CMMI Overview

Steven H. McKnight
Division Director for Civil, Mechanical and Manufacturing Innovation
Advanced Manufacturing

➢ Research leading to transformative advances in manufacturing and building technologies, with emphases on efficiency, economy, and sustainability

➢ Supporting programs
  o Manufacturing Machines and Equipment
  o Manufacturing Enterprise Systems
  o Materials Processing and Engineering
  o Nanomanufacturing
CMMI Research Clusters

Mechanics and Engineering Materials

- Research aimed at advances in the transformation and use of engineering materials efficiently, economically, and sustainably

- Supporting programs
  - Geomechanics and Geomaterials
  - Materials and Surface Engineering
  - Mechanics of Materials
  - Biomechanics and Mechanobiology
  - Structural Materials and Mechanics

PI: Andrew Norris (Rutgers)
PI: Chiara Daraio (Cal Tech)
CMMI Research Clusters

**Systems Engineering and Design**

- Research on the decision-making aspects of engineering, including design, control, and optimization

- Supporting programs
  - Control Systems
  - Dynamical Systems
  - Engineering Systems Design
  - Operations Research
  - Sensors and Sensing Systems
  - Service Enterprise Systems

**SSS/EFRI: Learning from Plants**

- Bending Motion
- Twisting Motion

- Multiple FMC cells

- Henderson (Cornell)

- Wang, Mayer, Nielson (Michigan) Bakis, Rahn (PSU)

- O.R. Methods for optimized ambulance deployment
CMMI Research Clusters

Resilient and Sustainable Infrastructures

- Research to advance fundamental knowledge and innovation for resilient and sustainable civil infrastructure and distributed infrastructure networks

- Supporting programs
  - Civil Infrastructure Systems
  - NEES – Ops and Research
  - Geotechnical Engineering
  - Hazard Mitigation and Structural Engineering
  - Infrastructure Mgt. and Extreme Events

NEES: New Concepts for Damage-Tolerant, Self-Righting Steel-Framed Buildings

CIS/GOALI: Mitigating Accidents via Advanced Active Safety Systems
CMMI FY12 By the Numbers

- 19 Core Research Programs accepting unsolicited proposals
  - Created 3 Cross-cutting Research Programs (CDSE, DEMS, SYS)
- Participation in numerous cross-cutting solicitations
- Primary Investment in Research Awards: $147 Million
- Research Proposals received & reviewed: 3355 Proposals
  - 45 CAREERS, 7 CREATIVs, 22 EAGERS, 7 RAPIDS
  - Submissions from 323 Institutions
  - Awarded Research Proposals: 488 Awards to 149 Institutions
    - This represents a 14.5% success rate
    - Median Award Size: ~$300k over 36 months
    - 292 REU Students Funded (40% of Awards have supplements)
Full Research Awards to institutions in 43 States

- California is highlighted in dark green.
- Texas is also highlighted in dark green.
- Illinois is highlighted in medium green.
- Other states are colored in varying shades of green, indicating the distribution of awards across different states.
CMMI Research Community: Submissions versus Awards, 2012

Proposals Submitted by Each Institution

Success Rate
FY09-FY12 Proposal Trends

- **2009**: 2199 applications, 664 awards (23.19% success rate)
- **2010**: 2804 applications, 499 awards (15.11% success rate)
- **2011**: 2719 applications, 475 awards (14.87% success rate)
- **2012**: 2867 applications, 488 awards (14.55% success rate)
CMMI Reviewers, FY 2012 by Classification

- Foreign Universities and Other International Organizations: 42 (1%)
- Industry & Other Non-Government Organizations: 79 (3%)
- Other Federal/State Agencies and National Labs: 65 (2%)
- PhD Level Institutions: 160 (5%)
- PUI & Masters-Level Institutions: 2883 (89%)
Programmatic Changes of Note

- Cross-cutting programs “Virtual”
  - Participation in CDS&E
  - DEMS
  - SYS

- Sensors and Sensing Systems – refocused

- NEES – Path Forward briefed to NSB
CMMI Research aligned to OneNSF and National Priorities

- National Priorities
  - National Nanotechnology Initiative
  - National Robotics Initiative

- OneNSF Initiatives
  - Advanced Manufacturing including Materials Genome Initiative
  - Cyber-Infrastructure for the 21st Century (CIF-21)
  - Education and Workforce
  - Innovation Ecosystem
  - Interdisciplinary Research
  - Sustainability and Clean Energy
New mathematical models for the distribution of aid after disasters

Optimizing the yearly design of the Flu Vaccine under uncertainty

Computer-driven disease models to plan optimal Diabetes Treatment
CMMI RAPID Research: Learning from Extreme Events

Japan 2011 Earthquake & Tsunami

Haiti 2010 Earthquake
Systems Approaches in CMMI Research:

- Infrastructure, Defense, Economy…
- Overcoming the grand challenges at the interfaces can yield unprecedented opportunities for discovery and strengthen U.S. scientific and engineering leadership.

- Broad areas of opportunity:
  - Design of Large-scale Engineered Systems
  - Robotics and autonomous systems
  - Resilient Civil Infrastructure Systems
  - Advanced Manufacturing and Service Systems
Advanced Manufacturing

- Support multi-scale modeling, nanomanufacturing, and complex engineering systems design

- Cyber-Enabled Materials, Manufacturing, and Smart-Systems (CEMMSS) – Materials Genome, Robotics, Cyber-Physical Systems

- Research at the Interface of the Biological, Mathematical, and Physical Sciences, and Engineering (BioMaPS)
Materials Genome Initiative:

New paradigm-“twice as fast, at a fraction of the cost”

18 -20 years
Thanks!!
CMMI Award Profile

Majority of Awards 250-300k; 36 Months in Duration
CMMI Enabling the Frontiers of Research
At all Scales

Nanoscale to Infrastructure Scale Research