



Opportunities in Manufacturing at NSF

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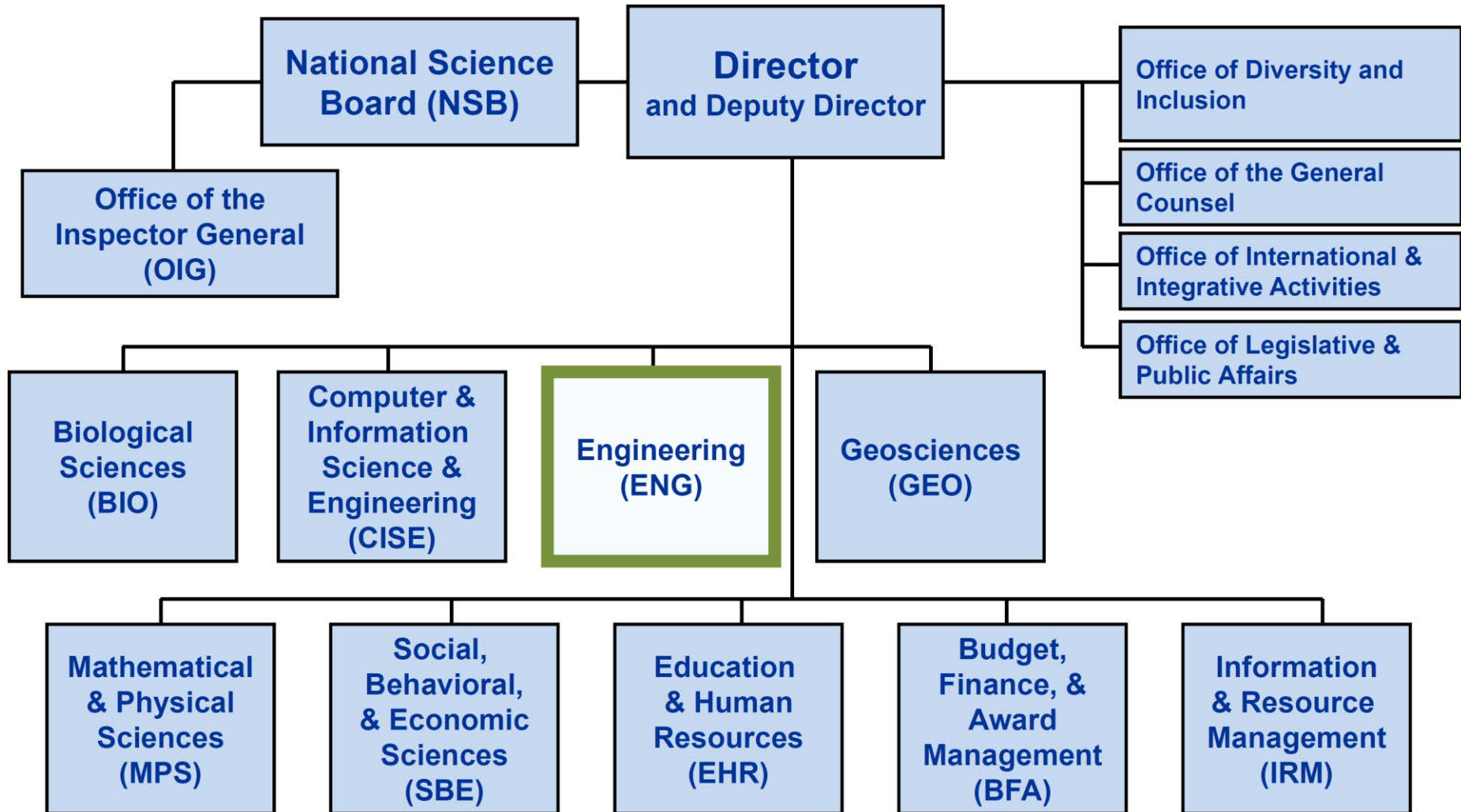
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- Although the presenter used to work at NSF, he does not currently have any affiliation with NSF, and does not claim to represent NSF in any way.
- Acknowledgment: Some of the materials are based on a program briefing by ZJ Pei (former PD for MME)

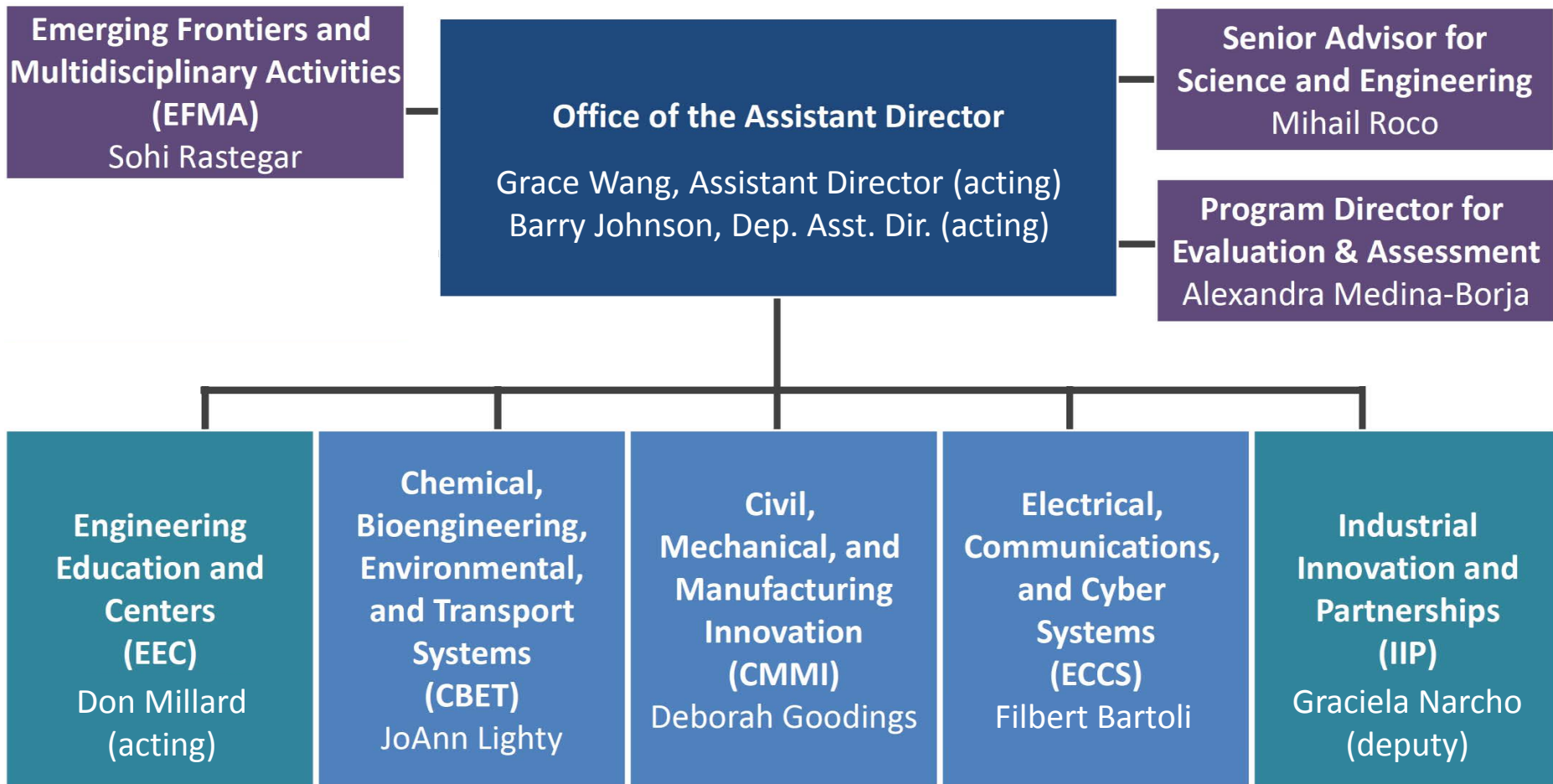
Overview

- Quick overview of the NSF organization
- Some manufacturing-related NSF programs, solicitations and initiatives
- Key characteristics of a winning NSF proposal
- Q&A

NSF Org Chart



NSF Directorate for Engineering



Division of Civil, Mechanical and Manufacturing Innovation (CMMI)

Senior Advisor
Bruce Kramer

Division Director
Deborah Goodings

Deputy Division Director
George Hazelrigg

Advanced Manufacturing

Manufacturing Machines and Equipment
Steven Schmid

Materials Engineering and Processing
Mary Toney, Alexis Lewis, Tom Kuech

NanoManufacturing
Khershed Cooper

Cybermanufacturing Systems
Bruce Kramer

Mechanics and Engineering Materials

Biomechanics and Mechanobiology
David Fyhrie

Mechanics of Materials and Structures
Kara Peters

Design of Engineering Material Systems
Rich Malak, Mary Toney, Kara Peters

Operations, Design and Dynamical Systems

Dynamics, Control and Systems Diagnostics
Atul Kelkar
Jordan Berg

Engineering and Systems Design
Rich Malak

Systems Science
Rich Malak

Service, Manufacturing and Operations Research
Georgia-Ann Klutke

Resilient and Sustainable Infrastructures

Civil Infrastructure Systems
TBD

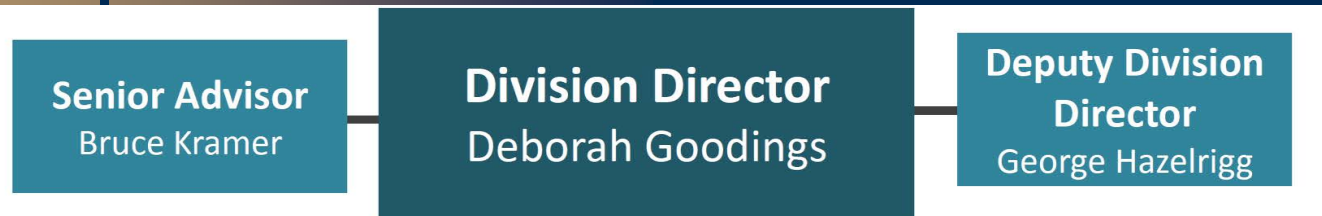
Natural Hazards Engineering Research Infrastructure
Joy Pauschke

Geotechnical Engineering and Materials
Richard Fragaszy

Structural and Architectural Engineering
Grace Hsuan

Infrastructure Mgmt. and Extreme Events
David Mendonca

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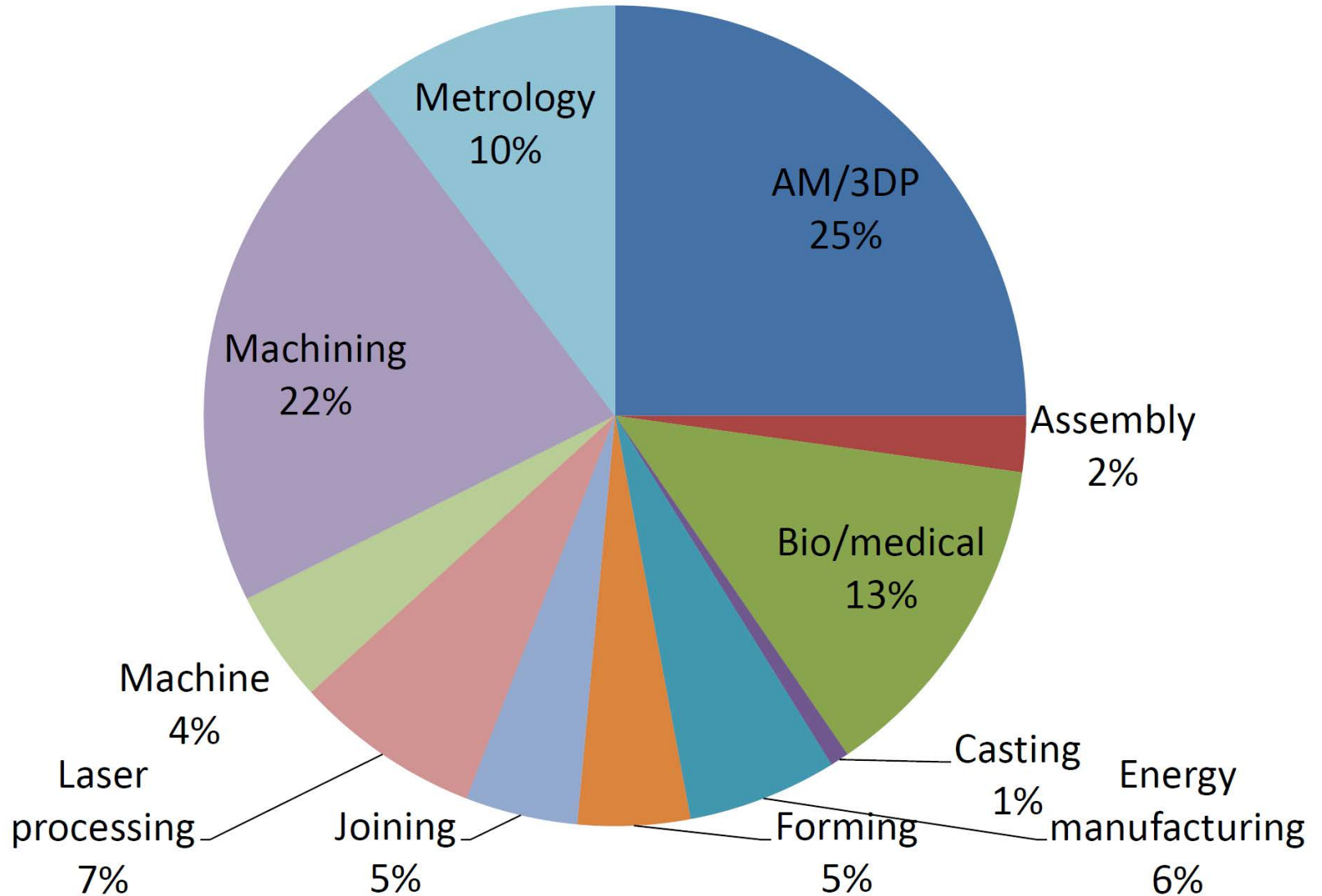
Manufacturing Machines and Equipment

PD: Steven Schmid

- MME supports **fundamental research that enables the development** of new and/or improved manufacturing machines and equipment, and optimization of their use.
- Proposals relating to a wide range of manufacturing operations are encouraged, including both subtractive and **additive processes**, forming, bonding/joining, and laser processing.
- Of particular interest are proposals that relate to the manufacture of equipment and facilities that enable the production of energy products.
- For more details google: “nsf mme”
- **Deadlines:** Jan 13 (typically, Feb 15) and Sep 15

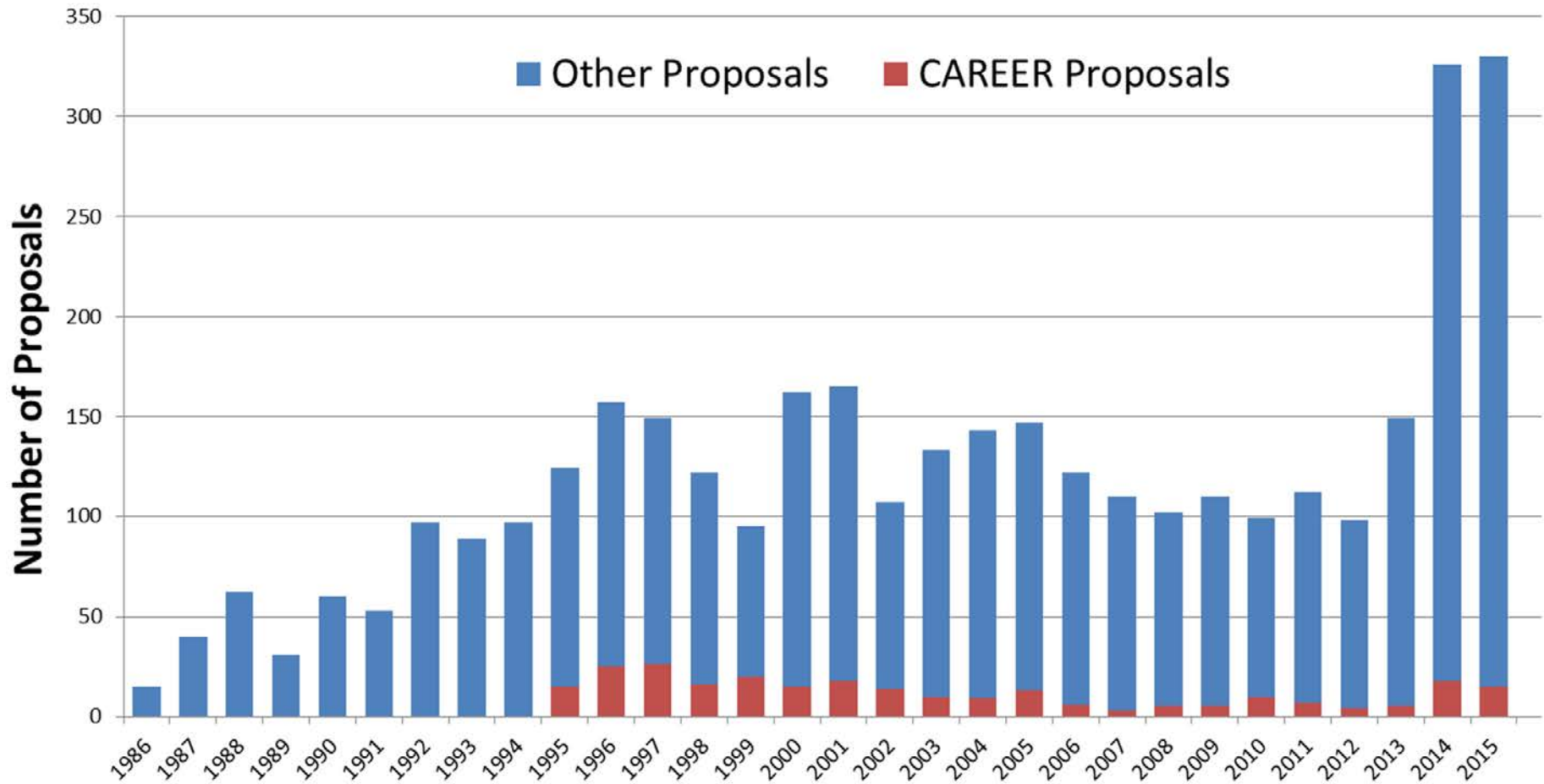
Manufacturing Machines and Equipment

PD: Steven Schmid



Manufacturing Machines and Equipment

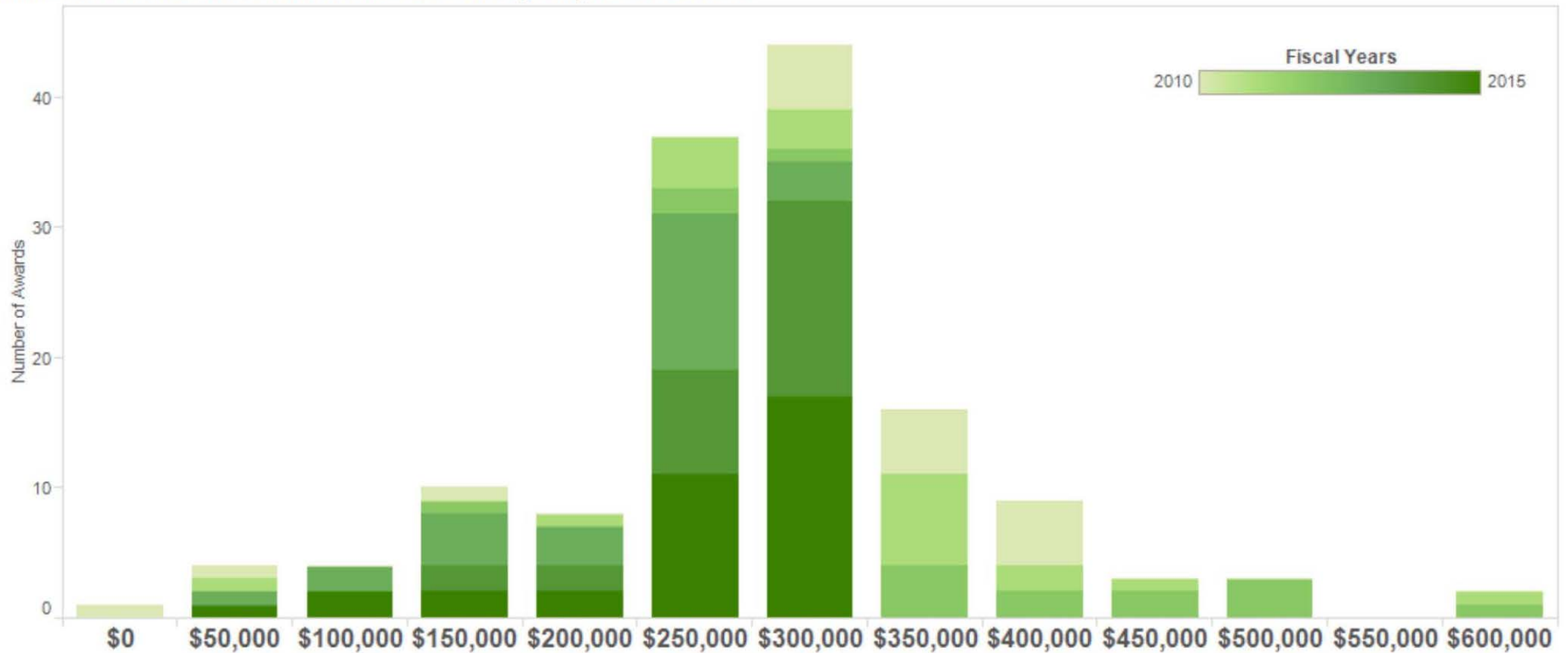
PD: Steven Schmid



Manufacturing Machines and Equipment

PD: Steven Schmid

MME Unsolicited Research Award Size Histogram, FY2010-2015



Materials Engineering and Processing

PDs: Mary Toney, Alexis Lewis, Tom Kuech

- MEP supports fundamental research addressing the **processing and performance of engineering materials** by investigating the interrelationship of materials processing, structure, properties and/or life-cycle performance for targeted applications.
- Manufacturing processes that convert material into a useful form as either intermediate or final composition: extrusion, molding, casting, forming, deposition, sintering and printing.
- For more details, google “nsf mep”

Nanomanufacturing

PD: Kershed Cooper

- Focus: **production of useful nano-scale materials, structures, devices and systems** in an economically viable manner
- NM supports fundamental research in:
 - Novel methods and techniques for batch and continuous processes
 - Top-down (addition/subtraction) and bottom-up (directed self-assembly) processes leading to the formation of complex heterogeneous nanosystems.
 - Nanostructure and process design principles
 - Integration across length-scales, and system-level integration
 - Address quality, efficiency, scalability, reliability, safety and affordability issues relevant to manufacturing.
 - Processes and production systems based on computation, modeling and simulation, use of process metrology, sensing, monitoring, and control, and assessment of product (nanomaterial, nanostructure, nanodevice or nanosystem) quality and performance.
- For more details, google “nsf nanomanufacturing”

Cybermanufacturing Systems

PD: Bruce Kramer

- CM supports fundamental research to enable the evolution of a wide range of **network-accessed manufacturing services** that:
 - employ applications (or “apps”) that reside in the “cloud” and plug into an expansible, interactive architecture;
 - are broadly accessible, guarantee reliable execution and have capabilities that are transparent to users; and
 - are accessible at low cost to innovators and entrepreneurs, including both users and providers.
- Main idea: **cybermanufacturing service layer**
- For more details, google: “nsf cybermanufacturing”
- Important: No submission deadline. Send one-pager to PD to start the submission process.

Service, Manufacturing and OR

PD: Georgia-Ann Klutke

- SMOR supports research leading to the **creation of models, analyses, and algorithms** that link data with decisions related to the design, planning, and operation of service and **manufacturing systems**
 - Advances in general-purpose optimization, stochastic modeling, and decision and game-theory methodology
 - Advances in customized methods (analytical and computational) required for the relevant applications
- Application areas of interest include
 - Supply chains and logistics; risk management; healthcare; environment; energy production and distribution; mechanism design and incentives; production planning, maintenance, and quality control; and national security.
- For more details, google: “nsf smor”

Other Related Solicitations and Initiatives

- ERC: Engineering Research Centers
- STC: Science and Technology Centers
- I/UCRC: Industry/University Cooperative Research Centers
- PFI:AIR-TT: Partnerships for Innovation: Accelerating Innovation Research – Technology Transfer
- PFI:BIC: Partnerships for Innovation: Building Innovation Capacity
- INSPIRE: Integrated NSF Support Promoting Interdisciplinary Research and Education
- EFRI: Emerging Frontiers in Research and Innovation

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What Makes a Good Proposal?

- NSF is all about basic research — **advancing the state of knowledge**
- Be clear, explicit and up-front about what the new knowledge will be
 - First sentence of summary: “The research objective of this proposal is...”
- Ideally: Novel, innovative, transformative — with broad impact
- A proposal is a plan for what you will do — provide sufficient detail
- The “project summary” (i.e., abstract) is crucial
- Convince the reviewers you are qualified and will deliver
 - Good literature review
 - Some initial results
- Keep your audience in mind — the review panel
- Letters of collaboration (no recommendation letters!)

Example: From MME Program Briefing

(provided by ZJ Pei)

- Competitive projects will propose **hypothesis-driven research** that advances the frontiers of knowledge in relevant areas.
- Proposals submitted to the MME program should include a **clearly articulated research (not developmental) objective** and a coherent plan to accomplish the stated objective.
- Both experimental and theoretical work are supported.
- All proposals must include a statement outlining the **societal benefits** of the proposed activities.

Steps to Increase your Chances Further

- Get to know the NSF “system”
- Volunteer to serve on review panel for the program you plan to submit to
 - Send e-mail to PD with your areas of expertise and experience
- Get to know your PD
 - Interact at conferences
 - Get feedback on your proposal ideas — send 1-pager
 - Try to understand the PD’s perspective on the field
 - Get additional feedback in case your proposal is declined
- Read the GPG (Grant Proposal Guide) and stick to the guidelines & deadlines

Summary

- Quick overview of the NSF organization
 - NSF / ENG / CMMI / Advanced Manufacturing Cluster
- Some manufacturing-related NSF programs, solicitations and initiatives
 - MME, MEP, NM, CM, SMOR
- Key characteristics of a winning NSF proposal
 - Clearly articulate the contribution to new knowledge

 Q&A