NSF-CMMI Overview and Outreach Panel

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CIVIL, MECHANICAL AND MANUFACTURING INNOVATION

NATIONAL SCIENCE FOUNDATION

International Mechanical Engineering Congress & Exposition

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- Q&A Session—The floor is yours!

Introduction

NATIONAL SCIENCE FOUNDATION

ENGINEERING DIRECTORATE

NSF Strategic Goals

Strategic Goal 1: Transform the Frontiers of Science and Engineering

"to promote the progress of science"

Strategic Goal 2: Stimulate Innovation and Address Societal Needs through Research and Education

"to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes"

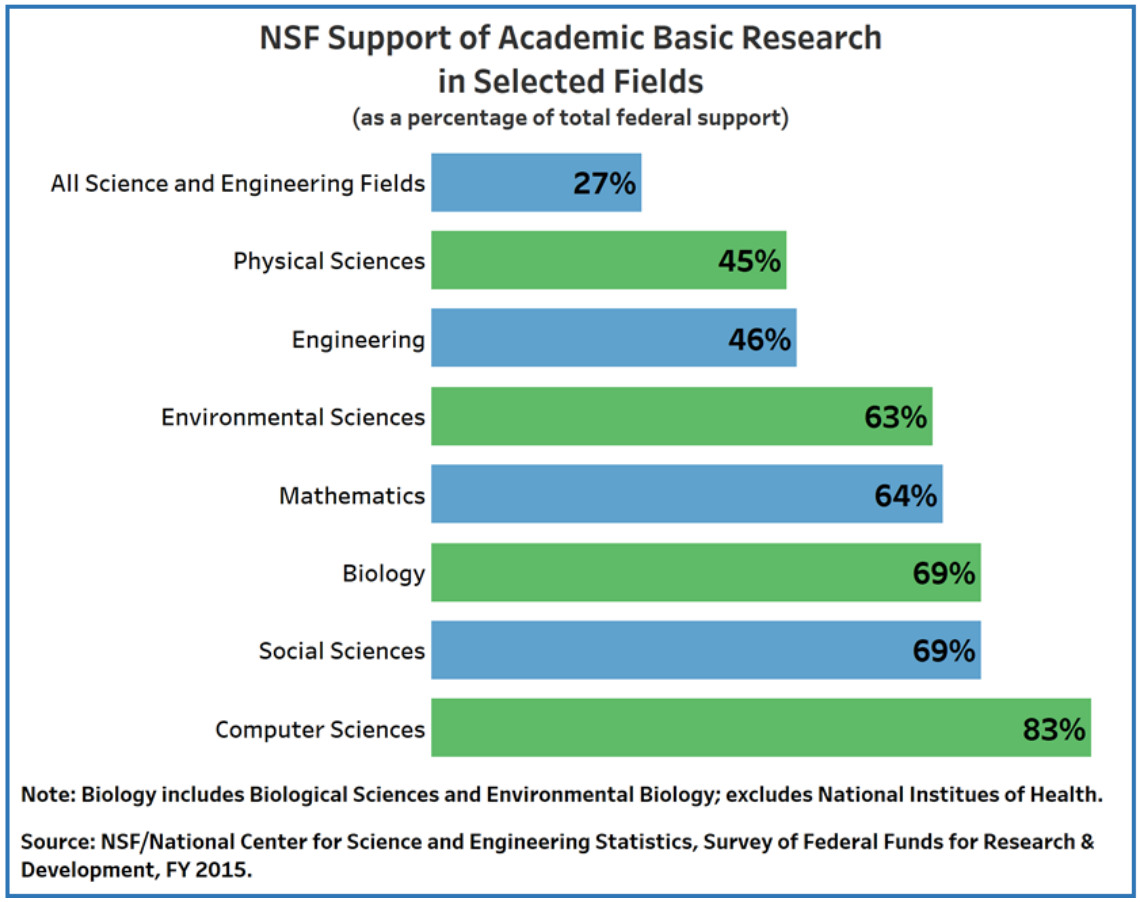
What NSF Does

- Supports all fields of fundamental science and engineering, except for medical sciences.
- Ensures that research is integrated with education so that today's revolutionary work will also be training tomorrow's top scientists and engineers.
- Vehicle of change: research grants

NSF Supports Basic Research

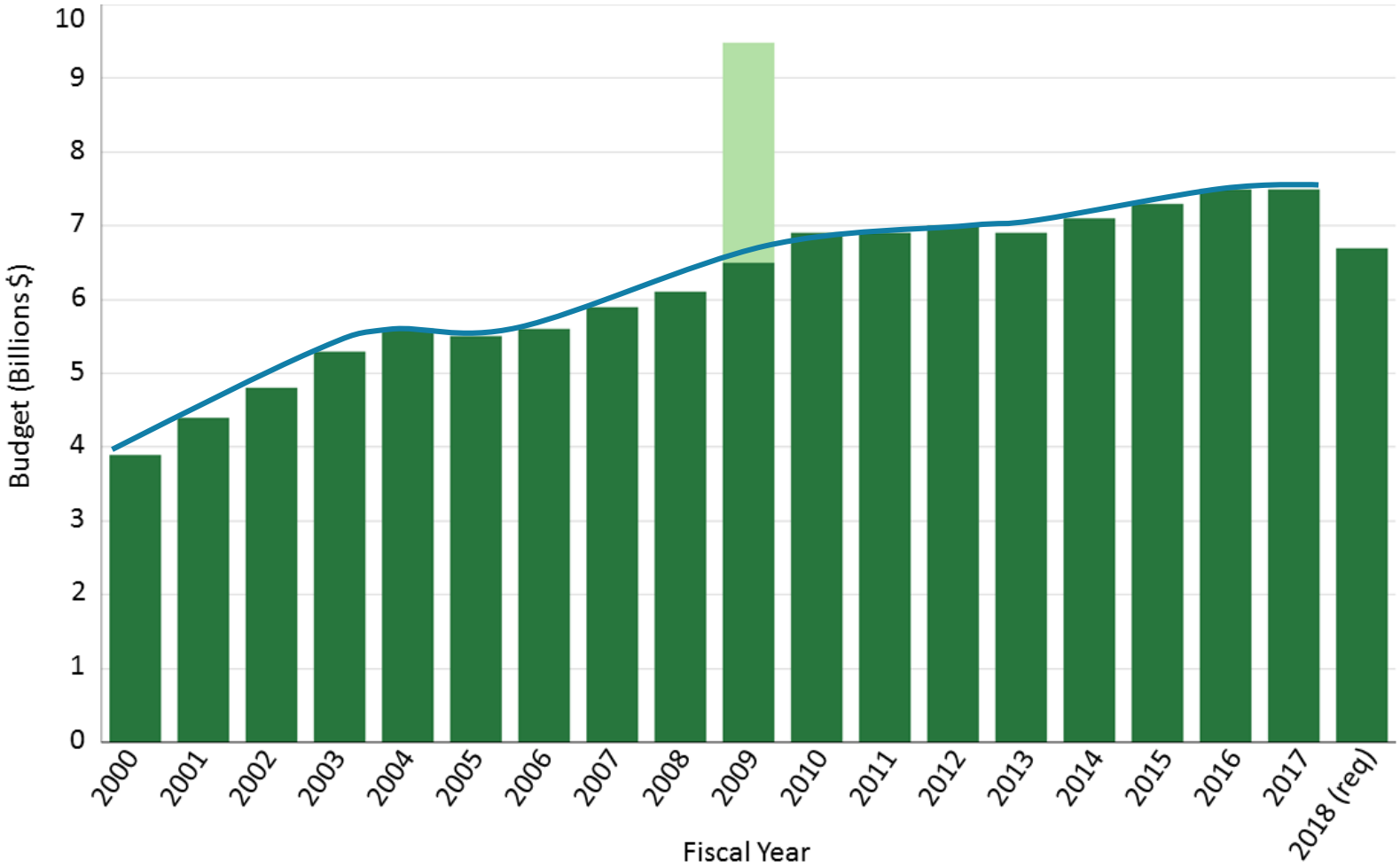
- **Not specific mission driven** → not applied research
- **Winning proposals focus on research**, not development
- **If the focus of the proposal is an artifact** (a device, system, product, process,…) → it's probably development
- **If the focus of the proposal is knowledge** (the truth of a hypothesis) → it's probably research

NSF Support for Basic Research

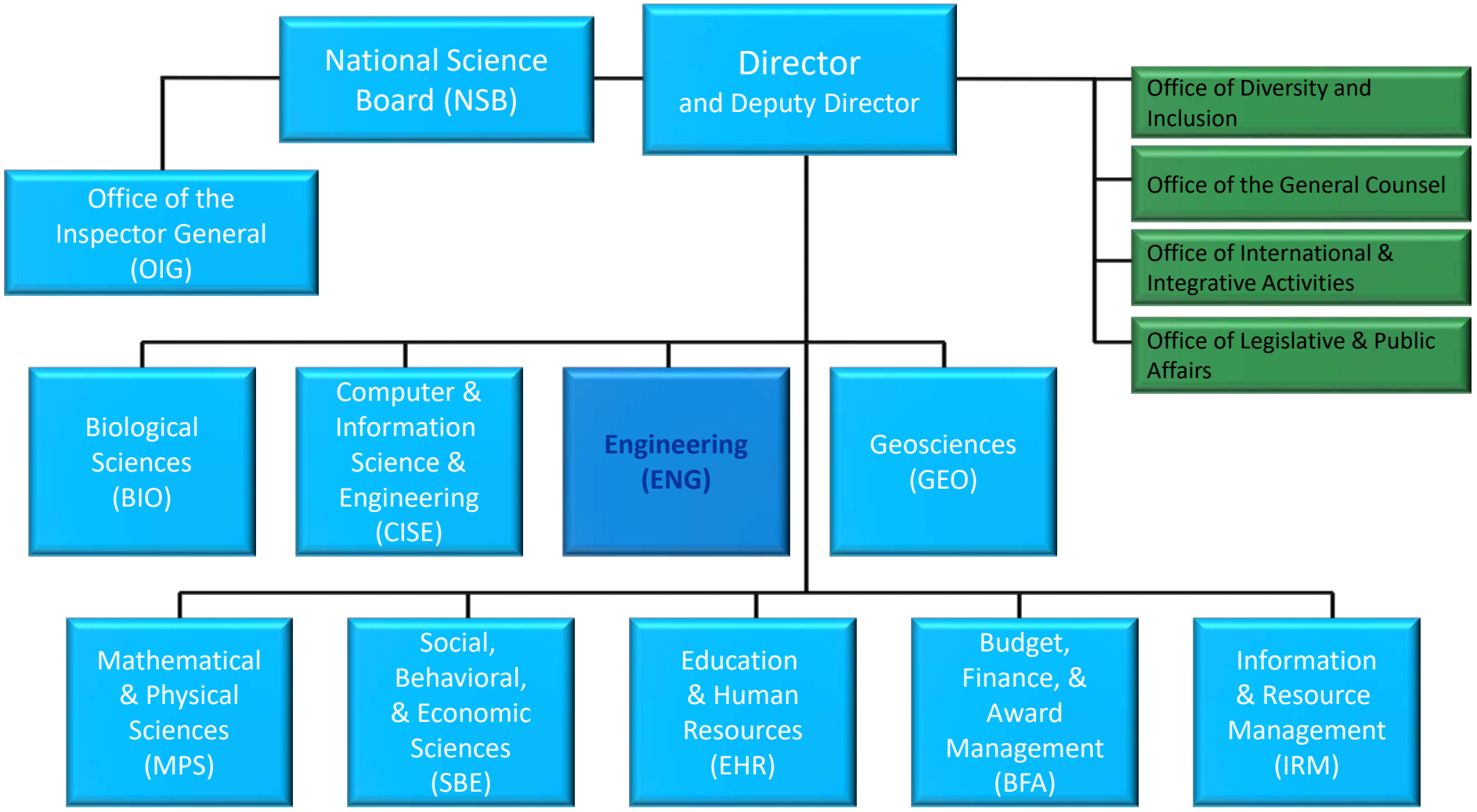


NSF By the Numbers

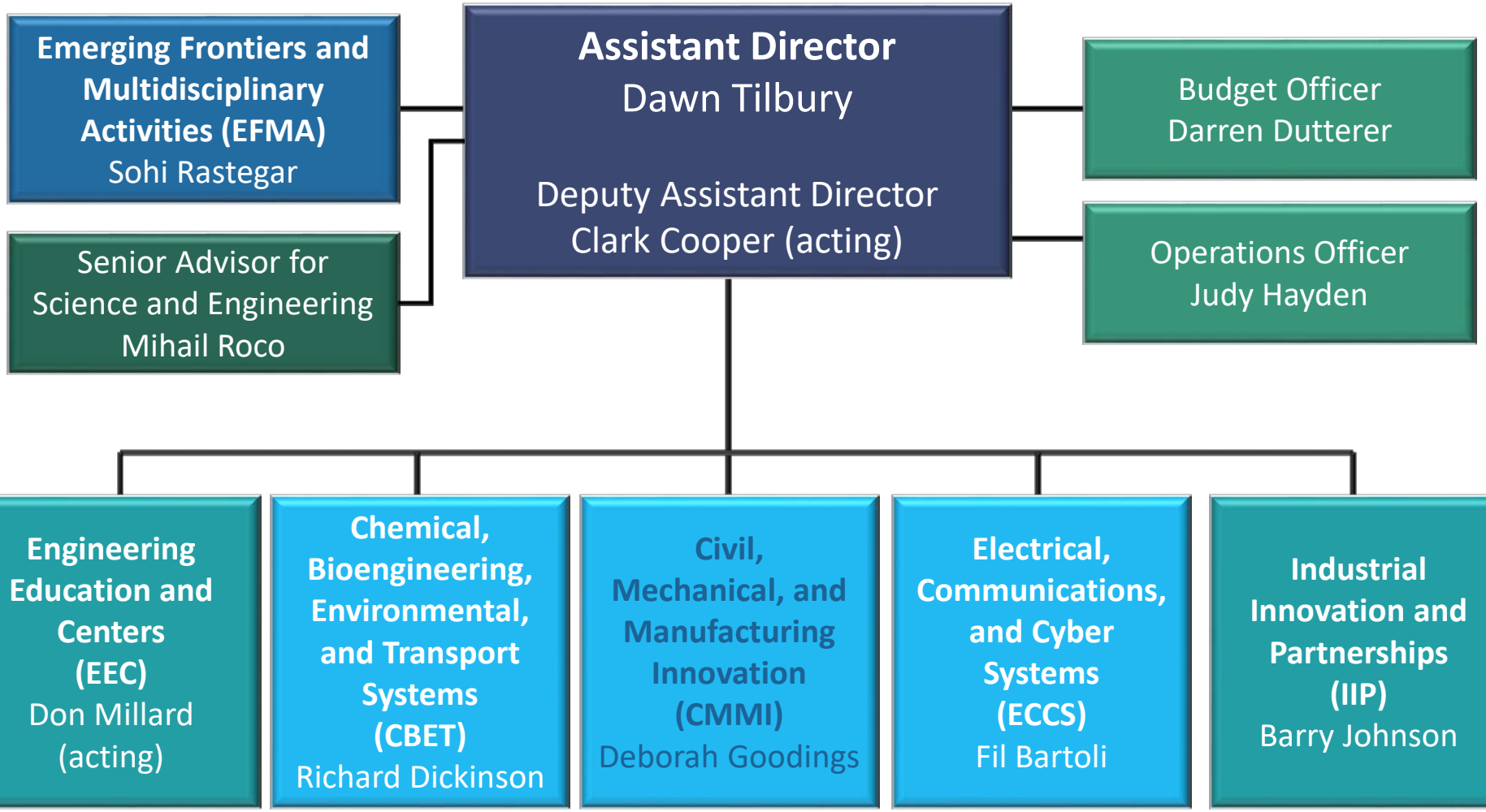
NSF Annual Budget



National Science Foundation

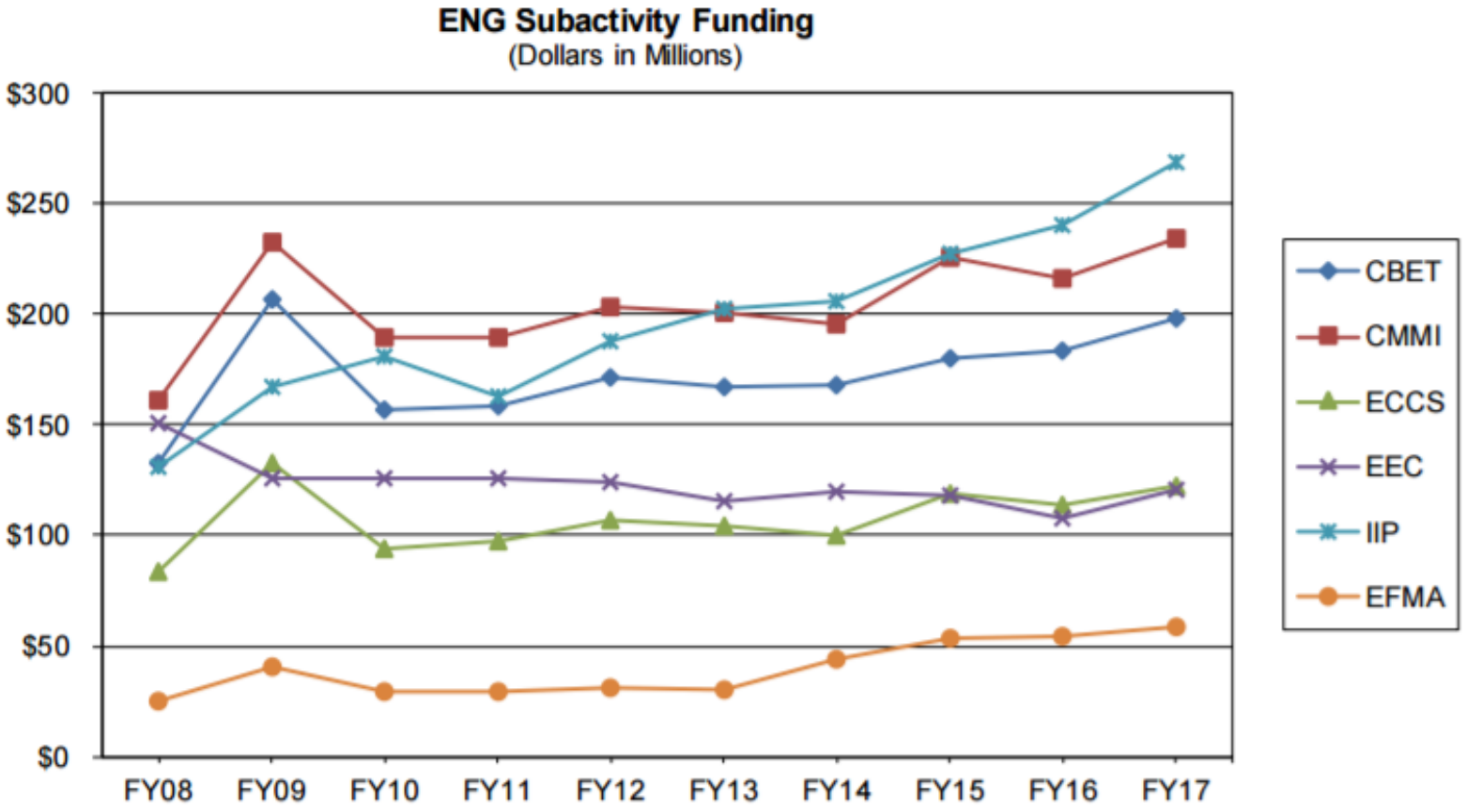


Directorate of Engineering



ENG and SBIR/STTR Budgets

ENG Sub-activity Funding ($M)



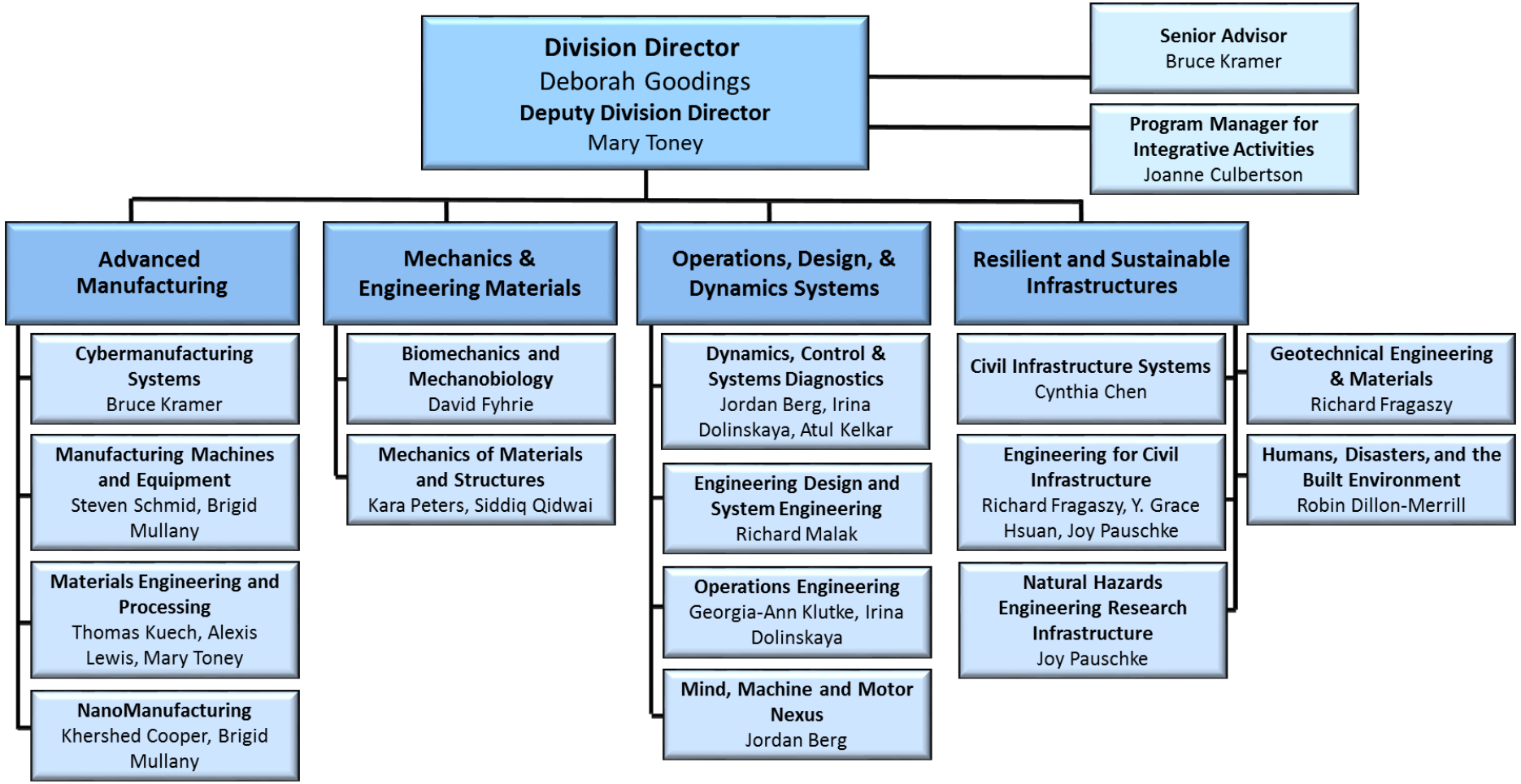
FY 2009 reflects both the FY 2009 omnibus appropriation and funding provided through the American Recovery and Reinvestment Act of 2009 (P.L. 111-5).

Civil, Mechanical and Manufacturing Innovation Division

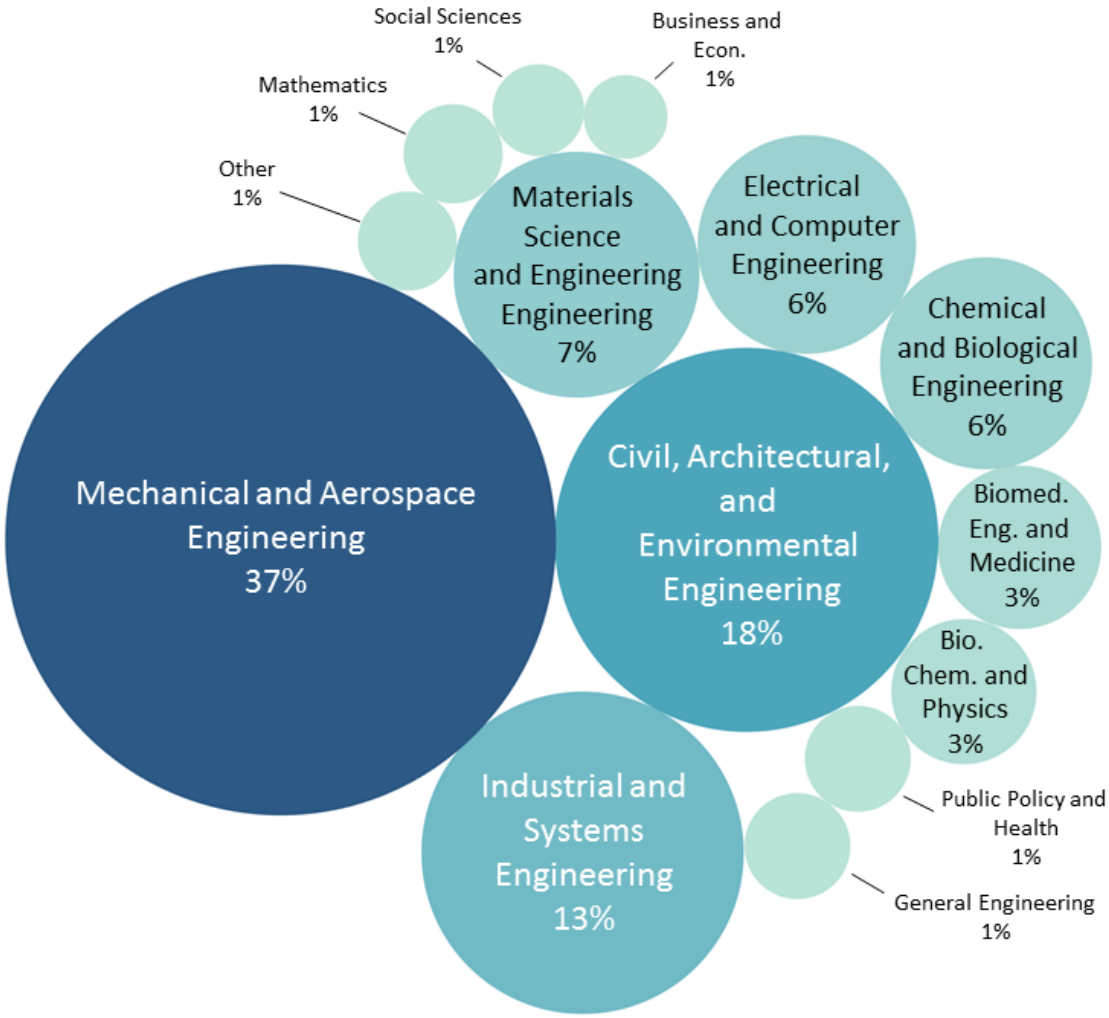
OVERVIEW

PROPOSALS & FUNDING MECHANISMS

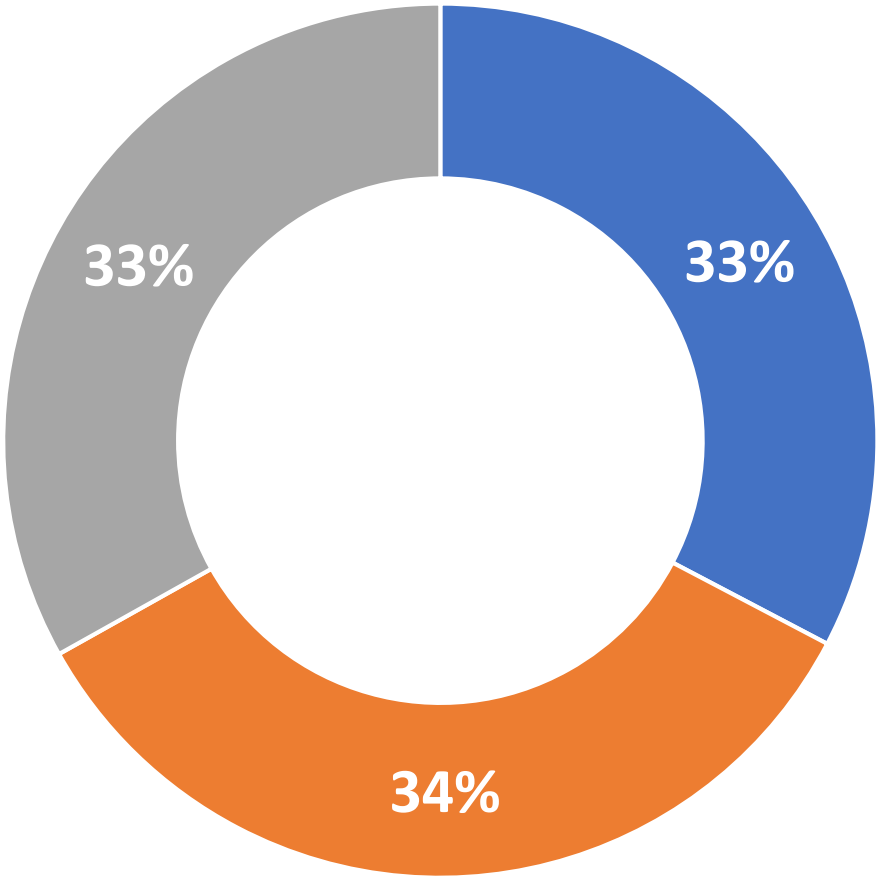
Division of Civil, Mechanical and Manufacturing Innovation



CMMI Awardees 2017



CMMI Awardee Career Level 2017



Early Career
(< 7 Years Post Ph.D.)

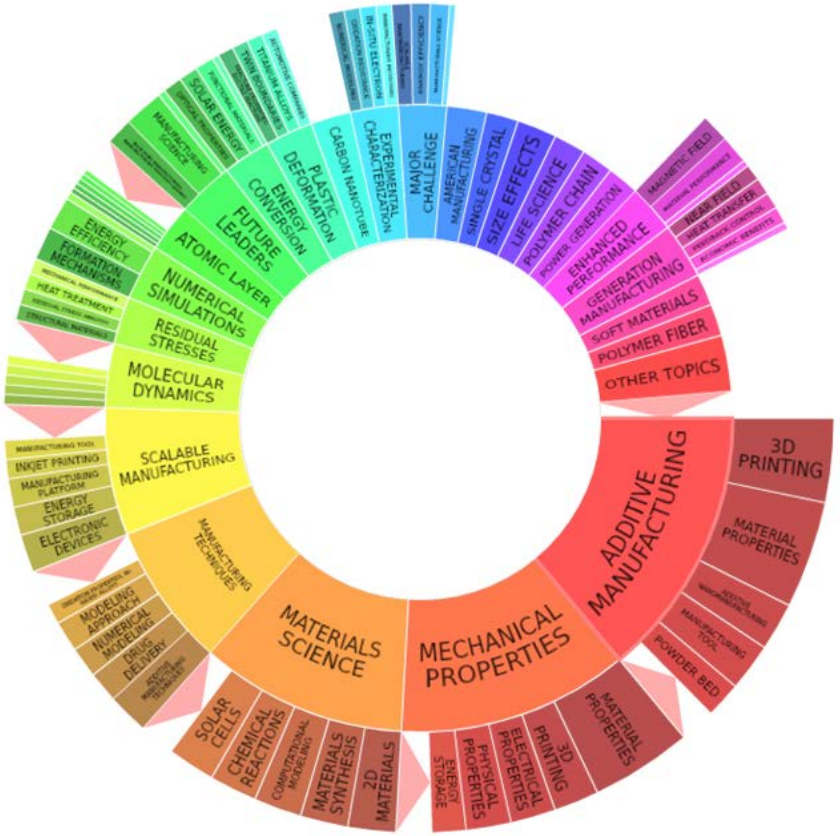
Mid Career
(7-15 Years Post Ph.D.)

Late Career
(> 15 Years Post Ph.D.)

Awardee breakdown reflects the breakdown of all competitive proposals received

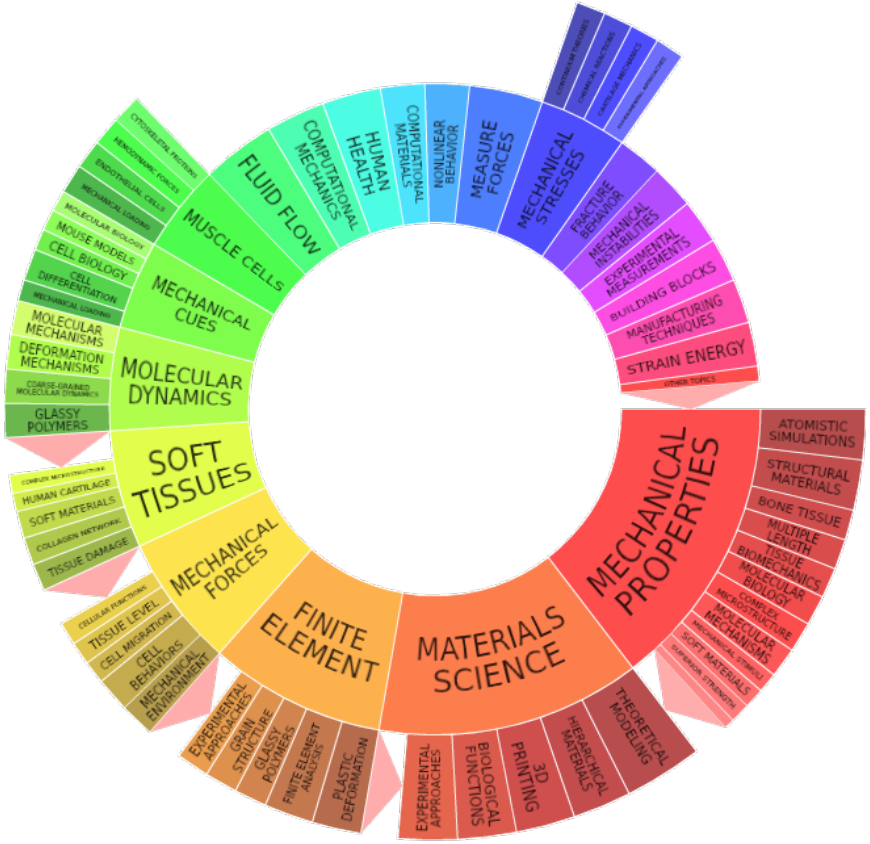
Advanced Manufacturing Cluster

Transformative advances in manufacturing and materials processing, with emphases on efficiency, economy, sustainability and scalability



Mechanics and Engineering Materials Cluster

Understanding the properties and use of materials in engineered and natural systems



Operations, Design, and Dynamic Systems Cluster

Decision-making aspects of engineering, including design, control, optimization and systems science

Resilient and Sustainable Infrastructure Cluster

Innovation to advance resilience and sustainability of civil infrastructure and distributed infrastructure networks

Proposal review

Proposals must address NSF goals

- Transform the frontiers of science and engineering
- Stimulate innovation and address societal needs through research and education

NSF merit review criteria

- Intellectual merit
- Broader impacts

How to Achieve Broader Impact?

NSF Mission: To promote the progress of science; advance the national health, prosperity, and welfare; and to secure the national defense

Broader Impact: Advancement of scientific knowledge and activities that contribute to the achievement of societally relevant outcomes

Can be accomplished through:

- the research itself, AND/OR
- the activities that are directly related to specific research projects, AND/OR
- through activities that are supported by, but are complementary to, the project.

Broadening Participation is <u>one</u> Broader Impact goal

What CMMI is NOT Looking for

- **Research that is supported by mission agencies**
- **Pure academic exercises with no clear motivation or little relevance to our society**
- **Development of artifacts as the main goal of the proposed research**
- **Incremental research that**
  - adds on or modifies the existing frameworks in a marginal way
  - applies techniques from other fields without comprehension of their appropriateness
  - lack theoretical foundations or generalizability, relying solely on empirical data

Funding Mechanisms

- **Core/Unsolicited:** Usually supports one graduate student and one month PI salary—typically $300-500k; 3-4 years
  - Individual/small collaborative teams: funds increase for collaboration
- **Solicitations:** Small to large funding size; multiple divisions can be involved
  - Special research call – DMREF, NRI, SNM, CRISP, BIGDATA
  - Early Career – CAREER
  - Instrumentation – MRI
  - Centers – ERC, STC, I/UCRC
- **Workshops/Conferences**
- **International Collaborations**

CAREER Awards

- Foundation-wide activity that offers NSF's most prestigious awards for faculty members beginning their careers
- Provides stable support at a sufficient level and duration to enable awardees to develop careers as outstanding researchers and educators who effectively **integrate teaching, learning, and discovery**
- *High priority for Engineering!*
- ENG award size is $500,000, period.

The CAREER award is not just a research award, it is a career development award.

IMPORTANT NOTICE: Submission Windows

CAREER Proposal:

- **Third Thursday in July**
- **Repeat annually**

Unsolicited Proposal:

- **September 1 - September 15**
- **January 10 - January 24**
- **Repeat annually**

Civil, Mechanical and Manufacturing Innovation Division

PROGRAM CHANGES

SELECT FOUNDATION-WIDE PROGRAMS OF INTEREST

Leading Engineering for America's Prosperity, Health, and Infrastructure (LEAP HI)

NSF 17-602

- **Defines goals not achievable through a series of small, short-term projects**
- **Incorporates knowledge and methods not normally included in CMMI proposals**
- **Emphasis on planning, coordination and management (Research Integration Plan)**
- **Emphasis on leadership and communication (Leadership Section): Upfront and close involvement of university communications professionals**

- Leadership Role for Engineering
- Fundamental Research
- Societal Impact
  - Economic Competitiveness
  - Quality of Life
  - Public Health
  - Essential Infrastructure
- Research Integration Plan
- Engineering Leadership Plan
- $1-2 million total for up to 5 years

LEAP HI: Timeline & Stipulations

- **LEAP HI Program Coordinator**
  - Bruce Kramer, bkramer@nsf.gov
- **Prepare a 2-page summary including:**
  - A description of the societal challenge that will be addressed,
  - A clear identification of the critical gaps in current understanding that will be researched, and
  - A brief explanation of the scientific basis for the proposed research that highlights the novelty and promise of the proposed methods for bridging current knowledge gaps.
- **Letter of Intent Due December 15, 2017**
  - Used to select reviewers for your proposal
  - Provide enough detail to make that possible
- **Submission Window: February 5-20, 2018**
  - No individual may be a PI, co-PI or Senior Investigator on more than one LEAP HI proposal in a given year
  - No limit on the number of LEAP HI submissions from a given institution
  - "Collaborative Proposals" are not allowed. Partner institutions must be funded by subcontracts from the submitting institution

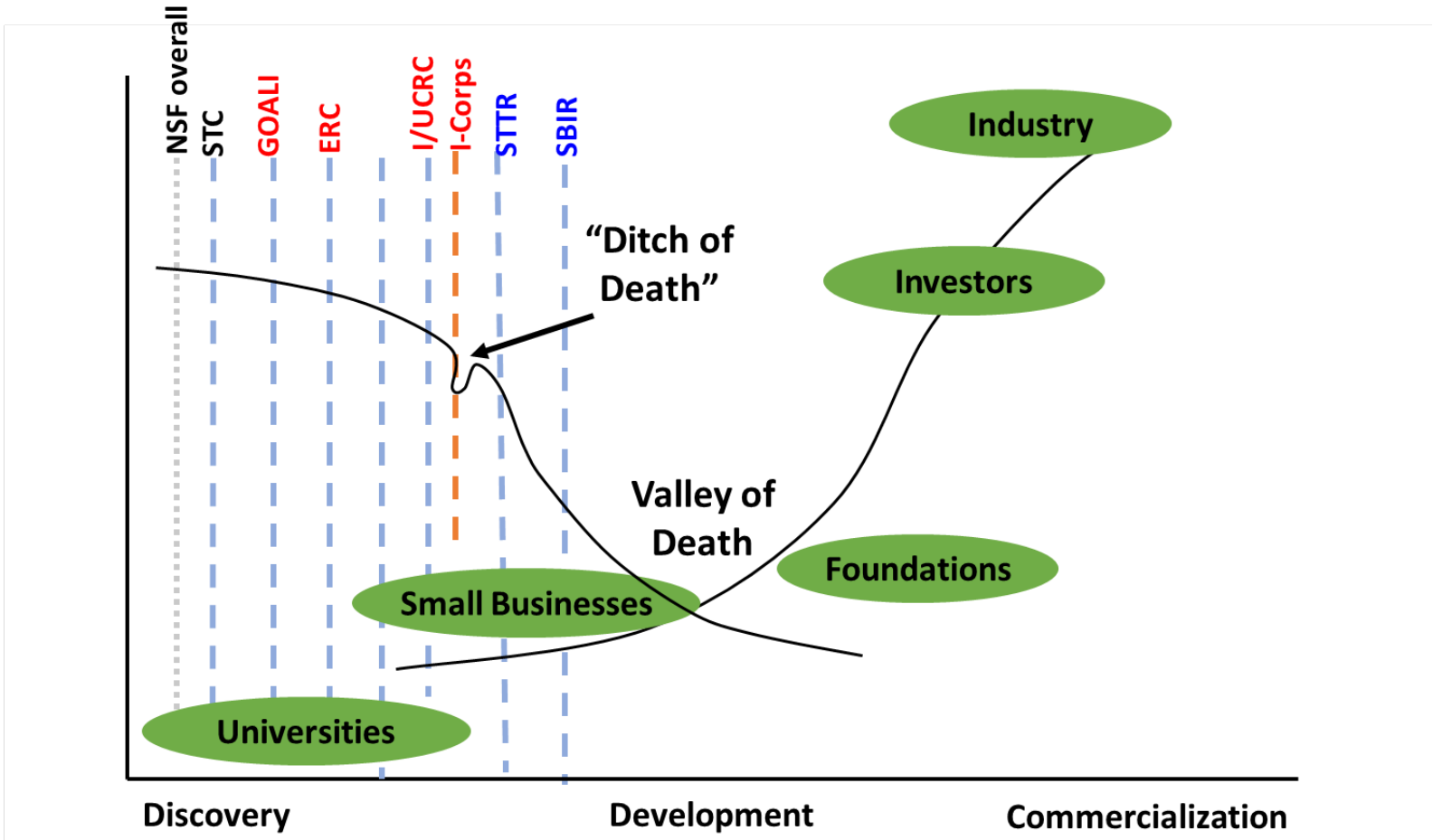
The Engineering for Civil Infrastructure (ECI) Program

- The ECI program replaces the following three programs:
  - Engineering for Natural Hazard (ENH),
  - Geotechnical Engineering and Materials (GEM), and
  - Structural and Architectural Engineering and Materials (SAEM).
- If you could submit it to ENH, GEM or SAEM, you can submit it to ECI!
- It represents a new and integrated vision for fundamental research to underpin transformative innovations for the built environment. The program focuses on the physical infrastructure, such as the soil-foundation-structure-envelope-nonstructural building system.
- It seeks proposals that advance knowledge and methodologies within geotechnical, structural, architectural, materials, coastal, and construction engineering.

The Engineering Design and Systems Engineering (EDSE) program

- The EDSE program replaces the following three programs:
  - Engineering and Systems Design (ESD),
  - Systems Science (SYS), and
  - Design of Engineering Material Systems (DEMS).
- If you could submit it to ESD, SYS or DEMS, you can submit it to EDSE!
- Supports fundamental research to advance theory and methodology for the disciplines of engineering design and systems engineering.
- Interest in advances pertaining to materials design, product design, multidisciplinary design, large scale systems engineering, systems of systems engineering, etc.
- Interest in any and all stages of ED & SE processes including, but not limited to, problem formulation, idea generation, design exploration, optimization, verification and validation, etc.

Beyond Unsolicited Proposals



TRL levels: 1 9

Grant Opportunities for Academic Liaison with Industry (GOALI)

- Industry/Academia partnerships
- NSF funds cannot go to an industry partner; they can only be used by the academic institution
- The industry partner is expected to participate in the research effort to facilitate in the commercialization of the research.
- Submit to a program or solicitation which accepts GOALI proposals
- New! GOALI is no longer a separate solicitation; GOALI proposals fall under "Types of Proposals," NSF PAPPG Chapter II. E.
- Proposals are reviewed alongside other (non-GOALI) proposals submitted in the same window
- Reviewers are instructed to evaluate the quality of the industrial partner's participation

Industry/University Cooperative Research Centers (I/UCRC)

NSF 17-516

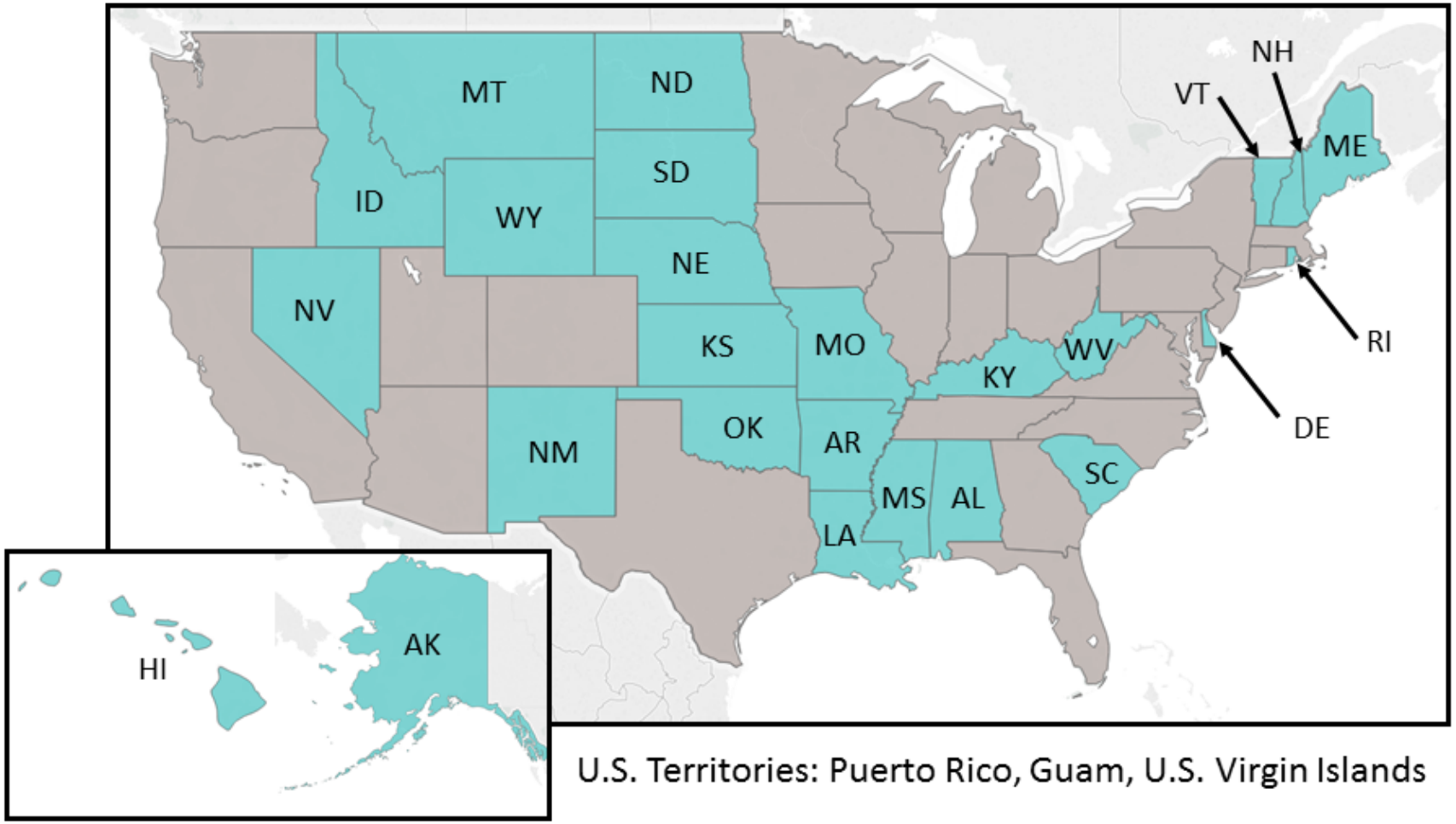
Centers bring together:

I/UCRC Sites Faculty and students from different academic institutions	+	***I/UCRC Members*** Companies, State/Federal/Local government and non-profits

to perform cutting-edge pre-competitive fundamental research in science, engineering, technology area(s) of interest to industry that can drive innovation and the U.S. economy. Members guide the direction of Center research through active involvement and mentoring.

Pre-Proposals: April and October

Experimental Program to Stimulate Competitive Research (EPSCoR)



U.S. Territories: Puerto Rico, Guam, U.S. Virgin Islands

*EPSCoR Map as of 8/15/17

Looking Ahead: Ten Big Ideas

Navigating the New Arctic

Harnessing Data for 21st Century Science and Engineering

Work at the Human-Technology Frontier: Shaping the Future

RESEARCH IDEAS

Understanding the Rules of Life: Predicting Phenotype

The Quantum Leap: Leading the Next Quantum Revolution

Windows on the Universe: The Era of Multi-messenger Astrophysics

PROCESS IDEAS

Growing Convergent Research at NSF

NSF-Includes: Enhancing Science and Engineering through Diversity

Mid-scale Research Infrastructure

NSF 2050: Seeding Innovation

ENG Investment in Data, Computation, and Infrastructure

Core DCI Investments	DCI Related Activities
Data Infrastructure Building Blocks (DiBBS)	Smart and Connected Communities
Computational and Data-Enabled Science and Engineering (CDS&E)	Innovations at the Nexus of Food, Energy and Water Systems (INFEWS)
Software Infrastructure for Sustained Innovation (SI2)	Natural Hazards Engineering Research Infrastructure (NHERI)
Cyber-Physical Systems (CPS)	Network for Computational Nanotechnology
Training-based Workforce Development for Advanced Cyberinfrastructure (CyberTraining)	Designing Materials to Revolutionize and Engineer our Future (DMREF)
BIGDATA	Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR)

CBET | CMMI | ECCS | EEC | EFMA | IIP

Closing Thoughts

- Think research: fundamental questions, basic issues
- Talk to program directors: a minimum of one month before the submission window is strongly advised
- Write clear proposals … for panel reviewers
- Recycling of proposals rarely ever yield success!
- Take part in the review process: volunteer for panels
- Focus on solicitations for multidisciplinary, large collaborative efforts in specific areas of research

Questions?

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