



NATIONAL SCIENCE BOARD



NSB Vision 2030: Priorities for STEM *A VISION FOR AMERICA'S S&E ENTERPRISE*

NASEM

June 8, 2021

Victor McCrary

Vice Chair - National Science Board
Vice President for Research and Graduate
Programs and Professor of Chemistry,
University of the District of Columbia

NATIONAL SCIENCE BOARD: TWO ROLES



Policy making body for NSF

- Establishes policies
- Identifies issues critical to NSF's future
- Approves strategic budget direction and major programs and awards

Advisors to the President and Congress

- Publishes *Science and Engineering Indicators*
- Issues policy reports on S&E, STEM education, and workforce

VISION LISTENING SESSIONS

- **University of the District of Columbia:** faculty, researchers and administrators from 8 Historically Black Colleges and Universities
- **Washington University in St. Louis:** reps from 6 local universities and foundations
- **Santa Fe Institute**
- **Arizona State University:** reps from minority serving and other institutions in Arizona
- **NSF AC Members, ADs, Division Leaders, Program Officers**



The U.S. has made the investments needed to fuel an innovation economy and remain preeminent in science and engineering.

The U.S. remains a magnet for the world's best talent.

U.S. scientists and engineers are modeling scientific values that are practiced throughout the world.

The U.S. has increased STEM skills in its workforce, creating more opportunities for all Americans.

The U.S. has created an accessible, attractive S&E enterprise that more closely reflects the nation's demographic and geographic diversity.

U.S. government, industry, and academic partners are working in coordination to realize national R&D priorities and accelerate the discovery-to-innovation cycle.

NSF continues to drive U.S. innovation through fundamental research and lead the evolution of the global practice of science and engineering.

VISION FOR THE FUTURE

nsf.gov/nsb/NSBActivities/vision-2030.jsp

NSBVision@nsf.gov

KEY QUESTIONS

How can America keep its lead in fundamental research?

How can American discoveries continue to empower U.S. businesses and entrepreneurs to succeed globally?

How can the U.S. increase STEM skills and opportunities for all Americans?

GOVERNMENT

State
Local
Federal
National Labs

PRIVATE

Businesses
Associations
Entrepreneurs
Foundations
Nonprofits
Philanthropies

THE S&E ECOSYSTEM

ACADEMIA

Trade Schools
Universities
Colleges
K-12



FOCUS ON THE FUTURE: NSB ROADMAP



**FOSTER A GLOBAL S&E
COMMUNITY**

**EXPAND THE GEOGRAPHY
OF INNOVATION**

**DELIVER BENEFITS
FROM RESEARCH**

**DEVELOP STEM TALENT FOR
AMERICA**

FOCUS ON THE FUTURE: NSB ROADMAP



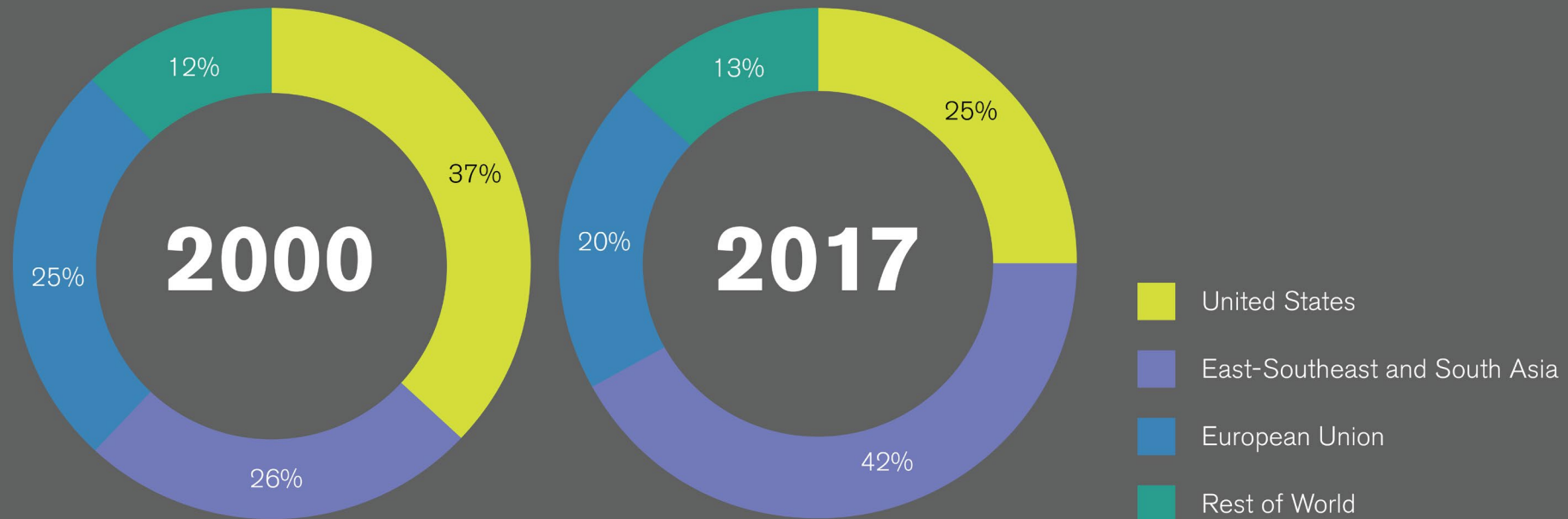
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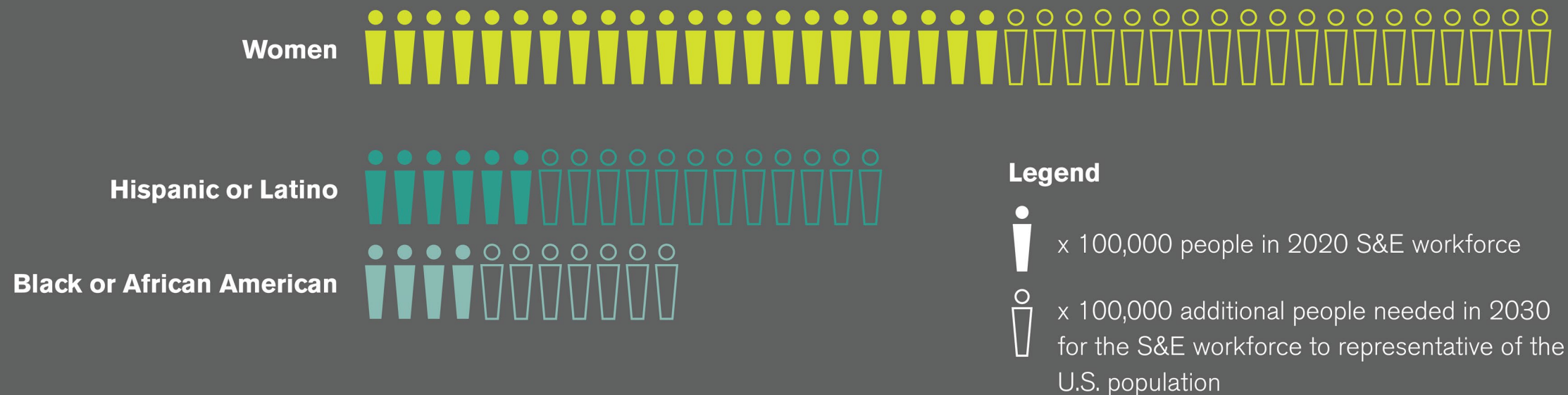
**DELIVER BENEFITS
FROM RESEARCH**

**DEVELOP STEM TALENT FOR
AMERICA**

CONTEXT: U.S. SHARE OF R&D DECREASING AS GLOBAL S&E GROWS



MISSING MILLIONS: FASTER PROGRESS IN INCREASING DIVERSITY NEEDED TO REDUCE SIGNIFICANT TALENT GAP



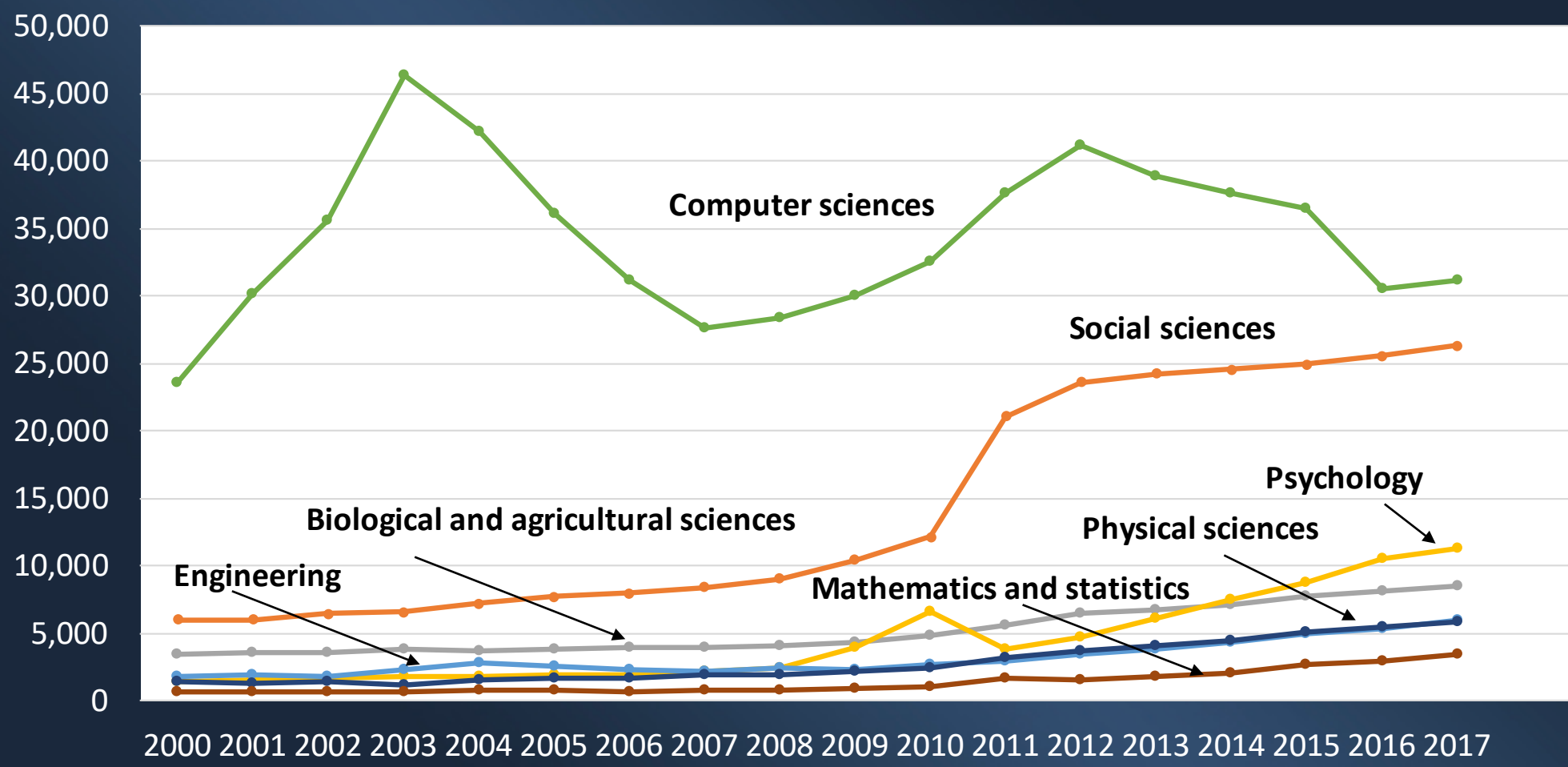
While the number of people from under-represented groups in the S&E workforce has grown over the past decade, faster increases will be needed for the S&E workforce to be representative of the U.S. population in 2030. To achieve that goal, the NSB estimates that the number of women must nearly double, Black or African Americans must more than double, and Hispanic or Latinos must triple the number that are in the 2020 U.S. S&E workforce. These estimates are based on projections from the U.S. Census and Bureau of Labor Statistics, together with data from the National Center for Science and Engineering Statistics, and assume that participation of these groups in the S&E workforce increases at current rates.

Develop STEM Talent For America

- **NSB Action:** Ensure that NSF improves the attractiveness, equity, and inclusivity of research careers, including attracting and retaining women and other underrepresented groups; and ensuring that these groups are achieving leadership roles in the S&E ecosystem through appropriate policies, funding, programs, and outreach.



S&E associate's degrees awarded in the U.S., by field: 2000



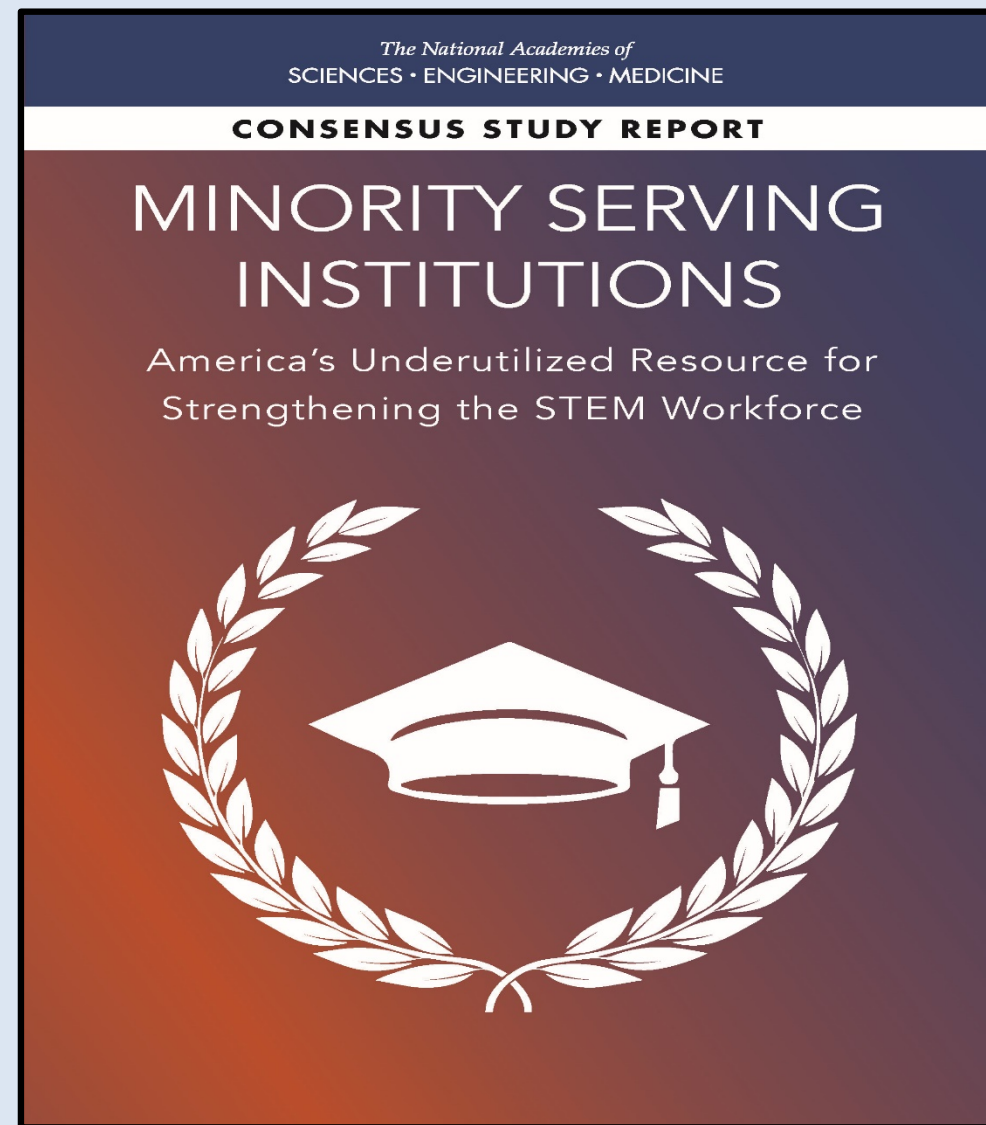
National Science Board

MINORITY SERVING INSTITUTIONS:

America's Underutilized
Resource for
Strengthening the STEM
Workforce

Free report available at:

<https://www.nap.edu/catalog/25257>



Authoring Committee

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VICTOR TAM, Santa Rosa Junior College

CRISTINA VILLALOBOS, University of Texas Rio Grande Valley

DOROTHY YANCY, President Emerita of Shaw University and Johnson C. Smith University

LANCE SHIPMAN YOUNG, Morehouse University



MSI Types

- Historically Black Colleges and Universities (HBCUs)
- Tribal Colleges and Universities (TCUs)
- Hispanic-Serving Institutions (HSIs)
- Asian American and Native American Pacific Islander-Serving Institutions (AANAPISIs)
- Alaska Native-Serving and Hawaiian Serving (ANNHIs)
- Predominately Black Institutions (PBIs)
- Native American-Serving Nontribal Institutions (NASNTIs)



Contributions and Reach

- Roughly 700 two- and four-year colleges and universities, enrolling nearly 30 percent of all undergraduates in U.S. higher education
- Constitute nearly a third of all two-year institutions or looked at another way, over half of all MSIs are two-year institutions
- More undergraduate students (from all backgrounds) are enrolled in STEM fields at four-year MSIs than at four-year non-MSIs
- Taken together, HBCUs, HSIs, and AANAPISIs produce one fifth (20%) of the nation's STEM bachelor's degrees



HBCU: *Fast Facts**



- 101 Accredited HBCUs
- HBCUs are 3% of the Nation's Colleges & Universities
- HBCUs enroll 10% of the Nations Black students (300,000)
- HBCUs produce 20% of all Black graduates
- HBCUs generate \$14.8B in economic impact
- HBCUs account for 24% of Blacks in STEM fields (30% in engineering at the bachelors level)
- The top eight institutions which produced Blacks who went on for STEM PhDs were HBCUs

* Source: UNCF

Research Capacity & STEM Talent: America's HBCUs

Entity	Carnegie Designation 2020	Moody's Rating	Research Expenditures (2018)	NSF Expenditures (2018)	NSF Expenditures (2016)	Endowment (2016-2019)
Clark-Atlanta	R2	Ba2	\$8M	\$1.9M	\$1.5M	\$69M
Delaware State	R2	Aa3	\$21M	\$3.3M	\$5.4M	\$28.6M
FAMU	R2	Baa1	\$40M	\$3.0M	\$2.4M	\$98M
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Morgan State	R2	A1	\$13M	\$1.0M	\$1.0M	\$32.9M
Tennessee State	R2	Aa1	\$18M	\$1.7M	\$1.6M	\$51M
Texas Southern	R2	Baa3	\$4M	\$0.5M	\$0.8M	\$54M
UDC	M2	Aaa	\$2.9M (FY19 = \$4.8M)	\$0.86M (FY19=\$1.014M)	\$0.86M	\$51M (FY19)
UMES	R2	Aa1	\$5M	\$0.0M	\$0.0M	\$26.2M

ABET ACCREDITED ENGINEERING HBCUs

- Alabama A&M University (M1)
- Florida A&M University (R2)
- Hampton University (R2)
- Howard University (R2)
- Jackson State University (R2)
- North Carolina A&T State University (R2)
- Morgan State University (R2)
- Norfolk State University (M2)
- Prairie View A&M University (M1)
- Southern University & A&M College (M1)
- Tennessee State University (R2)
- Tuskegee University (M2)
- University of the District of Columbia (M2)
- University of Maryland – Eastern Shore (R2)
- Virginia State University (M2)





NATIONAL SCIENCE BOARD

THE SKILLED TECHNICAL WORKFORCE:

Crafting America's
Science & Engineering
Enterprise

3.4M

Why do the National Academies expect 3.4 million unfilled skilled technical jobs by 2022?

139

What did 139 stakeholders from across the country say the U.S. should do to improve opportunities for skilled technical workers?

4

What 4 recommendations do we offer for building the Skilled Technical Workforce of the future?



The Skilled Technical Workforce: Crafting America's Science & Engineering Enterprise

*Victor McCrary, VP for Research & Graduate Programs,
University of the District of Columbia; Vice-Chair, National Science Board*

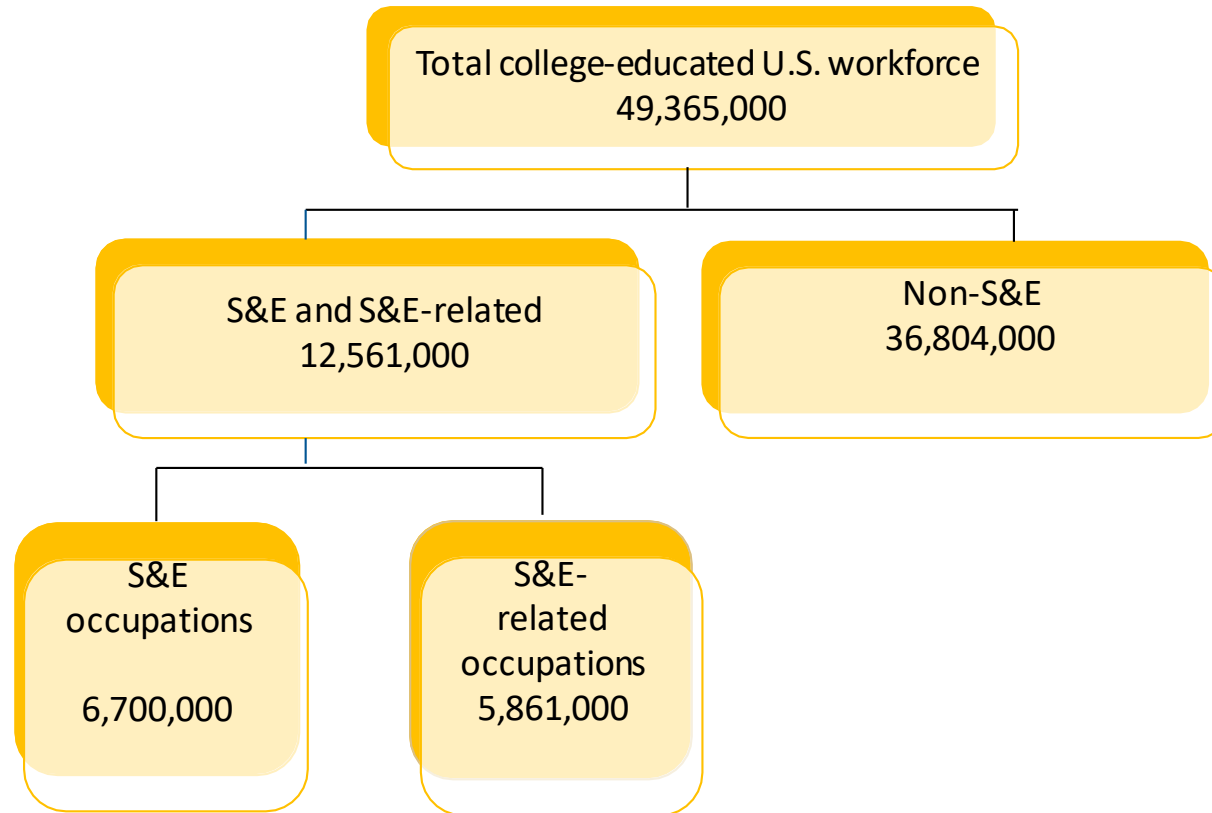
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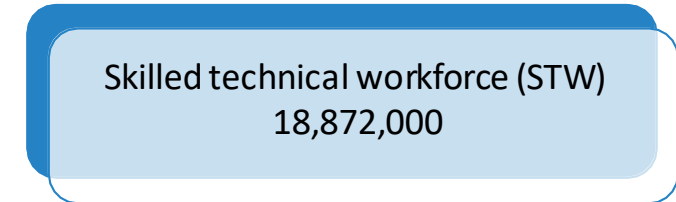
National Science Board

Former S&E workforce model limited to workers with a BA

U.S. S&E workforce, 2017



U.S. skilled technical workforce, 2017



- Without a bachelor's degree (without a HS diploma; HS diploma or equivalent; some college; or associate's degree)
- Bachelor's degree or above

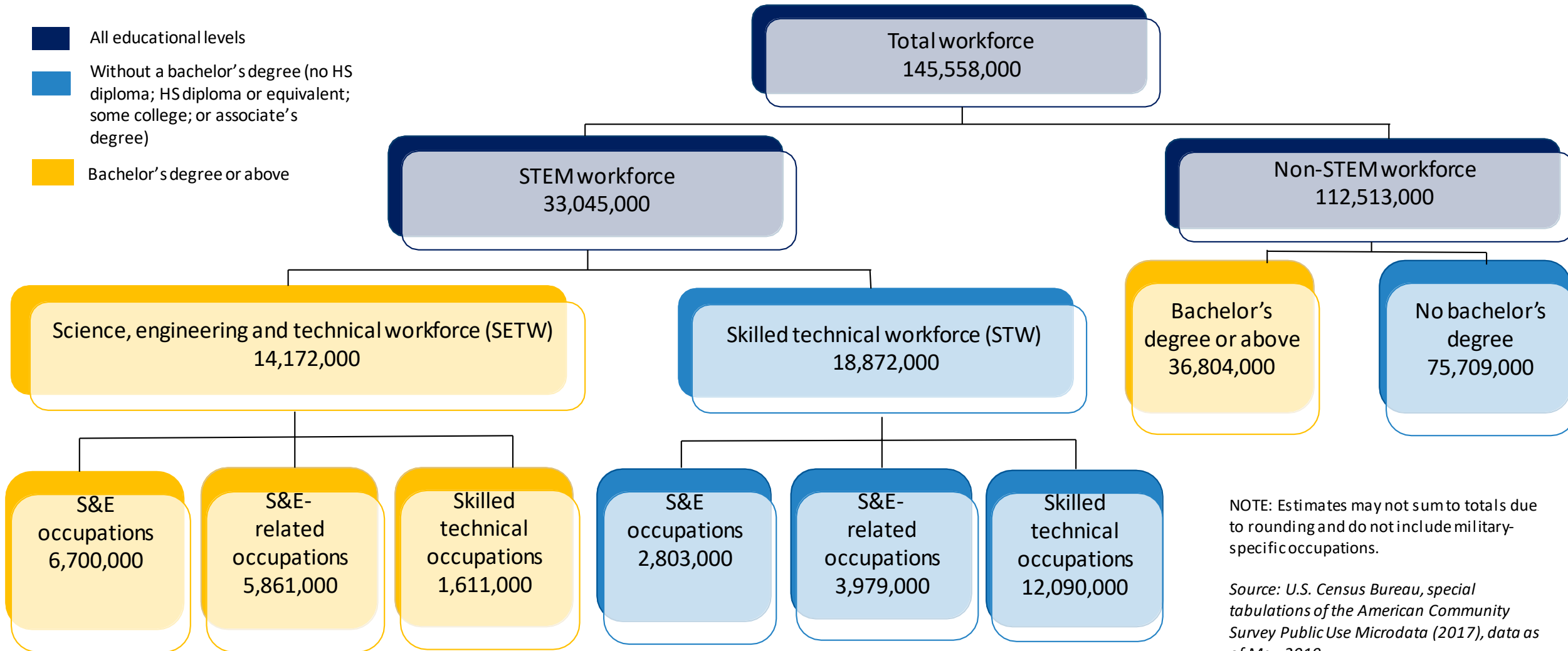
NOTE: Estimates may not sum to totals due to rounding and do not include military-specific occupations.

Source: U.S. Census Bureau, special tabulations of the American Community Survey Public Use Microdata (2017), data as of May 2019.

Amy Burke and Abigail Okrent: "Revisiting the STEM Workforce: A Data Framework"

New model provides extensive view of the STEM workforce

STEM in the U.S. Workforce, 2017

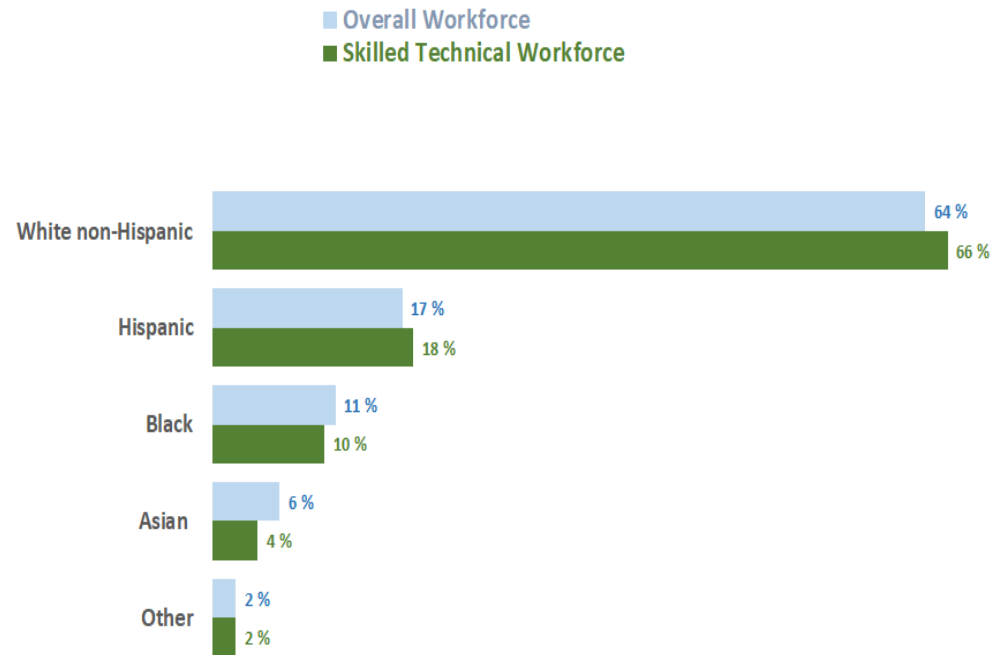


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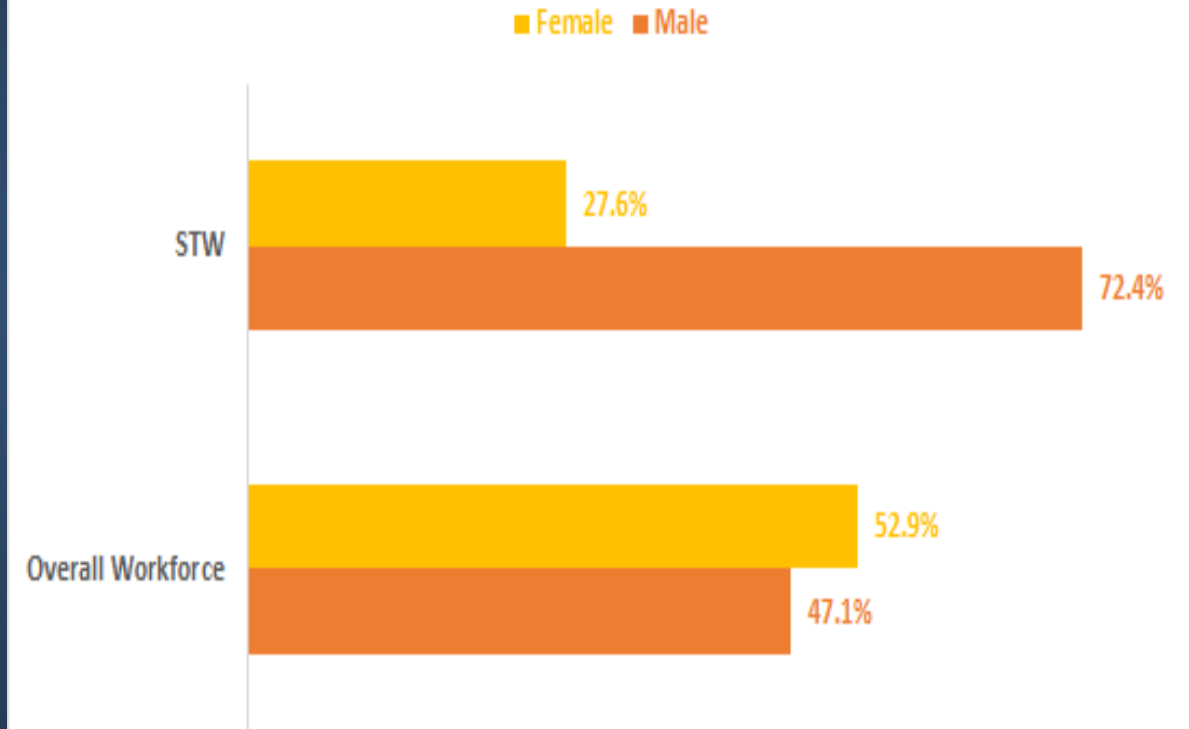
Source: U.S. Census Bureau, special tabulations of the American Community Survey Public Use Microdata (2017), data as of May 2019.

STW Data Portrait

The Skilled Technical Workforce by Race and Ethnicity: 2017



The Skilled Technical Workforce by Gender: 2017



Points to Consider Going Forward - PCAST

- Focus on nurturing, diverse domestic STEM talent:
 - Establish research centers at HBCUs/MSIs for national priorities in AI, quantum information processing, and cyber
 - Programs to introduce students early to National Security R&D and the value of holding a security clearance





INSPIRE - ENGAGE - EDUCATE - EMPLOY
The Next Generation of Explorers

NASA and MUREP

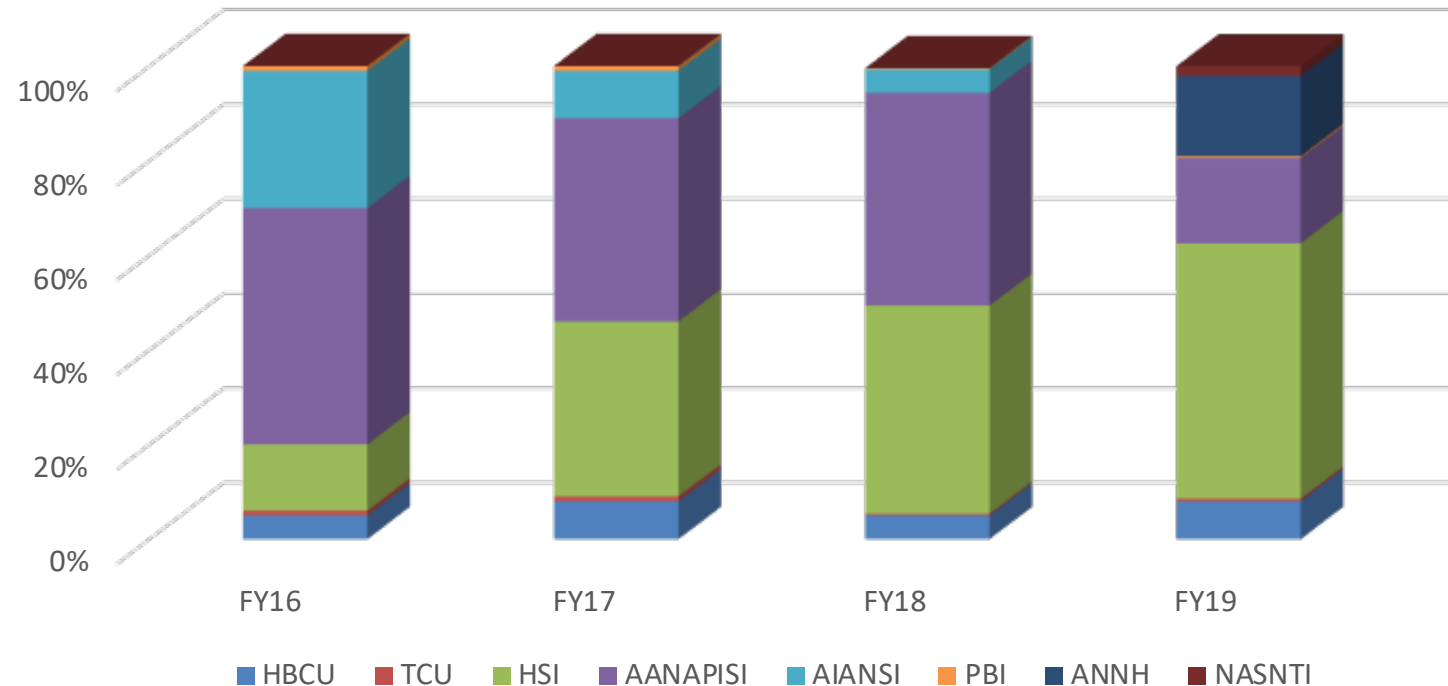
Investments and Engagement

at Historically Black Colleges and Universities

Investment FY 2016 – FY 2018 / Engagement FY 2019 – FY2020

Funding from Agency to MSIs (By Institution Type)

Out of the AGENCY dollars that went to all MSIs, what percentage went to each MSI type?



	HBCU	TCU	HSI	AANAPISI	AIANSI	PBI	ANNH	NASNTI
FY16	5%	1%	14%	50%	29%	1%	0%	0%
FY17	8%	1%	37%	43%	10%	1%	0%	0%
FY18	5%	0.35%	44%	45%	5%	0.20%	0%	0%
FY19	8%	0.54%	54%	18%	0%	0.40%	17%	2%

Note: ANNH and NASNTI did not exist as a separate category in 2018.

This chart further analyzes the funds that were awarded to the Minority Serving Institutions (MSIs) by MSI type.



INSPIRE - ENGAGE - EDUCATE - EMPLOY

The Next Generation of Explorers



MUREP FY2019 – FY2020 Engagement at HBCUs

MUREP HBCU ENGAGEMENT



CIAA Conference Support



President/Chancellor Meetings
Middle School Day
High School Day
Career Fair
Exhibit Booth



White House Initiative on HBCUs



Interagency Working Group
Student Engagement
Strategic Planning
Training Workshops/Sessions
Networking



NASA Aeronautics Research Mission Directorate (ARMD)



Two MUREP HighVolume Awardees –
Tuskegee/Virginia State;
New Lead HBCU – North Carolina A&T
Additional Funding Opportunities

MUREP HBCU ENGAGEMENT



MSI Capability Gateway



<https://msigateway.larc.nasa.gov/>

Externally Available
Database of MSIs
Listing of Research Capabilities
Searchable by HBCU

HBCU/MSI Road Tour



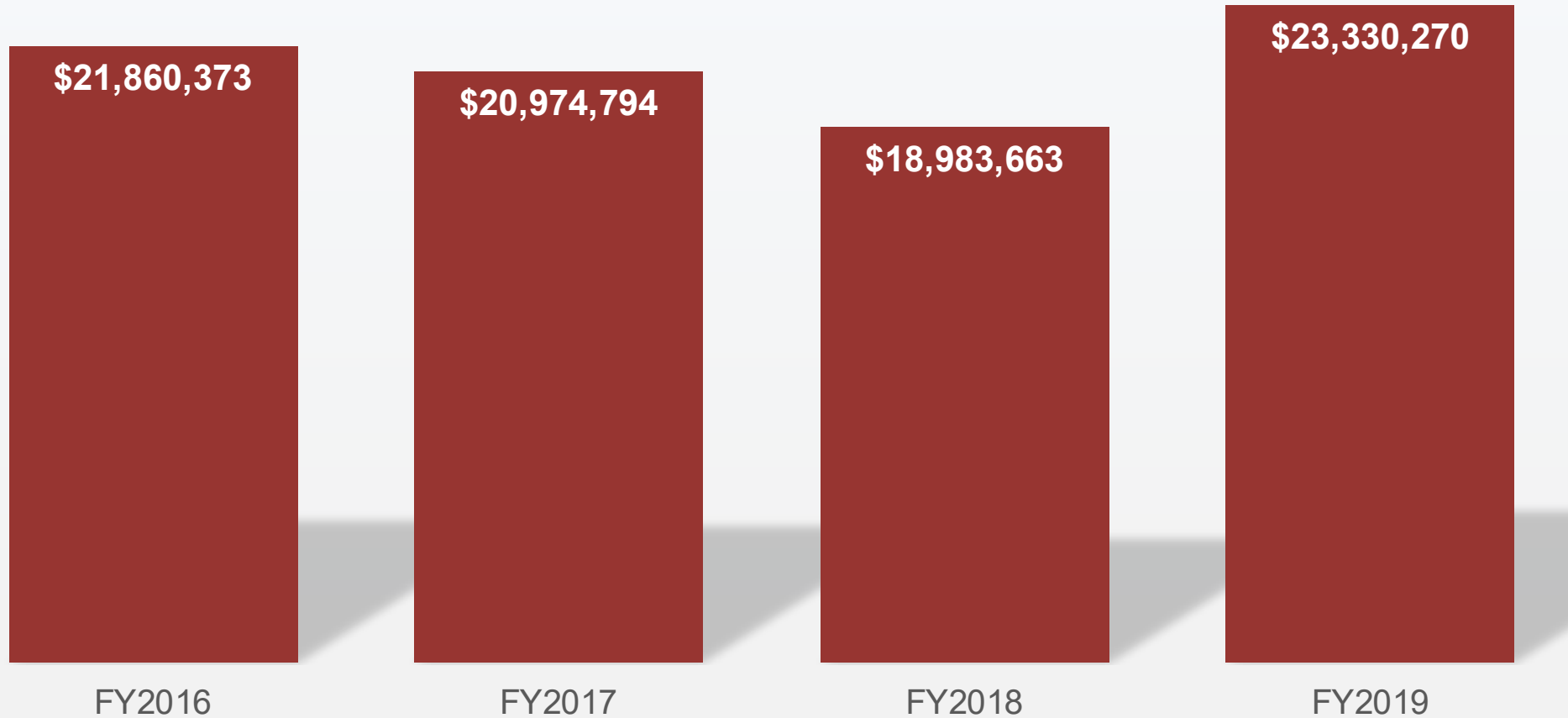
Agency 1% Contracting
Goal for MSIs
Training Workshops
Networking
Matchmaking

MUREP Institutional Research Opportunity (MIRO)

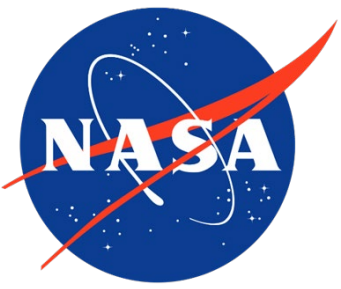


Seven HBCUs funded
out of 20 Existing Awardees

TOTAL VALUE OF AGENCY AWARDS TO HBCUS



**FY2019 data is preliminary*



NASA External Advisory Committee

Meeting February 7, 2020

UNIVERSITY OF THE
DISTRICT OF
COLUMBIA
—1851



EAC Lead, **Dr. Henry Molintas**, Lead Mechanical Engineering for Department of Defense Innovation Program, Booz Allen Hamilton

Dr. Jack Price, Director of Research, Naval Surface Warfare Center, West Bethesda, MD

Susan E. Dunnings, the Vice President and Associate General Counsel, Employment and Labor Law, for Lockheed Martin in Bethesda, Maryland

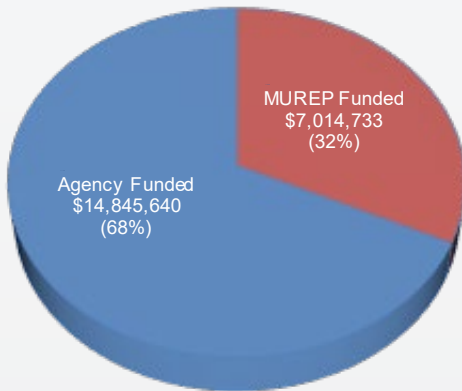
Walter Falconer, President of Space Consultant, member of the NOAA Science Advisory Board as well as the NASA JPL Science Advisory Board

Patrick Hill, Parker Solar Probe project manager, Space Department, Johns Hopkins University Applied Physics Laboratory

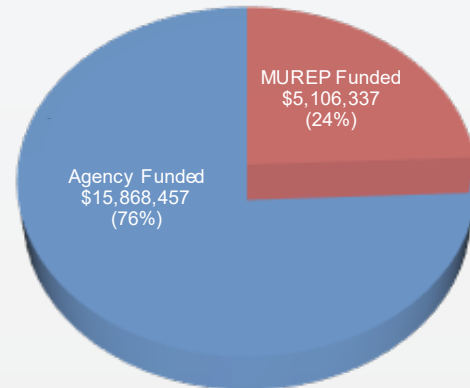
Michelle Pourciau, Former Director, Department of Transportation, Baltimore, MD

MUREP CONTRIBUTION TO HBCU AWARDS

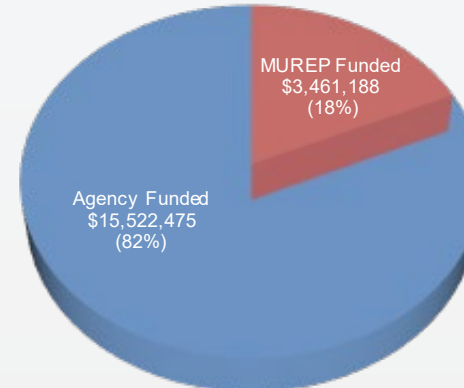
FY2016



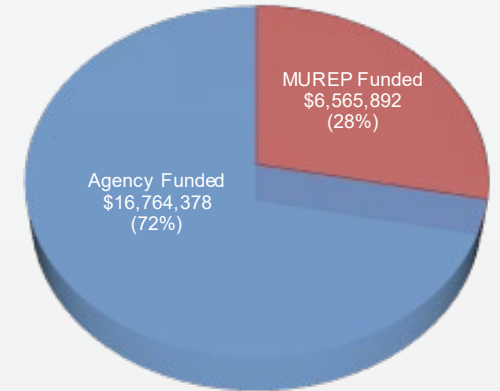
FY2017



FY2018

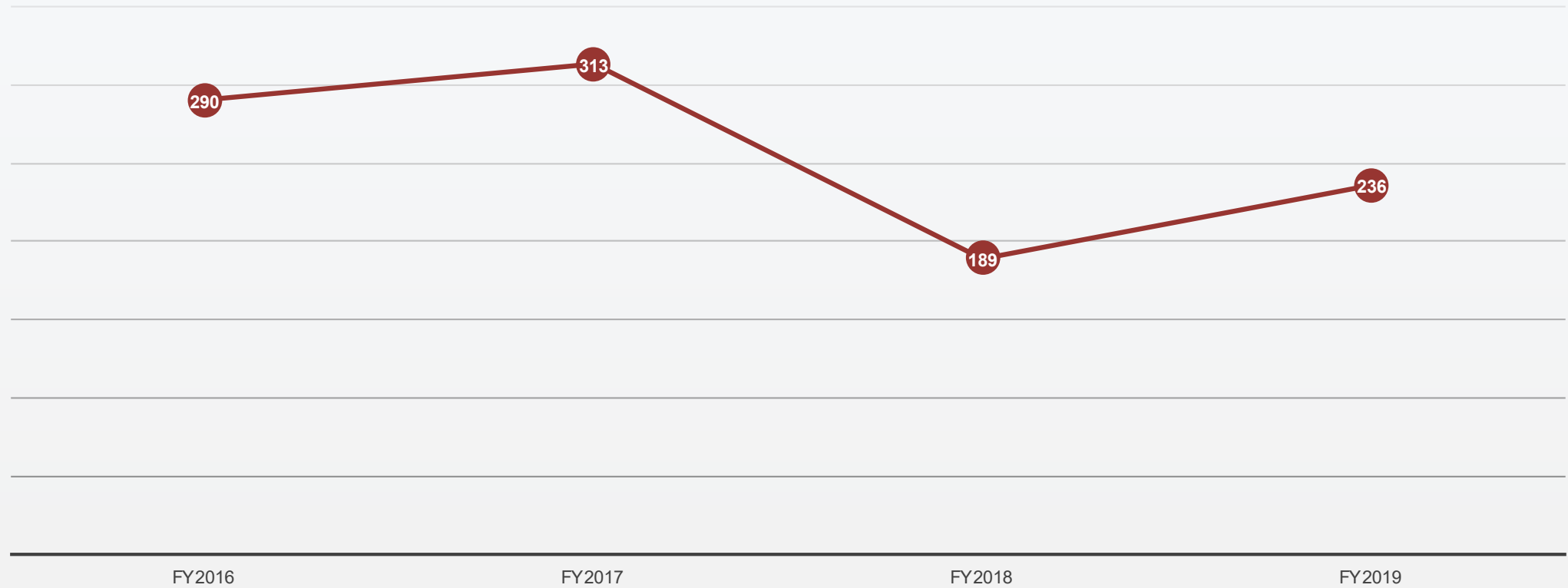


FY2019



**FY2019 data is preliminary*

NUMBER OF AGENCY AWARDS TO HBCUS



**FY2019 data is preliminary*

Number of HBCUs Receiving NSF Funding

Table - Number of HBCUs receiving NSF funding for science and engineering activities.

Number of HBCUs that...	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
received any SE funding	48	50	54	56	55	46	53	53	47	53
received any R&D funding	42	36	45	43	45	31	39	34	30	36
Received >\$1m R&D funding	17	11	13	10	10	11	9	12	6	13
Received >\$2m R&D funding	8	3	7	2	3	4	3	3	4	6



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** Source: National Science Foundation FY18 HERD Survey*

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** Source: National Science Foundation FY18 HERD Survey*

University	Carnegie Designation 2020	Research Expenditures (2018)	NSF* Expenditures (2018)	NASA* Expenditures (2018)	Endowment (2019)
Johns Hopkins	R1	\$2.2B	\$39M	\$264M	\$6.3B
U. Wash.	R1	\$989M	\$111M	\$20M	\$2.94B
U. Michigan	R1	\$850M	\$81M	\$29M	\$12.4B
Stanford	R1	\$711M	\$76M	\$22M	\$28B
UNC Chapel Hill	R1	\$701M	\$35M	\$1.8M	\$5B
U. Penn	R1	\$688M	\$45M	\$4.6M	\$14.7B
Columbia	R1	\$686M	\$87M	\$21M	\$11B
UC San Francisco	R1	\$669M	\$7.7M	\$0.5M	\$3.89B
Georgia Tech	R1	\$654M	\$66M	\$12.8M	\$2.17B
U. Pittsburgh	R1	\$649M	\$27.4M	\$1.1M	\$4.3B
Duke	R1	\$645M	\$38M	\$2.5M	\$3.8B
UC San Diego	R1	\$636M	\$82M	\$10M	\$1.73B

** Source: National Science Foundation FY18 HERD Survey*

The Value Proposition of HBCUs: **“We Are Essential for the National Security of the US Research Enterprise”**

DIVISION B—COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES APPROPRIATIONS ACT, 2018

NATIONAL SCIENCE FOUNDATION

This Act includes \$7,767,356,000 for the National Science Foundation (NSF). This strong investment in basic research reflects the Congress’ growing concern that China and other competitors are outpacing the United States in terms of research spending, as noted in the 2018 Science and Engineering Indicators report of the National Science Board.

Omnibus Budget, signed into law March 23, 2018



It just takes making the commitment and perseverance
If the US Military can do it – WE can help our US Research Ecosystem!!



*ADM Mike Mullen
Chairman of the Joint Chiefs of Staff
2007 - 2011*



*General (ret.) Lloyd Austin
Secretary of Defense*

**NSB needs you to help us
implement Vision 2030!!**



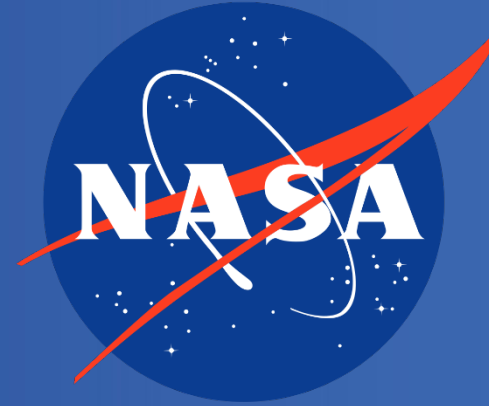
If You're Not at the Table, You're on the Menu



My Recommendations to the User Advisory Group in 2020

- **UAG/NASA members visit NASA-funded HBCUs during FY2022**
- **Increase NASA's budget commitment to HBCUs (from <1% to 2%) for FY 2022**
- **Partner w/ NSF/AFOSR/ONR/ARO to leverage HBCU budget portfolios & programs for FY 2022**
- **New NASA Administrator meet new NSF Director to discuss building research capacity at HBCUs – next 30 days- **DONE****





My Recommendations for 2021-2022

- **Review Space Grant Program to ensure HBCU members are participating equitably; explore opportunities for research capacity building & HBCUs to lead programs in states**
- **Create new program, similar to NIH, to increase staff in HBCU sponsored program offices, especially for technology translation**
- **Explore NASA partnerships with HBCUs/HSIs through through NSF's EPSCoR programs**



The U.S. has made the investments needed to fuel an innovation economy and remain preeminent in science and engineering.

The U.S. remains a magnet for the world's best talent.

U.S. scientists and engineers are modeling scientific values that are practiced throughout the world.

The U.S. has increased STEM skills in its workforce, creating more opportunities for all Americans.

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NSF continues to drive U.S. innovation through fundamental research and lead the evolution of the global practice of science and engineering.

VISION FOR THE FUTURE

[nsf.gov/nsb/NSBActivities/vision-2030.jsp](https://www.nsf.gov/nsb/NSBActivities/vision-2030.jsp)

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