



Division of Electrical, Communications, and Cyber-Systems (ECCS)

Robert J. Trew
Division Director

ASEE ERC





ECCS Mission

- Address fundamental research issues at the nano, micro, and macro scales underlying device and component technologies (electronic and photonic devices), energy and power, controls, networks, communications, computation, and cyber technologies
- Support integration of systems principles in complex engineering systems and networks for a variety of applications areas
- Ensure education of a diverse workforce to meet the technological challenges of a 21st century global economy



Electrical, Communications, and Cyber Systems (ECCS)

Division Director: Robert Trew

Senior Engineering Advisor: Lawrence Goldberg

Electronics, Photonics and Device Technologies (EPDT)

(Open)

- Optoelectronics/Photonics;
- Nanophotonics;
- Plasmonics and Metamaterials;
- Large-Scale Photonic Integration;
- Ultrafast Phenomena

Samir El-Ghazaly

- Micro/Nanoelectronics;
- Advanced Integrated Circuits;
- Beyond Silicon CMOS;
- Quantum-Level Devices
- Electromagnetics/Microwave/THz simulations and models

Pradeep Fulay

- Molecular Electronics;
- Organic and Flexible Electronics;
- Energy-Efficient Green Electronics and Photonics

Usha Varshney

- Bioelectronics and Biomagnetics;
- Spintronics and Magnetics;
- Sensor Technologies

Integrative, Hybrid and Complex Systems (IHCS)

Rajinder Khosla

- MEMS/NEMS Systems-on-a-Chip;
- Diagnostic and Implantable Devices;
- Environmental Monitoring;
- Micro Power and Energy
- Biological & medical devices

Andreas Weisshaar

- RF to Optical Communication Systems;
- Inter- and Intra-chip Communication/Network;
- Mixed Signal Systems;
- Millimeter Wave and Terahertz Systems

(Open)

- Cyber Physical Systems;
- Next-Generation Cyber Systems;
- Signal Processing

Power, Controls and Adaptive Networks (PCAN)

Radhakisan Baheti

- Control Theory and Applications;
- Networked Control Systems;
- Sensing and Imaging Networks;
- Robotic and Embedded Systems
- Modeling/Control of Flexible Electric Power Grids, including Micro Grids, Smart Grids;

George Maracas

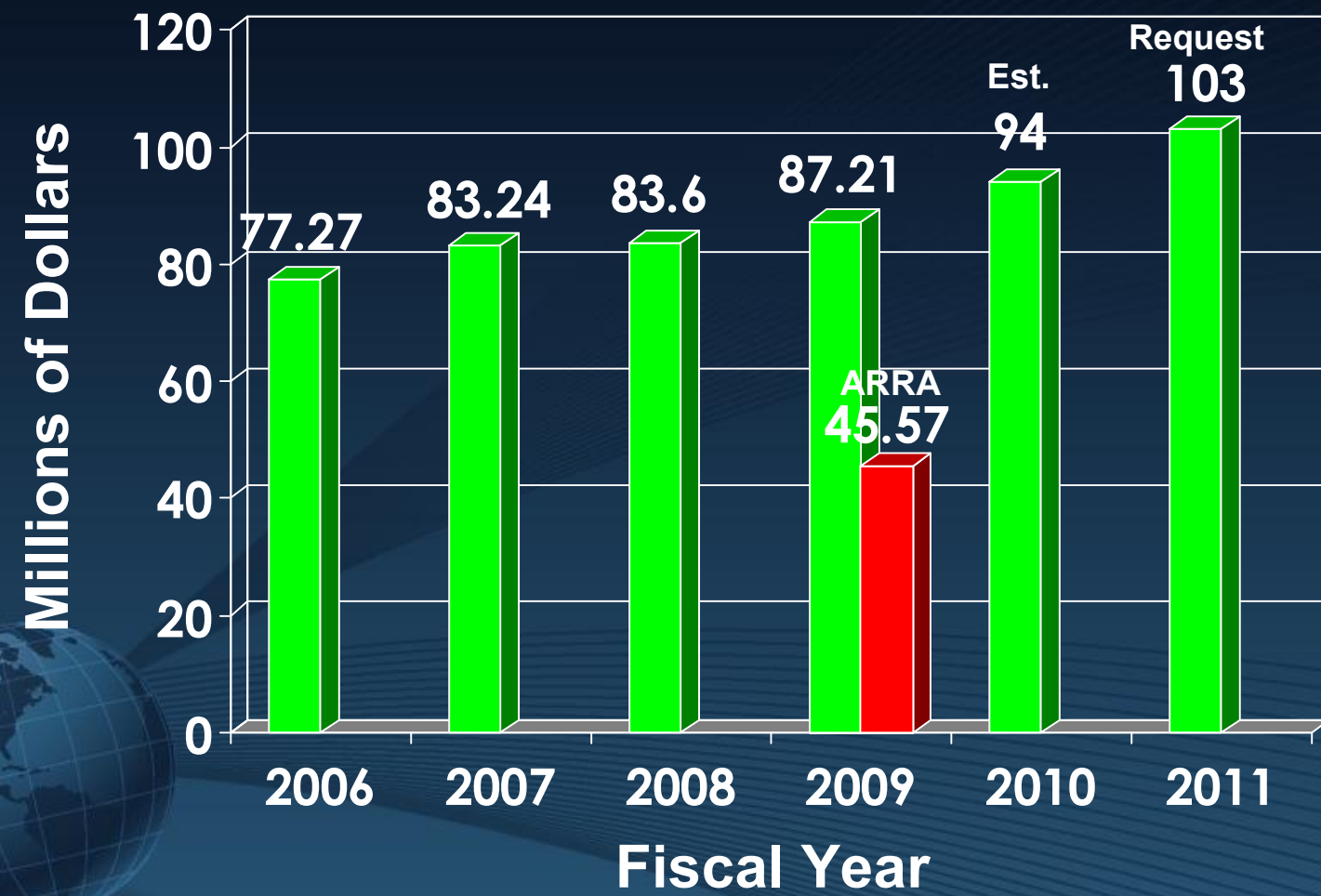
- Photovoltaics and novel energy conversion devices
- Alternate energy devices/systems
- Power and Energy Systems:
- Renewable/Alternative Energy Conversion and Storage;
- Interdependencies of Critical Infrastructures

Paul Werbos

- Neuromorphic Engineering;
- Bio-Inspired Complex Systems;
- Quantum Systems Engineering;
- Multi-Scale Modeling/Simulation of Devices and Systems

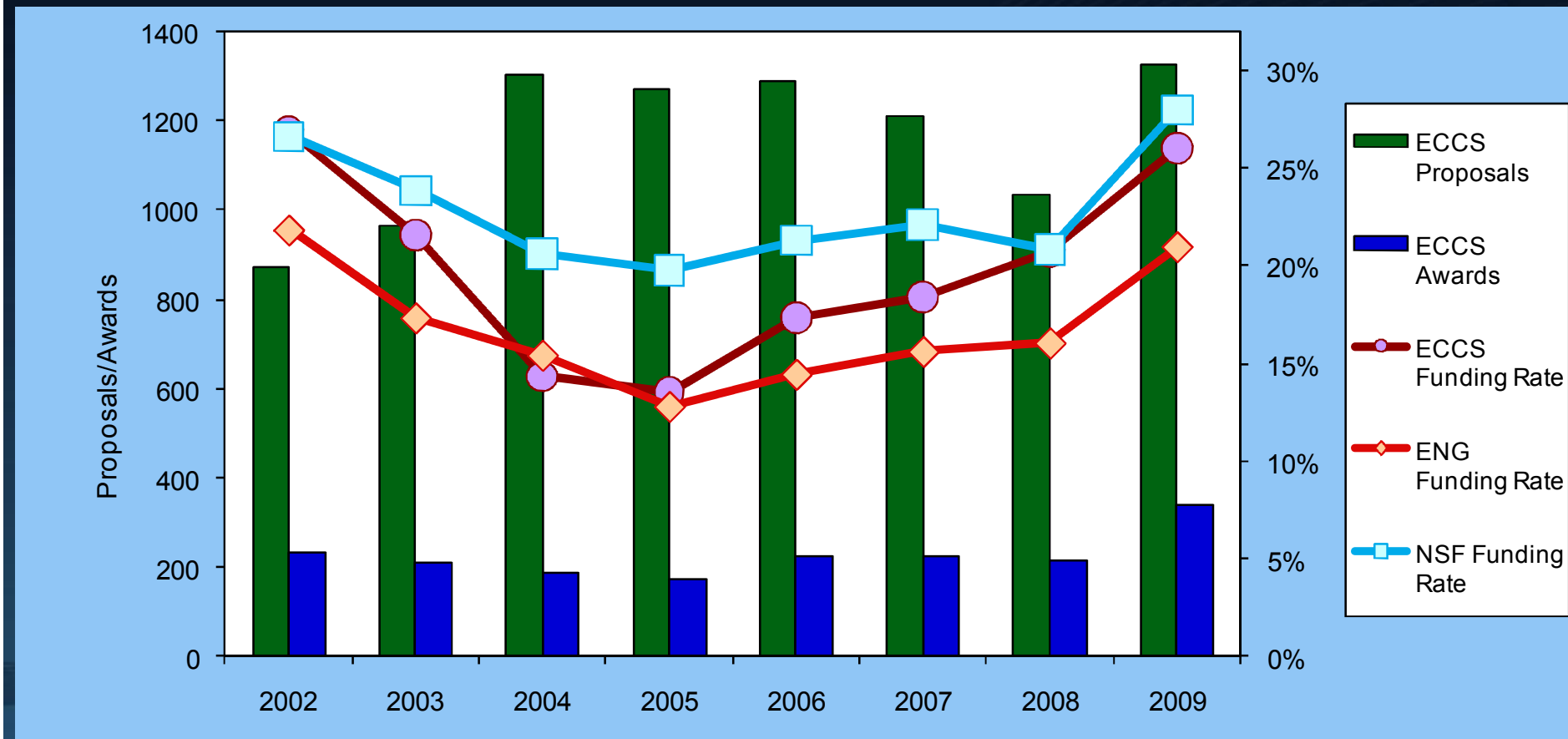


ECCS Budget



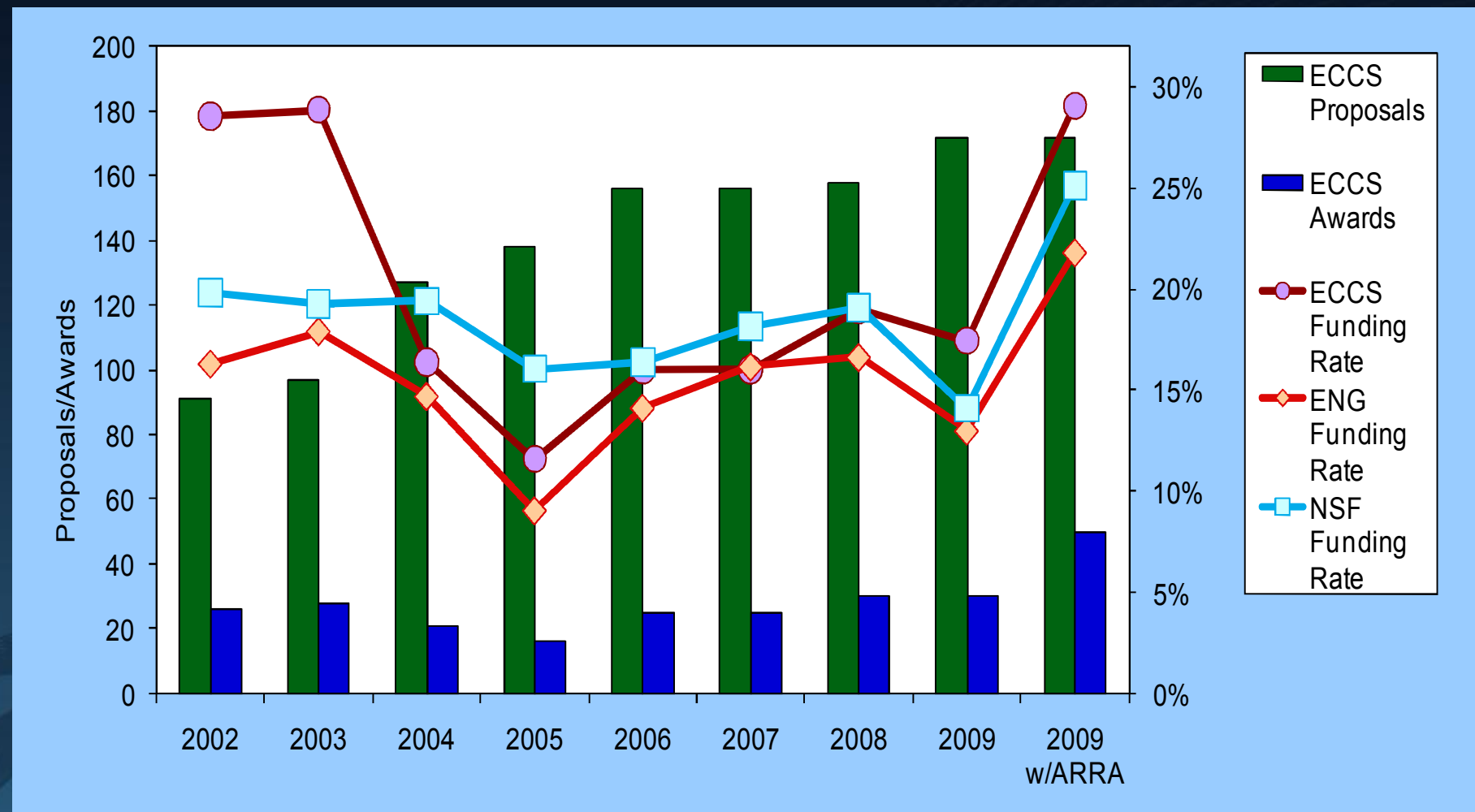


Funding Rates – Research Grants ECCS, ENG, NSF



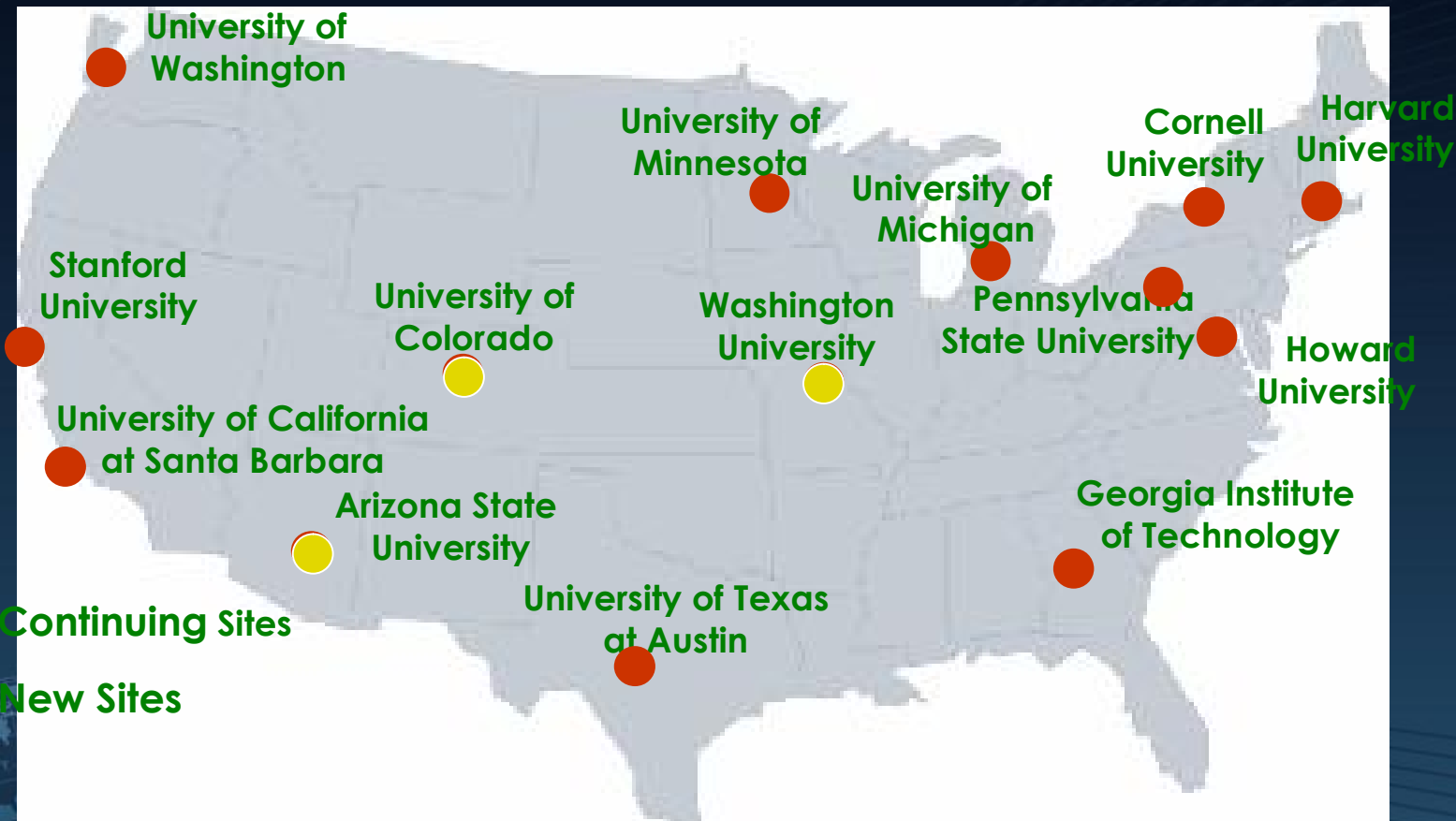


Funding Rates – CAREER Awards ECCS, ENG, NSF





National Nanotechnology Infrastructure Network (NNIN)



An integrated national network of user facilities providing researchers open access to resources, instrumentation and expertise in all domains of nanoscale science, engineering, and technology

<http://www.NNIN.org>



Emerging Emphasis Areas for ECCS

- Nanoelectronics
 - > SEBML
 - > QISE
- Energy and Sustainability
 - > Smart Grid
 - > Photovoltaics
 - > Alternate Energy
- Cyber-Physical Systems (CPS)
- Innovation Ecosystem



Science and Engineering Beyond Moore's Law (SEBML)

- Doubling ENG support to \$20 million for investigations into:
 - Devices
 - Systems and architecture
 - Multi-scale modeling and simulation research
 - Quantum information science and engineering
 - Design of efficient and sustainable manufacturing equipment, processes, and facilities





Smart Grid

- What's a 'smart grid'?
 - > Integrate information technologies with the electrical power infrastructure
 - Make use of the internet
 - Integrate computers and controllers in household heating/air conditioning units, appliances, etc.
- Why?
 - > 'Real time' control of electrical consumption to balance load, optimize electrical energy use, and minimize loss and disruption, as well as cost
 - > Integration of alternate energy sources (e.g., photovoltaics, solar panels, wind generators, etc.)
 - > Enable 'two-way' power flow (two-way meters)
- The Smart Grid is a **conservation** technology



What's a Cyber-Physical System?

- ⦿ A **cyber-physical system** (CPS) is a system featuring a tight combination of, and coordination between, the system's computational and physical elements
- ⦿ CPS originated from, but is now greater than, embedded systems
 - > First generation embedded systems emphasized the computational elements, with less focus upon the strong link with the hardware
 - > CPS emphasizes the network of interacting elements, rather than focusing upon stand alone elements





CPS at NSF

- CPS at NSF is a joint program with strong collaboration between the CISE and ENG Directorates
 - > CISE focuses upon the intelligent, computational, and networking aspects
 - > ENG/ECCS focuses upon the integration and hardware aspects
- Budget
 - > FY09: \$45M, including \$15M ARRA funds
 - > FY10: anticipate between \$30M to \$34M