National Aeronautics and Space Administration

NAC STEM Engagement Meeting

FEBRUARY 17, 2022

NAC STEM Engagement Committee Meeting

Thursday, February 17, 1 pm to 5 pm Eastern
Open to the Public

Returning Committee Members

Daniel Dumbacher
Executive Director
American Institute of Aeronautics & Astronautics

Ray Mellado
Founder & Chairman
Great Minds in STEM

Darryl Williams
Senior Vice President of Science and Education
The Franklin Institute

Norman Fortenberry
Executive Director
American Society for Engineering Education

New Committee Members

Kristin De Vivo
Executive Director
Lucas Education Research

Jamarius Reid, Student Representative
President, Student Government Association
Embry-Riddle Worldwide

Agenda:
- Opening Remarks by Chair
- STEM Engagement Update, Goals and Strategy
- Priorities for 2022
- Review Earlier Findings and Recommendations to the NASA Advisory Council
- Formulation of New Findings and Recommendations
- Other Related Topics

Full Details Available on the Federal Register website

AGENDA

Landscape

Overview of STEM Engagement

NAC Topics Review

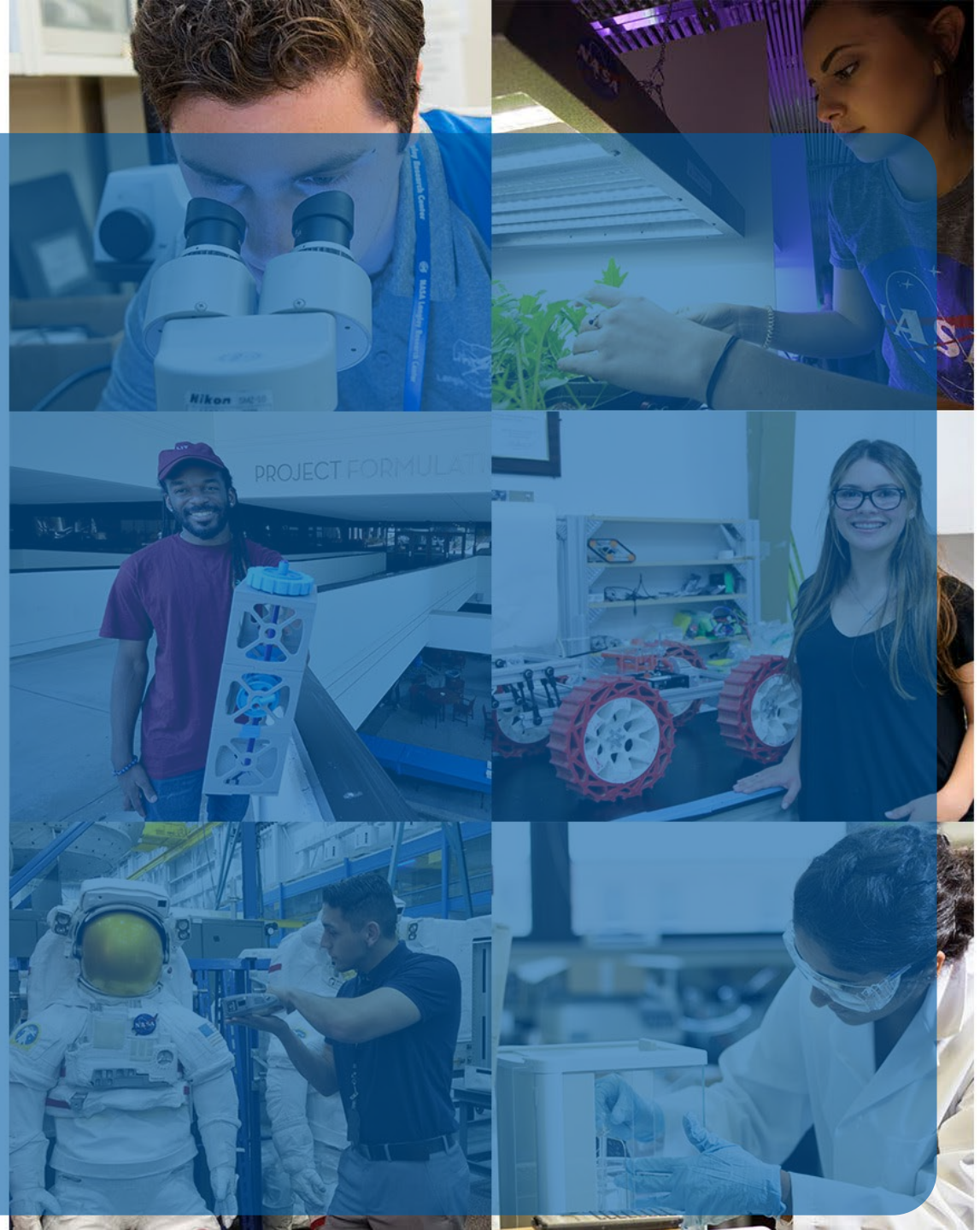
Broadening Participation

K-12 Efforts

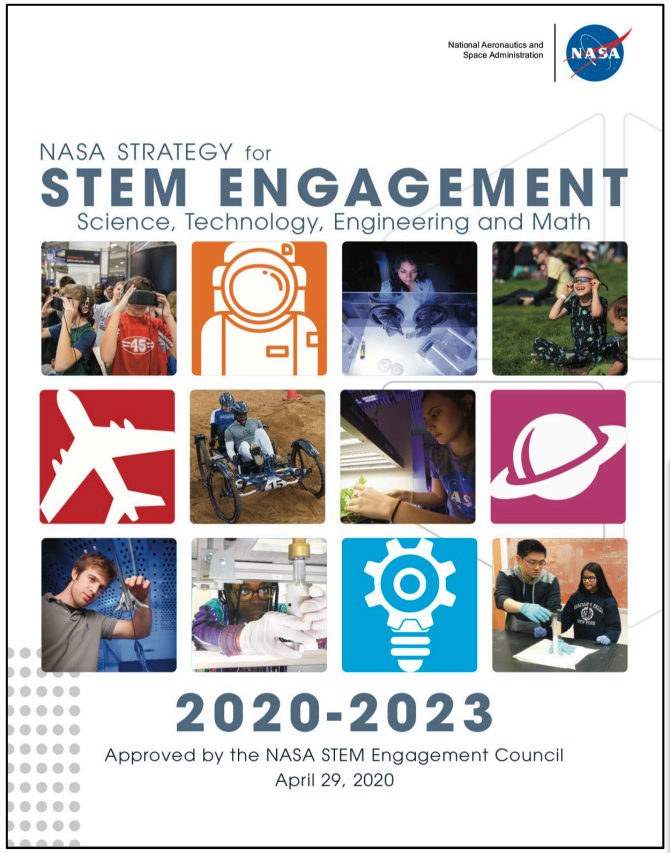
Partnerships

Measuring Success

Discussion



NASA Strategy for STEM Engagement 2020-23



Increased emphasis on diversity, equity and inclusion

VISION

We immerse students in NASA's work, enhance STEM literacy, and inspire the next generation to explore.

MISSION

We engage students in NASA's mission.

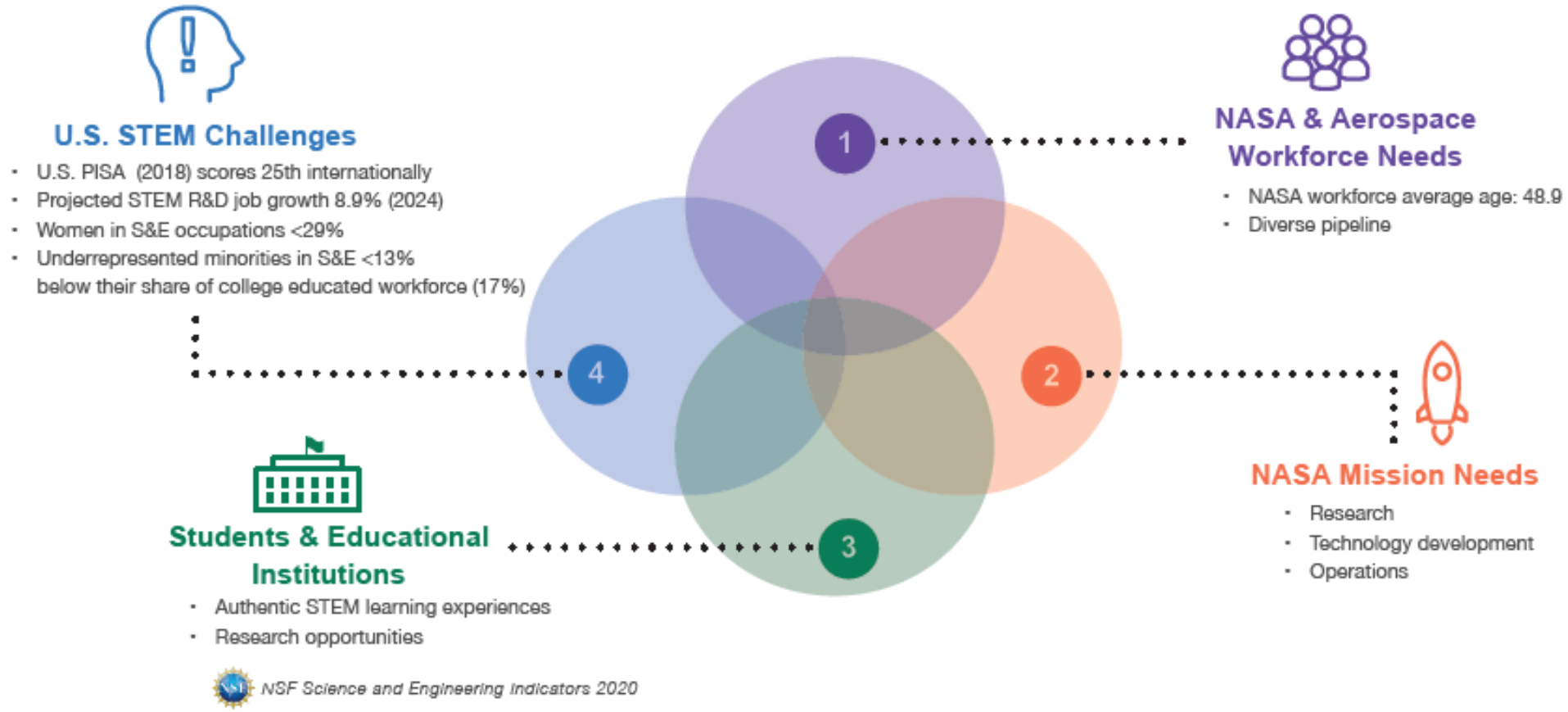
Strategic Goals

Create **unique opportunities** for a **diverse set of students to contribute** to NASA's work in exploration and discovery.

Build a diverse **future STEM workforce** by engaging students in authentic learning **experiences** with NASA's people, content, and facilities.

Attract diverse groups of students to STEM through learning opportunities that **spark interest** and **provide connections** to NASA's mission and work.

NASA'S CONTRIBUTIONS TO THE STEM ECOSYSTEM

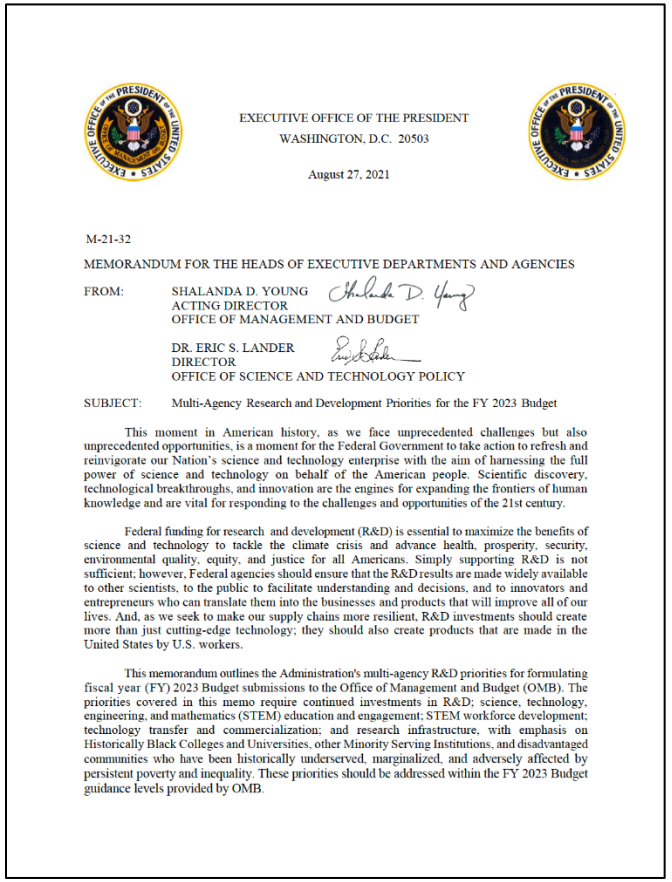


NASA's Contributions to the STEM Ecosystem

[1] Science Board, National Science Foundation. 2020. Science and Engineering Indicators 2020: The State of U.S Science and Engineering. NSB-2020-1. Alexandria, VA. Available at https://ncses.nsf.gov/pubs/nsb20201/.

[2] National Science Foundation, National Center for Science and Engineering Statistics. 2019. Women, Minorities, and Persons with Disabilities in Science and Engineering:

STEM Engagement Alignment with OSTP/OMB Priorities



EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20503

August 27, 2021

M-21-32

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: SHALANDA D. YOUNG
ACTING DIRECTOR
OFFICE OF MANAGEMENT AND BUDGET

DR. ERIC S. LANDER
DIRECTOR
OFFICE OF SCIENCE AND TECHNOLOGY POLICY

SUBJECT: Multi-Agency Research and Development Priorities for the FY 2023 Budget

This moment in American history, as we face unprecedented challenges but also unprecedented opportunities, is a moment for the Federal Government to take action to refresh and reinvigorate our Nation's science and technology enterprise with the aim of harnessing the full power of science and technology on behalf of the American people. Scientific discovery, technological breakthroughs, and innovation are the engines for expanding the frontiers of human knowledge and are vital for responding to the challenges and opportunities of the 21st century.

Federal funding for research and development (R&D) is essential to maximize the benefits of science and technology to tackle the climate crisis and advance health, prosperity, security, environmental quality, equity, and justice for all Americans. Simply supporting R&D is not sufficient; however, Federal agencies should ensure that the R&D results are made widely available to other scientists, to the public to facilitate understanding and decisions, and to innovators and entrepreneurs who can translate them into the businesses and products that will improve all of our lives. And, as we seek to make our supply chains more resilient, R&D investments should create more than just cutting-edge technology; they should also create products that are made in the United States by U.S. workers.

This memorandum outlines the Administration's multi-agency R&D priorities for formulating fiscal year (FY) 2023 Budget submissions to the Office of Management and Budget (OMB). The priorities covered in this memo require continued investments in R&D; science, technology, engineering, and mathematics (STEM) education and engagement; STEM workforce development; technology transfer and commercialization; and research infrastructure, with emphasis on Historically Black Colleges and Universities, other Minority Serving Institutions, and disadvantaged communities who have been historically underserved, marginalized, and adversely affected by persistent poverty and inequality. These priorities should be addressed within the FY 2023 Budget guidance levels provided by OMB.

**OSTP/OMB Memo*

OSTP/OMB R&D Priorities

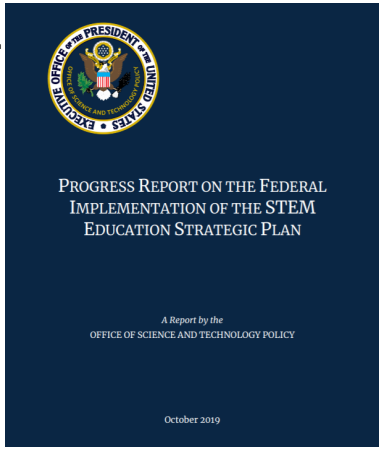
- Pandemic Readiness & Prevention
- Tackling Climate Change
- Catalyze Research and Innovation in Critical and Emerging Technologies
- Innovation for Equity
- National Security and Economic Resilience
- STEM Education and Engagement

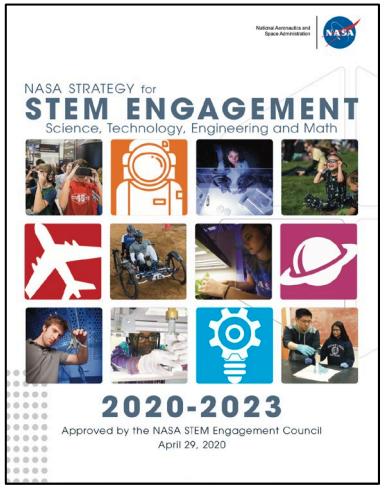
NASA Priorities

- Climate Change
- Equity and Inclusion
- Cybersecurity
- Exploration and Leadership

NASA STEM Engagement Strategic Goals

1. Create unique opportunities for a diverse set of students to contribute to NASA's work in exploration and discovery
2. Build a diverse future STEM workforce by engaging students in authentic learning experiences with NASA's people, content, and facilities
3. Attract diverse groups of students to STEM through learning opportunities that spark interest and provide connections to NASA's mission and work





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

Vice President's First National Space Council Meeting

"We must encourage more of our students to pursue STEM careers."

Vice President Harris
December 1, 2021
Opening remarks at the first meeting of the National Space Council

- Vice President Harris, along with NASA Administrator Nelson and Dept. of Education Secretary Cardona, discussed the importance of STEM in maintaining the competitiveness of the United States and the country's future progress.
- This video shows highlights from their remarks.
- Announced the release of the United States Space Priorities Framework
  - Guides the council's efforts to develop and implement national space policy and strategy
  - Includes language on increasing diversity, equity, accessibility, and inclusion in STEM.

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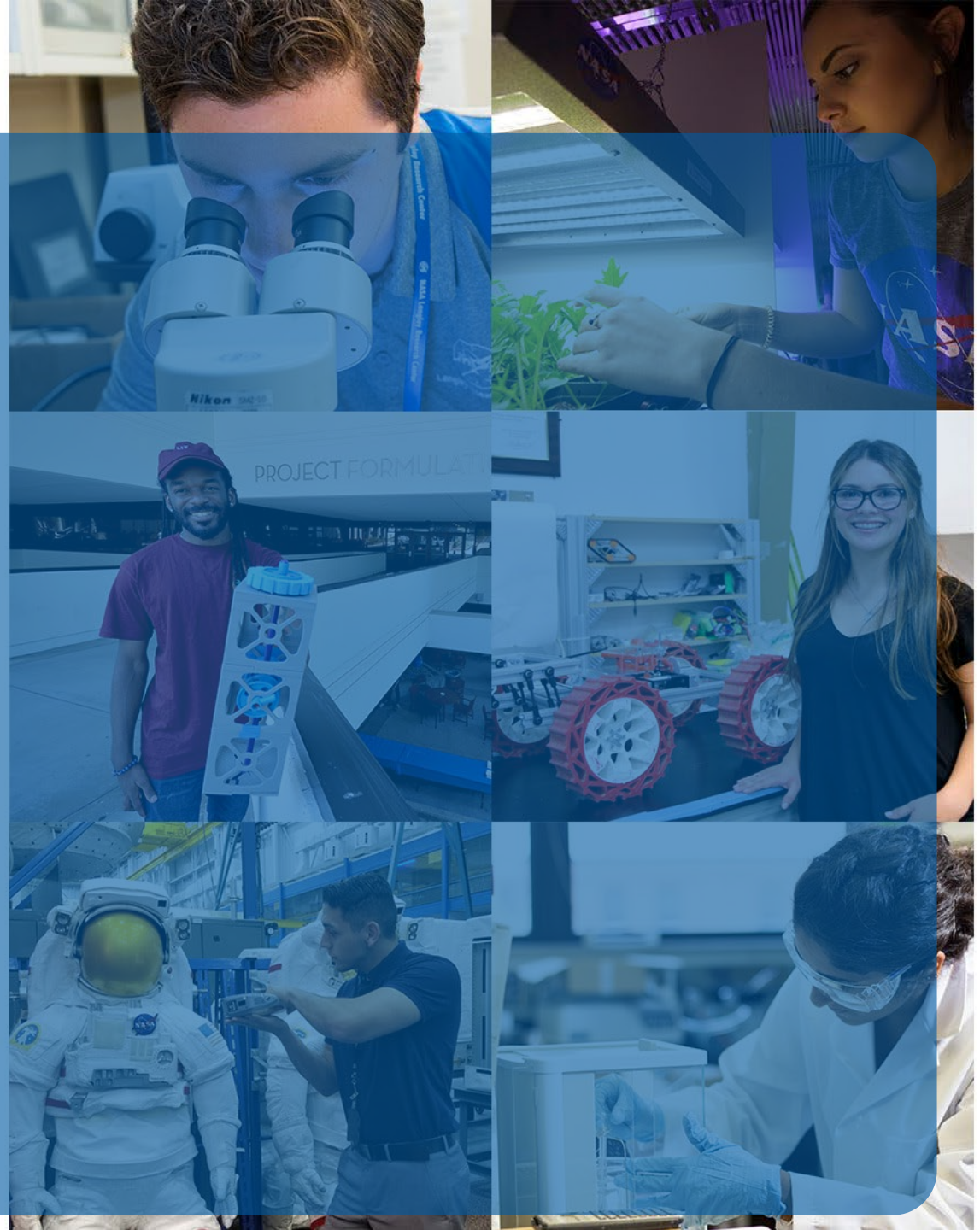
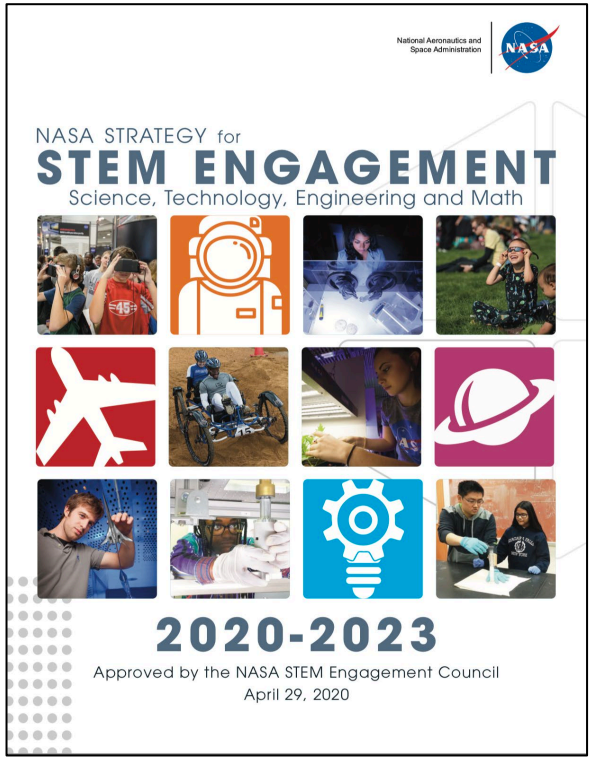


NASA Strategy for STEM Engagement 2020-23



Emphasis on ***diversity, equity and inclusion*** with focus on broadening participation

1

STRATEGIC GOAL 1: Create **unique opportunities** for a diverse set of students to contribute to NASA's work in exploration and discovery.

OBJECTIVES:

1.1 Provide student work experiences that enable students to contribute to NASA's missions and programs, embedded with NASA's STEM practitioners.

1.2 Create structured and widely-accessible experiential learning opportunities for students to engage with NASA's experts and help solve problems that are critical to NASA's mission.

2

STRATEGIC GOAL 2: Build a **diverse future STEM workforce** by engaging students in authentic learning **experiences** with NASA's people, content and facilities.

OBJECTIVES:

2.1 Develop and deploy a continuum of STEM experiences through authentic learning and research opportunities with NASA's people and work to cultivate student interest, including students from unrepresented and underserved communities, in pursuing STEM careers and foster interest in aerospace fields.

2.2 Design the portfolio of NASA STEM engagement opportunities to contribute toward meeting Agency workforce requirements and serving the nation's aerospace and relevant STEM needs.

3

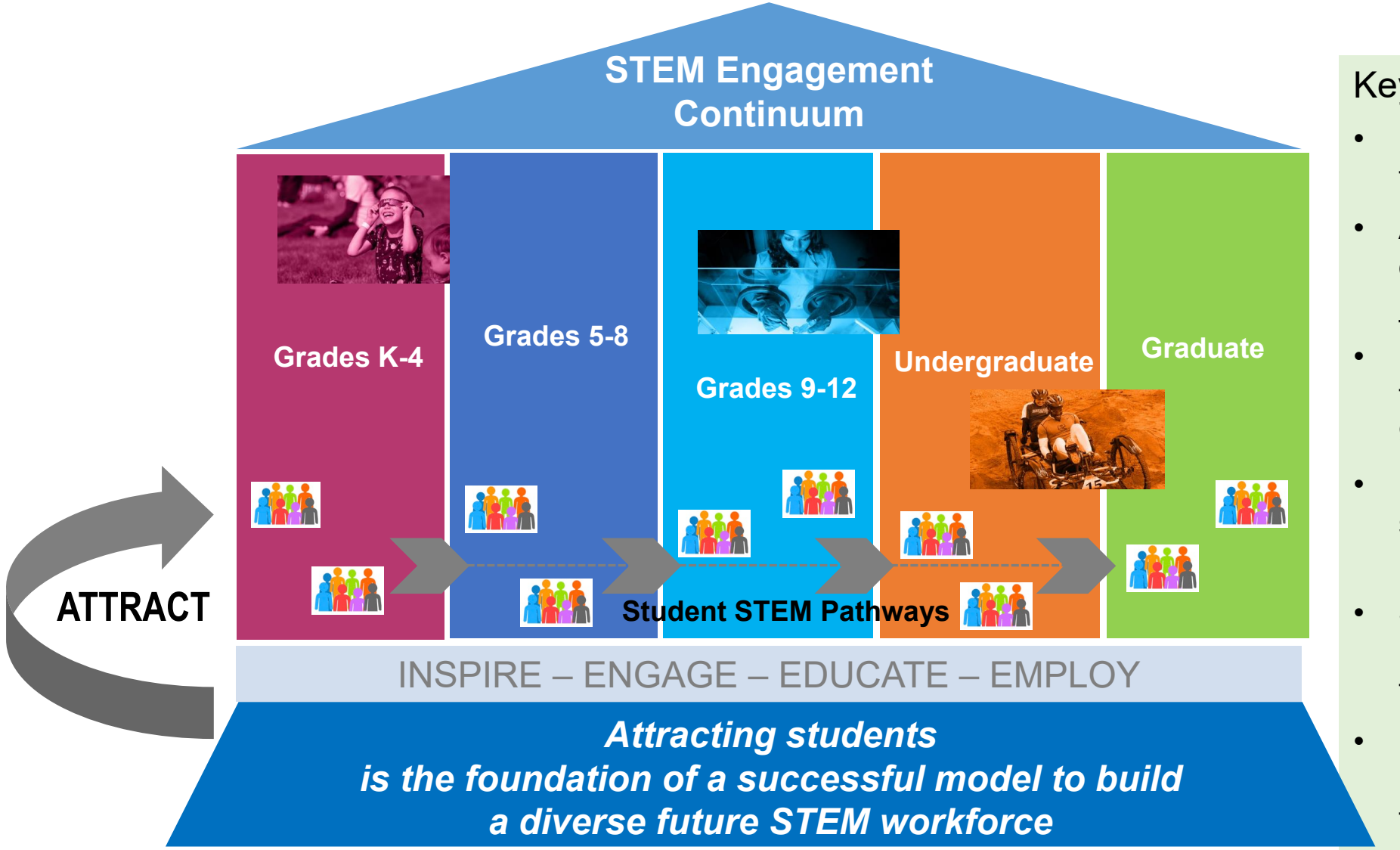
STRATEGIC GOAL 3: Attract diverse groups of students to STEM through learning opportunities that **spark interest** and **provide connections** to NASA's mission and work.

OBJECTIVES:

3.1 Attract a broad and diverse set of students to STEM through targeted opportunities and readily available NASA STEM engagement resources and content.

3.2 Foster student exposure to STEM careers through direct and virtual experiences with NASA's people and work.

NASA STEM ENGAGEMENT



Key Elements Moving Forward:

- Evidence-based opportunities that attract students (Gr K-5)
- Accessible and engaging opportunities that enable STEM pathways (Gr K-8)
- Immersive, experiential learning that leads to STEM pursuits (Gr 9-12)
- Experiences to support successful workforce entry (Higher Ed)
- Strategies to broaden student participation at all points along the continuum
- Partnerships and networks to build essential connections to the STEM ecosystem

STEM Engagement Strategic Direction - FY2022-23 Focus Areas

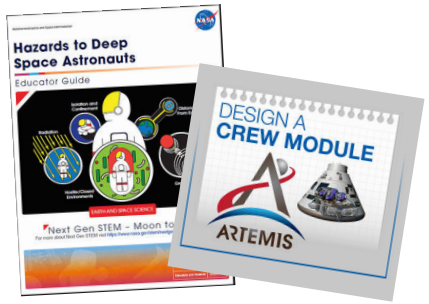
- ***Implement strategies to broaden student participation*** *to* ***increase diversity, equity, and inclusion in STEM*** *through NASA opportunities and activities.*
- ***Continue to build productive strategic partnerships and networks****, expanding NASA's STEM ecosystem to magnify reach and impact.*
- ***Expand NASA contributions in engaging K-12 students*** *in STEM pathways, with an approach toward a continuum of experiences.*

NASA STEM Engagement Resources and Opportunities

NASA Resources Available to Educators

Educator Resources and Awards

- Standards-aligned lessons, educator guides, activities, and supplements



Professional Development Opportunities

- Trainings and opportunities through the Educator Professional Development Collaborative (EPDC)
- NASA CONNECTS Community of Practice

NASA EPDC STEM EDUCATOR PROFESSIONAL DEVELOPMENT COLLABORATIVE

Where to Access

- Our website, **stem.nasa.gov**
- **NASA EXPRESS Newsletter**, a weekly email bringing you the latest STEM resources and activities directly to your inbox!
- Follow **NASA STEM** on Facebook, Twitter, YouTube and Pinterest

NASA CONNECTS COMMUNITY OF PRACTICE

An online, professional learning community for educators to collaborate with each other and NASA.

- Join Discussions & Connect With Others
- Ask Questions & Get Answers
- Share & Discover New Best Practices
- Download Free STEM Products
- Learn About Upcoming Events
- See The Latest Opportunities
- Museum & Informal Education Alliance

Ways Students Can Engage With NASA

Where Students Can Learn More

- Our website, **stem.nasa.gov**
- Internship website, **intern.nasa.gov**
- Follow **NASA STEM** on Facebook, Twitter, YouTube and Pinterest

Student Challenges and Experiences

- Lunabotics Junior (K-12) Challenge
- NASA GLOBE
- Artemis Student Challenges
- NASA SPARX Challenges and Competitions
- NASA Community College Aerospace Scholars

Internships

Students 16 years and older can apply for internships at NASA.

NASA Internships Program

Key Elements*

- U.S. Citizen
- Cumulative 3.00 GPA (on a 4.0 scale)
- Full –time student
- 16+ years of age
- Stipend payment
- Sessions: Summer, Fall and Spring

Virtual internships available

* Learn more at intern.nasa.gov

ARTEMIS STUDENT CHALLENGES

NASA is committed to landing the first woman and first person of color on the Moon using innovative technologies to explore more of the lunar surface than ever before! Discover the Artemis Student Challenges and explore how you can take part in one of NASA's mission-related challenges.

Student Launch is a research-based, competitive experiential exploration activity open to colleges, universities, high schools, and middle schools. It strives to provide relevant, cost-effective research and development of rocket propulsion systems.

Human Exploration Rover Challenge (HERC) is an annual competition that challenges high school and college students worldwide to create a vehicle designed to traverse the simulated surface of another world.

Micro-g Neutral Buoyancy Experiment Design Teams (Micro-g NExT) encourages undergraduate students to design, build, and test a tool or device that addresses an authentic, current space exploration challenge.

First Nations Launch Competition provides Native American college students the opportunity to build and launch class K high-powered rockets. Teams attend workshops to learn concepts necessary for a successful launch.

NASA Spacesuit User Interface Technologies for Students (SUITS) Design Challenge requires undergraduate and graduate student teams to design and create spacesuit information displays within an augmented reality environment.

Lunabotics Competition challenges university-level teams to design, build, and run their autonomously operated robot, traverse the simulated off-world terrain, and excavate the simulated lunar regolith.

Big Idea Challenge is an annual, open innovation challenge seeking new concepts and creative solutions from student teams at Space Grant-affiliated colleges and universities. These teams support the Space Technology Mission Directorate's work maturing high-impact technologies for a broad array of NASA missions.

NASA STEM
INSPIRE · ENGAGE · EDUCATE · EMPLOY

To learn more about the Artemis Student Challenges visit stem.nasa.gov/artemis

Getting Students Excited About Artemis

NASA's Artemis Student Challenges

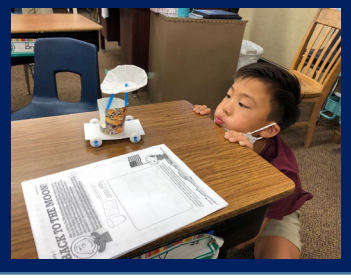
Middle, high school, undergraduate and graduate students compete in Artemis Student Challenges while building foundational knowledge on topics and technologies critical to the success of Artemis.

Artemis Launch and Splashdown Event Planning Guide

A comprehensive guide of Artemis topics, resources, and activities aligned with national STEM education standards to get you and your students actively engaged in Artemis.

Artemis Learning Pathway

An eight-week e-newsletter series bringing the latest Artemis-related resources directly to your inbox surrounding the Artemis I launch.

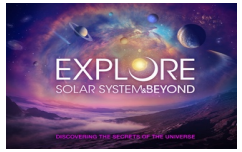


Explore the many ways you can get your student excited about the Artemis missions at: stem.nasa.gov/artemis/

Program Updates and Recent Accomplishments

STEM Engagement Program Elements

NASA's Mission Thematic Areas



NASA STEM Engagement Projects

Space Grant

A national network of colleges and universities with over 1,000 affiliate institutions and organizations located in all 50 states, the District of Columbia, and Puerto Rico.

Purpose: Expands opportunities for students to participate in NASA's aeronautics and space projects.

EPSCoR

The Established Program to Stimulate Competitive Research (EPSCoR) funds partnerships with government, higher education, and industry in 28 eligible jurisdictions (25 states and three territories).

Purpose: Effects sustainable improvements in a state or region's research infrastructure, capacity, and competitiveness.

MUREP

The Minority University Research and Education Project (MUREP) supports minority-serving institutions (MSIs) to enhance research, academic, and technology capabilities.

Purpose: Increases retention of underserved and underrepresented groups in STEM.

Next Gen STEM

Next Generation STEM (Next Gen STEM) creates K-12 and informal education STEM engagement initiatives aligned to NASA mission priorities.

Purpose: Attracts and retains student interest in STEM careers, building a vibrant next-generation workforce.

Enabling Cross-Cutting Functions

Educational Tools and Platforms

Focus: Access and scalability

- Suite of tools and platforms enabling student engagement and data collection
  - NASA STEM Gateway (Phase 1 operational in early FY21)
  - stem.nasa.gov
  - intern.nasa.gov
  - NASA STEM@Home

Performance Measurement and Evaluation

Focus: Outcomes and metrics

- Learning agenda
- Targeted studies

Strategic Partnerships

Focus: Scalability

- Comprehensive approach to foster and stimulate strategic partnerships
- New strategy began in FY 2020

Internships and Fellowships

Focus: Diversity and Inclusion

- Enterprise model in collaboration with mission directorates and centers

STEM Engagement Beneficiaries


K-Elementary School


Middle School

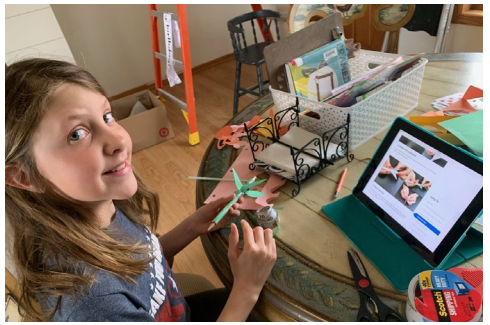

High School


Undergraduate


Graduate

NOTABLE FY2021 ACCOMPLISHMENTS: SPACE GRANT

- Expanded partnerships with other NASA mission directorates to further align Space Grant with NASA's mission objectives
  - BIG Idea Challenge - $1M+ to 7 university teams in FY21
  - Artemis Student Challenges - $2.4M in grants to 6 different states
  - SMD selected two different Space Grant lead institutions to oversee awards of $30M+ (including $3M+ of Space Grant funds) for activities associated with Climate and the 2024 Eclipse



FY2021 Notable Accomplishments: Space Grant – Mission Directorate Partnerships

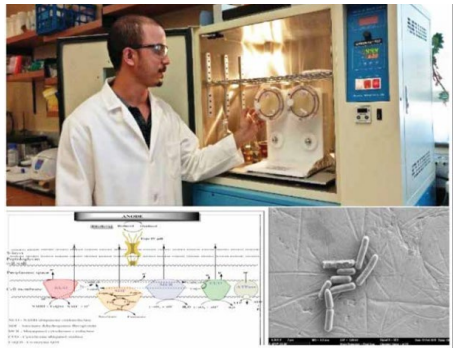
STMD:
Almost $1M in awards in FY2021 to seven state teams

HEO, STMD, SMD, and others:
Increased participation with SMEs and completed reviews of the extension proposals

SMD:
Partnering on expanding the reach of Science-related activities with total funding of $32M and an additional $3M in co-funding from Space Grant

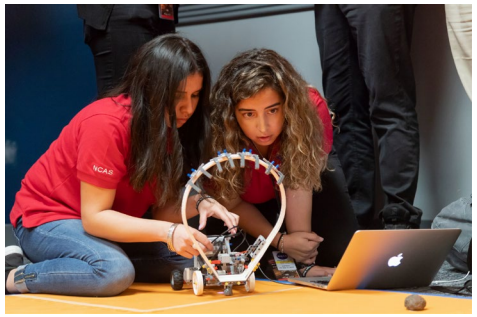
NOTABLE FY2021 ACCOMPLISHMENTS: EPSCoR

- Issued FY2021 awards at total of $22.9M direct awards to jurisdictions in partnership with mission directorates:
  - 28 Research Infrastructure Development (RID) awards: $4.9M
  - 16 Research Awards: $12M
  - 4 Suborbital Flight Opportunity Awards: $1.26M
  - 43 Rapid Response Research (R3): $4.3M
- Established partnership with NSF for Fellows Advancing in Science and Technology (FAST) pilot specifically focusing on Institutions of Higher Education, women's colleges and Primarily Undergraduate Institutions that serve underrepresented students Evaluation Awardees



NOTABLE FY2021 ACCOMPLISHMENTS: MUREP

- Provided 34 new awards to MSIs in direct collaboration/alignment with the Mission Directorates
- Issued 6 new MUREP INCLUDES awards to Broaden Participation in Engineering
- Developed 2 new Memorandums of Understanding to solidify engagement with NSF and Dept of Education



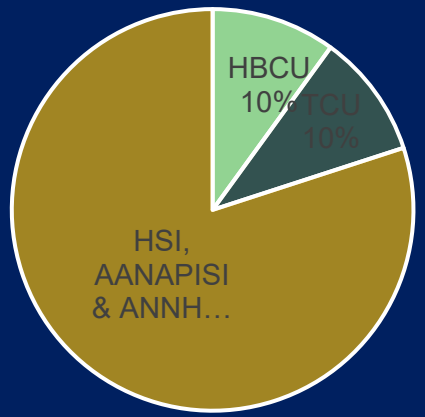
FY2021 Notable Accomplishments: MUREP Engagement with NASA's Earth Sciences Division

MUREP Ocean Biology and Biogeochemistry (OCEAN)

Building capacity at MSIs to participate in NASA's SMD / Earth Science research opportunities.

New Funding Opportunity:
Up to $250k per year
maximum 3 years

About $6.6M in awards went to 10 MSIs in partnership with SMD



OCEAN Awards by MSI Type

OCEAN Awardees

- Florida Atlantic University, Boca Raton
- University of Alaska, Fairbanks
- Northwest Indian College Foundation, Bellingham, Washington
- University of California, Irvine
- Texas State University, San Marcos
- University of California, Merced
- University of Puerto Rico, Mayagüez
- University of Hawaii Systems, Hilo
- University of the Virgin Islands, Charlotte Amalie
- University of Massachusetts, Boston

NOTABLE FY2021 ACCOMPLISHMENTS: NEXT GEN STEM

- Completed intensive project re-design to include new focus areas for design and delivery of products and opportunities
  - Evidence-driven design and mission alignment
- Initiated new Community of Practice (CONNECTS) environment for all types of educators
  - Began pilot phase with select educators providing real-time feedback
- Developed new structure for student challenges and competitions
  - Designed to lower barriers to entry, increase participation and be more inclusive of underserved/underrepresented students
- Completed conceptual design of subject matter expert training and support program to engage NASA STEM professionals in strategic and effective student engagement

NOTABLE FY2021 ACCOMPLISHMENTS: NEXT GEN STEM

TEAM II Informal Education Institution Awards and MIE Alliance

- Implemented a two-tier award structure, adding small **Community Anchor** awards to encourage participation of smaller institutions and to create a cohort of Community Anchors to partner with NGS and NASA in advancing diversity, equity and inclusion in STEM
- Released two-tier solicitation in April 2021. Selections made in December 2021.

Institution	Project	Award $
FY21 TEAM II Awards		
Space Science Institute, Boulder, CO	From Our Town to the Moon, Mars and Beyond	$998,198
The Science Center, Ithaca, NY	Explore Science, Destination Moon	$998,433
The Franklin Institute, Philadelphia, PA	Mission to Mars: Boosting Community Engagement with NASA Resources	$999,807
FY22 TEAM II Awards		
Orlando Science Center, Orlando, Florida	National Engineering Design Challenge with Orlando Science Center	$800,000
North Carolina Museum of Life and Science, Durham, NC	Sparking Interest in STEM Among Hispanic Learners Nationwide Through Meaningful Connections to NASA Explorations and Discoveries	$799,983
Franklin County Historical Society, Columbus, OH	The NASA Learning Lunchbox – Feeding STEM Diversity and Serving Underserved Youth with NASA Artemis and the James Webb Telescope Across the Nation	$799,921

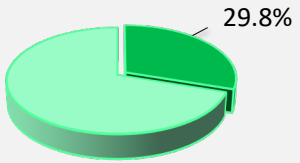
FY2020 STEM Engagement Performance at a Glance

Higher Education Students

In Fiscal Year 2020, NASA provided **6,410** internships, fellowships, scholarships, and other sustained engagement opportunities (e.g., engineering design challenges, student competitions) to 5,992 higher education students across all institutional categories and levels. These significant awards provided a total of over **$38M** in direct financial support to higher education students.

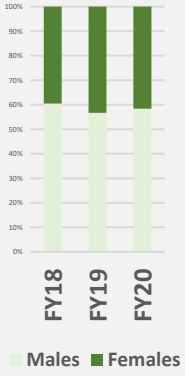
29.8% of participants in these opportunities were racially or ethnically underrepresented students, exceeding the national average of 26.2% for underrepresented students enrolled in STEM degree programs.

Underrepresented Race or Ethnicity



Additionally, **41.6%** of the Agency's higher education internships and fellowship positions were filled by women.

Significant Awards by Sex



Research and Development

NASA's performance in providing opportunities for learners to contribute to NASA's aeronautics, space, and science missions and work is assessed across peer-reviewed publications and technical paper presentations directly resulting from research funded by NASA STEM Engagement grants and awards to higher education institutions.

1,831

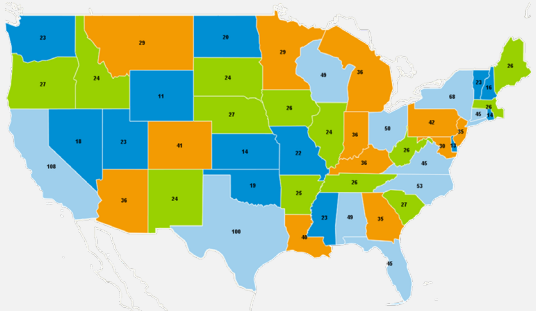
Space Grant, MUREP, and EPSCoR grantee and awardee institutions reported 1,831 peer-reviewed publications and technical papers and presentations in FY 2020.

Notably, **40%** percent of the peer-reviewed publications were authored or coauthored by students.

Additionally, **79** patents were awarded to higher education institutions as a direct result of their NASA STEM Engagement grants or cooperative agreements.

Collaborators

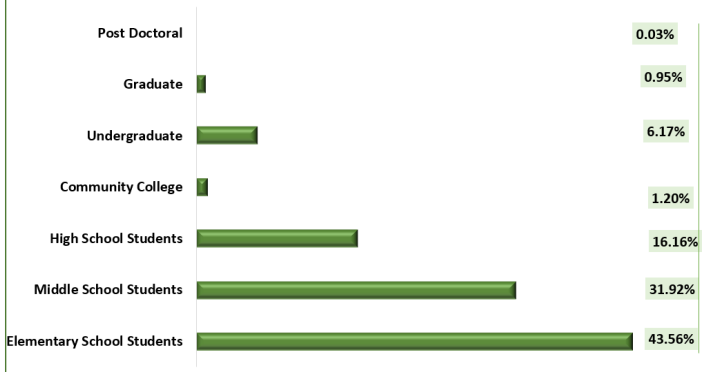
1,672



NASA's Office of STEM Engagement collaborators are funded and unfunded and located in all 50 states, DC, GU, PR, and VI. Collaborators include: government agencies, industry, formal and informal education institutions including museums, science centers, planetariums, and youth-serving organizations, non-profit, and other education organizations. Collaborators extend the reach of NASA STEM engagement opportunities by supporting the execution of an opportunity. In FY 2020 OSTEM collaborated with 1,672 institutions and organizations.

Engaging Students in NASA Missions

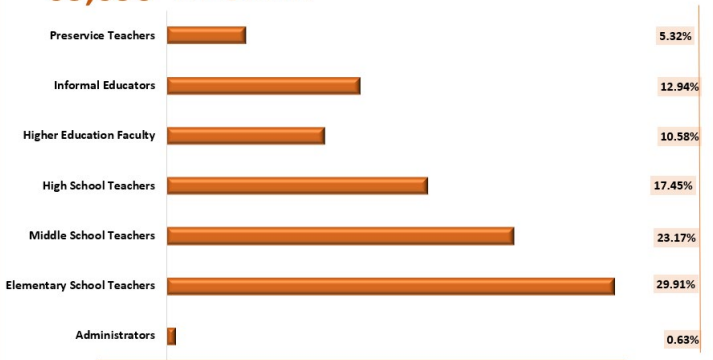
586,400 Students participated in NASA STEM engagement Activities



* Participation numbers are self-reported by external grantees, awardees, and collaborators.

Training STEM Educators to Engage the Next Generation of STEM Researchers and Explorers

65,090 Educators participated in NASA STEM engagement training Activities



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NASA STEM Engagement Highlights Report 2021

Targeted Release:

February 2022

Link to Highlights 2020:
https://www.nasa.gov/sites/default/files/atoms/files/nasa_ostem_highlights_2020_0.pdf

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CONNECTING WITH NASA STEM IN FY2021

96,107 Facebook followers

355,317 Twitter followers

437,955 Pinterest followers

332,738 views on YouTube

56,109 NASA EXPRESS subscribers

Follow and connect @NASASTEM or stem.nasa.gov

Average time spent on website ⇧ **17.5%** from FY20 to FY21

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Landscape

Overview of STEM Engagement

NAC Topics Review

Broadening Participation

K-12 Efforts

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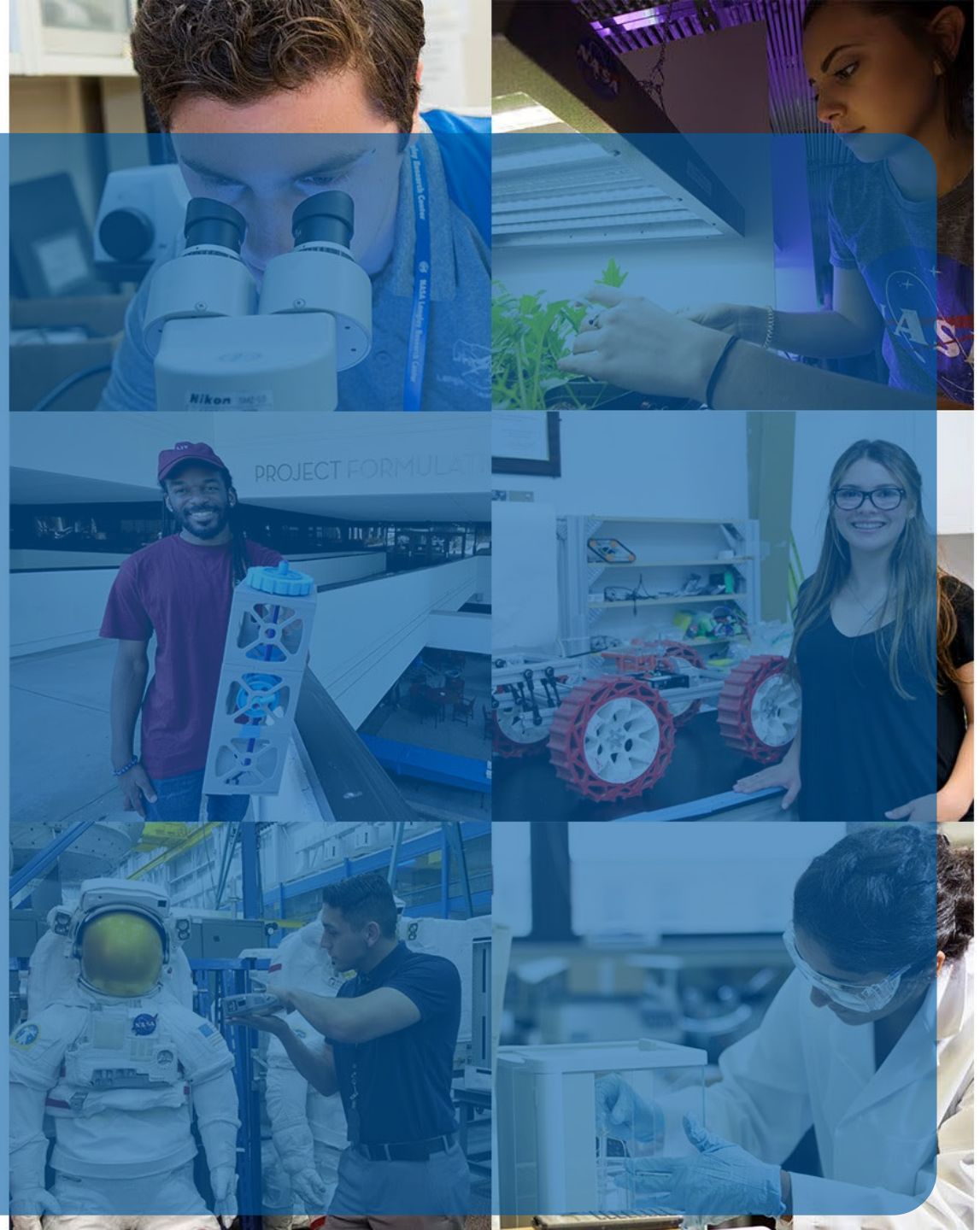
Measuring Success

Discussion



Discussion Topics from the Last NAC Meeting

- **COVID-19**
  - Equity issues – highlight this to the NAC
  - What can NASA STEM Engagement do to support the STEM ecosystem? Helping those who are struggling and helping them be nimble, effectively partner
  - Intersections between formal and informal learning environments, and how OSTEM can bridge these environments
  - NASA should emphasize flexibility permitted in OMB guidance, particularly in scholarships, internships and fellowships
  - Opportunity for NASA resources to provide support to those who need internet access?
  - How will COVID-19 impact the implementation of the strategic plan?
  - Thanks to NASA for their quick response with NASA STEM @ Home materials

Discussion Topics from the Last NAC Meeting

- **Strategic Plan**
  - Strategic goals are a positive, particularly goal three
  - Clarity in alignment between the goals and design principles
  - Need a strong baseline of data from which to measure progress
  - Suggest to prioritize objectives
  - At the objective level, how are underrepresented/underserved communities called out? Or should they be called out?

Discussion Topics from the Last NAC Meeting

- **MUREP**
  - Pleased with progress of this program, particularly with regard to intentionality
  - Positive partnership with NSF INCLUDES
  - Consideration for other partnerships within MUREP? (Science centers, informal learning, for science communication, etc.)
  - What is the 1% contracting goal? – Agency goal from procurement office – want to have more MSIs gain NASA contracts (OSTEM has aided in this endeavor, particularly through Road Tour)
  - More movement for joint partnerships with other agencies and MSIs? Torry – yes, we have ongoing discussions with NSF via NSF INCLUDES for potential partnerships
  - Like to better understand the amount of funding allocated to the different pillars
    - Torry – current portfolio includes about 30-40% funding for research. Working with mission directorates to craft synergies with OSTEM solicitations so outputs are valuable for MSIs and the agency
  - Capacity building should be a main priority, as other capabilities can follow
    - Opportunity for MSIs to form collaborations with majority institutions to support capacity building throughout the OSTEM programs
  - **Recommendation** – emphasize the importance of MSI engagement; partnerships to support MSIs
  - Work with community colleges is important to highlight
  - MUREP will “permeate” the strategic plan – help make this happen

Discussion Topics from the Last NAC Meeting

- **Other thoughts/comments**
  - Opportunity for NASA to play a convening role in the reinvention of the ecosystem. How can NASA bring the ecosystem together? (Similar to the Apollo Anniversary efforts) Encourage that we bring together the community we support (across OSTEM and SMD)
  - Bring together NASA and NSF to look at learning in virtual, formal, and informal contexts, and the intersections of these contexts, during and post-COVID-19. How can NASA look at the impacts of COVID-19?
    - Potential connection to broader federal community/FC-STEM?
    - What can be done via cell phone connection vs. on a desktop/laptop? This is related to equity concerns regarding who we are reaching.

Findings – Do Not Require Action

- NASA has had a great response to the COVID-19 outbreak, particularly NASA STEM @ Home resources, NASA's use of the flexibilities provided via OMB to support the STEM ecosystem
- Positive progress on the STEM Strategic Plan
- The COVID-19 crisis has highlighted the importance of access and diversity, equity, and inclusion
- MSIs are important to "permeate" across the strategic plan and agency more broadly
- Important to continue to measure the impacts of NASA STEM Engagement investments, and articulate their impacts. This work is underway. Metrics should help NASA STEM Engagement look ahead.
- 10-year cooperative agreements provide the ability to see longitudinal impacts of activities, but the agency must monitor the activity (as is appropriate for a cooperative agreement)
- Professional societies and associations (of all types) can amplify NASA STEM Engagement messaging and resources to broader audiences, particularly those OSTEM cannot reach alone

Recommendations – Require Action

- Keep up emphasis on strategic plan – integration and use of this across the MDs
  - Consequences – lack of coordination across the agency on STEM activities, could lead to duplication of efforts, unaddressed priorities
- Administrator and the Mission Directorates, along with the Office of Procurement, should ensure that there are higher goals to build research capabilities at MSIs. NASA should support and create infrastructure to sustain MSIs, to enable them to be competitive and be successful in contributing to NASA work. This helps build a strong K-12 pipeline of interest and engagement.
  - Consequences – lack of coordination, impedes NASA's capability to build a diverse workforce for the future
- NASA should continue collaborating with NSF and other FC-STEM agencies to convene and support the STEM community in navigating reinvention/recovery from COVID-19. NASA alone cannot solve this.
  - Consequences – lack of coordination around recovery efforts; duplication of efforts; gaps in support for the community; could impact metrics/evaluation efforts

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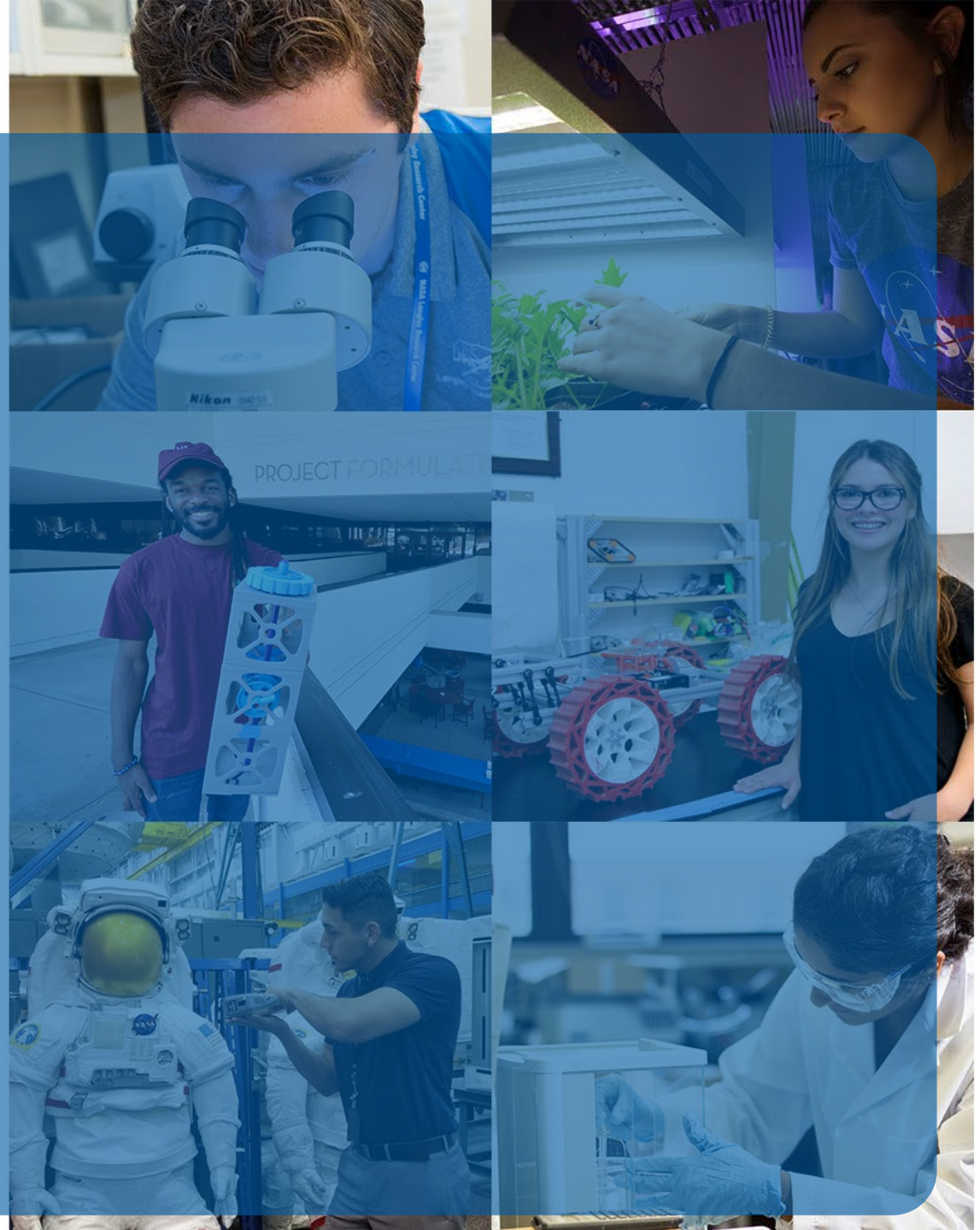


NASA's Commitment to DEIA

"NASA is fully committed to Diversity, Equity, Inclusion, and Accessibility (DEIA) for our entire workforce and all our workplaces. This means our Agency will continually prioritize the following: reinforcing a culture in which our employees feel they can be authentic, welcomed, respected, included, and engaged; maintaining an environment where our employees consistently and systematically receive fair, just, and impartial treatment; and ensuring our employees can fully and independently access facilities, information and communication technology, programs, and services."

Sen. Bill Nelson
NASA Administrator

September 29, 2021

Focus Area: Broadening Student Participation

Purpose: *Provides an integrated set of efforts for broadening student participation to increase diversity, equity, and inclusion in STEM through NASA opportunities and activities.*

Overarching Goals:

1. Enhance communications and stakeholder engagement and build networks and relationships.
2. Strengthen practices and systems.
3. Focus on metrics and evaluation to effectively measure progress.
4. Drive a collective focus across NASA's STEM Engagement community.

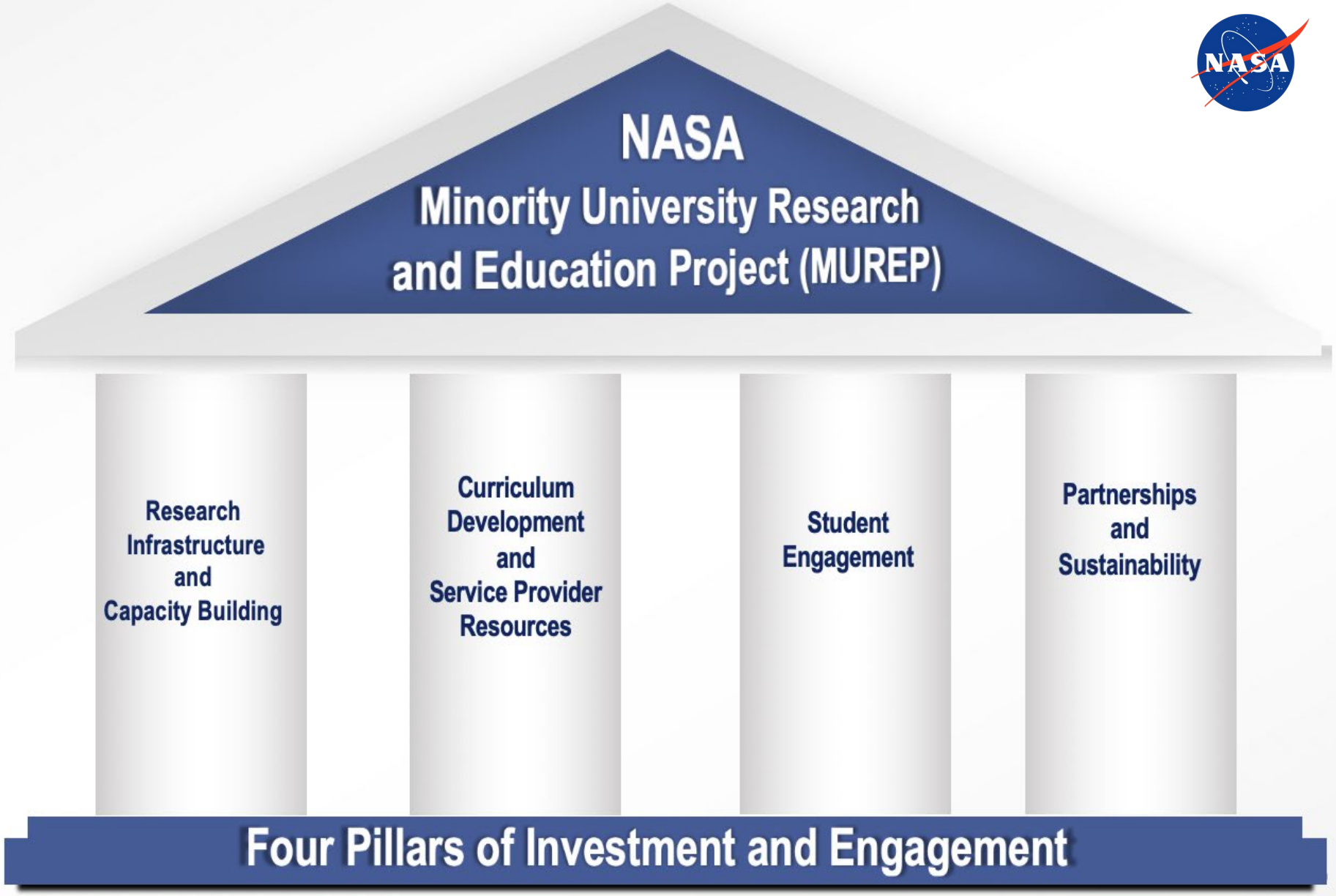
Efforts to Broaden Student Participation

Where Are We Headed?

- Reexamining existing efforts
- Reevaluating **target goals** and developing a **formalized feedback process**
- Integrating DEIA in award solicitations
- FY 21 **performance assessment** and **evaluation studies**
- **Expanding partnerships** with other federal agencies (NSF, DoD, ED, NOAA)
- Strategically **leveraging partners, networks and influencers** to expand reach to underrepresented/ underserved students

MUREP VISION

To enhance the **research**, **academic** and **technological capabilities** at MSIs by providing authentic **student learning experiences** related to **NASA missions** that contribute to a **diverse future STEM Workforce.**



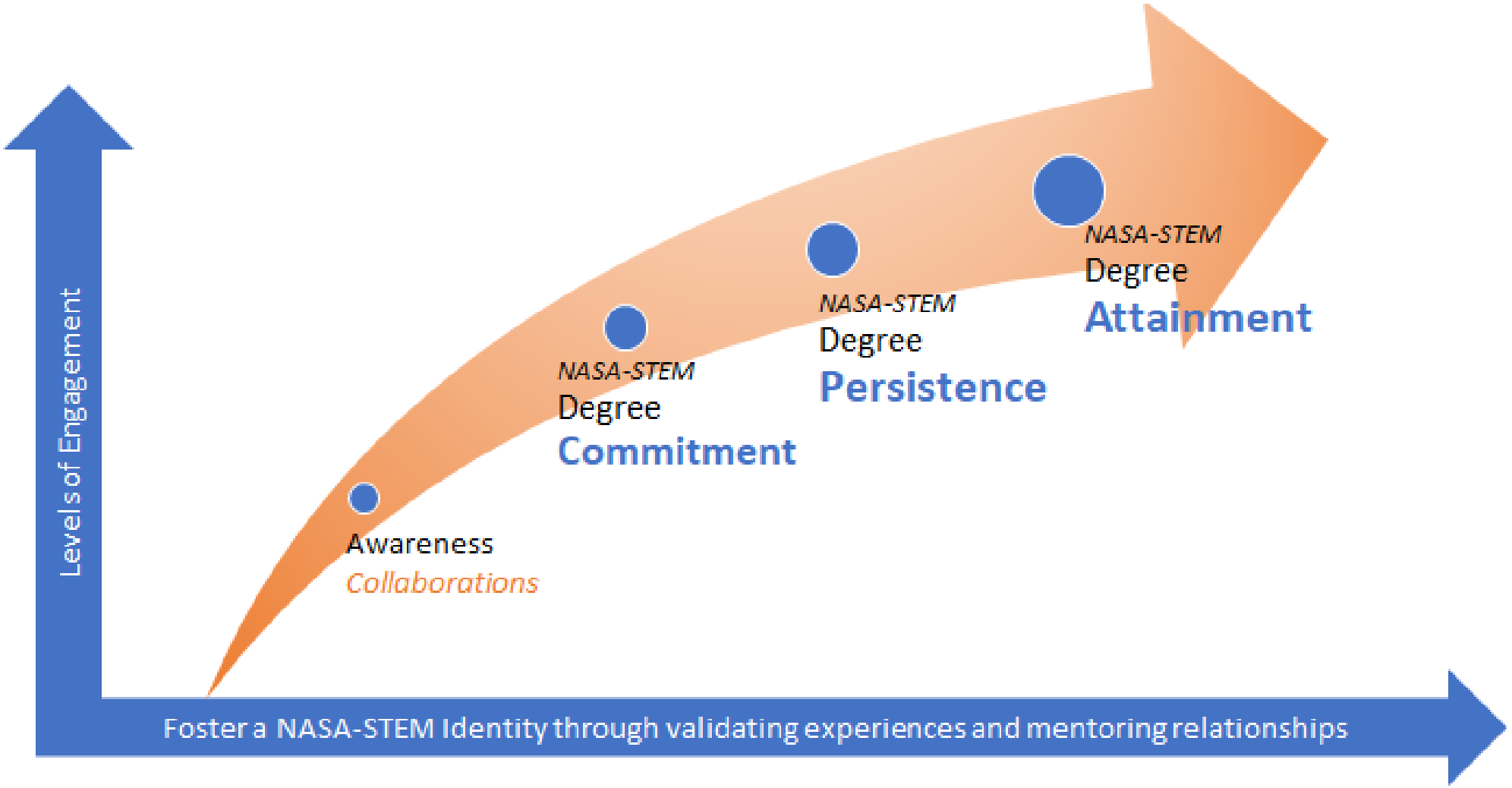
MINORITY UNIVERSITY RESEARCH AND EDUCATION PROJECT (MUREP)
PURPOSE AND STATUTORY AUTHORITY

AGENCY RESPONSE TO FEDERAL EXECUTIVE ORDERS FOR MINORITY SERVING INSTITUTIONS (MSIs)

MUREP is established to increase NASA's responsiveness to federal mandates related to MSIs and underrepresented and underserved communities, including women, girls, persons with disabilities and veterans.

- **EO 13779**: White House Initiative to Promote Excellence and Innovation at Historically Black Colleges and Universities (HBCU)
- **EO 13621**: White House Initiative on Educational Excellence for African Americans (PBI)
- **EO 13592**: Improving American Indian and Alaska Native Educational Opportunities and Strengthening Tribal Colleges and Universities (TCU/NASNTI)
- **EO 13935**: White House Hispanic Prosperity Initiative (HSI)
- **EO 13515**: Increasing Participation of Asian Americans and Pacific Islanders in Federal Programs (AANAPISI / ANNH)

MUREP STUDENT ENGAGEMENT CONTINUUM



NASA INTERNSHIPS DE&I FOCUS

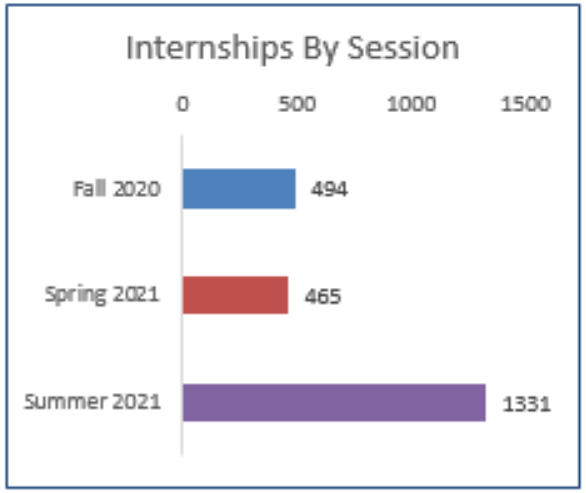
FY 21-23 Action Plan

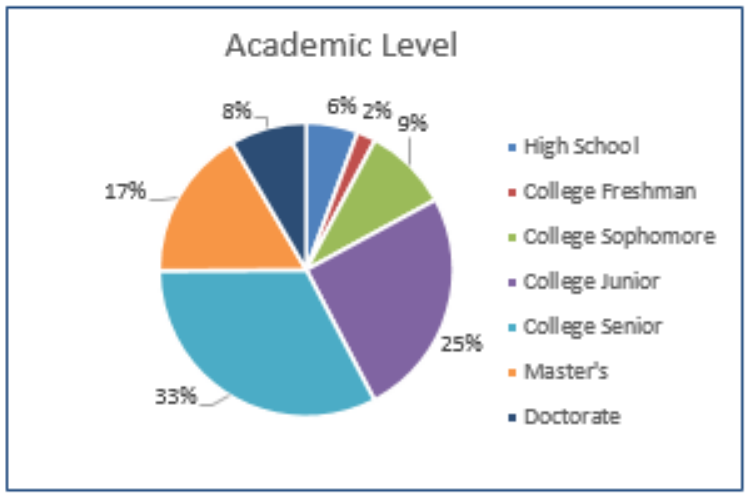
1. Identify barriers and inequalities in the recruitment and selection process
2. Increase outreach with minority-serving institutions
3. Build awareness through partnerships with internal and external stakeholders
4. Strengthen practices and systems Agency-wide
5. Establish a full-time MUREP internship coordinator
6. Increase HBCU placements

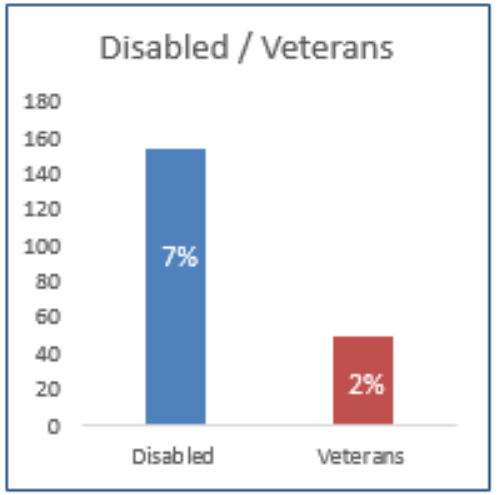
NASA Internships Summary - FY2021 (Fall 2020, Spring 2021, Summer 2021)

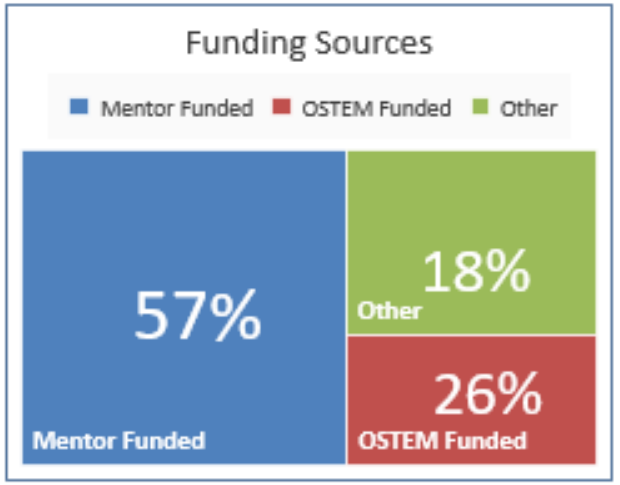
Total OSTEM Interns FY 2021: 2290

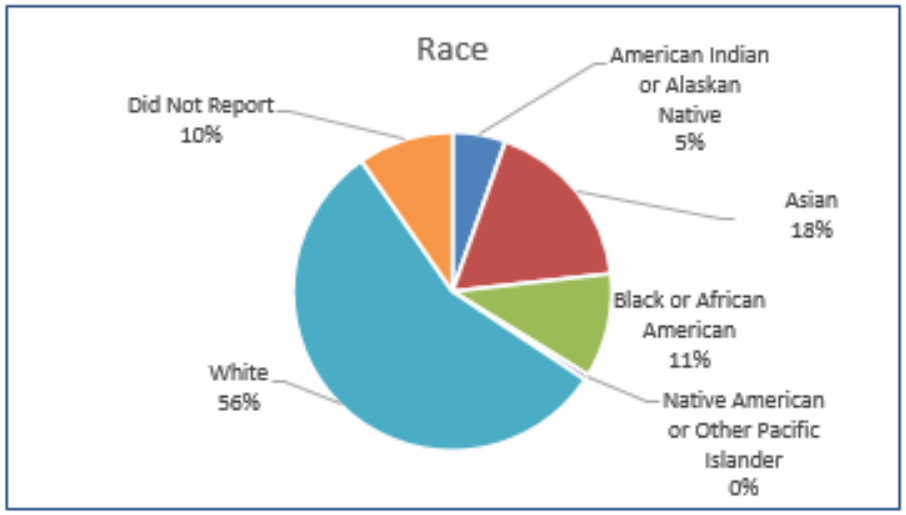
Data Based on Einstein Analytics

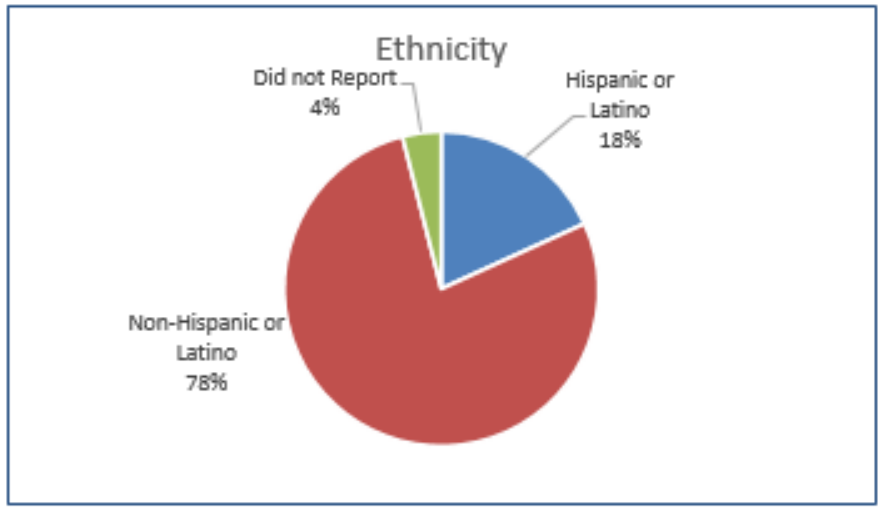


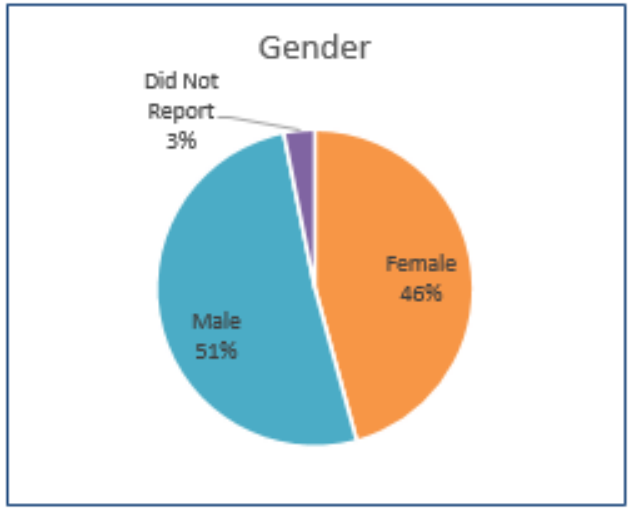












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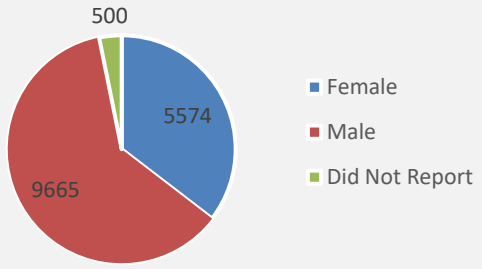
NASA Internships Diversity Results
Summer 2020 compared to Summer 2021

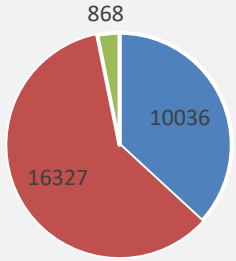
Applicant Pool - Diversity

Race/Ethnicity	Summer 2020	Summer 2021	% of Increase
American Indian or Alaskan Native	836	1663	99%
Asian	3231	6509	101%
Black or African American	1375	2172	58%
Native Hawaiian or other Pacific Islander	145	224	54%
Hispanic or Latino	2429	4417	82%
White	10049	16241	62%
Did Not Report	1406	2456	75%

Summer 2020 - Gender



Summer 2021 - Gender



% Change: Female = 80% / Male = 69%

Total Applicants

Session	# of Applicants
Summer 2020	15,739
Summer 2021	27,231

73% Increase

Total Selected Interns

Session	# of Interns
Summer 2020	1,163
Summer 2021	1,331

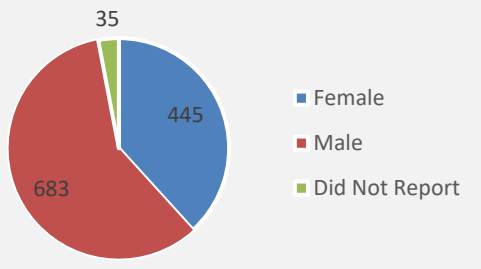
14% Increase

Diversity is self-reported. Students may select multiple races.

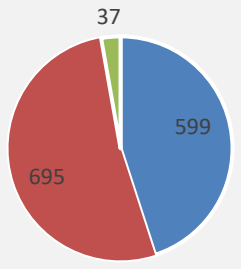
Selected Intern - Diversity

Race/Ethnicity	Summer 2020	Summer 2021	% of Increase
American Indian or Alaskan Native	71	79	11%
Asian	187	264	41%
Black or African American	121	162	34%
Native Hawaiian or other Pacific Islander	8	6	(25%)
Hispanic or Latino	171	218	27%
White	782	811	4%
Did Not Report	103	115	12%

Summer 2020



Summer 2021



% Change: Female = 35% / Male = 2%

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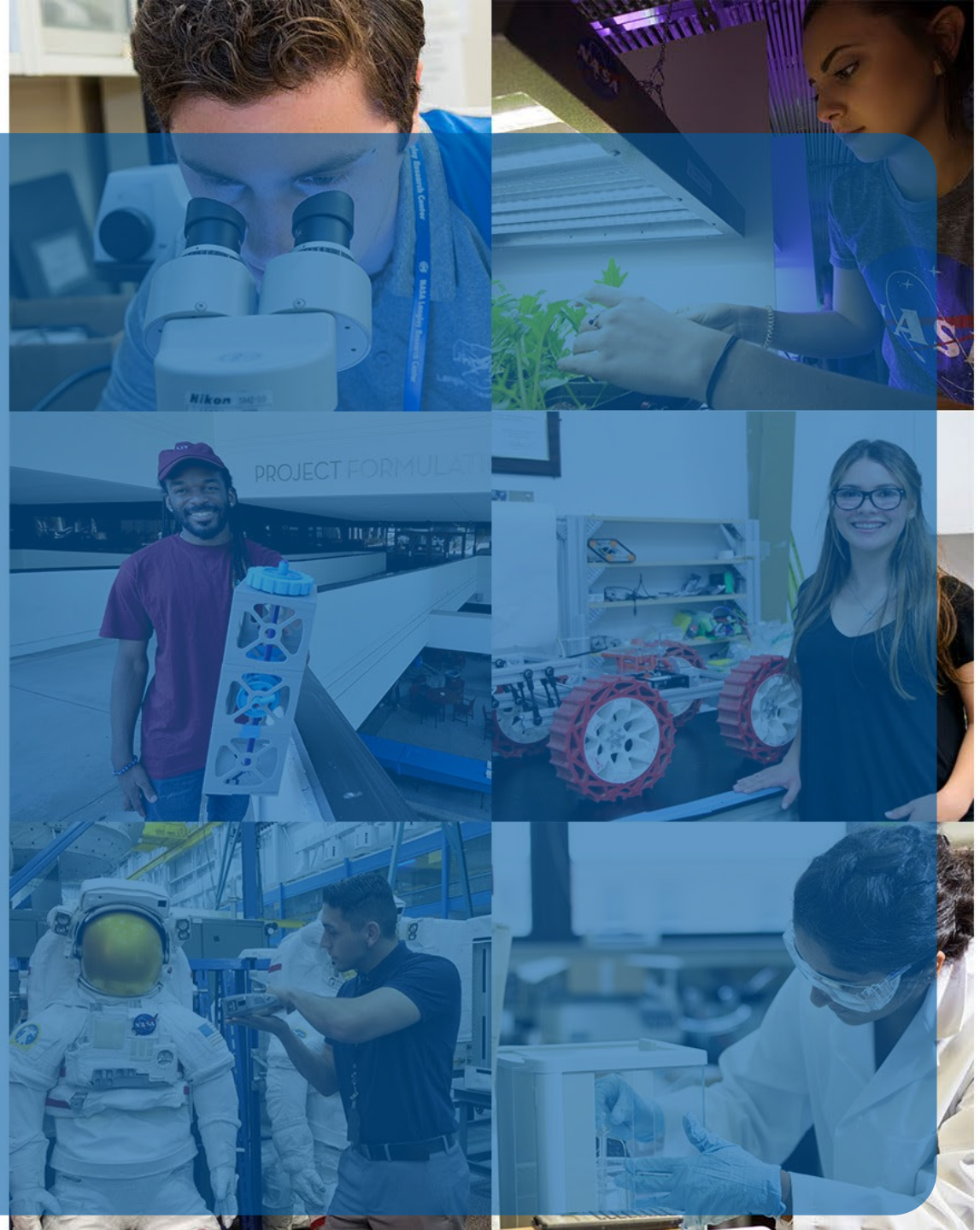
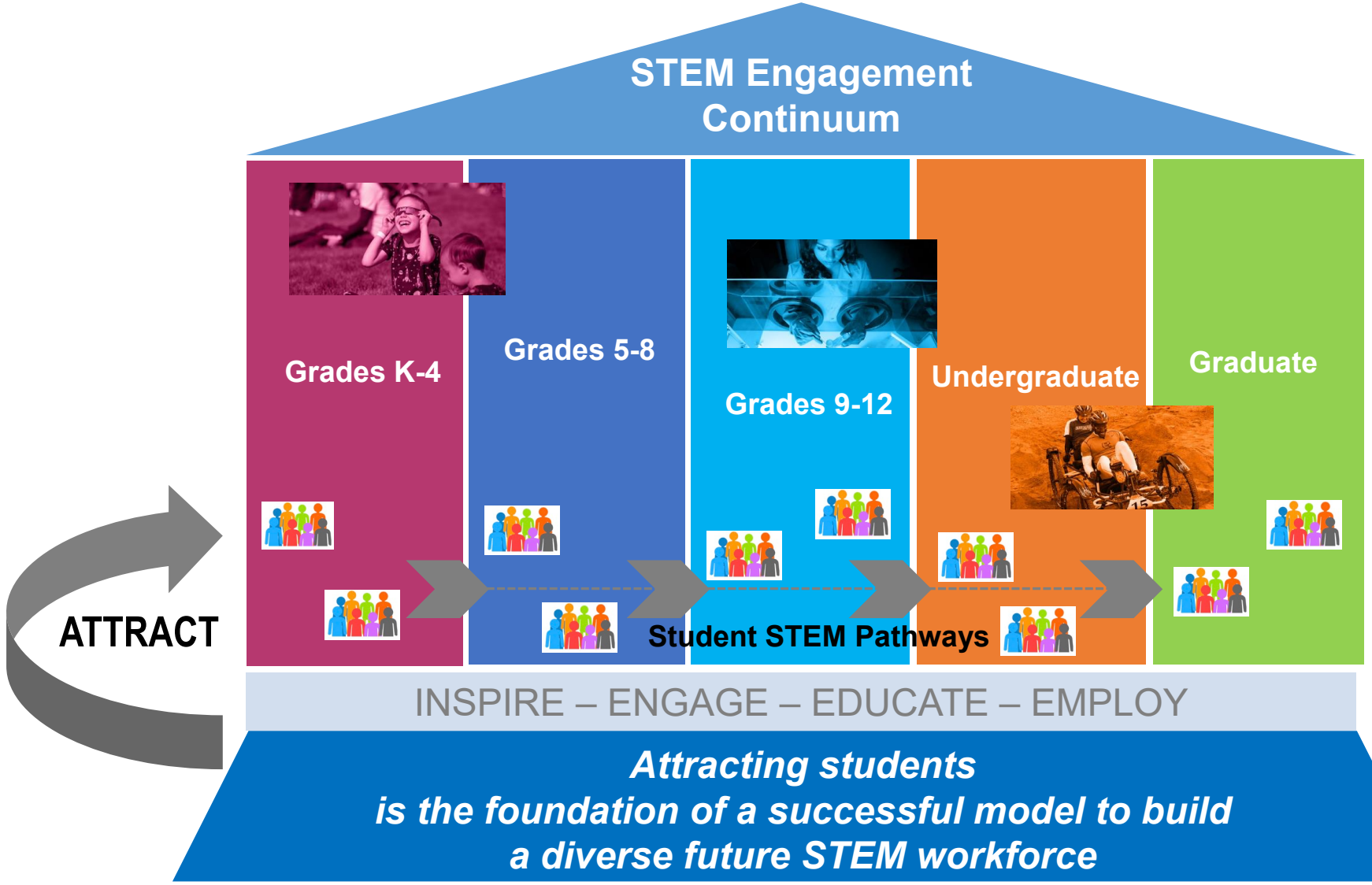


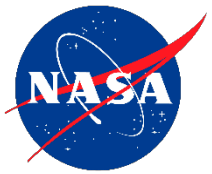
Focus Area: Critical Need for Investments in K-12



Key Elements Moving Forward:

- Evidence-based opportunities that attract students (Gr K-5)
- Accessible and engaging opportunities that enable STEM pathways (Gr K-8)
- Immersive, experiential learning that leads to STEM pursuits (Gr 9-12)
- Experiences to support successful workforce entry (Higher Ed)
- Strategies to broaden student participation at all points along the continuum
- Partnerships and networks to build essential connections to the STEM ecosystem

KEY INGREDIENTS IN ATTRACTING AND ENGAGING K-12 STUDENTS



K - 12

	NASA-unique learning opportunities to attract students	Incremental learning activities to enable STEM student pathways	Immersive, experiential learning opportunities to prepare for STEM pursuits
Students	• Accessible, low barrier to entry classroom and out-of-school activities • Informal education programs	• Classroom activities • Out-of-school activities • Competitions • Camps and informal education programs • Student engagement	• Capstone projects • Challenges and competitions • H.S. internships • Student engagement
Educators	• Enhanced access, navigability, and use of NASA STEM Engagement products and activities by formal and informal educators • Increased educator efficacy in delivering NASA Engagement products and activities		

Build on the current portfolio to create a system of NASA-unique K-12 learning opportunities:

- ✓ Use evidence-based practices
- ✓ Partner with mission directorates to leverage mission milestones
- ✓ Leverage NASA STEM practitioners as role models and guides in engaging students

An architecture that offers a continuum of NASA STEM student experiences

DRIVERS TO DESIGN A K-12 FOUNDATION

Strategy for STEM Engagement 2020-23

STRATEGIC GOAL 1: Create **unique opportunities** for a diverse set of students to contribute to NASA's work in exploration and discovery.

OBJECTIVES:

1.1 Provide student work experiences that enable students to contribute to NASA's missions and programs, embedded with NASA's STEM practitioners.

1.2 Create structured and widely-accessible experiential learning opportunities for students to engage with NASA's experts and help solve problems that are critical to NASA's mission.

STRATEGIC GOAL 2: Build a **diverse future STEM workforce** by engaging students in authentic learning **experiences** with NASA's people, content and facilities.

OBJECTIVES:

2.1 Develop and deploy a continuum of STEM experiences through authentic learning and research opportunities with NASA's people and work to cultivate student interest, including students from unrepresented and underserved communities, in pursuing STEM careers and foster interest in aerospace fields.

2.2 Design the portfolio of NASA STEM engagement opportunities to contribute toward meeting Agency workforce requirements and serving the nation's aerospace and relevant STEM needs.

STRATEGIC GOAL 3: Attract diverse groups of students to STEM through learning opportunities that **spark interest** and **provide connections** to NASA's mission and work.

OBJECTIVES:

3.1 Attract a broad and diverse set of students to STEM through targeted opportunities and readily available NASA STEM engagement resources and content.

3.2 Foster student exposure to STEM careers through direct and virtual experiences with NASA's people and work.

STEM Engagement K-12 Portfolio

Leveraging NASA's missions, content, people, and facilities to attract and engage students in STEM

Where?

In school, after school, informal education institutions and at home

What?

An integrated portfolio of products, experiences, challenges and competitive awards that spans the continuum K-12 educational levels and reduces barriers to entry

Applying STEM Engagement Design Principles

1. Mission-driven:
   - Authentic content to create the spark and maintain interest

2. Evidence-based:
   - Alignment to national K-12 education standards
   - Use current research in designing program elements

3. Diversity & Inclusion:
   - Broadening student and educator participation
   - Employ Culturally Relevant Engagement and teaching principles

4. Scalability:
   - Use established networks and effective partnerships to achieve greater numbers and diversity

5. Outcome-driven:
   - Keep beneficiary viewpoints and needs in mind
   - Informal, continual lessons-learned process
   - Plan and execute formal evaluation of offerings

K-12 Framework

Building Blocks for a K-12 Framework to Engage Educators and Students

Educator Community of Practice (NASA CONNECTS)
- Creates and sustains real relationships with and among formal and informal educators
- Curates and promotes offerings and opportunities

Educator Training and Support
- Focused on effective use of NASA educational products and building educator STEM identity and efficacy.

NASA STEM Subject Matter Expert (SME) Training, Support and Development
- Enabling impactful virtual and in-person engagements as purposeful components of STEM Engagement programming

Strategic Partnerships
- Extend NASA's reach and impact with focus on students from underserved and underrepresented communities

Core infrastructure and services to enable delivery

Opportunities and Products to Attract and Engage Students and Educators

Educational Products
- Content suitable for formal + informal settings
- Purposeful curation and "toolkits"
- Easy-to-use, less "intimidating" products
- Cultural relevance, eliminating barriers to use

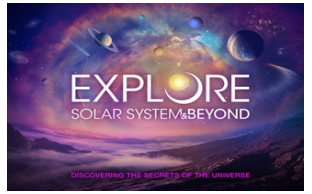
Challenges and Competitions
- SPARX innovative challenge and competition model (FY22 pilot)
- Built for **depth-of-knowledge** levels and multiple mission themes

Competitive Funding Opportunities
- For effective development, extension and dissemination of NASA-fueled content supporting STEM ecosystems
- TEAM II and Community Anchor small awards

Connections to NASA STEM experts
- Learning opportunities through exposure and interactions with NASA SMEs

Evidence-driven design and development of opportunities and products

Mission-Driven Spheres Aligning products and opportunities with NASA mission priorities



Alignment with NASA missions to attract students to exciting content

K-12 Areas of Focus – FY2022 and Beyond

- Build foundational elements to more effectively deliver learning opportunities and products along a continuum of experiences to attract students and sustain them on STEM pathways.
- Enhance accessibility, navigability and use of the integrated NASA K-12 portfolio of activities and products toward broadening student participation
- Build ecosystem networks to drive the design and deployment of NASA learning opportunities through the lens of educator and institutional needs
- Use performance and evaluation methodologies with targeted studies to drive evolution of K-12 opportunities and products, shaping future efforts

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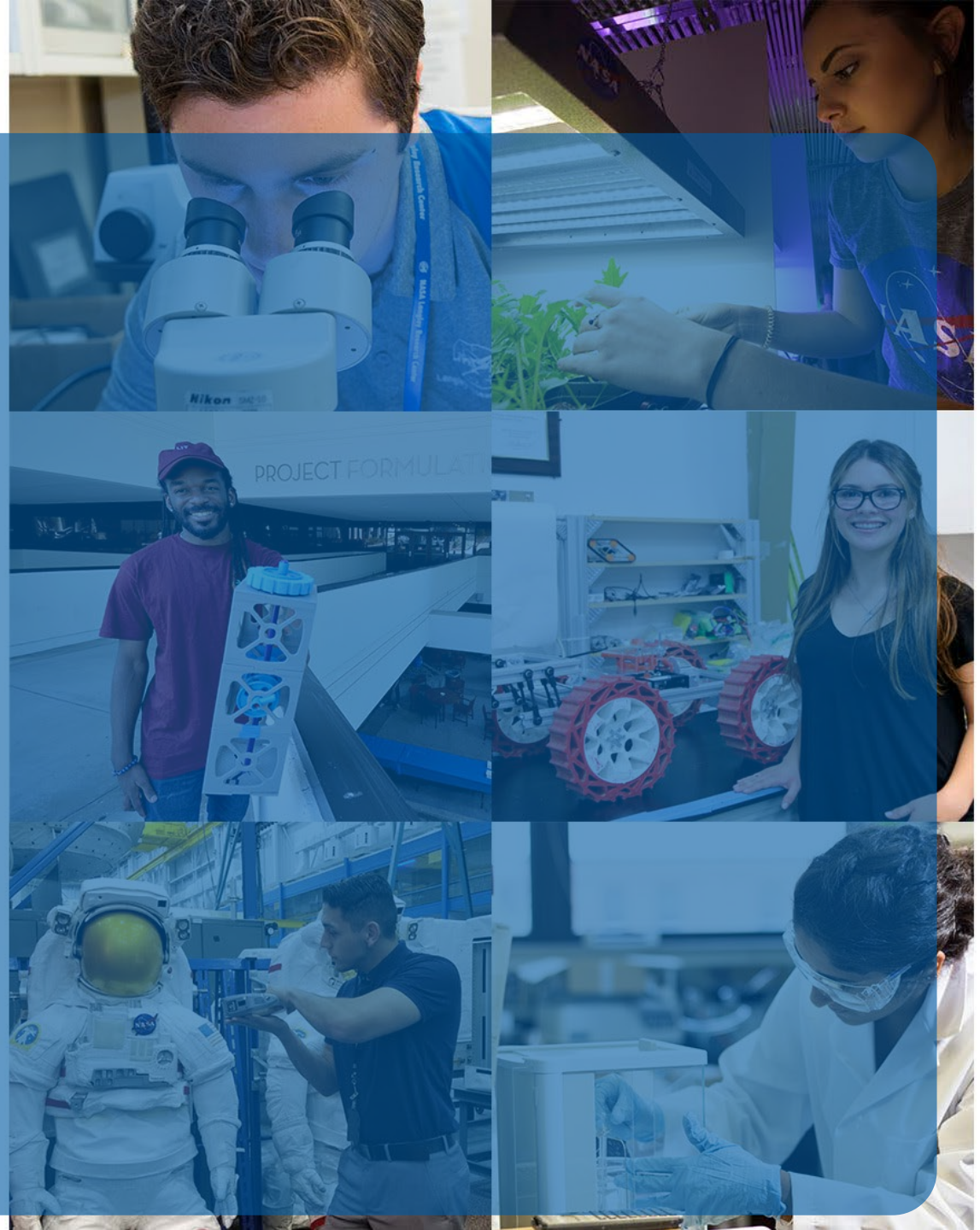

BUILDING STRATEGIC PARTNERSHIPS

Expand NASA's STEM Engagement Reach | **Catalyze Internal and External Innovation** | **Collaborate to Address High Priority National Goals**

RECENT EXAMPLES

LEGO EDUCATION

Goal: Prepare students for the upcoming mission, extend Student Curiosity about the Mission, and connect the mission to careers at NASA

Through open-ended lessons, students will get hands-on experience and solve the same problems the Artemis I Team faces as they build toward launch!

STEM NEXT OPPORTUNITY FUND

Goal: Million Girls Moonshot aims to cultivate 1 million girls with an engineering mindset by 2025

Collaboration to support the Million Girls Moonshot in Afterschool programs through:

- curriculum support
- STEM mentors
- educator support

ISS downlink and watch party reached over **24K** students and educators

MICROSOFT LEARN

Goal: Teach high priority CS, AI and data science skills to high school and college students

NASA is supporting Microsoft in use of Artemis data sets and themes as a real-world context for online coursework. As of Mar 2021:

- **65K** users have earned badges
- Courses have a **4.8** (out of 5) approval rating and **50%** completion rate

DISCOVERY EDUCATION

Goal: Expand student and educator access to high quality digital resources

Collaboration on a week-long campaign during the Mars Perseverance landing:

- Simulcast (**241K views**)
- Curated NASA resources (**800K+ inter actions**)
- Awareness of Mars opportunities (**1M teachers** in distribution)

GIRL SCOUTS USA

Goal: Collaborate on 1st ever Virtual STEM Summit

NASA supported the Girls Scouts in their first virtual STEM summit:

- Utilized **17** NASA speakers
- Reached **14K** girls during the 5-hour event

FY2021 Notable Accomplishments: Strategic Partnerships

Engagement with **94** Organizations (April 2020-May 2021)

12 New Agreements (Active or In-progress)

17 informal collaborations to share content or engage students

ARTEMIS SUMMIT MEETING

The Offices of STEM Engagement, Communication and Human Exploration Operations Mission Directorate are hosting a one-day meeting for partners, grantees, and other interested organizations to learn about Public and STEM Engagement plans and opportunities for the upcoming Artemis I Mission. This event is designed to introduce participants to the importance of the Artemis program and support them in the use of Artemis I content as they serve students, educators, families, and the general public.

Date and Location:
Kennedy Space Center and virtual participation
Wednesday, March 16, 2022
10 a.m. – 2 p.m. Eastern

Audience:
- Museums & Science Centers
- Youth Serving Organizations
- Universities and Other Institutions of Higher Educa
- Education Networks
- Non-Profit Institutions
- Commercial Content Creators
- Other Interested Organization

ARTEMIS

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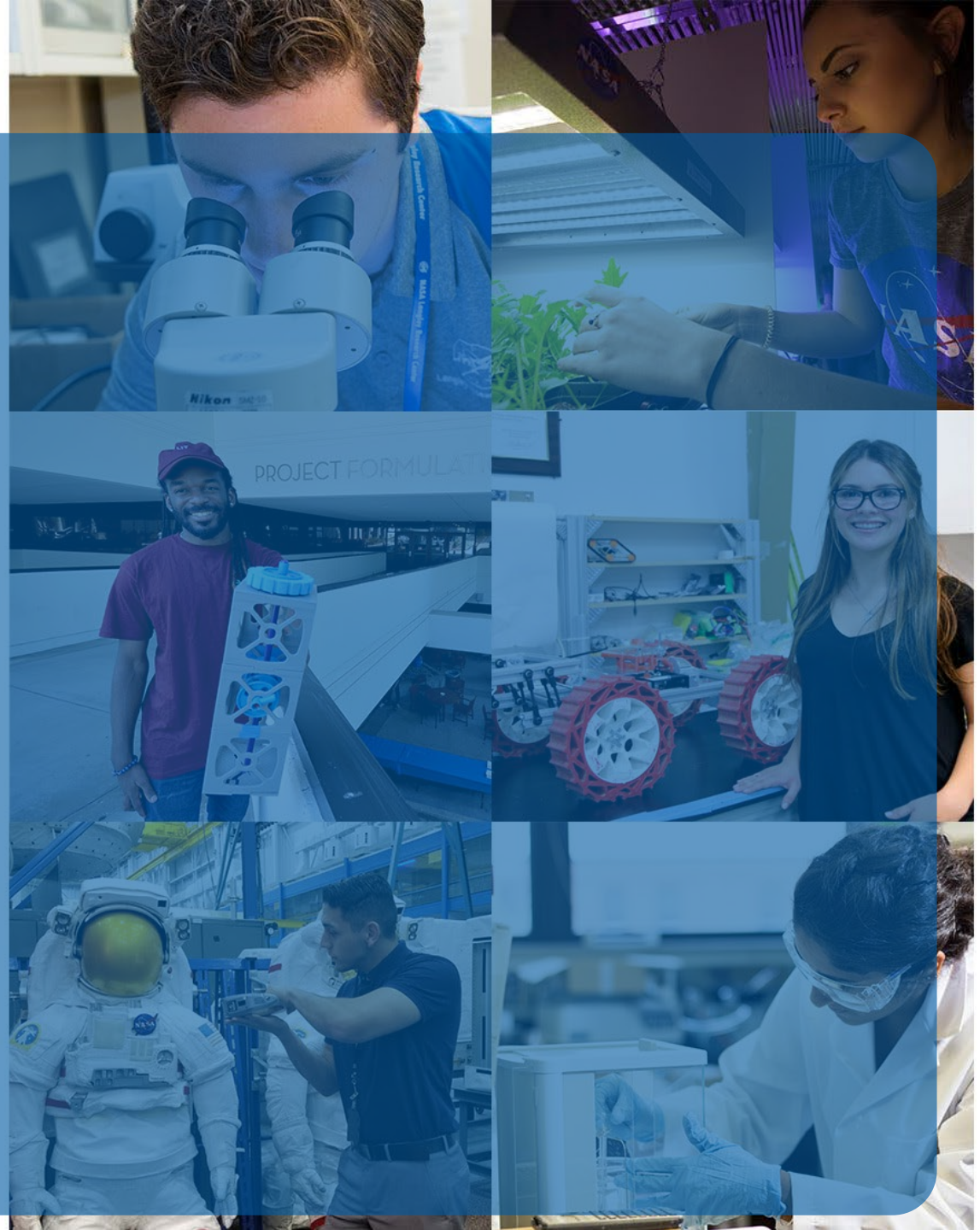


NASA STEM Engagement Performance Assessment & Evaluation

P&E's comprehensive performance assessment and evaluation strategy includes three key pieces: performance activities, evaluation activities, and a learning agenda.

- Through our *performance activities*, we monitor program accomplishments, particularly progress toward our established performance goals.
- Through our *evaluation activities*, we examine how a particular program meets its objectives, typically executed through year-long studies.
- The *learning agenda* allows us to look systematically across performance and evaluation activities to identify gaps in knowledge and establish a research agenda that generates knowledge to fill these gaps.

COMPREHENSIVE PERFORMANCE ASSESSMENT AND EVALUATION STRATEGY

Performance Strategy Framework

- Broad strategic goals designed to advance NASA's mission and address relevant national problems, needs, challenges and opportunities.
- Timeframe: **2018 – 2022**

Performance Assessment

- Ongoing monitoring and reporting of program accomplishments, particularly progress toward pre-established goals.
- Includes *outputs* such as: higher education interns and fellows demographics and number of paper presentations and peer-reviewed publications; and *outcomes* such as developing higher education students' science or engineering identity.
- Timeframe: **Short term (Annual)**

Evaluation

- Systematic study using research methods to collect and analyze data to assess how well a program is working and why.
- Includes *outcomes* such as: developing higher education students' science or engineering identity, cognitive understanding of research processes and skills, or longitudinal study of interns.
- Timeframe: **Long term**

Learning Agenda

Strategic Performance Framework

2018 NASA Strategic Plan

Strategic Goal 3: Address National Challenges and Catalyze Economic Growth

Strategic Objective 3.3: Inspire and Engage the Public in Aeronautics, Space, and Science

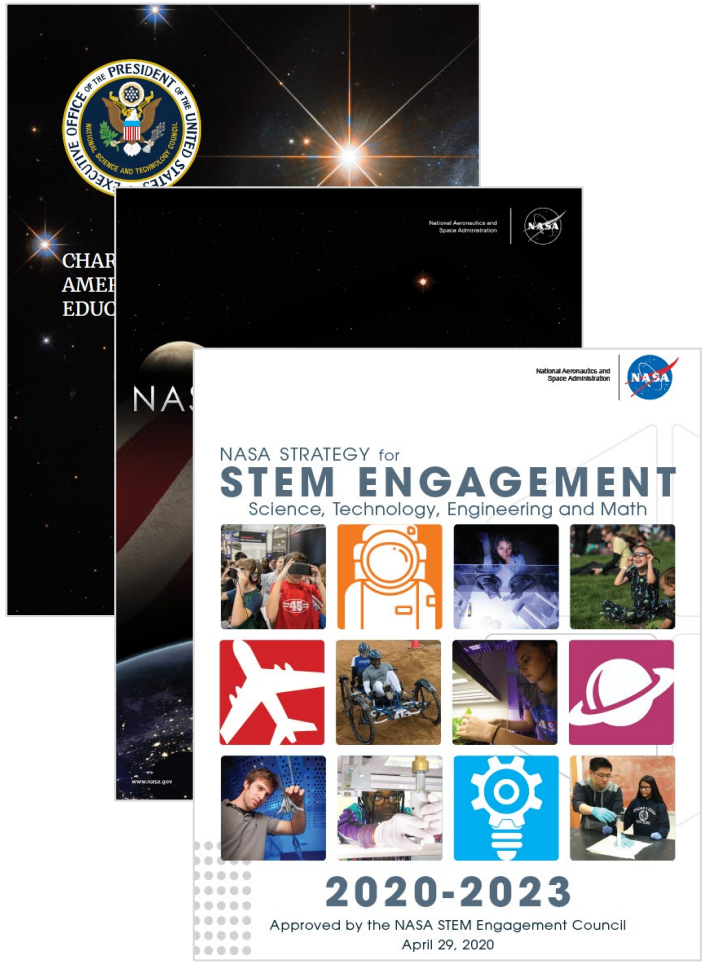
Office of STEM Engagement

Performance Goals

Success Criteria

External

Internal



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

Learning Agenda Development & Implementation Timeline

Goal: Generate and refine a process to look systematically across performance and evaluation activities to identify gaps in knowledge and establish a research agenda that generates knowledge to fill these gaps.

FY18

Development of Learning Questions/Activities

- Review past performance
- Research performance assessment models and gather input from stakeholders
- Develop Learning Questions and Learning Activities

FY19

Refine Practice and Operations

- Operationalize Learning Agenda
- Execute Learning Agenda Activities (FY19)
- Refine practice and operations
- Convene Expert Review Panel

FY20 - FY21

Implement Refined Strategy

- Implement refined Learning Agenda
- Execute Learning Agenda Activities (FY20 – 21)
- Convene Expert Review Panel

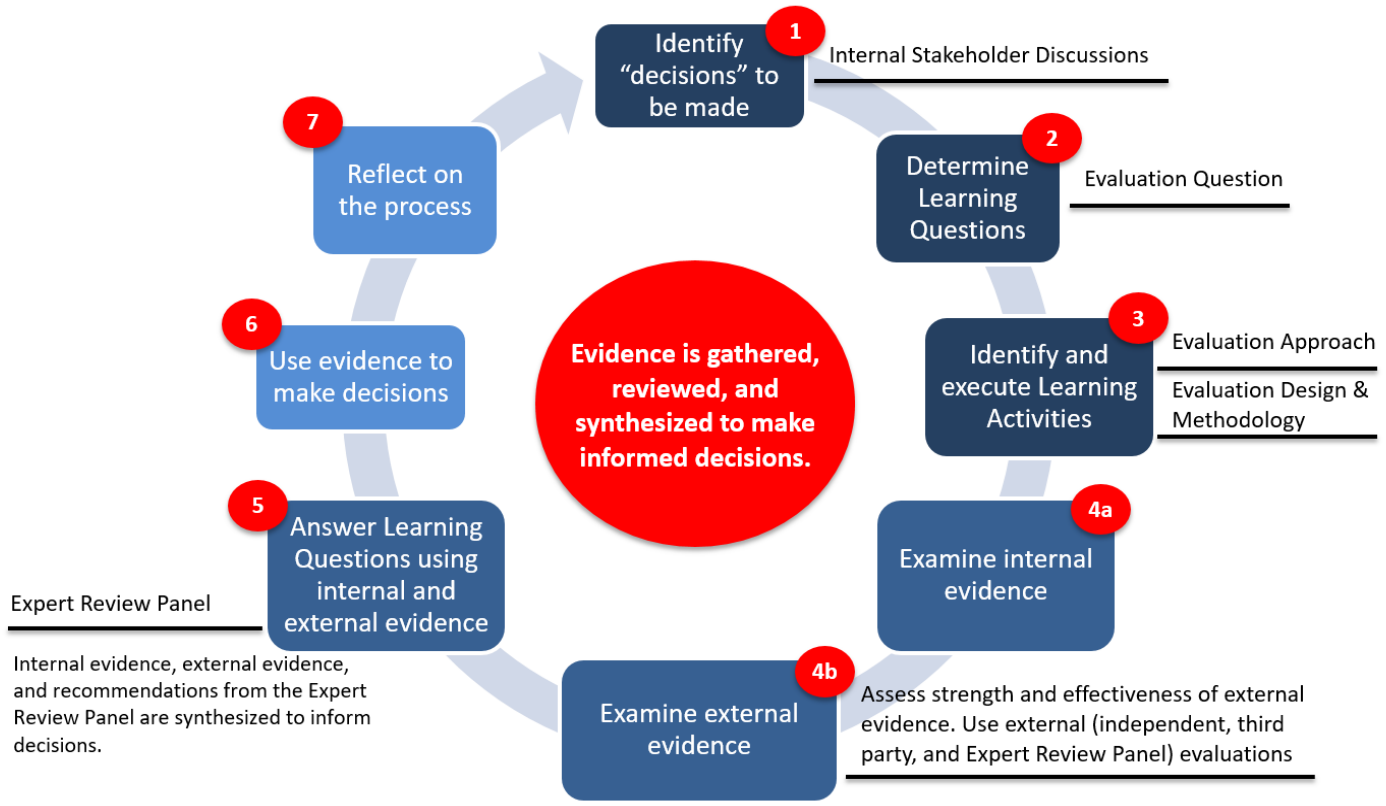
FY22

Support Evidence-Based Decision-Making Process

- Analyze Learning Agenda Activities (FY19 – 21)
- Summarize recommendations for stakeholders
- Internal stakeholder meetings
- Programmatic decision-making
- Revise Learning Questions
- Finalize performance metrics

EVIDENCE-BASED DECISION-MAKING PROCESS

Goal: Generate and refine a process to look systematically across performance and evaluation activities to identify gaps in knowledge and establish a research agenda that generates knowledge to fill these gaps.



CONTRIBUTIONS TO NASA'S MISSIONS AND WORK (FY19-FY21)

Learning Question 1: To what extent are NASA's STEM Engagement investments contributing to NASA's missions and work?

FY 2019 Evidence Activities

- Higher Education Challenges, Competitions, and Internships Multiple Case Study
- Higher Education Mentor, Intern, Fellow, and HE Design Challenge Participant Customer Satisfaction Survey
- Analyze Higher Education Grantee and Cooperative Agreement R&D Data

FY 2020 Evidence Activities

- Diversity Deep Dive
- Analyze Higher Education Grantee and Cooperative Agreement R&D Data

FY 2021 Evidence Activities

- Intern Outcome Assessment
- Career Readiness Assessment
- Analyze Higher Education Grantee and Cooperative Agreement R&D Data
- EPSCoR Literature Review & Benchmarking Study

DIVERSITY OF THE FUTURE STEM WORKFORCE (FY19-FY21)

Learning Question 2: How have NASA STEM Engagement investments broadened participation of historically underrepresented and underserved groups in STEM fields in NASA STEM Engagement activities?

FY 2019 Evidence Activities

- STEM Engagement Activity Participant Longitudinal Tracking Feasibility Assessment
- Analyze Higher Education Participant Demographic Data

FY 2020 Evidence Activities

- Pilot Internship Longitudinal Study.
- Diversity Deep Dive
- MUREP Portfolio Assessment (Phase 1)
- Analyze Higher Education Participant Demographic Data

FY 2021 Evidence Activities

- Intern Outcome Assessment
- Career Readiness Assessment
- MUREP Portfolio Assessment (Phase 2)
- Analyze Higher Education Participant Demographic Data

ENHANCEMENTS TO PERFORMANCE & EVALUATION (FY19-FY20)

Learning Question 3: To what extent have enhancements to STEM engagement performance assessment and evaluation been implemented?

FY 2019 Evidence Activities

- Assessment of the Office of Education Performance Management (OEPM) System Capabilities/Design Enhanced Data Management System.
- Design a comprehensive data management
- Develop and Execute Office of STEM Engagement Learning Agenda

FY 2020 Evidence Activities

- Award two competitive agreements to pilot methods for a multi-year, third-party, pilot project-level evaluation of the National Space Grant College and Fellowship Project
- Revise and Execute Office of STEM Engagement Learning Agenda

FY 2021 Evidence Activities

This Learning Question was removed from the Learning Agenda after FY20

UNDERSTANDING K-12 STEM ENGAGEMENT INVESTMENTS (FY21)

Learning Question 4: What are effective strategies to support and measure STEM Engagement Investments' ability to spark K-12 students' STEM interests?

FY 2019 Evidence Activities

- Sparking STEM Interest Forum*

FY 2020 Evidence Activities

- Sparking STEM Interest Study*

FY 2021 Evidence Activities

- K-12 Internal Strategic Assessment
- NextGen STEM Pilot Outcome Study

*Studies were executed prior to inclusion of Learning Question 4

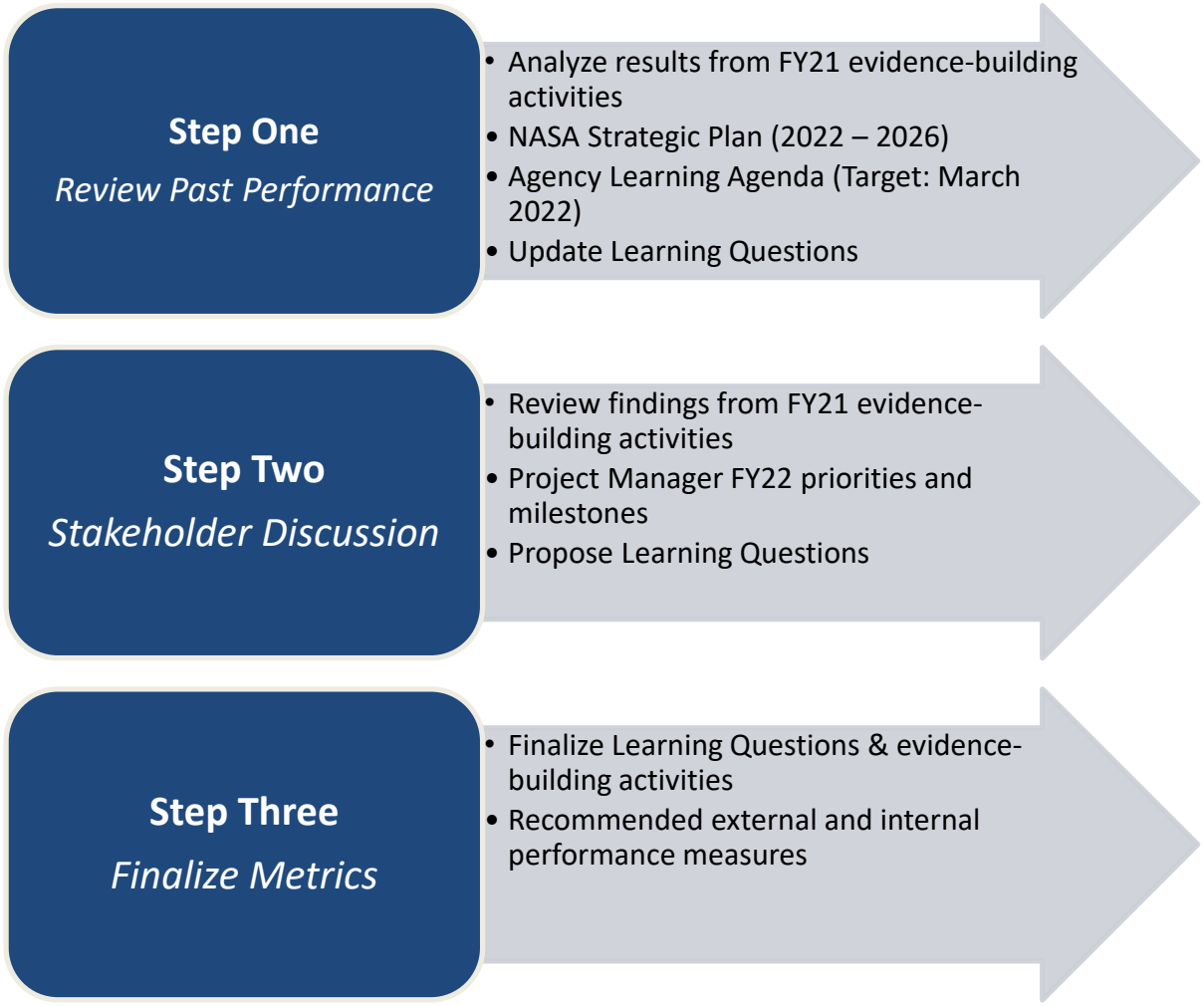
FUTURE STATE

Performance & Evaluation Objectives:

- Provide coordinated framework for evaluation across OSTEM STEM Engagement efforts
- Culture of evidence-based planning and decision-making addressing program goals, milestones, and performance/evaluation metrics
- Increase access and use of program-level data through NASA STEM Gateway to support decision making

Framework for Efforts:

- Portfolio Evaluation – evaluation across multiple programs to determine collective impact on strategic goals
- Program Evaluation- evaluation of single program to program goals
- Principle Evaluation – evaluating principles and methods for implementing quality STEM programs that would be applicable across programs



FUTURE STATE

NASA STEM Gateway

- Universal Registration/Application:
  - Single entry point for participants
  - Reduced duplication in establishing/maintaining:
    - ATOs
    - PRA approval
    - System dev
  - Reduction in manual processes
  - Reduce burden on participants

- Performance Management:
  - Direct connection to source data from activities
  - Longitudinal tracking
  - Capabilities for performance assessment and evaluation
  - Real-time reports & analytics
  - Data on participants AND applicants

AGENDA

Landscape

Overview of STEM Engagement

NAC Topics Review

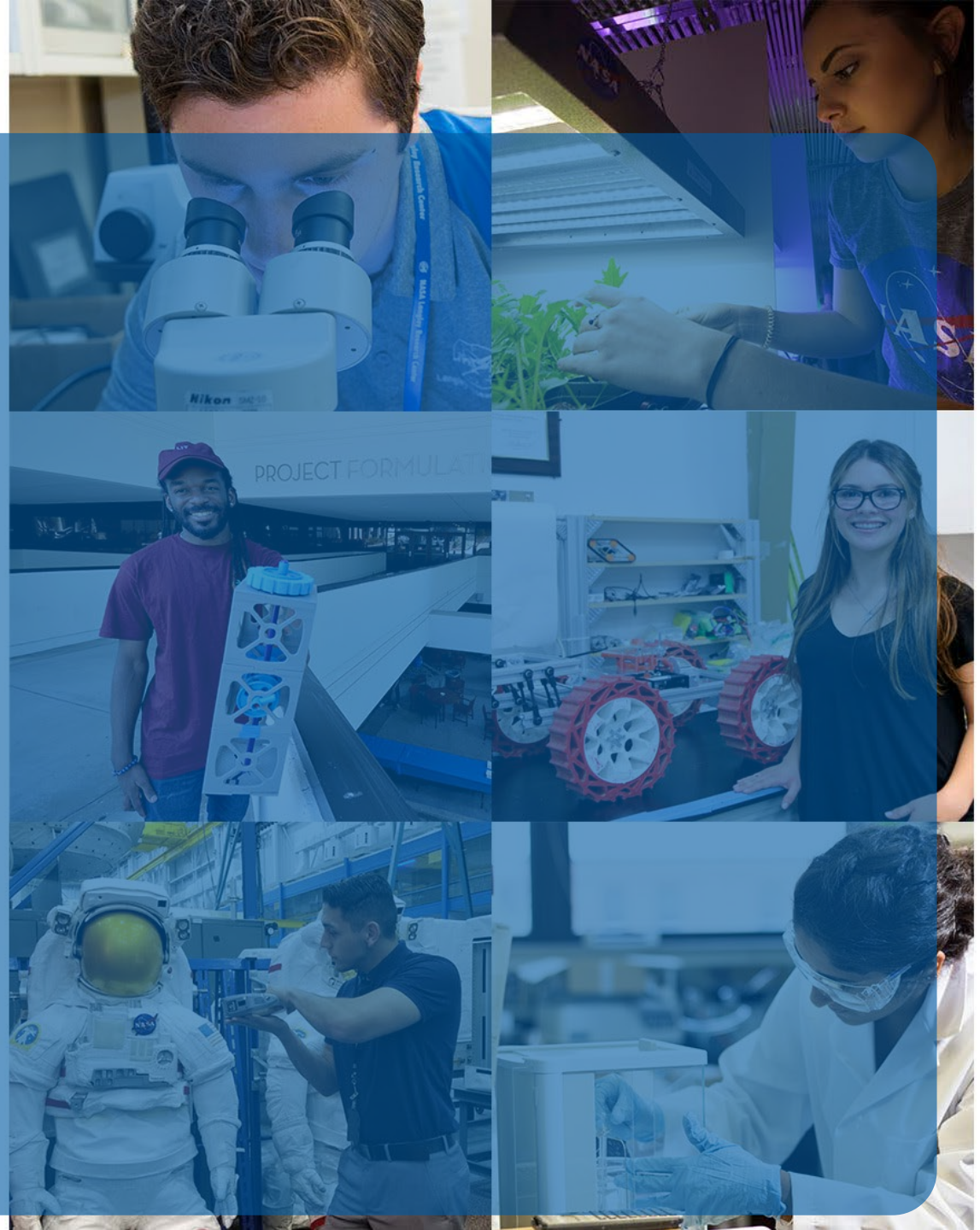
Broadening Participation

K-12 Efforts

Partnerships

Measuring Success

Discussion



Discussion