

CONSENSUS STUDY REPORT

A New Vision for
Center-Based
Engineering
Research



CONVERGENCE



TEAM SCIENCE



GRAND
CHALLENGES



A New Vision for Center-Based Engineering Research

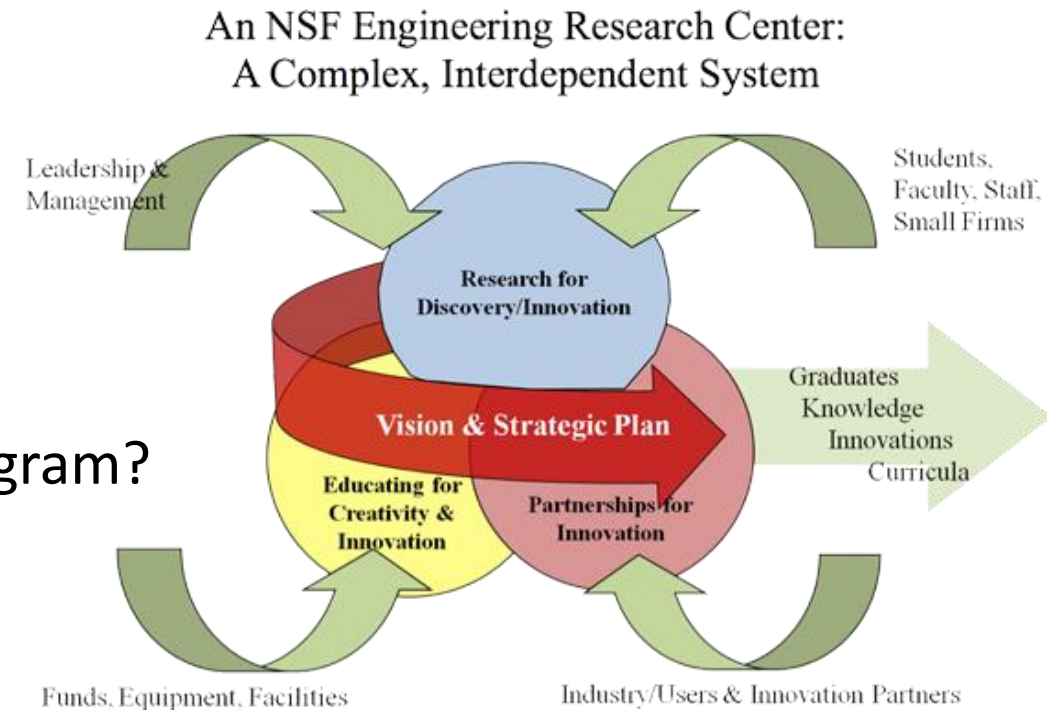
Committee on a Vision for the Future of Center-Based
Multidisciplinary Engineering Research
National Materials and Manufacturing Board
Division on Engineering and Physical Sciences
National Academy of Engineering

<http://www.nap.edu/24767>

May 2017

Why do a study?

- ERC program started in 1985, focus on promising new technologies
- ~70 ERCs have been funded, \$3-5M/year for 10 years (unchanged)
- Flagship program of ENG
- Innovation, economic development, educational excellence
- Burdensome management & reporting
- Many things have changed in 30 years...
 - What is most successful about the ERC program?
 - What can be improved?
 - Vision for the future of the ERC program?



Committee Members

- Maxine Savitz, Co-Chair, Honeywell, Inc. (retired)
- David Walt, Co-Chair, Tufts Univ.
- Nadine Aubry, Northeastern Univ.
- Cheryl Blanchard, Microchips Biotech
- Robert Braun, Univ. Colorado
- Curtis Carlson, Practice of Innovation
- Jim Chang, North Carolina State Univ.
- Martha Cyr, Worcester Polytech. Inst.
- Mike Gregory, Univ. of Cambridge, UK
- William Harris, Science Foundation Arizona
- Fred Lee, Virginia Tech
- Philip Neches, Teradata Corp.
- Monica Olvera de la Cruz, Northwestern Univ.
- Darryll Pines, Univ. of Maryland
- Richard Rashid, Microsoft Research, Emeritus
- Shankar Sastry, Univ. California, Berkeley
- Edwin Thomas, Rice Univ.
- Karan Watson, Texas A&M Univ.
- Yannis Yortsos, Univ. Southern California



Questions for the committee

1. What **models might most effectively enable breakthrough engineering research and discoveries** that require center-scale investment considering the convergence of physical sciences, engineering and life sciences, and social sciences?
2. What **educational models of center-based engineering research programs are best suited** to creating a more diverse, internationally aware, and flexible engineering talent pool that is capable of addressing complex, real-world problems?
3. What **academic-industry/practitioner partnership models might most effectively promote advances** in use-inspired basic and translational research, accelerate technology commercialization, and strengthen the broader innovation ecosystem?
4. What **metrics can be used to define successes and risks** of such center programs?



Major finding: Context for the Vision

- **Enormous opportunity**
 - **Exponentially expanding knowledge** in previously distinct fields
 - Combined in new ways to **create innovations of great value for society**
 - *Example: Human Performance Enhancement (HPE)*
- **Convergent engineering**
 - Deeply collaborative, team-based engineering
 - Defining and solving important, complex societal problems
 - Combine disciplines, skills, and capabilities
 - Using best team-research and value-creation practices



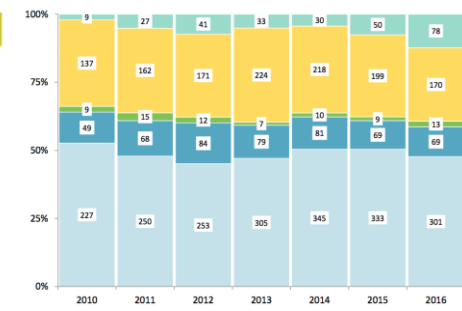
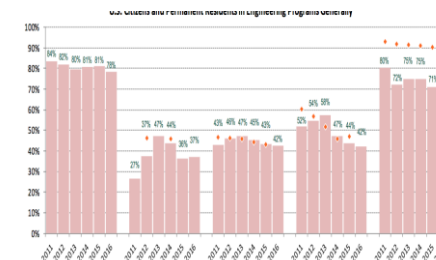
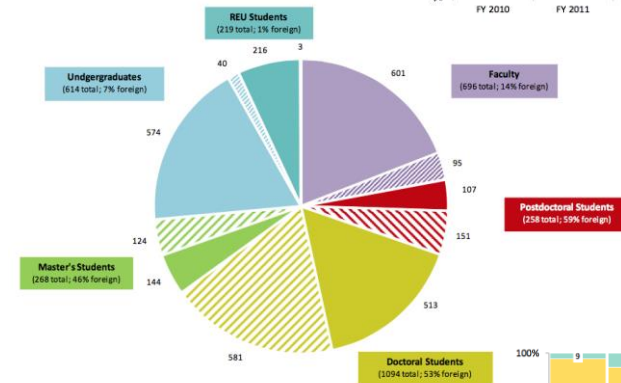
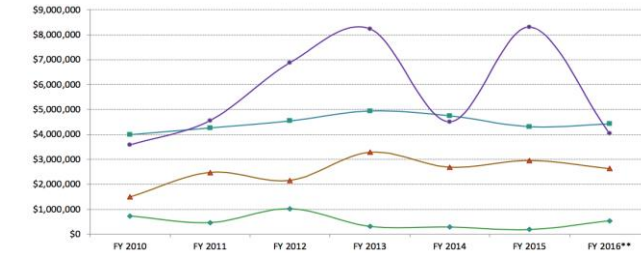
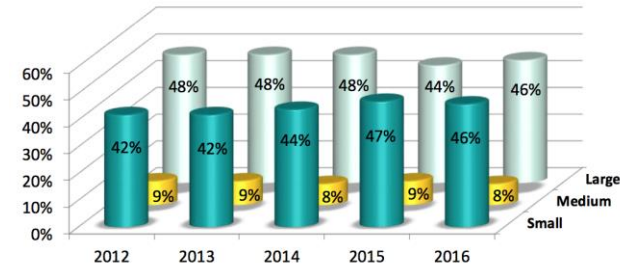
Major Recommendation: Create Convergent Engineering Research Centers (CERC)

- Address **grand-challenge-like problems** (instead of technology)
 - NAE Grand Challenges
 - Bill & Melinda Gates Foundation
 - Millennium Project
- Alternate models: prize-based, Federal-state-local partnerships
- Systematically adopt best practices for team-based research and value creation
 - Leverage research findings and industry practices
 - Amplify collaboration and simplify reporting via web-based collaboration platform
 - Create handbook of best practices



Other recommendations

- **Increased funding** per center: either fewer centers (if flat budget), more cost sharing, or partnerships
- **Metrics should track impact, not just outputs**
 - Current reporting emphasizes funding, students, papers, patents (**easy to count**)
 - Impact: placement of students in positions of influence, evidence of center products being widely used (**hard to quantify**)
- Reporting requirements should be **minimal, essential, and aligned** with center milestones and processes

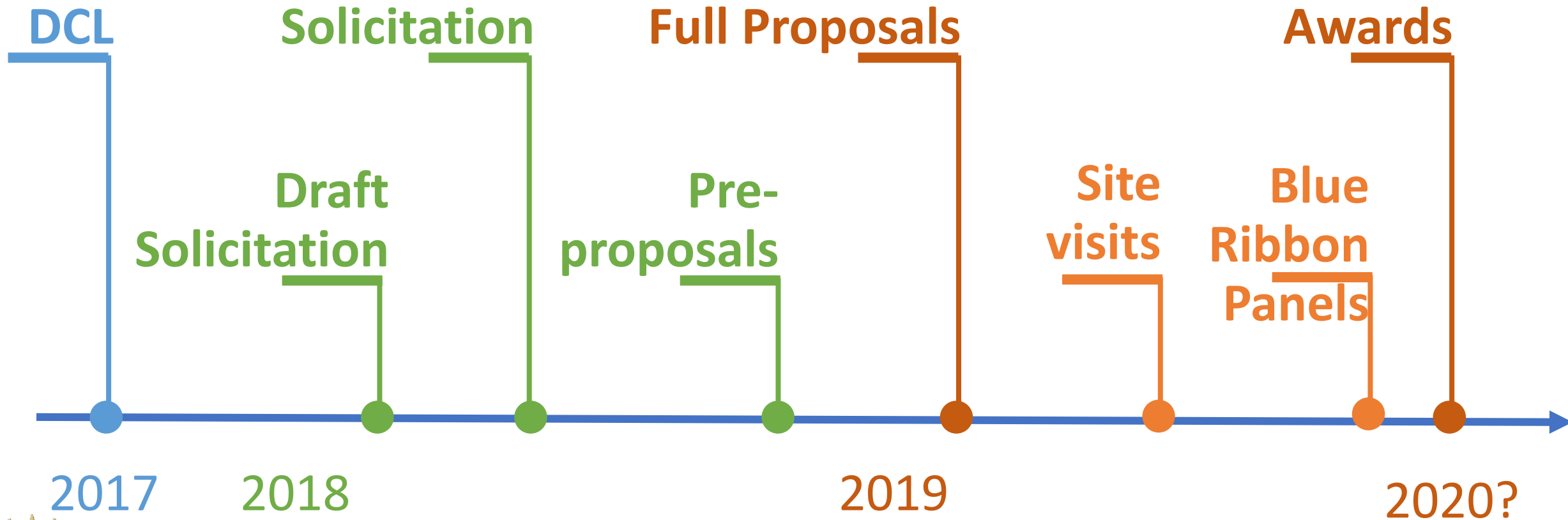


Next step #1: Working group charged

- Gather input from ERC Program Managers, other NSF center managers, other recent reports
- Analyze recommendations from report: Difficulty of implementation vs. potential benefit to program
- Prioritize report recommendations, in context and comparison with other NSF center scale programs (STC, MRSEC)
- Draft solicitation for future ENG center program



Next step #2: New solicitation



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Questions?

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