NSF
Supporting Research to Benefit the Nation

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Chief Operating Office
Senior Science Advisor
May 2016
NSF Core Mission: Fundamental Research

Strategic Goals

- Transform the Frontiers
- Innovate for Society
- Perform as a Model Organization

NSF by the Numbers

- $8B FY 2017 budget request
- 93% funds research, education and related activities
- 50,000 proposals
- 12,000 awards funded
- 2,000 NSF-funded institutions
- 350,000 NSF-supported researchers
- 217 Nobel Prize winners

Fund research in all S&E disciplines
Fund STEM education & workforce
Source: NSF/ Center for National Science and Engineering Statistics, FY 2014
NSF Funding History

NSF Budget*

$ 8000 M

$ 6000 M

$ 4000 M

$ 2000 M

$ 0 M


Fiscal Year

*Constant 2014$
(Note that Funding Rate has declined by 30% since 1990)
NSF FY 2016 Funding

<table>
<thead>
<tr>
<th></th>
<th>FY 2015 Appropriation</th>
<th>FY 2016 Request</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSF</td>
<td>$7,344 M</td>
<td>$7,724 M</td>
</tr>
<tr>
<td>R&amp;RA</td>
<td>$5,934 M</td>
<td>$6,186 M</td>
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</tbody>
</table>

**FY 2016 Plan**

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>NSF</td>
<td>$7,463 M</td>
</tr>
<tr>
<td>R&amp;RA(^1)</td>
<td>$6,010 M</td>
</tr>
</tbody>
</table>

\(^1\) The FY 2016 Plan for R&RA includes a $24 million transfer to AOAM.
NSF Addressing National Priorities

- Food/Energy/Water
- Risk and Resilience
- Understanding the Brain
- INCLUDES
### FY 2017 Budget Request to Congress

<table>
<thead>
<tr>
<th></th>
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<th>FY 2017 Request</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSF</td>
<td>$ 7,463 M</td>
<td>$ 7,964 M 6.7%</td>
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<tr>
<td>R&amp;RA(^1)</td>
<td>$ 6,010 M</td>
<td>$ 6,425 M 6.9%</td>
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<tr>
<td><strong>Two Components to R&amp;RA</strong></td>
<td></td>
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<tr>
<td>Discretionary</td>
<td>$ 6,010 M</td>
<td>$ 6,079 M 1.1%</td>
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<tr>
<td>Mandatory(^*)</td>
<td>--</td>
<td>$ 346 M</td>
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<tr>
<td><strong>Total</strong></td>
<td>$ 6,010 M</td>
<td>$ 6,425 M 6.9%</td>
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</tbody>
</table>

\(^*\)Congress not considering Administration's proposal for this new mandatory funding.

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<table>
<thead>
<tr>
<th>Appropriation</th>
<th>FY 2016 Estimate</th>
<th>FY 2017 Discretionary</th>
<th>FY 2017 Mandatory</th>
<th>FY 2017 Total</th>
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</thead>
<tbody>
<tr>
<td>BIO</td>
<td>$744</td>
<td>$746</td>
<td>$45</td>
<td>$790</td>
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<tr>
<td>CISE</td>
<td>936</td>
<td>938</td>
<td>56</td>
<td>995</td>
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<tr>
<td>ENG</td>
<td>916</td>
<td>946</td>
<td>56</td>
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<td>ENG Programs</td>
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<td>745</td>
<td>45</td>
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<td>SBIR/STTR</td>
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<td>202</td>
<td>12</td>
<td>213</td>
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<tr>
<td>GEO</td>
<td>1319</td>
<td>1320</td>
<td>79</td>
<td>1399</td>
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<tr>
<td>MPS</td>
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<td>1355</td>
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<tr>
<td>SBE</td>
<td>272</td>
<td>272</td>
<td>16</td>
<td>289</td>
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<tr>
<td>ISE</td>
<td>49</td>
<td>49</td>
<td>3</td>
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<tr>
<td>IA</td>
<td>447</td>
<td>451</td>
<td>9</td>
<td>460</td>
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<td>US Artic Research Commission</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
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<tr>
<td>Research and Related Activities</td>
<td>6034</td>
<td>6079</td>
<td>346</td>
<td>6425</td>
</tr>
</tbody>
</table>

Totals may not add because of rounding ($ in millions)
NSF Ideas for Future Investment

**RESEARCH IDEAS**
- Harnessing Data for 21st Century Science and Engineering
- Shaping the New Human – Technology Frontier
- Understanding the Rules of Life – Predicting Phenotype
- The Quantum Leap – Leading the Next Quantum Revolution
- Navigating the New Arctic
- Windows on the Universe – The Era of Multi-messenger Astrophysics

**PROCESS IDEAS**
- Growing Convergent Research at NSF
- Mid-scale Research Infrastructure
- NSF 2050
Harnessing Data for 21st Century Science and Engineering

Pursue fundamental research in data science and engineering, the development of a cohesive, federated, national-scale approach to research data infrastructure, and the development of a 21st-century data-capable workforce.

NSF can uniquely lead a bold initiative to create a data-enabled future for the Nation’s science, engineering and educational enterprises, and for the country more broadly.
Shaping the New Human — Technology Frontier

Designing, building and deploying the human-centered engineered systems with cognitive and adaptive capacities that are best matched to collaboration with humans, individually and in their smart-and-connected communities.

Seek to understand how technologies affect human behavior and social organizations and how technologies are and can be shaped through interactions with people and designers.
Understanding the Rules of Life – Predicting Phenotype

The universally recognized **biggest gap** in our biological knowledge is our inability to predict the phenotype of a cell or organism from what we know about the genome and environment.

We simply **do not understand the rules** that govern phenotypic emergence at this scale. To understand the “rules of life” will require fundamental research across biology, computer science, mathematics, the physical sciences, behavioral sciences and engineering.
Quantum mechanics is a powerful concept that has led to many of the transformative technologies of today. The next quantum revolution will exploit quantum phenomena, such as superposition, entanglement, and squeezing, to capitalize on the rich behavior of many-body systems.
Navigating the New Arctic

Vast and rapid environmental changes in the Arctic will have a climactic effect on the rest of the planet and also bring new global access to the Arctic's natural resources. Knowledge of the changes underway and their potential local and global effects is incomplete.

An observing network of mobile and fixed platforms and tools across the Arctic is needed to document biological, physical and social changes, and invest further in theory, modeling and simulation of this changing ecosystem and its broader effects on the planet.
Observing the cosmos through three different windows – opened by detecting electromagnetic waves, gravitational waves, and particles – can answer some of the most profound questions before humankind.

• How did the universe begin?
• What is the unseen matter that constitutes much of the universe?
Growing Convergent Research at NSF

“The key message of convergence, however, is that merging ideas, approaches, and technologies from widely diverse fields of knowledge at a high level of integration is one crucial strategy for solving complex problems and addressing complex intellectual questions underlying emerging disciplines.” – NAS report

To support convergence research, NSF would address the key technical, organizational and logistical challenges that hinder truly interdisciplinary research.
Mid-scale Research Infrastructure

Rapidly changing patterns of research require a new approach to research infrastructure for NSF’S science and engineering activities.

The funding structure available at NSF ranges from relatively small research infrastructure projects through the Major Research Instrumentation (MRI) program, to larger projects through the Major Research Equipment and Facilities Construction (MREFC) funding. Missing that opportunity leaves essential science undone.
NSF 2050

NSF wants to create a breakthrough scientific pathway to its centennial in 2050. With this initiative NSF would dedicate a special fund to invest in bold foundational research questions that are large in scope, innovative in character, originate outside of any particular directorate, and require a long-term commitment.

NSF 2050 would invite community input into long-term program development, and capture the imagination of critical stakeholders.
NSF Ideas for Future Investment

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**PROCESS IDEAS**
- Growing Convergent Research at NSF
- Mid-scale Research Infrastructure
- NSF 2050
Supporting basic research to create knowledge that transforms our future

Drives the economy
Enhances our security
Sustains global leadership
## FY 2017 Request by Appropriation

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<td>$6079</td>
<td>$346</td>
<td>$6425</td>
</tr>
<tr>
<td>Education &amp; Human Resources</td>
<td>880</td>
<td>899</td>
<td>54</td>
<td>953</td>
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<tr>
<td>Major Res Equip &amp; Facilities Const.</td>
<td>200</td>
<td>193</td>
<td>-3.6%</td>
<td>193</td>
</tr>
<tr>
<td>Agency Operations &amp; Award Mgmt.</td>
<td>330</td>
<td>373</td>
<td>13%</td>
<td>373</td>
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<tr>
<td>National Science Board</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Office of the Inspector General</td>
<td>15</td>
<td>15</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td><strong>Total NSF</strong></td>
<td><strong>$7463</strong></td>
<td><strong>$7564</strong></td>
<td><strong>$400</strong></td>
<td><strong>$7964</strong></td>
</tr>
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