NASEM Spring 2023 Meeting

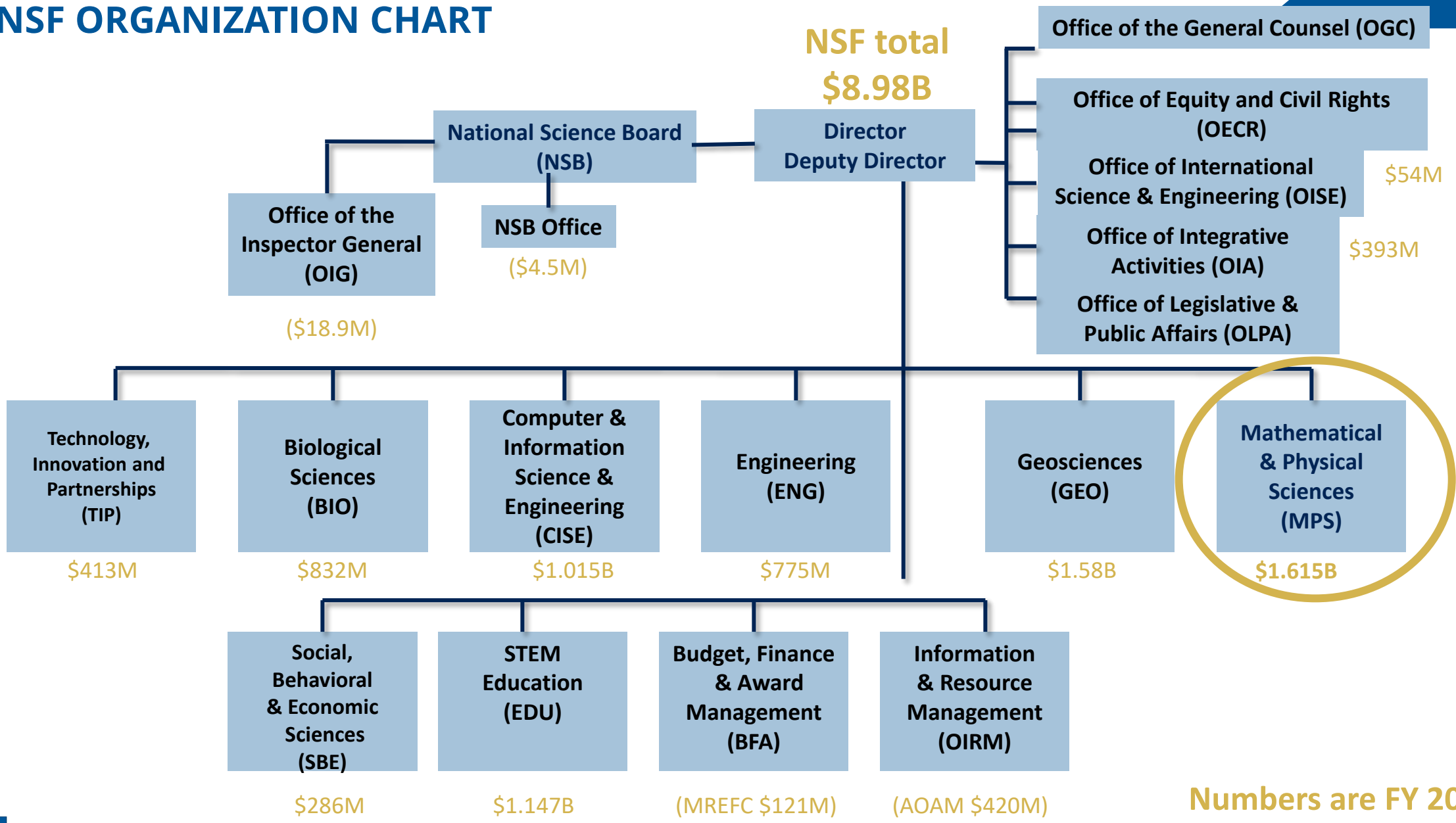
Discipline Committees of the Space Studies Board

March 28, 2023

Dr. Sean L. Jones, Assistant Director
Mathematical and Physical Sciences Directorate

Programmatic directorates and offices supporting the NSF Mission

NSF ORGANIZATION CHART



Numbers are FY 2022 Actuals

MPS CURRENT ORGANIZATIONAL STRUCTURE

$1.685 B
(FY 23 Budget)

MPS Office of the Assistant Director

Assistant Director

Deputy Assistant Director

Communications

Office of Multidisciplinary Activities

Senior Advisor for Major Facilities

Senior Advisor for Strategy and Engagement

Astronomy $292.33M	Chemistry $268.83M	Materials Research $339.41M	Mathematics $251.99M	Physics $313.13M
Disciplinary Programs	Disciplinary Programs	Disciplinary Programs	Disciplinary Programs	Disciplinary Programs
Midscale / Instrumentation	Centers	Centers	Institutes	Centers
Major Facilities	Instrumentation	Groups	Partnerships	Midscale / Instrumentation
		Major Facilities		Major Facilities

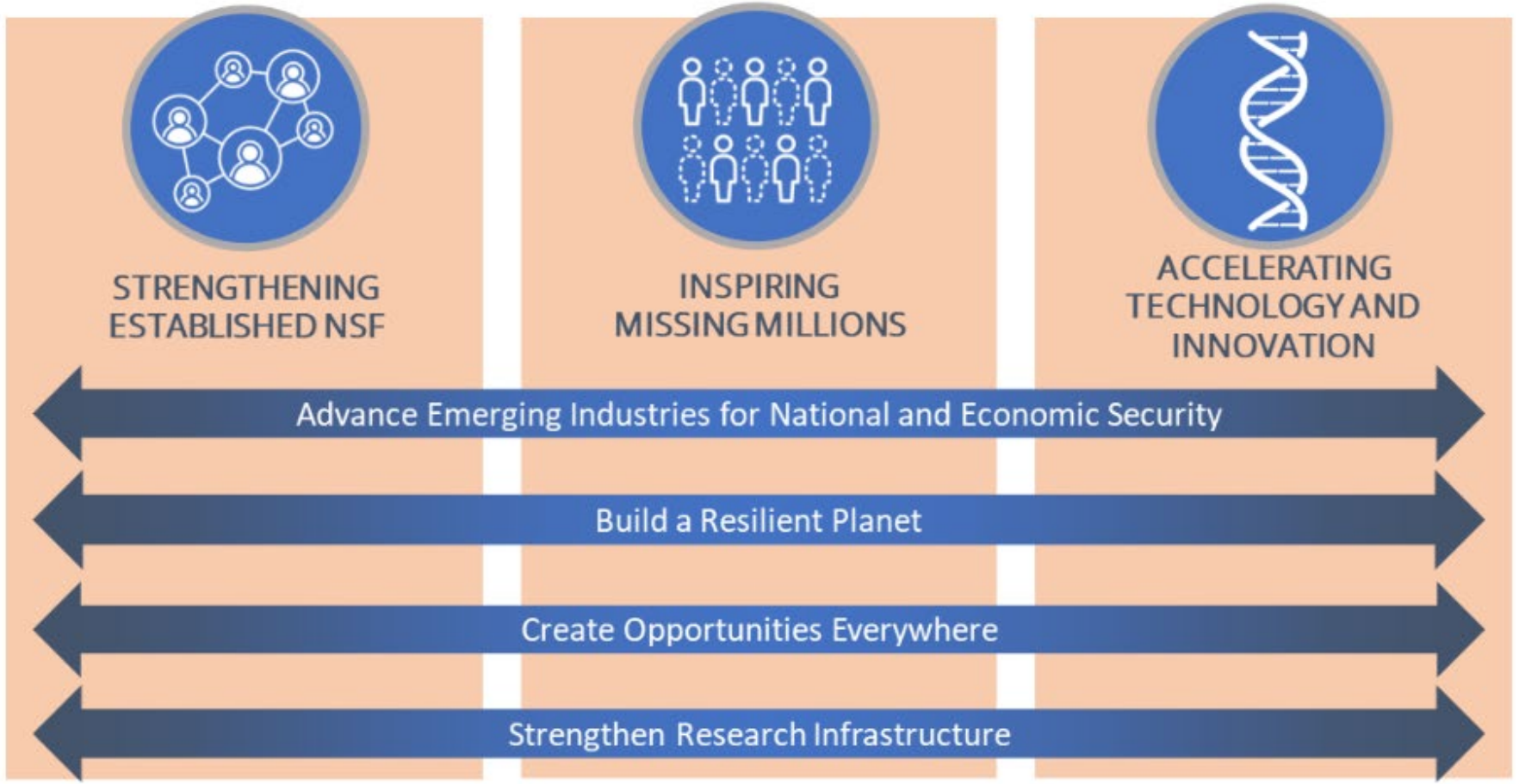
NSF's 3 Major Priorities Align with White House and Congressional Priorities

STRENGTHENING ESTABLISHED NSF

INSPIRING THE MISSING MILLIONS

ACCELERATING TECHNOLOGY AND INNOVATION

NSF's 3 Major Priorities Align with White House and Congressional Priorities



FY 2023 Enacted

- **$9.9 Billion**
  - +$1.03 billion
  - +11.8% above
  - FY 2022 Current Plan

Signed by the President December 29, 2022
(Current Plan in progress)

Provides NSF with a total $9.876 billion between Omnibus and Disaster Relief Supplemental Act funding.

Disaster Relief Supplement has 3 parts:

- Base activities - $700 million
- CHIPS & Science Set-Aside - $335 million (2 year)
- Damaged Research Facilities and Science Equipment - $2.5 million

FY 2023 $1 Billion Increase includes:

$467 Million	TIP Directorate to accelerate technology and innovation and support CHIPS & Science
$225 Million	EDU Directorate to support critical workforce investments and support CHIPS & Science
$199 Million	Directorate increases to support Inspiring Missing Millions, Emerging Industries, Build a Resilient Plant, Enhance Research Infrastructure
$154 Million	Agency-wide investments including EPSCoR, GRANTED, new class of STCs
$43 Million	AOAM to support agency growth and additional FTE
$27 Million	Expanded role of NCSES in govt-wide leadership of statistical agencies

FY 2023 Enacted

Leading With Strategic Investment Decisions

NSF is also investing in Congressional and Administration priorities, such as:

- **EPSCoR** and equity programs
- Global leadership in addressing **climate** issues
- **Research security**
- **Emerging industries**

Affirms **NSF has an important role to play in securing our nation's future**

NSF **partnerships** are deepened by embedding these priorities in the FY 2023 plan

CREATE OPPORTUNTIES EVERYWHERE

FY 2023 Key Program Investments:

Broadening Participation Programs, $1.57B, or +$235.0 million above FY 2022 Plan

Graduate Research Fellowships:

- $325 million to support 2,500 new fellows, +400 above the FY 2022 Plan
- Stipend increase of $3,000 per year for all active fellows

EPSCoR Program:

- $255 million, of which $10 million is directed to co-funding

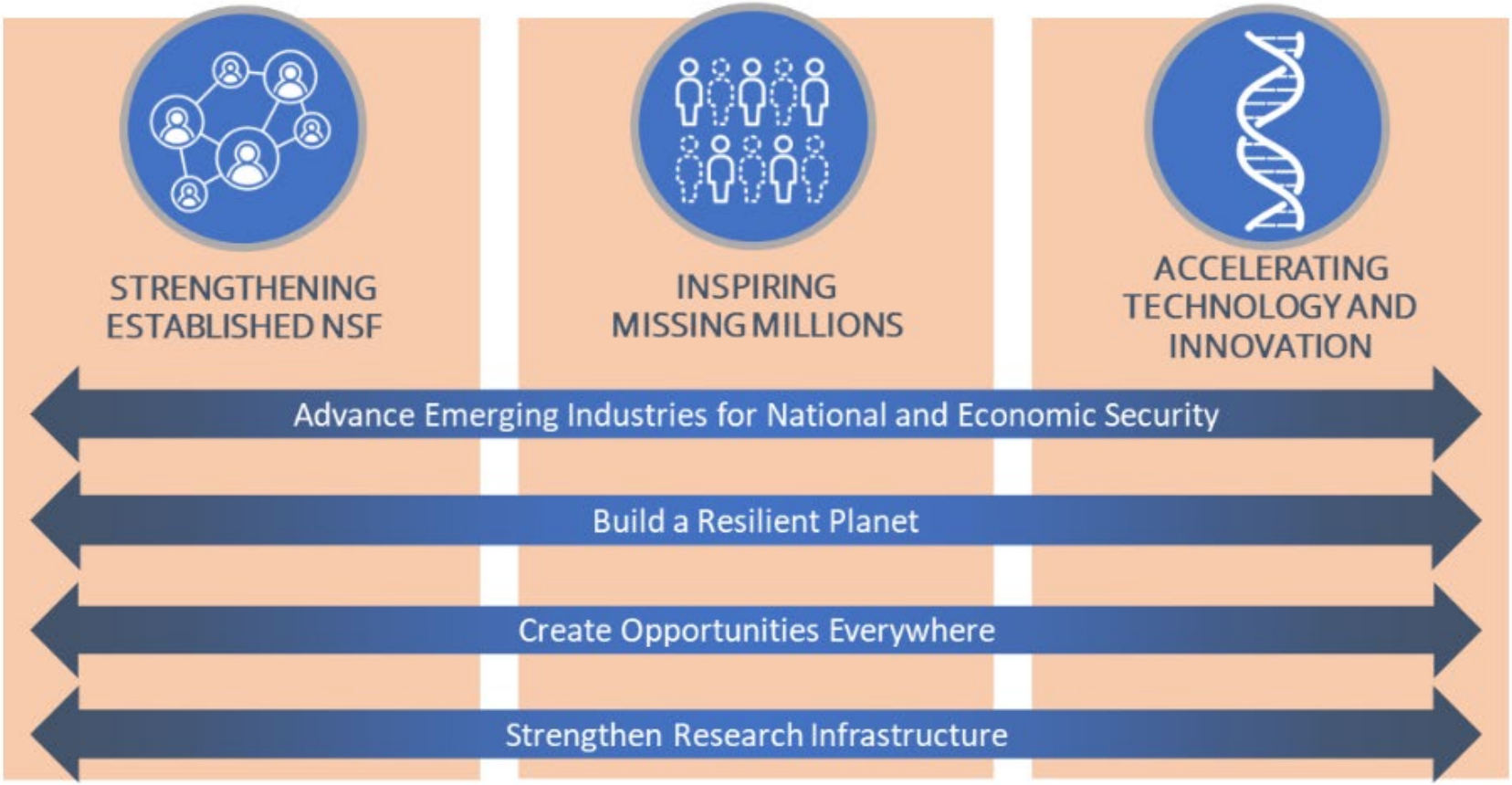
GRANTED:

- $45 million, of which $10 million is directed to Emerging Research Institutions

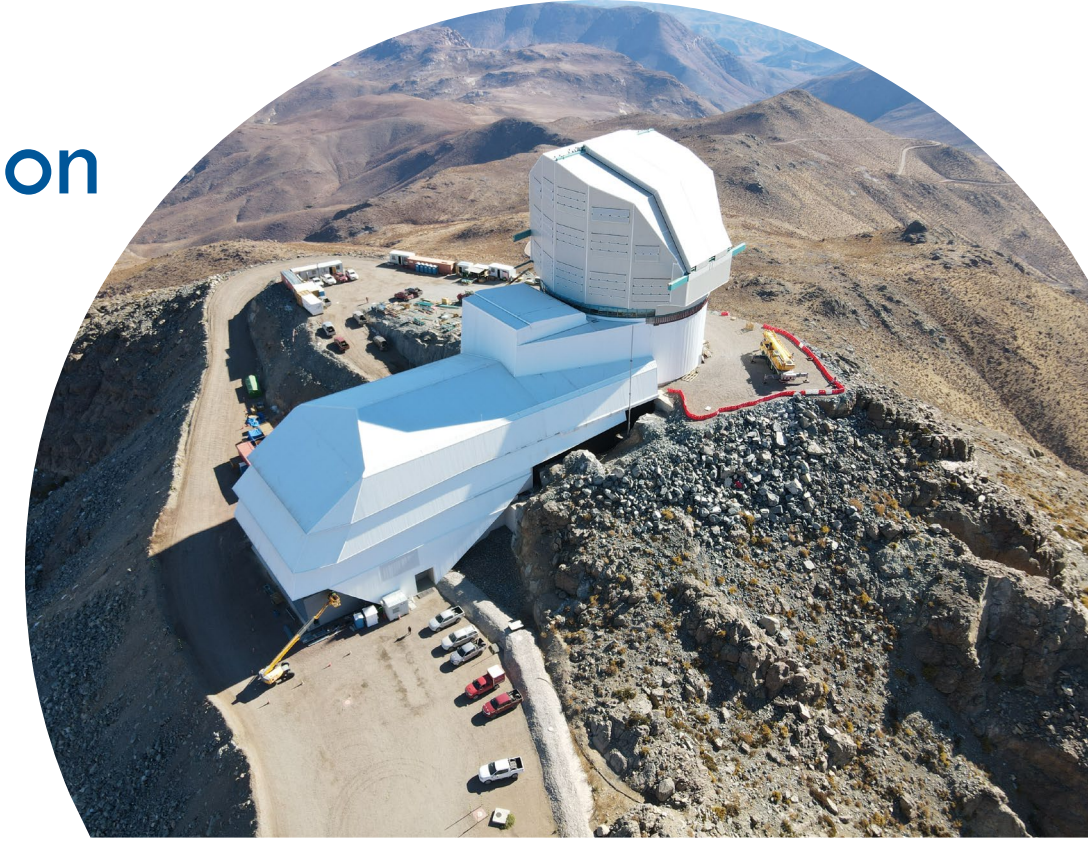
FY 2024 President's Request to Congress

$11.314 Billion

+$1.775 billion
+18.6% above
FY 2023 Enacted



Construction: Facilities coming soon



- Rubin Observatory
  - Construction started in 2014
  - Significant COVID-19 impacts
    - Rebaselined in Spring 2022
  - ETA: Operations in late-2024

- High-luminosity LHC Detector Upgrades: ATLAS and CMS
  - Started in April 2020
  - Impacts due to COVID-19, CERN Schedule delay, Ukraine (loss of Russian contribution)
    - Rebaseline in mid 2023
  - ETA: New CERN schedule = installation in January 2026 (+1yr)

Development: Community input is central

Development: Facilities on the Horizon

- AST: Astro2020
  - Several Major Facility recommendations critical to advances in the field
- PHY: What is next in Gravitational Wave observations?
  - Cosmic Explorer “Horizon Study”
  - AC Subcommittee on next-generation facility concepts
- DMR: What is next in high magnetic field instrumentation?
  - National Academies Study

Recommendations: Build Game-changing new major facilities

ASTRO 2020 Recommendations and Big Projects

At least one and ideally two Extremely Large Telescopes (GMT and TMT) with a target level of at least 25% of the time on each telescope.

NSF and DOE should pursue ground-based CMB experiment (CMB-S4).

The NSF should proceed with the next generation very large array.”

Are these investments that we should consider?

Is there a role for the Nation in these facility recommendations?

- Ensure US leadership and scientific competitiveness
- National Service (GPS, Near Earth Asteroids, space weather)
- Develop workforce – not just for astronomy, but for the nation.

A role for the federal government?

- Too big for states or universities
- Partnerships with other countries, agencies, national defense

A role for the NSF?

- Broaden participation – STEM for the missing millions.
- Access to facilities for all astronomers

ELTs

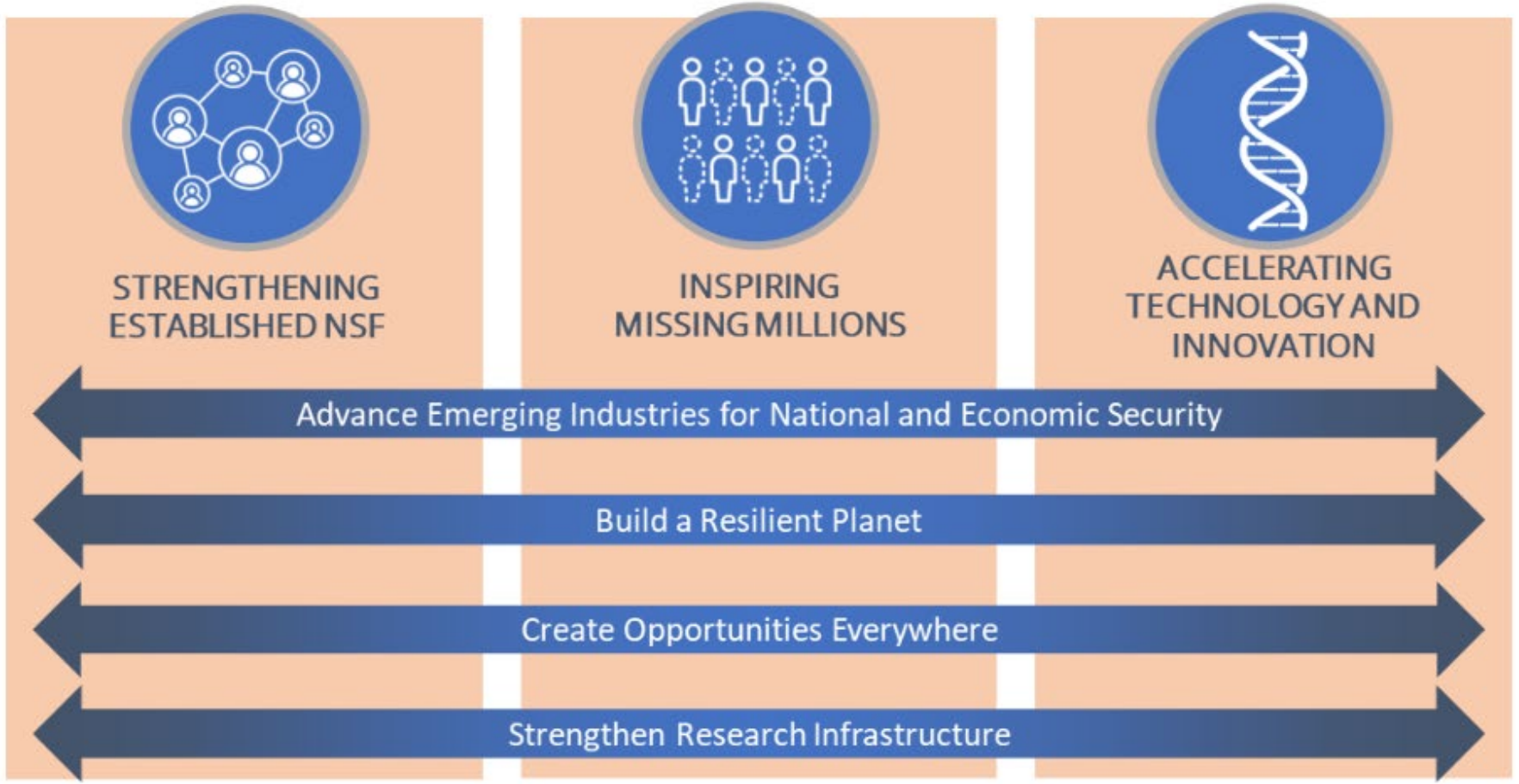
- A decision has not yet been made regarding possible partnerships.
- Regular (weekly+) engagement between NSF and the GMT and TMT teams; both projects are technically advanced
- Working with NOIRLab to define their role in data management for a US-ELT program.
- Preliminary design reviews completed for both GMT and TMT. No decision to go forward, NSF deliberating on path forward.

Working with Indigenous Populations: Example Native Hawaiians

Maunakea Stewardship and Oversight Authority (MKSOA):

- 11 members representing a broad range of interests and expertise including the traditions and culture of Native Hawaiians.
- NSF is committed to working lock-step with the MKSOA
- No matter what happens with a TMT partnership, NSF looks forward to finding ways to improve STEM opportunities for Native Hawaiians.

NSF's 3 Major Priorities Align with White House and Congressional Priorities



Emerging Industries Crosscuts

NSF Crosscuts (in $ millions) for Emerging Industries	FY 2021 Actuals	FY 2022 Actuals	FY 2023 Estimate	FY 2024 Request
Advanced Manufacturing	$452	$426	$367	$453
Advanced Wireless	$131	$162	$161	$179
Artificial Intelligence	$702	$782	$688	$796
Biotechnology	$336	$370	$401	$470
Microelectronics & Semiconductors	$131	$153	$164	$210
Quantum Information Science	$255	$348	$275	$333

Emerging Industries have funding overlap and thus should not be summed.

Data Sources: https://beta.nsf.gov/about/budget/fy2024#summary-tables; https://www.nsf.gov/about/budget/fy2023/pdf/07_fy2023.pdf

Opportunities to highlight

- Artificial Intelligence (AI)
- Quantum Information Science and Engineering (QISE)
- Creating Opportunities Everywhere (Geography of Innovation)
  - ASCEND
  - LEAPS
  - Supplemental opportunities: MPS High, Graduate Students, US Veterans

AI FUNDING OPPORTUNITIES

AI Institutes

- NSF-led in partnership with: Dept. of Agriculture, Dept. of Commerce, Dept. of Defense, Dept. of Education, and Dept. of Homeland Security
- 19 institutes funded so far, and more coming soon
- Each award is $20M over 5 years
- Program touches 40 states encompassing more than 120 universities, MSIs and community colleges

Accelerate AI

- Promotes revolutionizing the scientific method
- Reasoning: Artificial Intelligence for pattern discovery and generating scientific hypotheses
- Data and Modeling: Digital twins for real time modeling and accurate forecasting
- Sensing and Analytics: Smart technologies for real time data collection and aggregation
- Verifying: Formal methods and theorem provers for checking mathematical proofs, hypotheses

ExpandAI

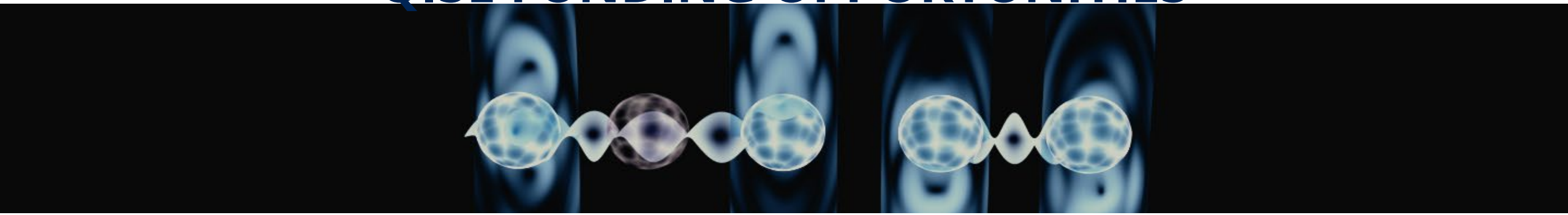
- Promotes capacity development for new AI programs at MSIs, as well as partnerships between MSIs and AI Institutes
- Collaboration across NSF and with USDA, NIST, DHS, and DOD
- Capacity Building grants for planning and growth to establish AI activities
- Partnership grants to scale up established AI activities in collaboration with AI Institutes
- NSF 23-506

  January 09, 2023 - March 13, 2023

  March 14, 2023 - June 26, 2023

  June 27, 2023 - October 20, 2023

QISE FUNDING OPPORTUNITIES



QCLI

- Support large-scale projects driven by a *cross-disciplinary challenge research theme* at the frontier of quantum information science and engineering
- Maintain a timely and bold research agenda aimed at making breakthroughs on compelling challenges in a 5-year period
- Enable the development of a well-trained workforce with strong cross-disciplinary skill sets

Q-AWS

- Enabling Quantum Computing Platform Access for National Science Foundation Researchers with Amazon Web Services, IBM, and Microsoft Quantum
- coordinating the availability of cloud-based access to quantum-computing platforms in order to advance research and build capacity in the academic setting
- DCL NSF 22-092 https://www.nsf.gov/pubs/2022/nsf22092/nsf22092.jsp

ExpandQISE

- Aims to increase nation's research capacity and broaden participation in QISE
- Track 1 Funding: Institutions with minimal current focus on research (Up to $800,000 per award; up to three years)
- Track 2 Funding: Institutions with strong research activity, but no substantial investment in QISE (Up to $5M per award; up to five years)
- Track 1: Full proposals: April 07, 2023

CREATNG OPPORTUNITY EVERYWHERE FUNDING OPPORTUNITIES

MPS-High

- High School Student Research Assistantships Funding to Broaden Participation in the Mathematical and Physical Sciences
- Invite requests which foster interest in the pursuit of studies in the Mathematical and Physical Sciences.
- DCL NSF 22-041

AGEP-GRS

- Supplement for a current MPS re search awardee for one (additional) Ph.D.
- Improve diversity and retention at the doctoral level within MPS disciplines.
- PIs requesting a supplement must be either at or collaborating with faculty at an institution that has received an EHR AGEP award.
- DCL NSF 20-083

MPS-GRSV

- MPS Graduate Research Supplement for Veterans
- Supplement for a current MPS re search awardee for one (additional) Ph.D., as long as the student is a United States (U.S.) veteran
- DCL NSF 20-097

Creating Opportunities Everywhere

Mathematical and Physical Sciences Ascending Postdoctoral Research Fellowships – MPS-Ascend (NSF 21-573)
Excellence Through Diversity

Purpose. To support postdoctoral Fellows who will broaden the participation of underrepresented minorities in MPS fields in the U.S., enabling Fellows to develop as future leaders in science.

Intent: To recognize and support beginning investigators of significant potential

- research experiences that will broaden perspectives, facilitate interdisciplinary interactions, and help broaden participation within MPS fields.
- prepare fellows for their next career stage (e.g., faculty position).

Awards in any scientific area within the purview of the five MPS Divisions: Astronomical Sciences (AST), Chemistry (CHE), Materials Research (DMR), Mathematical Sciences (DMS), and Physics (PHY).

Creating Opportunities Everywhere

MPS Ascend Postdoctoral Fellows FY22

12 to 36 Months, $100,000 per year

- A monthly stipend of $5,833 (up to $70,000 annually)

- An annual allowance of $30,000 for:
  a) expenses directly related to the conduct of the research and/or
  b) support of fringe benefits, dependent care, and moving expenses.

31 MPS Ascend Awards Made

NSF 23-501 MPS-Ascend: Deadline Jan. 25, 2023.
Anticipating 20-50 awards

Creating Opportunities Everywhere

Launching Early-Career Academic Pathways in the Mathematical and Physical Sciences (LEAPS-MPS)

Purpose. To help to launch the careers of pre-tenure faculty in MPS fields at U.S. minority-serving institutions (MSIs), predominantly undergraduate institutions (PUIs), and Carnegie Research 2 (R2) universities.

Intent. To initiate viable independent research programs for researchers attempting to launch their research careers in MPS supported fields.

Goal: achieving excellence through diversity and broadening participation to include members from groups underrepresented in the Mathematical and Physical Sciences, including African Americans, Hispanics, Native Americans, Alaska Natives, and Native Hawaiians, and other Pacific Islanders.

LEAPS-MPS FY22

- Proposal describes how activities will facilitate development of a subsequent research proposal.
- A specific plan on broadening participation activities that will increase (1) the participation of scientists from underrepresented groups and (2) the numbers of such individuals that serve as role models for the scientific workforce of the future.
- LEAPS Impact Statement (3 pages): (1) impact on institutional research environment, (2) impact on career of PI and department's ability to prepare students to enter STEM careers, including provisions for increasing broader participation.
- 24 Months, $250,000 (Total Costs).
- **58 LEAPS- MPS Awards Made**

NSF 22-604 LEAPS-MPS, DEADLINE JAN. 26TH , 2023
FOURTH THURSDAY IN JANUARY, ANNUALLY THEREAFTER

Thank You !

Contact Information:
sljones@nsf.gov