NSF’s Origin, Mission, and Structure

- Independent federal agency established by Congress in the NSF Act of 1950
  - “To Promote Progress of Science,” and “Advance National Health, Prosperity, and Welfare,” and “Secure the National Defense”
- Supports fundamental research and education across all fields of science and engineering
- Sponsors research primarily through grant mechanism, but operates no laboratories
- Discipline-based structure with cross-disciplinary mechanisms
- Uses “rotators” or IPAs primarily from universities
- FY2017 NSF Appropriation of $7.47B (total) – FY2018 Budget Request $6.65B
- FY2019 Budget Request $7.47B
NSF Budget, FY2009-2018

ENG and SBIR/STTR R&RA Budgets ($M)
ENG by the Numbers: FY 2017

- Total number of proposals: 13,029
- Total number of new awards: 2,421
- Total number of research proposals (excludes SBIR/STTR and I-Corps Teams): 9,473
- ENG funding rate (excludes SBIR/STTR and I-Corps Teams): 17.4%
- Estimated number of researchers and students supported: ~22,300
- Supported 19 ERCs, 3 STCs, 75 I/UCRCs, and 3 research facility networks

ENG and SBIR/STTR R&RA Budget ($M)

<table>
<thead>
<tr>
<th></th>
<th>FY 2015 Actuals</th>
<th>FY 2016 Actuals</th>
<th>FY 2017 (estimate)</th>
<th>FY 2018 Request</th>
<th>FY 2018 Request Total change over FY 2017 Estimate</th>
<th>Amount</th>
<th>Percent</th>
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<tr>
<td>CBET</td>
<td>$180.40</td>
<td>$183.76</td>
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<td>216.27</td>
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<td><strong>ENG TOTAL</strong></td>
<td><strong>$923.53</strong></td>
<td><strong>$915.67</strong></td>
<td><strong>$1,002.73</strong></td>
<td><strong>$833.49</strong></td>
<td><strong>-$82.19</strong></td>
<td><strong>-$82.19</strong></td>
<td><strong>-9.0%</strong></td>
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Community Input to Engineering

- Future of Center-Based, Multidisciplinary Engineering Research
  - 2015-2017 National Academies study
- Alliance for Advanced Manufacturing Foresights
  - 2015-2018 University of Michigan consortium
- Grand Challenges and Opportunities in Environmental Engineering and Science for the 21st Century
  - 2016-2019 National Academies study
- A new Electrical and Computer Engineering Research Community Organization
  - 2017-2019 planning grant to University of Pennsylvania
Electrical, Communications, and Cyber Systems (ECCS)

- Address fundamental research issues at the nano, micro, and macro scales underlying device and component technologies for energy and power, controls, networks, communications, computation and sensing applications
- Support research on systems and networks for advanced engineering applications
- Support education of a diverse workforce in electrical and computer engineering to meet the technological challenges of a 21st century global economy

ECCS Emerging Areas & Possible Future Directions

- Smart Cities (Urban Science)
- Low-Power Computing
- Big Data, Internet of Things
- Sensors and Large Sensor Networks
- Optics & Photonics
- Brain Imaging (Advanced Non-Invasive Medical Imaging)

- Paper & Silk Electronics
- Terahertz Technologies
- Web based Systems Control - Social Networks
- Expanding the 2G Area
- Valleytronics
- Wireless Energy Transfer
- Exotic, Autonomous & Faint Photonics
- Remote Sensing & Stimulation of Brain Functions
- Man-Machine Interfaces
- Driverless Vehicles
- Flexible, conformable 2D electronics
- Extreme bandgap devices
- Remote Access Testbed
- Cybersecurity of Control Systems
- Green & Reconfigurable Electronics
Crosscutting and NSF-wide Opportunities

- Faculty Early Career Development Program (CAREER)
- Critical Techniques and Technologies for Advancing Big Data Science & Engineering (BIGDATA)
- Cyber-enabled Sustainability Science and Engineering (CyberSEES)
- Cyber-Physical Systems (CPS)
- Grant Opportunities for Academic Liaison with Industry (GOALI)
- Innovation Corps (I-Corps)
- Integrative Strategies for Understanding Neural and Cognitive Systems (NSF-NCS)
- National Robotics Initiative (NRI)
- Partnerships for International Research and Education (PIRE)
- Research Coordination Networks (RCN)
- Scalable Nanomanufacturing (SNM)
- Sustainability Research Networks (SRN)
- Sustainable Chemistry, Engineering, and Materials (SusChEM)

Cyber-Physical Systems (CPS)

- Abstract from application sectors to more foundational principles
- Apply these principles to problems in new sectors
- Safe, secure, reliable, verification, real-time adaptation….
Funding Opportunities

- Core Programs
- Initiatives & Solicitations
- Collaborative/Interdisciplinary Areas
- Crosscutting and NSF-wide Programs

ECCS Unsolicited (Core) Proposals

- Submission Window
  - October 1 – November 1 annually
  - Some divisions have two windows
- Award Size for Unsolicited
  - Typically $360K for three years
- Funding Rates
  - 15-17%
- Reviewers
  - from university, industry, and government
Examples of Other Programs

- **Core Programs**
  - Early Faculty Career Development Grants (CAREER)
  - EAGER

- **Supplements**
  - Research Experiences for Undergraduates (REU)
  - Research Experiences for Teachers (RET)
  - GOALI
  - Equipment
  - International

- **Workshops**
- **Cross-cutting Programs**

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
Five Elements to Consider for IM & BI

1) What is the potential for the proposed activity to:
   - **Advance knowledge** and understanding within its own field or across different fields (Intellectual Merit); and
   - **Benefit society** or advance desired societal outcomes (Broader Impacts)?

2) To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?

3) Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?

4) How well qualified is the individual, team, or organization to conduct the proposed activities?

5) Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

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Review Timeline

- PI communicates with Program Director to determine program fit
- Proposal is Submitted
- Program Director reads proposals, identifies reviewers, assembles panels
- Reviewers perform 6-8 proposal reviews
- Panels convene to discuss and rank proposals
- Program director recommends proposals for funding
- Recommendation goes through the approval process
- PIs are notified
Early Career Development

- Supports early-career investigators who exemplify the role of teacher–scholar
- Stimulates breakthrough research ideas and encourages risk-taking and innovative thinking among young investigators
- 157 ENG CAREER awards in FY 2017

CAREER

- Foundation-wide activity that offers NSF's most prestigious awards for faculty members beginning their independent 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 typical award size now $500,000
- Note: the CAREER award is not just a research award, it is a career development award
CAREER Program Goals

➢ “a Foundation-wide activity that offers NSF’s most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration or research and education”

➢ PIs should submit “creative, integrative and effective research and education plans, developed within the context of the mission, goals, and resources of their organizations, while building a firm foundation for a lifetime of contributions to research, education and their integration”

➢ To provide 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.

Eligibility

➢ Tenure track assistant professor at US institution
  ➢ As of Oct 1

➢ Doctoral degree in a field supported by NSF

➢ Three tries
To Do List

- Strategic Plan
  - Personal goals
- Technical topic
  - Beyond PhD, literature search, fit strategic plan
  - Discuss with senior colleagues
- Education and Outreach
  - Integration with research, assessment
- Identify program fit
  - Fundamental research
- Write
  - Audience, context
  - Internal review by colleagues
  - Department chair letter, letters of collaboration
  - Budget, 5 years
- Proofread
- Submit
- Wait

Review Criteria

- Intellectual Merit
- Broader Impacts
- Integration of Research and Education
Reviewer Guidelines

- All CAREER proposals must have an integrated research and education plan at their core.

- NSF recognizes that there is no single approach to an integrated research and education plan, but encourages all applicants to think creatively about how their research will impact their education goals and, conversely, how their education activities will feed back into their research.

- These plans should reflect the proposer’s own disciplinary and educational interests and goals, as well as the needs and context of his or her organization.

- Because there may be different expectations within different disciplinary fields and/or different organizations, a wide range of research and education activities may be appropriate for the CAREER program.

Reviewer Points to Consider

- Does the PI propose creative, effective and integrated research and education plans as well as plans for assessing these components?

- Is it a well-argued and specific proposal for activities that will, over a 5-year period, build a firm foundation for a lifetime of contributions to research and education in the context of the PI’s organization?

- While excellence in both education and research is expected, activity of an intensity that leads to an unreasonable workload is not.

- The research and educational activities do not need to be addressed separately, if the relationship between the two is such that the presentation of the integrated project is better served by interspersing the two throughout the Project Description.
NSF New Location – Alexandria, VA