Advancing Technology, Innovation and Partnerships

Erwin Gianchandani
NSF Assistant Director for Technology, Innovation and Partnerships

September 27, 2022
Introductory Webinar
Today’s agenda

• Inspiration, vision

• Mission, functions, programs

• Status
75 years ago: The Endless Frontier
A defining moment

Global Competition

Defining Moment

Missing Millions

Socioeconomic Challenges
A defining moment

Global Competition

Defining Moment

Missing Millions

Socioeconomic Challenges
A defining moment: global competition

| Advanced manufacturing                      |
| Advanced wireless                           |
| Artificial intelligence                     |
| Biotechnology                               |
| Quantum information science                 |
| Semiconductors and microelectronics         |
| ...                                         |
A defining moment
A defining moment

Global Competition

Defining Moment

Missing Millions

Socioeconomic Challenges
A defining moment: socioeconomic challenges

- Changing climate
- Equitable access to education, health care
- Critical and resilient infrastructure
A defining moment: society + technology

Climate

Equity

Critical infrastructure

Advanced manufacturing

Advanced wireless

Artificial intelligence

Biotechnology

Quantum information science

Semiconductors and microelectronics

...
A defining moment

Global Competition

Defining Moment

Missing Millions

Socioeconomic Challenges
An evolving research, innovation ecosystem

Pace of discovery accelerated by data, emerging technologies
Demand for societal impact
Opportunity to leverage partnerships
### Catalyzing a paradigm shift

<table>
<thead>
<tr>
<th>Today</th>
<th>Tomorrow</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Largely investigator-driven</td>
<td>• Users / beneficiaries engaged in shaping, conducting research</td>
</tr>
<tr>
<td>• Primarily academic research teams</td>
<td>• Multi-sector teams – academia, industry, government, civil society, communities of practice</td>
</tr>
<tr>
<td>• Stream of discoveries improve prosperity, resilience, quality of life</td>
<td>• Important societal and/or economic problems drive research pursuits</td>
</tr>
</tbody>
</table>
Catalyzing a paradigm shift

<table>
<thead>
<tr>
<th>Today</th>
<th>Tomorrow</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Largely investigator-driven</td>
<td>• Users / beneficiaries engaged in shaping, conducting research</td>
</tr>
<tr>
<td>• Primarily academic research teams</td>
<td>• Multi-sector teams – academia, industry, government, civil society, communities of practice</td>
</tr>
<tr>
<td>• Stream of discoveries improve prosperity, resilience, quality of life</td>
<td>• Important societal and/or economic problems drive research pursuits</td>
</tr>
</tbody>
</table>

“Technology / supply push” + “Market / demand pull”
Today: *Jump-Starting America*
CHIPS and Science Act of 2022

- Appropriates $54 billion for semiconductors incentives, R&D, workforce development
- Authorizes NSF, DOE, NIST, NASA
- Authorizes $81B for NSF:
  - +$36B for the agency
  - Of that, +$20B for TIP
- Authorizes a new NSF Directorate for Technology, Innovation and Partnerships
Today’s agenda

• Inspiration, vision

• Mission, functions, programs

• Status
NSF mission

- Promote the progress of science
- Secure the national defense
- Advance the national health, prosperity and welfare
Meeting our moment with an intentional focus

- Pure Basic Research
  - Quest for Fundamental Understanding
  - Translation Innovation
- Use-Inspired Basic Research
  - Consideration of Use
- Pure Applied Research
  - Edison
  - Carver
- Pasteur

Bohr
Curie
The Milky Way’s Black Hole
COVID-19 Response

USE-INSPIRED, SOLUTIONS-FOCUSED INNOVATIONS
Meeting our moment with an intentional focus

Quest for Fundamental Understanding

Pure Basic Research

Use-Inspired Basic Research

Pure Applied Research

Translation Innovation

Consideration of Use

Bohr
Curie

Pasteur

Carver
Edison
NSF’s existing directorates and offices
A new “horizontal” to enhance use-inspired and translational research
Partnerships as a Foundation

Accelerate Partnerships

- Biological Sciences
- Mathematical & Physical Sciences
- Engineering
- Geosciences (including Polar Programs)
- Integrative Activities
- Social, Behavioral & Economic Sciences
- Education & Human Resources
- International Science & Engineering
Partnerships: A timely, illustrative example

Intel to Invest at Least $20 Billion in New Chip Factories in Ohio

Building up U.S. chip production has been a focus of lawmakers and companies alike amid a global shortage of the crucial components.

“To help develop and attract a pipeline of skilled talent from within the region, Intel plans to invest approximately $100 million over the next decade in partnership with Ohio universities, community colleges and the U.S. National Science Foundation [ranging] from collaborative research projects to building semiconductor-specific curricula for associate and undergraduate degree programs.”

“Significant investments such as this one will allow us to harness the best ideas from around the country to drive future semiconductor design and manufacturing as well as develop a diverse, next-generation semiconductor workforce, reaffirming U.S. competitiveness in this vital area. Today’s announcement builds on our long history of collaboration with industry like Intel to accelerate fundamental research and rapidly bring solutions to market.”

- Sethuraman Panchanathan
U.S. National Science Foundation Director
NSF, Intel partners to fund the development of a high-quality manufacturing workforce

$10 Million Investment

- To advance education and training for semiconductor manufacturing and design.
- To improve equitable STEM education at:
  - Two-year colleges;
  - Four-year universities, including minority-serving institutions.

More information @ beta.nsf.gov/tip/latest
Partnerships as a Foundation

Innovation & Technology Ecosystems

- Convergence Accelerator
- Emerging Technologies
- Regional Innovation
- Experiential & Entrepreneurial Learning

Realigned investments

New investments
Partnerships as a Foundation

Innovation & Technology Ecosystems

- Convergence Accelerator
- Emerging Technologies
- Regional Innovation
- Experiential & Entrepreneurial Learning

Realigned investments

New investments
Convergence Accelerator

Track A
Open Knowledge Networks

Track B
AI and the Future of Work

Track C
Quantum Technology

Track D
AI-Innovation Data Sharing & Modeling

Track E
Networked Blue Economy

Track F
Trust & Authenticity in Communication Systems

Track G
Securely Operating Through 5G Infrastructure (joint with DOD)

Track H
Enhancing Opportunities for Persons with Disabilities

Track I
Sustainable Materials for Global Challenges

Track J
Food & Nutrition Security

Track K
Track Topic: TBD

Track L
Track Topic: TBD

2019 COHORT
Phase 2

2020 COHORT
Phase 2

2021 COHORT
Phase 1

2022 COHORT

FUTURE COHORT
NSF Convergence Accelerator, DOD partner to advance 5G technologies

$12 Million Investment

- 16 multidisciplinary teams in Track G: Securely Operating Through 5G Infrastructure.
- Supports enhancement and augmentations to 5G infrastructure, while meeting security and resilience requirements.

More information @ beta.nsf.gov/tip/latest
Partnerships as a Foundation

Innovation & Technology Ecosystems

- Convergence Accelerator
- Emerging Technologies
- Regional Innovation
- Experiential & Entrepreneurial Learning

Realigned investments

New investments
What is an NSF Engine?

A multi-sector coalition of regional partners working together to catalyze a regional innovation ecosystem in a topic area of regional relevance and national and societal significance.

Engines are led by CEOs and include partners from industry, institutions of higher education, government, and non-profit and community organizations.
NSF Engines: Intentionally different

• A different scale
• Iterative co-design/co-creation through intentional engagement of broad, diverse stakeholders (“users”)
• Cohort-based training
• Milestone requirements for continued funding
• Focused success expectations:
  • Regional development
  • Individual and geographic diversity, including mentoring
  • Scaling and sustainability
  • Active participation and engagement
  • IP ownership extends to all contributing parties
  • Changing culture
  • Practitioner/entrepreneur development
  • Integrative/additive
• Evaluation of the overall approach
NSF Engines: Expanding innovation across the US
NSF Engines: Accepting two proposal types

- **TYPE-1** - $1M (2 YEARS)
- **TYPE-2** - Up to $160M (Up to 10 YEARS)

**PHASE 1:** DEVELOPMENT
**PHASE 2:** NASCENT
**PHASE 3:** EMERGENT
**PHASE 4:** GROWTH
**PHASE 5:** MATURE
NSF Engines: Timeline and status

May 3: NSF Engines issues funding opportunity

June 30: Concept Outlines due

Aug. 31: Type-1 Letters of Intent due

Winter 2022/2023: Type-1 Awards made

Jan. 31: Type-2 Full Proposals due

May-June: Webinars, regional roadshows, office hours

Aug. 1: Proposers' Day

Sept. 29: Type-1 Full Proposals due

Dec. 15: Type-2 Letters of Intent due
CHIPS and Science Act: NSF + EDA

Regional Technology Hubs

Regional Innovation Engines

Fundamental research

Economic growth
NSF and EDA are working together

**Regional Innovation Engines**

- Start at the fundamental research and R&D layer
- Piping into existing economic growth structures
- Create research and translation spine for regions
- Broaden participating by URM populations in STEM
- Multiple entry points and different stages of development
- 8-10 years, up to $160M per Engine

**Regional Tech Hubs**

- Build on a region’s now and future economic drivers
- Later-stage technology development & demonstration
- Scale up capacity to deploy breakthrough technologies
- Create physical, human, and systems infrastructure
- Lead tech-/industry-aware workforce development initiatives
- Designation, planning, and implementation for hubs

**Place-based**
- Long-term investments
- Economic growth, tech focus
- Connective tissue for innovation ecosystem
- Public and private partnerships

**Long-term**

**Economic**

**growth, tech focus**

**Connective tissue for innovation ecosystem**

**Public and private partnerships**
Partnerships as a Foundation

Innovation & Technology Ecosystems

- Convergence Accelerator
- Emerging Technologies
- Regional Innovation
- Experiential & Entrepreneurial Learning

Realigned investments

New investments

Accelerate Partnerships
US/UK Privacy Enhancing Technologies (PET) Prize Challenges

Goal: Advance Privacy-Preserving Federated Learning

- Drive innovation in development and application of PETs
- Develop a privacy-preserving solution that is capable of efficiently generating high-utility machine learning models
- Deliver strong end-to-end privacy guarantees against a set of common threats and privacy attacks, leveraging a combination of input and output privacy techniques

Challenge Tracks:

- **Track A**: Develop a model to identify anomalous financial transactions
  - **Data provider**: SWIFT

- **Track B**: Develop a model to predict an individual’s risk to infection
  - **Data provider**: University of Virginia

- **Generalizable**: Develop a solution that can be adapted for use in both data sets

Total Prize Awards = $800,000

Phases & Timeline:

- **Phase 1**: Concept Development
  - July-September 2022

- **Phase 2**: Solution Development
  - October 2022-February 2023

- **Phase 3**: Red Teaming
  - February-March 2023

- **Phase 4**: Open Source & Transition
  - March 2023 - TBD
Partnerships as a Foundation

Accelerate Partnerships

Technology Translation
- I-Corps
- PFI
- SBIR/STTR
- Innovative Pathways

Innovation & Technology Ecosystems
- Convergence Accelerator
- Emerging Technologies
- Regional Innovation
- Experiential & Entrepreneurial Learning

Realigned investments
New investments
Research Impacts

Impacts/Societal Benefits

Government missions

Educational adaptations

Ongoing impacts

Lab-to-Market

Open-source Ecosystems

POSE

Public policies

Transition to Practice (TTP)

NSF research projects

NSF

44
NSF expands the National Innovation Network with 5 new I-Corps Hubs

More information @ beta.nsf.gov/tip/latest

- I-Corps Hubs work collaboratively to build and sustain a diverse and inclusive innovation ecosystem across the U.S.
- Each Hub receives up to $3 million investment per year for five years.
- Now, a total of 10 regional I-Corps Hubs with nearly 100 universities scale the NSF-led National Innovation Network

$15 Million Investment
Partnerships as a Foundation

Technology Translation
- I-Corps
- PFI
- SBIR/STTR
- Innovative Pathways

Innovation & Technology Ecosystems
- Convergence Accelerator
- Emerging Technologies
- Regional Innovation
- Experiential & Entrepreneurial Learning

Partnerships as a Foundation
- Accelerate Partnerships
“Designing in” DEIA

**GOAL:**
To ensure the successful inclusion of minority-serving institutions, two-year institutions, and other academic institutions underrepresented in the NSF portfolio in the NSF Engines program.

**OBJECTIVES:**
1. Emphasize the essential role that MSIs will play in realizing the mission of the NSF Engines
2. Gather insight from participating institutions about how they can benefit from and best contribute to the NSF Engines
3. Address the questions, concerns, and challenges about engaging in the NSF Engines, or TIP more generally

Focus Group Discussions
- HBCUs
- HSIs
- TCUs
- 2-Yrs

259 participants
143 different organizations
“Designing in” DEIA

Challenges to building strong partnerships

Need for capacity building at small institutions

Issues related to NSF policy

Challenges due to geographic isolation

The value of mentoring
Today’s agenda

• Inspiration, vision

• Mission, functions, programs

• Status
Ramping up TIP

Jan. 21: NSF + Intel announce semiconductor workforce partnership

March 16: NSF establishes TIP

July 20: NSF, NIST, OSTP, UK announce privacy prize challenges

Sept. 7: NSF, DOD partner to advance 5G security

Feb. 15: Pathways to enable Open-Source Ecosystems launches

May 3: NSF Engines program launches

July 28: NSF Engines Concept Outlines published

Sept. 8: NSF awards five new I-Corps™ Hubs

Sept. 19: NSF announces Entrepreneurial Fellowships

Activate
FY 2023 President’s Budget Request

$10.492 billion
+19% over FY 2022 Enacted

Investments in the Administration’s priorities of responding to the pandemic, tackling climate change, spurring economic recovery, innovating for equity, and ensuring national security and economic resilience.

THE DIRECTORATE FOR TECHNOLOGY, INNOVATION, AND PARTNERSHIPS (TIP)
$879.87 million

ADVANCED MANUFACTURING
$421.51 million

ADVANCED WIRELESS
$168.56 million

ARTIFICIAL INTELLIGENCE
$734.41 million

MICROELECTRONICS AND SEMICONDUCTORS
$145.69 million

BIOTECHNOLOGY
$392.26 million

QUANTUM INFORMATION SCIENCE
$261.0 million
NSF programs power breakthroughs

TIP bridges the gap

RAMP OF OPPORTUNITY

Valley of Death

Public Funds

Private Funds

LAB
Foundational Research
Use-Inspired Research
Proofs-of-Concept
Prototype Development

SOCIETY
Product/Solution Development
National and Societal Impact, Commercialization
TIP
Technology, Innovation and Partnerships

https://beta.nsf.gov/tip/latest
tip@nsf.gov

Erwin Gianchandani
Assistant Director, TIP

Gracie Narcho
Deputy Assistant Director, TIP

Thyaga Nandagopal
Division Director, TIP/ITE

Barry Johnson
Deputy Director, TIP/TI