National Academy of Sciences Report on Advanced Research Instrumentation and Facilities. During FY 2008 the MRI funding cap will rise from \$2.0 million to \$4.0 million for single instrument requests submitted by eligible institutions. Examples in this mid-size range include: biological imaging instruments; 3-D shake tables; e-beam lithography and nanofabrication tools; large scale environmental monitoring instruments; proteomics facilities; spectroscopy instruments; beam line development; detectors for use at accelerator labs; large scale petawatt lasers; larger computing systems; and ocean observatories.

Science and Technology Policy Institute/RaDiUS +\$0.19

The NSF's FY 2008 Budget Request provides \$3.04 million for the Science and Technology Policy Institute (STPI) and \$1.43 million for the Research and Development in the United States (RaDiUS) database for a total request of \$4.47 million for FY 2008. This represents a 4.4 percent increase over the FY 2007 Request of \$4.28 million. The increase ensures the collection, access, and archiving of information on federal funding for research and development as well as support for science and technology policy formation by the Office of Science and Technology Policy (OSTP).

Subtotal, Changes +\$31.63

**FY 2008 Request, IA.....\$263.00**

**IA Portfolio Updates**

EPSCoR

Please see two-page narrative below.

Major Research Instrumentation

MRI is a Foundation-wide, cross-cutting initiative that supports the acquisition and development of instrumentation relating to several goals and objectives of the American Competitiveness Initiative (ACI), including nanotechnology, computing, physical sciences, and materials science and engineering. Funding provides for a diverse portfolio that emphasizes state-of-the-art instrumentation, access and training to support modern research approaches, cross-disciplinary research, integration of research and education, public/private partnerships, and assistance to minority-serving institutions. Funding also provides for acquisition and development of state-of-the-art instrumentation that is too costly to be supported through regular NSF programs. It promotes partnerships between academic researchers and private sector instrument developers. Approximately \$20.0 million support teaching-intensive and minority-serving institutions, including Historically Black Colleges and Universities, Tribal Colleges, and community colleges, with a focus on research training.

In the FY 2006 MRI competition, NSF received 769 proposals and funded 235 for a total of \$88.39 million. Minority-serving institutions received 24 awards totaling \$4.82 million. Non-Ph.D. granting

institutions received 92 awards totaling \$19.48 million. At the FY 2008 Request level, approximately 241 competitive awards are anticipated.

#### Partnerships for Innovation (PFI)

PFI program links knowledge created in the discovery process to learning and innovation. Goals are to: (1) stimulate knowledge transformation created by the national research and education enterprise into innovations that create new wealth; build strong economies; and improve the national well-being; (2) broaden participation to more fully meet the broad workforce needs of the national innovation enterprise; and (3) enhance enabling infrastructure necessary to foster and sustain innovation in the long-term. In these ways, the PFI program directly addresses the key objectives of the ACI; namely, introducing valuable techniques to the marketplace. Partnerships must include a U.S. academic institution as the lead and a partner from the private sector; state/local government partnerships are also encouraged. At a flat funding level of \$9.19 million, 10 to 15 awards are expected in FY 2008.

#### Science of Learning Centers (SLC)

NSF's investment builds on the Foundation's support for multidisciplinary research that advances fundamental knowledge about the science of learning. SLCs are built around a unifying research focus and incorporate a diverse, multidisciplinary environment involving appropriate partnerships with academia, industry, international partners, all levels of education, and other public and private entities. Funding is designed to support a diverse portfolio of research, providing leadership across a broad range of science and engineering approaches to the science of learning research. FY 2008 funds provide continuing support for the portfolio of six Centers as well as support the development of infrastructure and activities to maximize coordination and exchange of information among all SLCs.

#### Science and Technology Policy Institute/RaDiUS

STPI is a Federally-Funded Research and Development Center established by Congress in 1991 to support the complex task of devising and implementing science and technology policy. The Institute provides analytic support to OSTP to identify near-term and long-term objectives for research and development and options for achieving those objectives. In addition, STPI provides analytic support to other federal agencies. Since 2003, the Institute for Defense Analyses has operated the Institute. RaDiUS is a database developed by the RAND Corporation to support the work of OSTP. Since its inception, the database has been maintained by the RAND Corporation in cooperation with NSF.

#### Science and Technology Centers (STCs)

The STC Program advances discovery and innovation in science and engineering through the integration of cutting-edge research, excellence in education, targeted knowledge transfer, and development of a diverse workforce while broadly advancing the goals and objectives of the ACI. The STC portfolio includes continuing investment in areas from cyber-security, materials and devices for information technology research, and embedded networked sensing to nanobiotechnology, behavioral neuroscience, and multi-scale modeling of atmospheric processes. Partnerships established by the STC program go beyond NSF and academia to the active participation of industry and national laboratories in research projects, the transfer of technology to appropriate industries, the application of patents derived from the work of the STCs, and the launching of spin-off companies. The number of STCs currently supported (17) is expected to remain the same in FY 2008.

## **QUALITY**

NSF uses various internal and external mechanisms to ensure the quality and relevance of existing and proposed programs and to help identify new and emerging opportunities that support agency-specific goals. These mechanisms include merit-based review of proposals, Committees of Visitors (COVs), advisory committees and other expert panels, National Academies and other reports, workshops, and long-range planning documents.

NSF maximizes the quality of the R&D supported through the use of a competitive, merit-based process. To ensure the highest quality in processing and recommending proposals, NSF convenes COVs, composed of qualified external evaluators, to review each program. These experts assess the integrity and efficiency of proposal review processes and provide a retrospective assessment of the quality of results of NSF's investments. Several programs conduct annual reviews and undergo reviews and assessments of program outcomes.

Activities such as the STC program maintain a variety of ongoing practices that ensure quality during the 10-year tenure of each project. These practices include strategic planning; annual review by an external team of expert site visitors; fourth-year, in-depth competitive review of renewal proposals; training of NSF technical coordinators; and shared governance between research directorates and the Office of Integrative Activities. Additionally, each Center is required to submit an annual report to NSF; participate in annual workshops developed for Center directors and the center education network; provide ethics training; provide specialized communications equipment; and maintain and convene annually a conflict-free external advisory board that provides guidance, advice, and oversight.

Another example is found in the MRI program, a Foundation-wide cross-cutting activity. MRI proposal actions are reviewed on a three-year basis by COVs in the directorates and divisions that recommend and award grants. In addition to these reviews, the program conducts an overall evaluation. In FY 2005, the MRI program convened a COV during which external evaluators examined overall program management and processes, proposal actions, and results of NSF investments from FY 2000 to FY 2004. The COV commended the program for enhancing the research capacity of the science and engineering community.

As for EPSCoR, in FY 2006 a workshop was held to envision the program in the year 2020. The report provided recommendations on how to move EPSCoR to the next level of quality and performance through its continuing programmatic focus on accomplishments and improvement. A COV or an external program evaluation will be planned in FY 2007 and implemented in FY 2008 for the purpose of assessing the EPSCoR award portfolio, studying and reporting on the management of the EPSCoR activities, and assessing the research and education outcomes.

**EXPERIMENTAL PROGRAM TO STIMULATE  
COMPETITIVE RESEARCH**

**\$107,000,000**

The FY 2008 Budget Request for the Experimental Program to Stimulate Competitive Research (EPSCoR) is \$107.0 million, an increase of \$7.0 million, or 7.0 percent, over the FY 2007 Request of \$100.00 million. EPSCoR has been transferred from Education and Human Resources to Integrative Activities. This move places EPSCoR within the NSF Office of the Director in order to maximize cross-directorate interaction and to ensure continued integration with the research and education directorates.

**Experimental Program to Stimulate Competitive Research Funding**

(Dollars in Millions)

|                | FY 2006 | FY 2007  | FY 2008  | Change over     |         |
|----------------|---------|----------|----------|-----------------|---------|
|                |         |          |          | FY 2007 Request |         |
|                |         |          |          | Amount          | Percent |
| EPSCoR Funding | \$98.22 | \$100.00 | \$107.00 | \$7.00          | 7.0%    |

**About EPSCoR:**

EPSCoR's mission is to assist Foundation in its statutory function “to strengthen research and education throughout the United States and to avoid undue concentration of such research and education.” Hence, the primary goals of the EPSCoR program are: (1) to stimulate sustainable improvements in the R&D capacity and competitiveness within the major research universities of the designated EPSCoR jurisdictions, and (2) to advance scientific and engineering capabilities in these jurisdictions for discovery, innovation and overall knowledge-based prosperity. NSF’s EPSCoR program currently operates in 25 states – Alabama, Alaska, Arkansas, Delaware, Hawaii, Idaho, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Dakota, Oklahoma, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, West Virginia, and Wyoming – plus the Commonwealth of Puerto Rico and the Territory of the Virgin Islands

EPSCoR goals and objectives are strongly aligned with major actions recommended recently by the National Academies’ Committee on Prospering in the Global Economy of the 21<sup>st</sup> Century. That is, programmatic objectives are designed to stimulate further scientific and engineering prowess in the 27 EPSCoR jurisdictions. These jurisdictions have significant unused potential for contributing to the Nation’s technological-based discovery, innovation, and related competitive productivity.

The EPSCoR portfolio includes support for infrastructure development, instrumentation, workforce development, and research grants. Approximately 51 percent is available for new awards each year while approximately 30 percent of the EPSCoR portfolio is available for new research grants. The remainder is distributed for various EPSCoR priorities and continuing funding for grants made in previous years.

**EPSCoR Priorities for FY 2008:**

To pursue its goals and objectives during FY 2008, the EPSCoR program will employ a portfolio of four complementary investment strategies:

**Research Infrastructure Improvement (RII) Grants** – Research Infrastructure Improvement Grants are 36 to 48 month awards of up to \$9.0 million to support infrastructure improvements in research areas selected by the jurisdiction’s EPSCoR governing committee as having the best potential to improve future

research and development competitiveness. Successful awards will build the core strength and capacity needed to develop collaborative methods for the solution of research and education problems of both regional and national import.

**Strength-Based Research Collaborative (SBRC) Grants** – SBRC awards are 48 month awards of up to \$12.0 million to support collaborative groups of scientists and/or engineers focusing on targeted research topics identified by the jurisdictions’ EPSCoR governing committees as having regional significance and national importance. SBRC investigator teams may be composed of scientists and/or engineers from either the same or multiple jurisdictions. Successful awards will build and use the capacity already developed in the jurisdiction(s) and will lead to innovation and a new level of amplified competitiveness for the collaboration and the whole region.

**Co-Funding** – Joint support may be provided for meritorious research and education proposals submitted directly to the research and education directorates and offices of the NSF. Co-funding is an internal NSF mechanism that allows the EPSCoR program to support cutting-edge research and education projects that have competed successfully through the merit review process within the regular NSF programs and initiatives. This mechanism allows the EPSCoR program to continue to build capacity in EPSCoR jurisdictions at the research frontier.

**Outreach** – Financial support is provided for outreach visits by NSF staff to inform the EPSCoR research community about NSF priorities, programs, and policies and to more fully acquaint NSF staff through “in-reach” activities with the research and development resources and potential residing within EPSCoR jurisdictions.

**Changes from FY 2007:**

In FY 2008, the EPSCoR program expects to provide \$61.0 million to fund a combination of new and continuing RII awards. In addition, the program plans to fund two SBRC awards for a total of \$6.0 million. Hence, the RII/SBRC will require a total of \$67.0 million, which represents no change from the FY 2007 Request. Co-funding of proposals submitted from EPSCoR jurisdictions to other research and educational programs at NSF will be funded at \$36.0 million, or a \$7.0 million increase over the FY 2007 Request. This will take advantage of increased cyberinfrastructure opportunities to improve research and education networks within the EPSCoR community. EPSCoR co-funding of Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) proposals will be supported at \$2.7 million, or no increase over the FY 2007 Request. About \$1.3 million will be used to support outreach/inreach activities, workshops, conferences, and office operational functions. Support for co-funding, new SBIR/STTR projects, outreach, and other activities is similar to the FY 2007 Request level.

**Number of People Involved in EPSCoR Activities**

|                               | FY 2006<br>Estimate | FY 2007<br>Estimate | FY 2008<br>Estimate |
|-------------------------------|---------------------|---------------------|---------------------|
| Senior Researchers            | 517                 | 525                 | 570                 |
| Other Professionals           | 222                 | 225                 | 255                 |
| Postdoctorates                | 69                  | 70                  | 75                  |
| Graduate Students             | 435                 | 440                 | 480                 |
| Undergraduate Students        | 378                 | 380                 | 420                 |
| <b>Total Number of People</b> | <b>1,621</b>        | <b>1,640</b>        | <b>1,800</b>        |

## PERFORMANCE

The FY 2008 Budget Request is aligned to reflect funding levels associated with NSF's four strategic outcome goals stated in the FY 2006-2011 Strategic Plan. These goals provide an overarching framework for progress in fundamental research and education and facilitate budget and performance integration.

### Integrative Activities By Strategic Outcome Goal (Dollars in Millions)

|                         | FY 2006<br>Actual | FY 2007<br>Request | FY 2008<br>Request | Change over<br>FY 2007 Request |              |
|-------------------------|-------------------|--------------------|--------------------|--------------------------------|--------------|
|                         |                   |                    |                    | Amount                         | Percent      |
| Discovery <sup>1</sup>  | \$130.45          | \$127.55           | \$134.14           | \$6.59                         | 5.2%         |
| Learning                | 9.34              | 9.19               | 9.19               | -                              | -            |
| Research Infrastructure | 92.67             | 94.28              | 118.91             | 24.63                          | 26.1%        |
| Stewardship             | 0.84              | 0.35               | 0.76               | 0.41                           | 117.1%       |
| <b>Total, IA</b>        | <b>\$233.30</b>   | <b>\$231.37</b>    | <b>\$263.00</b>    | <b>\$31.63</b>                 | <b>13.7%</b> |

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## Recent Research Highlights

► **Center for Remote Sensing of Ice Sheets:** A group of NSF-supported researchers at the Center for Remote Sensing of Ice Sheets (CReSIS) are developing new sensors, platforms, and cyberinfrastructure tools that will lead to a better understanding of Antarctic and Greenland ice sheets and how they contribute to sea level change. Because of the immense size and complexity of these ice sheets, data from satellite and airborne platforms, combined with ground-based measurements and observations, are needed to accurately assess them. One of the new radar-based sensors can produce a high-resolution map of layers within the ice, and has produced the first image of 3 kilometer thick ice. The technological innovations will provide long-term benefits to the polar community and also have wide applications outside of the polar community.



Collecting data in Greenland. Credit: CReSIS, University of Kansas.

The tools being developed under CReSIS will lead to a better understanding of polar ice sheets and how they contribute to sea level change. Because of the immense size and complexity of these ice sheets, data from satellite and airborne platforms, combined with ground-based, in-situ measurements and observations, are needed to accurately assess their mass balance state. Technological innovations are being made in three areas, including sensors, platforms, and cyberinfrastructure.

The next generation of researchers should reflect the diversity of our society. To this end, the Center is working closely with two minority-serving institutions, Haskell Indian Nations University in Lawrence, Kansas, and Elizabeth City State University in Elizabeth City, North Carolina. The Center is conducting

extensive outreach and education programs to attract minority students to careers in science and technology. (OPP/STC)

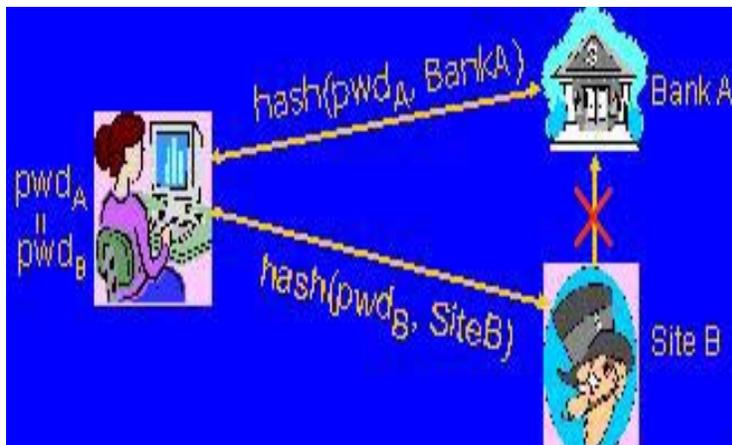
► **New Organic Electronic Materials and Devices:** The Center on Materials and Devices for Information Technology Research (CMDITR), which is researching novel light sources and organic electronics, has developed highly efficient organic solar-energy cells that perform extremely well with visible light. These new devices have the potential to provide lower-cost replacements to traditional crystalline silicon-based solar energy cells. These replacements, in turn, could provide new portable and clean power solutions for technologies such as wireless sensor networks.



A sample of an organic solar cell fabricated on a flexible plastic substrate. An array of conventional silicon solar cells is shown in the background. Credit: Nicole Cappello, Georgia Tech.

CMDITR, under the leadership of the University of Washington, fosters innovative partnerships that integrate multiple academic institutions from different regions of the country with a wide-range of non-academic institutions to examine novel uses of materials and devices leading to the development of new technologies. (MPS/STC).

► **Team for Research in Ubiquitous Secure Technologies (TRUST) - Password Hashing:** Computer scientists at Stanford University have developed a new tool called Password Hash (PwdHash) that adds additional security to Internet browsers. The PwdHash tool is a user-installed, transparent add-on that stops “phishing” attacks – malicious attempts to obtain personal information such as account numbers or passwords.



The PwdHash browser extension transparently produces a cryptographically customized password for each site, defeating phishing. See also the Spoof Guard tool at <http://crypto.stanford.edu/SpoofGuard/>. Credit: Dan Boneh and John Mitchell.

In phishing attacks, a user is sent a deceptive email explaining that the recipient has an account problem and should visit their financial site and log in. However, the link provided in the phishing email sends the user to a "spoof" site that exists solely to collect the user's information. Once the personal information is collected, criminals may subsequently log into the user's real account to steal assets or cause other damage. The PwdHash tool automatically converts a user's password into a new, domain-specific password by translating the contents of password fields into a mathematically generated number. The new number, called a

“hash,” cannot be translated back into the password. The easy-to-use PwdHash tool can be used at public computers and requires only the user – not the user and the bank – to use it.

The researchers have also developed a second browser extension called SpoofGuard, which warns users with a traffic light motif (green, yellow, red) when they are visiting suspected spoof sites. The extension does not transmit sensitive information until the user responds to the warning. (CISE/STC).

► **Solar Energy Efficiency Breakthrough Made Possible by State-of-the-Art Equipment:** Funded in part by NSF's Experimental Program to Stimulate Competitive Research (EPSCoR), a research team from New Mexico State University (NMSU) and Wake Forest University has brought a variety of futuristic solar-cell applications closer to reality. Examples include roofing paints that could provide enough alternative energy to heat and cool your home, or energy sources that soldiers could carry around like a roll of plastic wrap in their backpacks. The organic solar cells developed by this team are made of relatively inexpensive and flexible plastic that can be wrapped around structures or even applied by spin or spray coating, according to Seamus Curran, head of the NMSU nanotechnology laboratory and member of the research team. This puts them in sharp contrast to traditional solar panels made of silicon, which is expensive, brittle and shatters like glass. The new organic solar cells are also impressively efficient. To be effective producers of electricity, solar cells must be able to convert 10 percent of the energy in sunlight to electricity – a landmark many believed would take at least a decade to achieve. Yet Curran's research team recently achieved 5.2 percent solar energy efficiency with organic solar cells, and he predicts it may take fewer than five years before they reach the 10 percent level. (EPSCoR).