Influencing Innovation in Education

Samir El-Ghazaly
Division Director
Electrical, Communications and Cyber Systems (ECCS) Division
Engineering Directorate
National Science Foundation
Arlington, VA
NSF’s Origin, Mission, and Structure

- Independent federal agency established by Congress in the NSF Act of 1950
  - “To Promote Progress of Science,” and “Advance National Health, Prosperity, and Welfare,” and “Secure the National Defense”
- Supports fundamental research and education across all fields of science and engineering
- Sponsors research primarily through grant mechanism, but operates no laboratories
- Discipline-based structure with cross-disciplinary mechanisms
- Uses “rotators” or IPAs primarily from universities
- FY2013 budget of $5.6 billion for Research and Related Activities (R&RA) – FY2014 Budget Request for R&RA at $6.2 billion ($7.626 Billion Operating Plan Request). 8.4% over FY2012 enacted level.
Electrical, Communications, and Cyber Systems Division (ECCS) Clusters

- **Fundamental research at the nano, micro, and macro scales underlying device and component technologies, energy and power, controls, networks, communications, computation, sensing and cyber systems**

- **Integration of systems principles in complex engineering systems and networks for a variety of applications areas**
Geographic Distribution of ECCS Awards FYs 2011-2013

[Map showing the geographic distribution of ECCS awards from 2011 to 2013, with California and Texas highlighted in dark blue.]
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Dimitris Pavlidis</strong></td>
<td><strong>Zhi (Gerry) Tian</strong></td>
<td><strong>Kishan Baheti</strong></td>
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<tr>
<td>- Microwave/mm-Wave/THz Devices &amp; Components</td>
<td>- Cyber-Physical Systems</td>
<td>- Control Theory &amp; Hybrid Dynamical Systems</td>
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<tr>
<td>- Nanoelectronics &amp; Next Generation Devices</td>
<td>- RF/Wireless, Optical, &amp; Hybrid Communications</td>
<td>- Distributed &amp; Mobile Networked Control</td>
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<td>- Vacuum Devices &amp; Electronics</td>
<td>- &amp; Networking</td>
<td>- Networked Sensing &amp; Imaging Systems</td>
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<tr>
<td>- Electromagnetic Propagation &amp; Scattering</td>
<td>- Integrated Sensing, Communications, &amp;</td>
<td>- Control Aspects of Cyber-Physical Systems</td>
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<tr>
<td>- Metamaterials-Based Devices &amp; Components</td>
<td>Computational Systems</td>
<td>- Cyber Secure Control of Power Systems</td>
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<tr>
<td>- Device/Circuit Simulation &amp; Modeling</td>
<td>- Spectrum Access and Spectrum Sharing</td>
<td>- Systems Theory in Molecular, Cellular, &amp; Synthetic</td>
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<tr>
<td><strong>Anupama Kaul</strong></td>
<td>- Signal Processing and Compressive Sampling</td>
<td>- Biology</td>
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<td>- Flexible &amp; Printed Electronics</td>
<td>- Cyber Security</td>
<td>- Networked Robotics &amp; Transportation Networks</td>
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<td>- Organic Light Emitting Devices &amp; Displays</td>
<td>- Cognitive Radio</td>
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<tr>
<td>- Molecular/ Organic Electronics &amp; Photonics</td>
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<tr>
<td>- Carbon-based Electronics</td>
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<tr>
<td>- Micro and Nanoelectronics</td>
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<td>- Energy-Efficient Green Electronics</td>
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<tr>
<td><strong>Usha Varshney</strong></td>
<td><strong>George Haddad</strong></td>
<td><strong>Eyad Abed</strong></td>
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<td>- Bioelectronics &amp; Biomagnetics Devices</td>
<td>- Low Power, Low Noise, High Efficiency</td>
<td>- Energy Collection &amp; Harvesting Devices and</td>
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<tr>
<td>- Science &amp; Engineering Beyond Moore’s Law</td>
<td>Communications, Sensing and Imaging Systems</td>
<td>- Systems</td>
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<tr>
<td>- Quantum Devices</td>
<td>- RF/Microwave &amp; mm-Wave Circuits for Imaging</td>
<td>- Energy Storage</td>
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<tr>
<td>- Magnetics, Multiferroics, &amp; Spintronics</td>
<td>and Sensing Systems</td>
<td>- Advanced Power Electronics</td>
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<tr>
<td>- Sensor Devices &amp; Technologies</td>
<td>- Inter- and Intra-Chip Communications &amp;</td>
<td>- Electric Grid Interfaces</td>
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<tr>
<td>- Next Generation Memories</td>
<td>Networking</td>
<td>- Electric &amp; Hybrid Vehicles</td>
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<tr>
<td><strong>John Zavada</strong></td>
<td><strong>Mona Zaghloul (Expert Appointment)</strong></td>
<td><strong>Paul Werbos</strong></td>
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<tr>
<td>- Nanophotonics and Plasmonics</td>
<td>- Micro, Nano, and Bio Systems</td>
<td>- Adaptive &amp; Intelligent Systems</td>
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<tr>
<td>- Advanced Sources and Detectors</td>
<td>- MEMS/NEMS Systems-on-a-Chip</td>
<td>- Transmission &amp; Distributed Systems</td>
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<tr>
<td>- Optical Devices and Components</td>
<td>- Sensors, Actuators, and Electronic Interfaces</td>
<td>- Intelligent Power Grid &amp; Economics</td>
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<tr>
<td>- Optical Devices based on Metamaterials</td>
<td>- Diagnostic and Implantable Systems</td>
<td>- Quantum Systems &amp; Modeling</td>
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<tr>
<td>- Optical Imaging and Sensing</td>
<td>- Chemical, Biological, and Physical Diagnostics</td>
<td>- Theory and Modeling for Systems &amp; Devices</td>
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<tr>
<td><strong>Dominique Dagenais</strong></td>
<td>- Environmental Sensing and Monitoring</td>
<td>- Neuromorphic Engineering</td>
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<tr>
<td>- Fiber Optic Components and Devices</td>
<td>- Infrastructure Monitoring</td>
<td>- Cognitive Optimization &amp; Prediction</td>
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<tr>
<td>- Nonlinear and Ultrafast Photonics</td>
<td>- Micro Power and Energy Scavenging</td>
<td>- Intelligent Vehicles</td>
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<tr>
<td>- Photonic Integrated Circuits</td>
<td>- System-Level Fabrication, Packaging, and</td>
<td>- Learning &amp; Intelligence for Robotics</td>
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<tr>
<td>- Optical Communications and Computing</td>
<td>Assembly</td>
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<tr>
<td>- Quantum Optics and Optical Modeling</td>
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ECCS Research Areas by Cluster

- **Electronics, Photonics, and Magnetic Devices (EPMD)**
  - Nanoelectronics & Nanophotonics
  - Bioelectronics & Biomagnetics Devices
  - Quantum Devices, Optics and Photonics
  - Magnetics, Multiferroics & Spintronics
  - Sensor Devices & Technologies
  - Next Generation Memories

- **Communications, Circuits, and Sensing Systems (CCSS)**
  - Wireless Communications, Networks, Signal Processing, Cognitive Radios
  - Spectrum Access & Spectrum Sharing
  - Micro, Nano, and Bio Systems, Sensors, Actuators
  - Low-Power, Low-Noise, High Efficiency, Communications, Sensing/Imaging

- **Energy, Power, and Adaptive Systems (EPAS)**
  - Electric Grid, Renewable Energy, Energy Storage
  - Power electronics
  - Controls and networks
  - Intelligent systems, neural networks
  - Cyber-Physical Systems, Cybersecurity

*One submission window each year between: Oct. 1 - Nov. 1*
Funding Opportunities

- **Core programs**
  - Unsolicited: One window (October 1 – November 1 Annually)
  - Eager (Early Concept, Can be submitted anytime)

- **Directed programs (Special CFP’s)**
  - CAREER
  - Emerging Frontiers in Research and Innovation (EFRI)
  - Interdisciplinary Research (IDR)
  - Cyber-Physical Systems (CPS)
  - Major Research Instrumentation (MRI)
  - Broadening Participation Research Initiation Grants in Engineering (BRIGE)
  - REU, RET Supplements
  - Others….
ECCS Transition to One Core Solicitation Window in FY13

Prior to FY13, ECCS Core Solicitation Windows occurred in Fall and Spring

In FY13, ECCS transitioned to one Solicitation window from October 1\textsuperscript{st} - November 1\textsuperscript{st} annually. Due to Hurricane Sandy, window was extended.

Outcomes of transition in year one:

- No significant change in dwell times for core or initiative programs
- Fortunately, no significant drop in proposals submitted
- Slight increase in funding rate, despite budget cut backs
- Significant benefit of processing all proposals within the same time frame:
  - 90\% of all ECCS Core Panels completed by March 2013, affording more time and effort for ECCS Initiatives (the majority of which occur in the Spring and Summer)
  - With panel obligations made in the earlier part of the year, ECCS could navigate more smoothly through the uncertainty of FY13 final allocations towards the end of the year
  - Funds were available to obligate and hold next year’s CAREER panels

<table>
<thead>
<tr>
<th>ECCS Core Program</th>
<th>Number of Proposals in FY13</th>
<th>3 Year Average (FY10-FY12)</th>
<th>FY13 Dwell Time Average (Months)</th>
<th>3 Year Dwell Time Average (FY10-FY12)</th>
<th>FY13 Funding Rate</th>
<th>3 Year Average (FY10-FY12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1517 Electronics, Photonics and Magnetic Devices</td>
<td>486</td>
<td>558</td>
<td>5.69</td>
<td>5.09</td>
<td>21%</td>
<td>20%</td>
</tr>
<tr>
<td>7564 Communications, Circuits and Sensing Systems</td>
<td>350</td>
<td>375</td>
<td>5.41</td>
<td>5.11</td>
<td>23%</td>
<td>17%</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1,162</strong></td>
<td><strong>1,301</strong></td>
<td><strong>5.78</strong></td>
<td><strong>5.44</strong></td>
<td><strong>21%</strong></td>
<td><strong>19%</strong></td>
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EDUCATION

Directorate for Education and Human Resources (EHR)

- Division of Research on Learning in Formal and Informal Settings
- Division of Graduate Education
- Division of Human Resource Development
- Division of Undergraduate Education
Funding Mechanisms

- Supplements
- Integrated with traditional research
- Co-funding with other divisions
Expectations

- Innovation
- Impact
- Assessment
- Sustainability
- Reasonable and justified budget

Review Criteria

- Intellectual Merits
- Broader Impact
ECCS Investments in Education and Research Community Outreach

- **Recent Research Workshops funded by ECCS**
  - NSF Workshop 2D Materials and Devices
  - Workshop on Next-Generation High-Efficiency Organic Solar Cells: Opportunities and Challenges
  - NSF SEP (Sustainable Energy Pathways) Grantees Meeting
  - NSF Workshop on US-Czech Frontiers in Photonics
  - Workshop on Big Data: From Signal Processing to Systems Engineering

- **ECCS Curriculum and Student Support**
  - STEM Student Travel Grants for Bioelectronics Training
  - Funded over $150K for student travel to conferences and workshops in FY12-FY13
  - Over $3M in ECCS REU, RET Supplements in FY12-FY13
Follow Up

- Visit the ENG and Divisions web sites
- Contact the Program Officer in your area of interest
- Volunteer to serve as an NSF panel or mail reviewer ([Enroll: http://www.nsf.gov/eng/eccs/reviewer/](http://www.nsf.gov/eng/eccs/reviewer/))
- If your proposal doesn’t succeed at first, don’t give up
- Consider spending 2 years at NSF as a Program Officer
NSF Web Sites

- National Science Foundation (NSF)

- Directorate for Engineering (ENG)

- Electrical, Communications and Cyber Systems (ECCS)

- Division of Engineering Education & Centers (EEC)

- Directorate for Education & Human Resources (HER)
Thank you!

Questions?