NSF Programs in Energy and Power Systems

Program Director Perspective

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Directorate for Engineering

Outline

- The Current Environment: Issues Addressed by NSF Funded Research
- Energy, Power, Control and Networks (EPCN)
- NSF Review Process
- Cyber Physical Systems (CPS)
- Open/Remote Access Test Beds
- Opportunities for International Collaborations

Something to think about..

- Electricity production contributes to 40% world carbon dioxide emission
- Electricity use in the U.S. is expected to double by mid-century
- Electric power grids are going through major transformation
- The rise in distributed generation, microgrids, smart meters, changing consumer expectations, new regulations, …

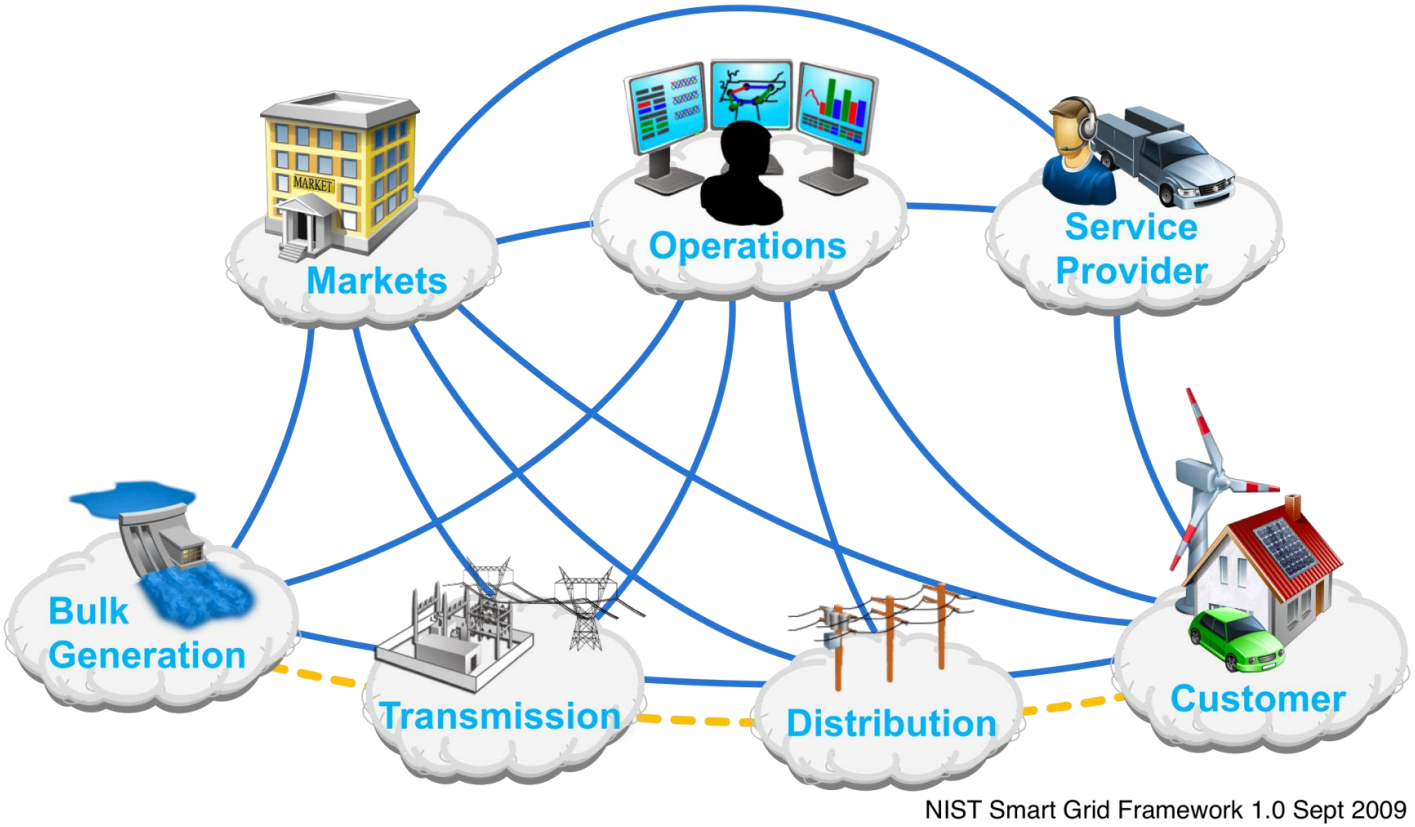
Something to think about..

- Interdependence of food, energy, and water
- Need for greater resilience in the face of natural and man made disasters
- Cybersecurity
- *All of these require greater power systems innovations and a new generation of power systems engineers with broad and deep training*

Energy, Power, Control and Networks (EPCN) – A Core Program

- Design and analysis of complex systems including sensing, imaging, control and computational technologies
- Emphasis on electric power networks including all aspects of generation, transmission, distribution systems
- High power electronics and drives
- Energy harvesting devices and systems
- New regulatory and economic structures

Smart Grid Framework



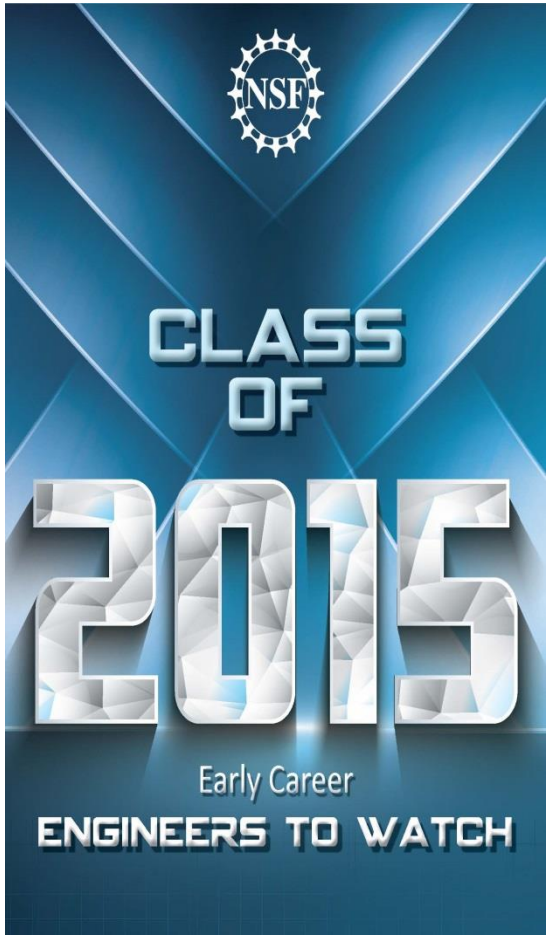
NIST Smart Grid Framework 1.0 Sept 2009

Energy, Power, Control and Networks Program

- Types of Proposals
  - Faculty Early Career Development (CAREER)
  - Single Investigators / Small group
  - Industry Collaborations (GOALI)
  - Exploratory Research (EAGER)
  - Workshops in emerging areas
  - International collaborations
  - Research experience for undergraduates
  - Research experience for teachers

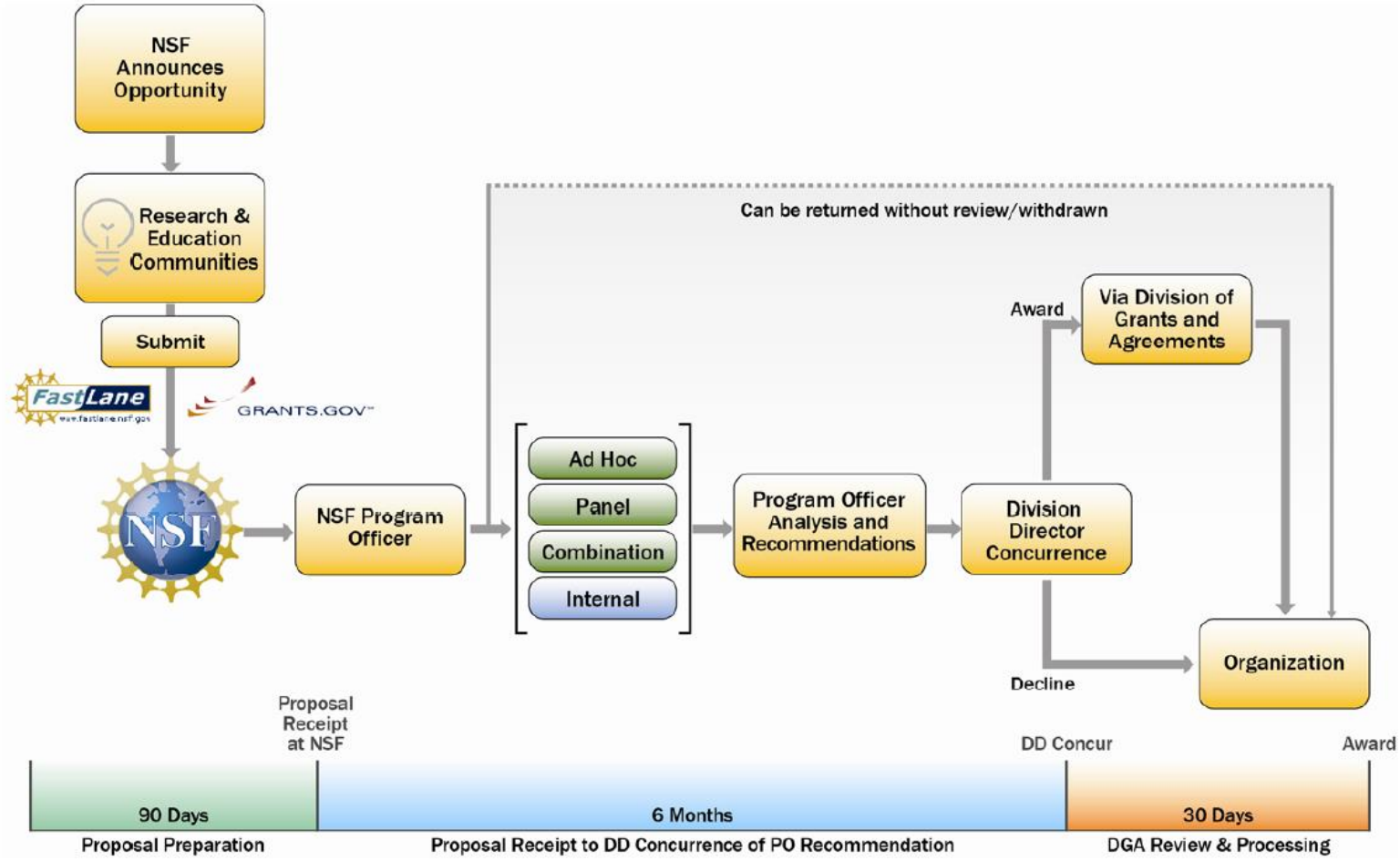
Engineering CAREER Awards for FY 2015

- $73M total investment in the next generation of engineering early-career faculty
- 146 grants at $500K each
  - 81 institutions in 36 states, including 16 EPSCoR states
  - 29% women and 9% under-represented minorities, according to available demographic data
  - 51% to new PIs



Announcement at http://www.nsf.gov/news/news_summ.jsp?cntn_id=134554

Exhibit III-1: NSF Proposal & Award Process & Timeline



Merit Review Criteria

- **Intellectual Merit**
  - Advance knowledge and understanding within its own field or across different fields
  - Explore creative, original or potentially transformative concepts
- **Broader Impacts**
  - Benefit society or achieve specific desired societal outcomes

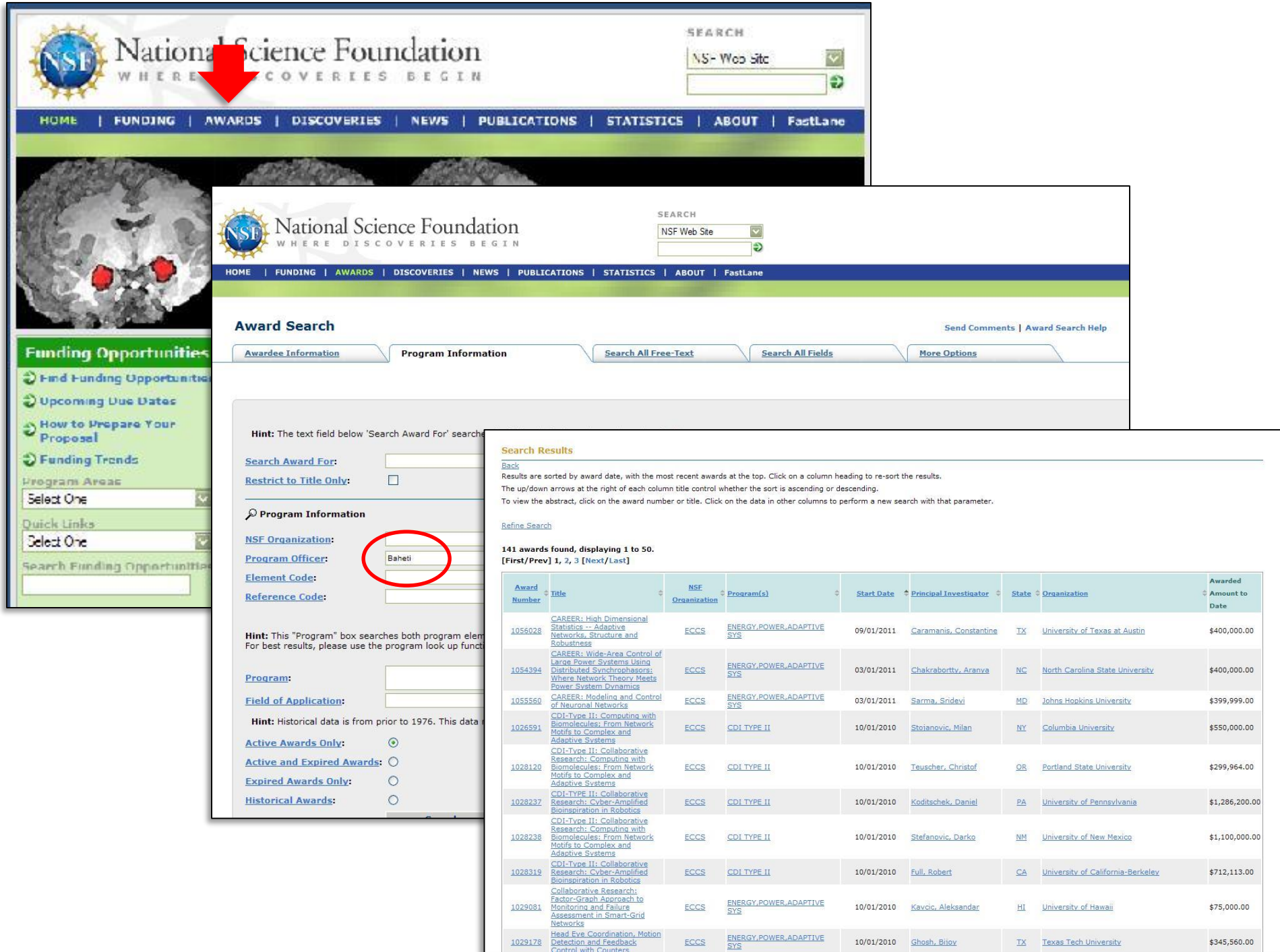
NSF Panel Review

Energy, Power, Control and Networks Program

- Eyad Abed and Kishan Baheti (Program Directors)
- October 1 – November 1 (Submission Window)
- 250-300 proposals reviewed in 10 panels
- Each proposal has minimum 3 independent reviews and panel summary
- Awards to support graduate students, summer salary, travel, equipment

NSF AWARD SEARCH

- www.nsf.gov
  - Search awards
    - Advanced search
      - Program officer
- Many options available
  - Program Information
  - Keyword search “power Systems” “power Electronics” “Energy Harvesting”…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Element Code:
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Hint: This "Program" box searches both program elem
For best results, please use the program look up funct
Program:
Field of Application:
Hint: Historical data is from prior to 1976. This data
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Search Results
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Results are sorted by award date, with the most recent awards at the top. Click on a column heading to re-sort the results.
The up/down arrows at the right of each column title control whether the sort is ascending or descending.
To view the abstract, click on the award number or title. Click on the data in other columns to perform a new search with that parameter.
Refine Search
141 awards found, displaying 1 to 50.
[First/Prev] 1, 2, 3 [Next/Last]
Award Number | Title | NSF Organization | Program(s) | Start Date | Principal Investigator | State | Organization | Awarded Amount to Date
1056028 | CAREER: High Dimensional Statistics -- Adaptive Networks, Structure and Robustness | ECCS | ENERGY,POWER,ADAPTIVE SYS | 09/01/2011 | Caramanis, Constantine | TX | University of Texas at Austin | $400,000.00
1054394 | CAREER: Wide-Area Control of Large Power Systems Using Distributed Synchrophasors: Where Network Theory Meets Power System Dynamics | ECCS | ENERGY,POWER,ADAPTIVE SYS | 03/01/2011 | Chakrabortty, Aranya | NC | North Carolina State University | $400,000.00
1055560 | CAREER: Modeling and Control of Neuronal Networks | ECCS | ENERGY,POWER,ADAPTIVE SYS | 03/01/2011 | Sarma, Sridevi | MD | Johns Hopkins University | $399,999.00
1026591 | CDI-Type II: Computing with Biomolecules: From Network Motifs to Complex and Adaptive Systems | ECCS | CDI TYPE II | 10/01/2010 | Stojanovic, Milan | NY | Columbia University | $550,000.00
1028120 | CDI-Type II: Collaborative Research: Computing with Biomolecules: From Network Motifs to Complex and Adaptive Systems | ECCS | CDI TYPE II | 10/01/2010 | Teuscher, Christof | OR | Portland State University | $299,964.00
1028237 | CDI-TYPE II: Collaborative Research: Cyber-Amplified Bioinspiration in Robotics | ECCS | CDI TYPE II | 10/01/2010 | Koditschek, Daniel | PA | University of Pennsylvania | $1,286,200.00
1028238 | CDI-Type II: Collaborative Research: Computing with Biomolecules: From Network Motifs to Complex and Adaptive Systems | ECCS | CDI TYPE II | 10/01/2010 | Stefanovic, Darko | NM | University of New Mexico | $1,100,000.00
1028319 | CDI-Type II: Collaborative Research: Cyber-Amplified Bioinspiration in Robotics | ECCS | CDI TYPE II | 10/01/2010 | Full, Robert | CA | University of California-Berkeley | $712,113.00
1029081 | Collaborative Research: Factor-Graph Approach to Monitoring and Failure Assessment in Smart-Grid Networks | ECCS | ENERGY,POWER,ADAPTIVE SYS | 10/01/2010 | Kavcic, Aleksandar | HI | University of Hawaii | $75,000.00
1029178 | Head Eye Coordination, Motion Detection and Feedback Control with Counters | ECCS | ENERGY,POWER,ADAPTIVE SYS | 10/01/2010 | Ghosh, Bijoy | TX | Texas Tech University | $345,560.00

Cyber-Physical Systems Program

Deeply integrating computation, communication, and control into physical systems

- Launched in 2009
- Aims to develop the core system science needed to engineer complex "smart" cyber-physical systems
- Serves key national priorities
- Coordinated across NSF and with other government agencies

Transportation

Manufacturing and Industrial Automation

Energy

Healthcare and Biomedical

Critical Infrastructure

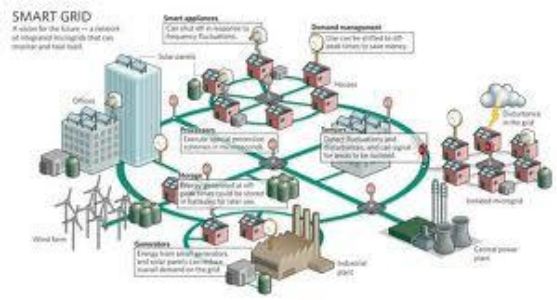
114 active awards:

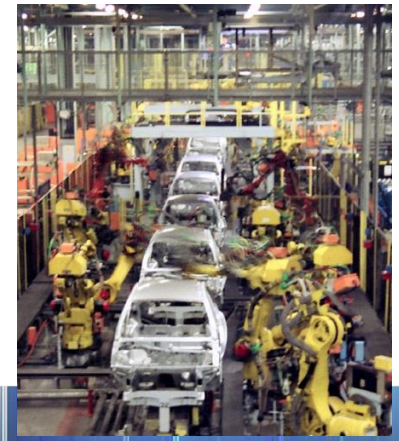
- $140M+ total investment
- 43 small, average $527K
- 66 medium, average $1.5M
- 5 large, average $4.7M

Cross-Directorate Solicitation: CISE and ENG

Open/Remote Access Test-beds

A new opportunity for the research community





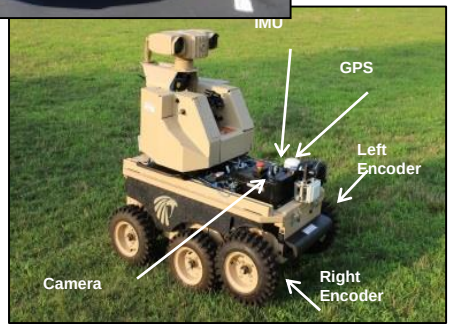
Outline: the innovation framework[1]

- Need
  - Understanding the trade-offs between networked engineering systems, cybersecurity, open/remote access, tele-immersive communications and real-time performance
  - Improving and broadening research and education
- Approach
  - Developing open/remote access engineering test beds for research, education, learning, and competition
  - Sharing valuable engineering resources
  - Involving the multi-disciplinary research community
- Benefit
  - Improved understanding of engineered network control systems
  - Improved access to research and education
- Competition
  - Unfocused development of remote test beds
  - Using Traditional IT security systems rather than CPS based security

[1] Curtis Carlson. NSF Workshop. December 3, 2014.

Approach: Distributed laboratory space with open/remote access

- Develop and use remote-access, online, shared engineering laboratory spaces
- Potential laboratories: robotics, power systems, drones, medical systems, etc.
- Shared cost and leveraging expertise



Images: Vehicle: I. Lee, KOCSEA Workshop 2014; Microgrid: https://der.lbl.gov/

Opportunity for International Collaborations

- Dear Colleague Letter: Research opportunity in Germany for NSF CAREER Awardees (NSF 15-059)
  - Connecting researchers with complementary strengths and shared interests
  - Short-term and long-term visits of CAREER awardees
  - DFG-Funded hosts will provide funding to support in-country living

Opportunity for International Collaborations

- Energy and Power Systems research is a National Priority with major societal benefits
- EPCN Program will use existing funding structure to support US researchers for international collaborations
  - October 1-November 1 submission window
  - Provide supplements to current NSF awards

Partnership for International Research and Education (PIRE)

- Program Announcement NSF 14-587
- Advance research and education which could not occur without international collaborations
- Award size – upto $4M over 5 years
- Pre-proposal - October 21, 2014
- Full proposal – May 15, 2015