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Advancing Diversity, Equity, Inclusion and Accessibility in the Leadership of Competed Space Missions

Sponsor:
National Aeronautics and Space Administration

Outline of Presentation

- **Overview of study context and study charge**
- **Overview of study process**
- **Report's key messages and recommendations**
- **Questions and Discussion**

Context

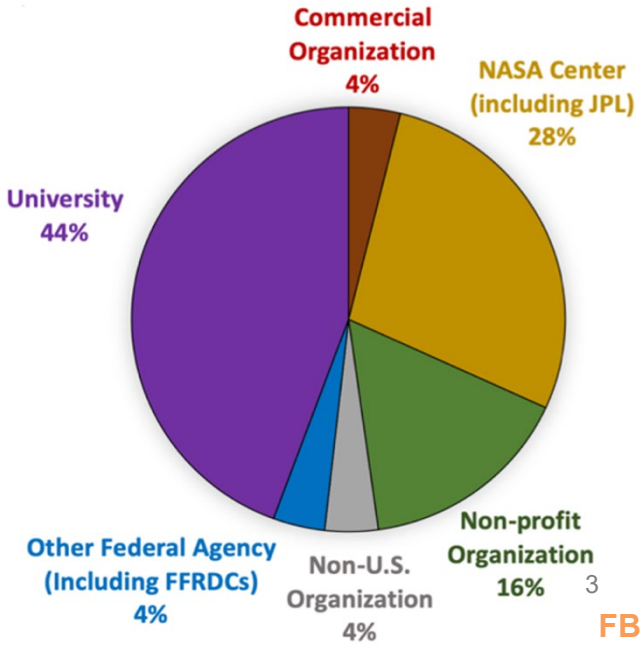
Competed Space Missions:

NASA's Science Mission Directorate has 4 Divisions that solicit space mission investigations via Announcements of Opportunities (AOs):

Astrophysics, Earth Science, Heliophysics, Planetary Science

- **Strategic Missions** – large, instruments often competed
- **Competed Missions** – small, medium, large ($35M-$1B)
- Mission team led by **Principal Investigator (PI)** at range of institution types ------->

- Also cubesats, suborbital balloons, rockets, instruments and Missions Of Opportunity (usually international collaborations)



Context

- **Diverse perspectives, experiences, and backgrounds are beneficial to the creativity, innovation, and impact of science teams**
- ***"NASA believes in the importance of diverse and inclusive teams to tackle strategic problems and maximize scientific return***." (NASA's Science Plan 2020-2024**)**
- **Currently, mission teams lack demographic diversity: principal investigators (PIs) and teams are largely white and male**

Study Charge

Recommend actions to increase **diversity, inclusion, equity and accessibility (DEIA)** in the leadership of space mission proposals submitted to NASA SMD:

- requisite tasks, organizational processes, and human networks necessary to navigate mission proposal process
- barriers and bottlenecks to potential proposers
- social and behavioral elements presenting impediments (e.g., bias, discrimination, harassment, work/life balance considerations, tenure requirements, lack of inclusion & accommodations for disabilities)
- differences in pool of mission leaders across SMD divisions and compared to pool of potential proposers
- best practices from other federal agencies

Committee and Study Staff

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- physical sciences
* - social sciences

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The Study Process

- **14-person committee, 8 public fact-finding meetings**

- **Engaged with numerous experts**
  - NASA personnel (past and present)
  - Research institutions, universities, professional societies
  - Social Science scholars
  - Representatives from other federal agencies

- **Evidence**
  - Documentation provided by NASA, other federal agencies, space sciences professional societies, universities, industry, and research institutes
  - Peer-reviewed research in the social sciences on equity, inclusion, and bias in scientific organizations and on pathways in STEM education and careers
  - Collective expertise of committee members with mission experience

The Study Process

Commissioned a pilot, qualitative study involving semi-structured interviews with a sample of individuals with experience preparing and submitting a mission proposal as PI in the last decade:

- Barriers to and facilitators of DEIA in the proposed leadership for competed missions
- Impacts of educational and professional experiences, information access, mentorship, and post-submission activities

Committee Perspectives

Focus on the overall **domestic science workforce**:

- Importance of providing opportunities to every U.S.-born person, especially those from underrepresented communities, to pursue a career in the space sciences
- Supply of foreign talent in flux, unclear how it will change in the near future

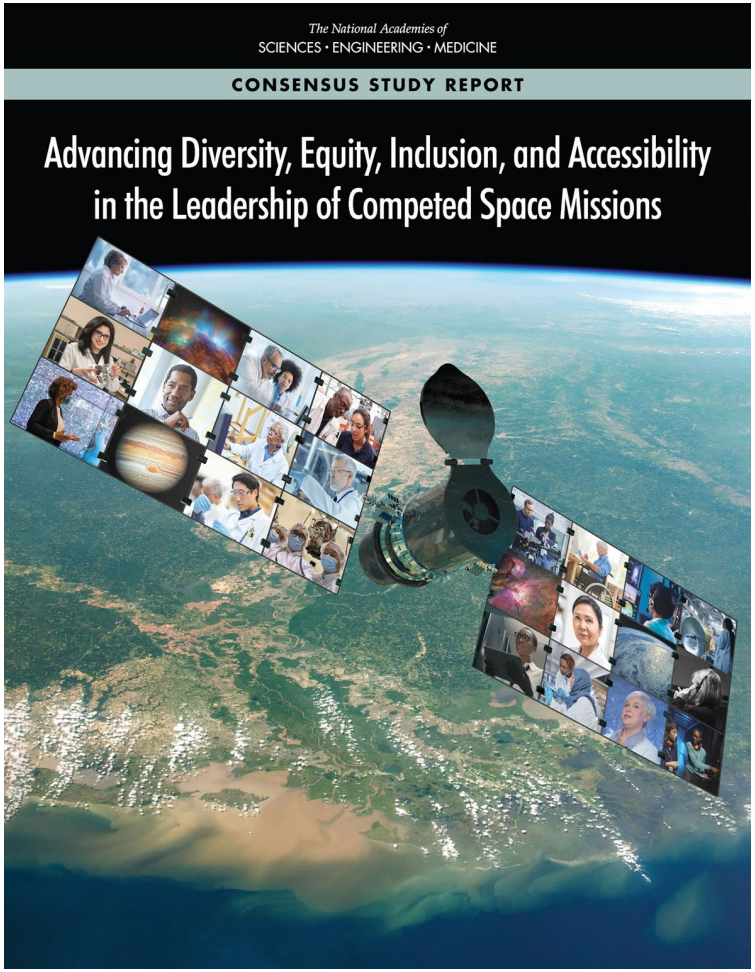
Focus on **full pathway in the space sciences**:

- Mission PIs tend to be at senior levels of their career (e.g., >20 yrs since PhD degree)
- Need to identify opportunities earlier in education-to-career STEM pathways for diversifying potential mission leadership teams

Focus on **Minority Serving Institutions (MSIs)**:

- Educate nearly 30% of all undergraduates in U.S. higher education
- Produce a significant proportion of STEM graduates (e.g., physics degree earners) from underrepresented groups
- More likely to employ physics and astronomy faculty who are women and/or from underrepresented groups in STEM

Report Content



- The Mission Formulation and Proposal Process (Ch 2)
- The Space Sciences Demographic Landscape (Ch 3)
- Pathways into Space Sciences (Ch 4)
- Barriers and Opportunities for NASA Space Missions (Ch 5)
- Best Practices for Advancing DEIA at the Federal Level (Ch 6)
- Paths Forward: Recommendations (Ch 7)

Report Recommendations

Over-arching: Oversight of Implementation of DEIA Efforts

1. Proposal Process and Review — Enhancing Opportunities, Mitigating Barriers
2. Data System — Collection, Analysis, and Reporting of Data on Proposal Teams, Proposal Pools, and Workforce
3. Training and Mentoring Potential PIs
4. Investment in Career Pathways for Underrepresented Groups

Oversight of Implementation of DEIA Efforts

Accountability and Promoting DEIA in S&E Fields

- Both internal and external committees are utilized at the federal level as a best practice **to promote and ensure accountability concerning stated DEIA policies and goals**.

- NASA Advisory Council (NAC)-independent committee that provides advice, guidance, and recommendations on major program and policy issues to NASA.

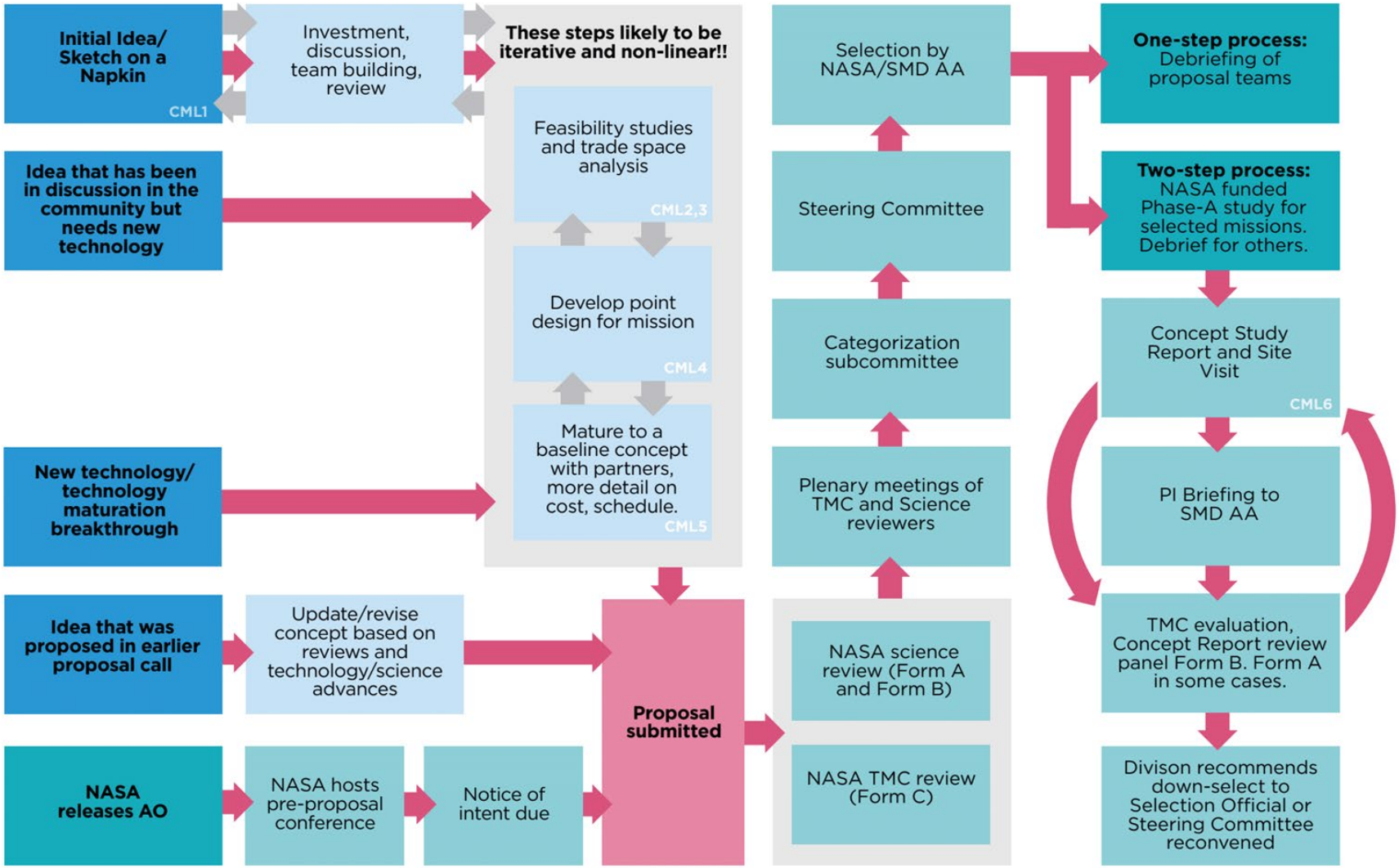
- At the time of this report, lack of evidence about NAC being **appropriately leveraged to promote meaningful change in the area of broadening participation** in NASA's S&E activities.

Recommendation 1

NASA should empanel an ongoing NASA Advisory Council (NAC) committee specifically focused on DEIA, whose committee Chair serves directly on the NAC. This Committee should have a broad charter and external world-class membership in this area to directly advise top NASA leadership and ensure an ongoing strong focus on NASA's broadening DEIA efforts.

THEME 1:
Proposal Process and Review—Enhancing Opportunities, Mitigating Barriers

Proposal Process and Review



It's complicated!

Proposal Process and Review

Team formation, concept development, proposal preparation and submission—including site visits:

- are in part **informal, idiosyncratic, organic, opaque and often personality-driven**
- are **resource-intensive processes** requiring large investments of time, money, and expertise, **often years before proposal submission**
- access to resources is **not uniformly available across proposing institutions**

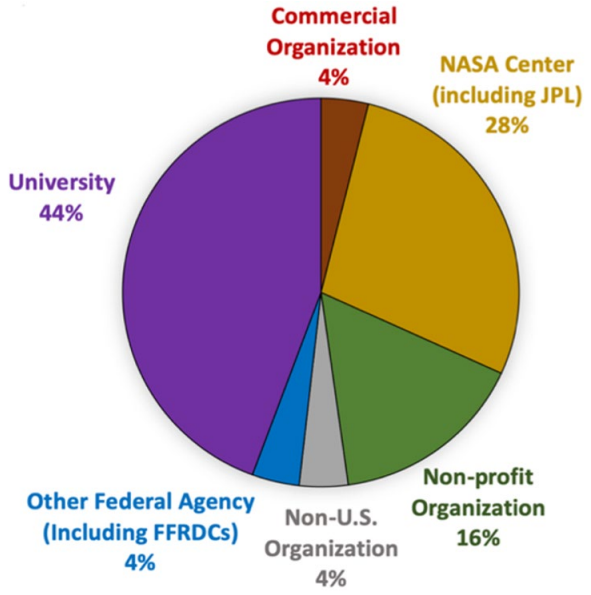
This directly impacts the diversity of the PI candidate pool and likely disadvantages prospective PIs from underrepresented populations.

Proposal Process and Review

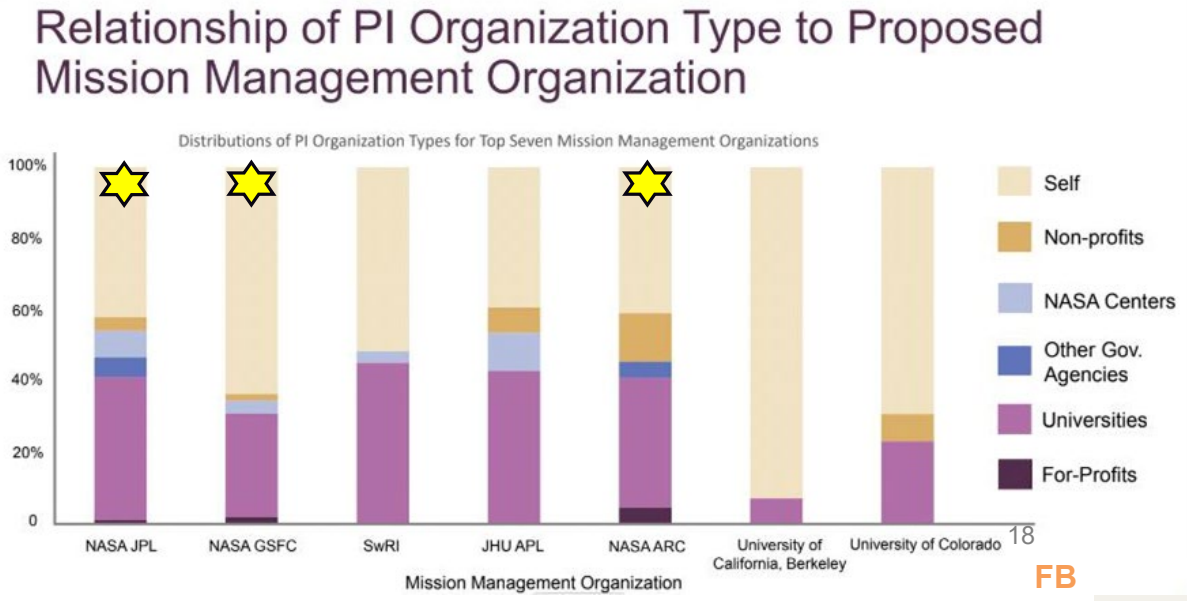
Mission proposal development often involves collaboration of NASA institutions, spacecraft providers, and potentially instrument providers, research laboratories and universities.

"Competition before the competition"

Decision-makers at the institutions effectively control the investments and the opportunities to become a PI.



During 1996-2019, NASA Centers supported ~28% of mission proposals, and of these **~40-70% had in-house, NASA PIs.**



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Recommendation 2

NASA should work to make the pre-proposal "competition before the competition" process transparent and accessible. Additionally, NASA should use its own resources to expand support of pre-proposal and proposal efforts of diverse, external PIs through its field centers and encourage other institutions in the business of supporting and investing in SMD proposals and missions to do the same.

Proposal Process and Review

- Concept Study Report and the associated site visit for two-step proposals **are intense and demanding activities**
- Some institutions provide additional funds to supplement the NASA Phase A funding.
- The **variability of resources available and the critical role of a single presentation** (PI to SMD AA) **merit reconsideration** of the resource allocation, review content, and purpose.

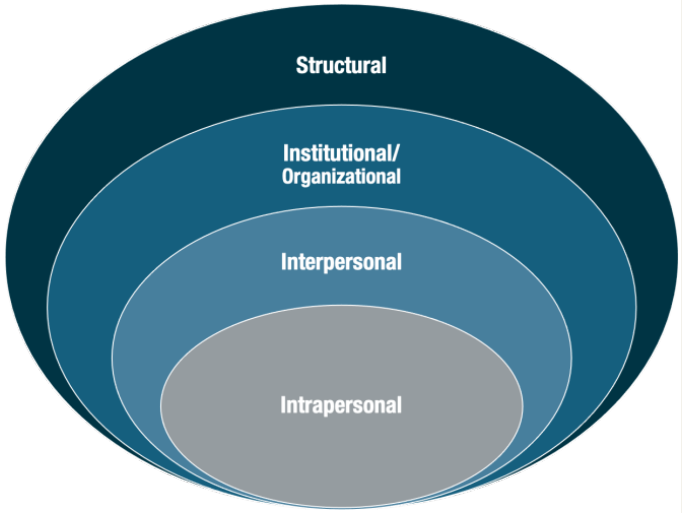
RECOMMENDATION 3:

NASA should reconsider the requirements for site visits to emphasize the evaluation of technical and programmatic readiness, and eliminate any unnecessary elements. NASA should evaluate the benefit of providing uniform funding to each team that is preparing a site visit, and disallowing supplemental funding and other contributions that may result in inequities across teams.

Proposal Process and Review

Proposal PIs report in interviews:

- **Multiple forms of bias** throughout the proposal development, preparation, and submission processes (structural and institutional/organizational factors)
- **Experiencing discrimination** even after assuming the leadership position for a successful competed mission. (institutional/organizational and interpersonal factors)
- Interpersonal interactions with others in their field **undermined their sense of belonging and fueled experiences of imposter phenomenon** (those from historically excluded populations) (interpersonal factors)
- **Mismatch in the messaging** about "what it takes" to be a PI versus their self-perceptions (intrapersonal factors)



Summary: These are all potential barriers to diversity along the pathway to competed space mission leadership positions.

Proposal Process and Review

- **Team diversity is not included in the criteria used to evaluate NASA Mission proposals**, but currently may be included with "other factors".
- NASA has taken steps to require and evaluate DEIA plans as part of its AOs for competed missions.
- NASA SMD has begun to test and implement changes to peer review of some proposal types: preliminary results after instituting Dual-Anonymous Peer Review (DAPR) included **a broadened applicant pool and selections with gender ratios closer to submission gender ratios.**
- Overall, fewer approaches have been employed by NASA to identify and reduce any possible bias in the current mission proposal process, compared to NIH and NSF**.**

Recommendation 4

NASA SMD should develop and make public a systematic and transparent process to assess how the review of proposals submitted for research support is conducted.

- Moreover, NASA SMD should **collaborate with experts to develop and employ an assessment of its mission proposal review process** as well as involve **experts on disparities in research funding** experienced by historically marginalized groups. Such an assessment should also include gathering feedback from proposers.

- In the longer term, NASA Headquarters should **develop a comprehensive assessment of its proposal review processes,** not only with the PI-led missions, but **to be employed agency-wide**.

- This analysis and assessment should include **consideration of emergent bias-reducing practices** (such as Dual-Anonymous Peer Review) and **methods to track, identify, and reduce bias in the review and evaluation** process.

Recommendation 5

In keeping step with its core values of diversity, equity, inclusion, and accessibility, NASA SMD should:

- **Require AOs to include a description of how the dimensions of DEIA**, including talent development and workforce diversity, **are critical to NASA**, and require proposals to include a plan for DEIA in the proposed missions describing how the proposed DEIA activities **are key for mission success**
- **Establish a separate, scorable evaluation criterion of the proposed DEIA plans** as part of mission proposal review and **provide training for reviewers** to better equip them to appropriately evaluate proposals concerning DEIA dimensions
- **Engage with DEIA experts to implement the new requirements** for mission proposals in ways that advance the overarching goal of broadening participation of underrepresented groups in missions
- **Establish monitoring and assessment processes** to continually measure the impact of the new DEIA plan requirement on progress toward NASA's stated DEIA goals.

Recommendation 6

NASA should regularly monitor and assess adherence to the proposed DEIA plans throughout the mission lifecycle and require up-to-date reporting on climate within mission teams in ways that go beyond compliance.

For designing and interpreting climate assessments, NASA SMD should engage with content experts (e.g., survey design experts, social science scholars).

THEME 2:
Data System — Collection, Analysis, and Reporting of Data on Proposal Teams, Proposal Pools, and Workforce

Data Collection, Analysis, and Reporting

524 Mission Proposals Submitted Across 4 SMD Divisions (2010-2019)

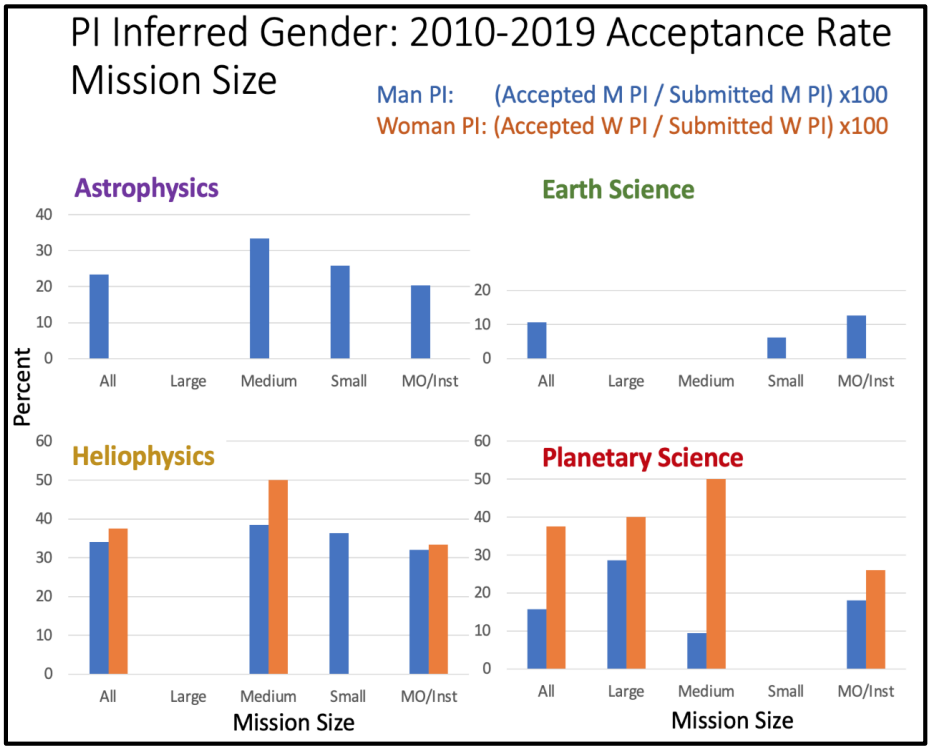
Total 524	Astrophysics 101		Earth Science 108		Heliophysics 96		Planetary Science 219	
	Funded	Denied	Funded	Denied	Funded	Denied	Funded	Denied
Men	22	72	11	92	30	58	27	144
Women	0	7	0	5	3	5	18	30
Total	22	79	11	97	33	63	45	174

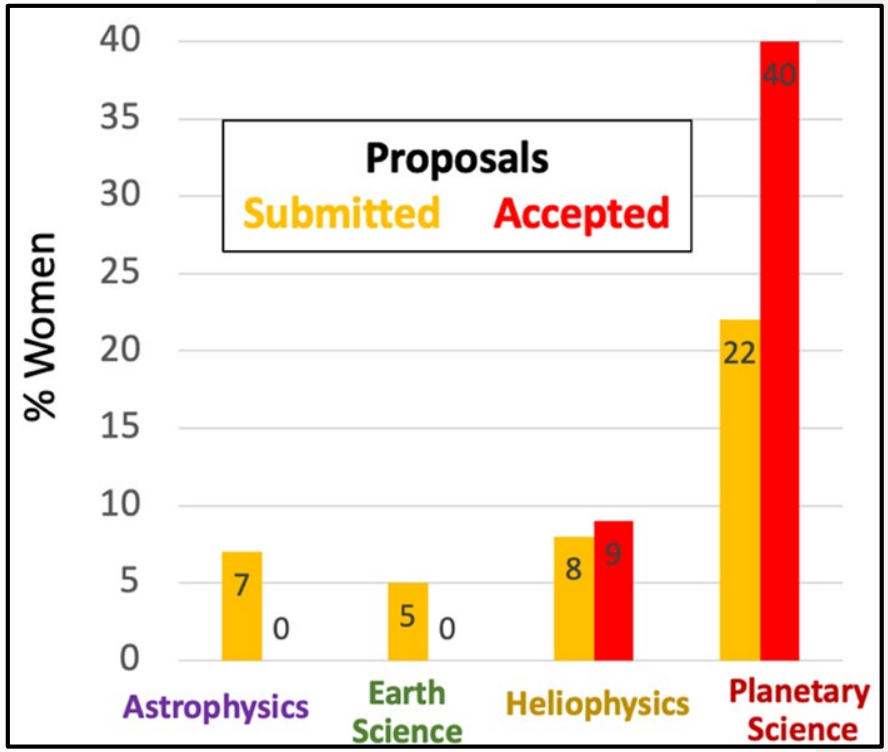
SOURCE: NASA SMD Data Analytics Team

Overall award rates vary: **10-34%**

Award rates by (inferred) gender: **Men: 10-31%; Women: 0-8%**

Data Collection, Analysis, and Reporting



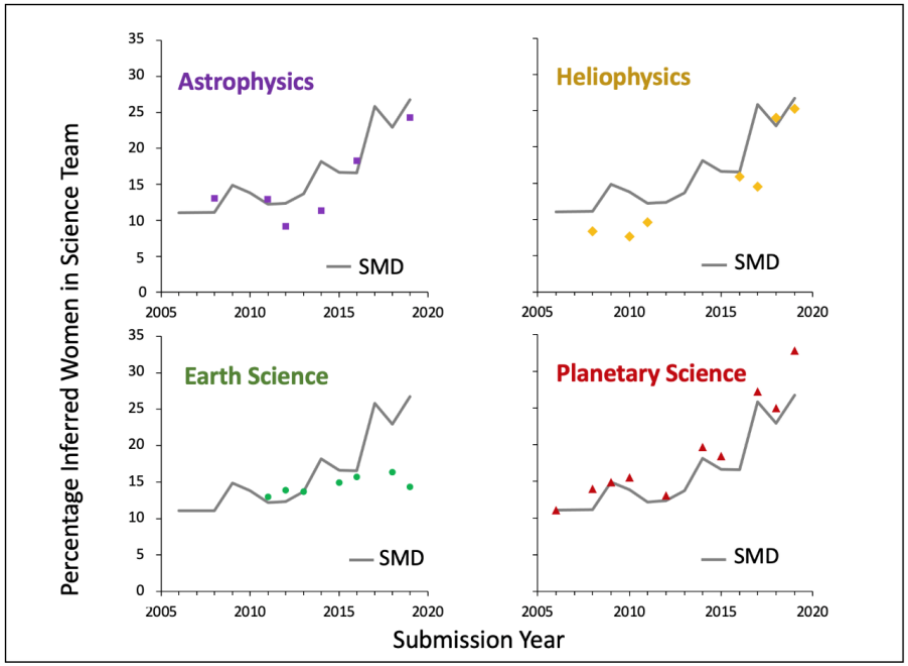


SOURCE: NASA SMD Data Analytics Team

- Stark **variation in award rates by gender** across all Divisions and mission sizes
- **Fewer than 10%** of mission proposals across 3 Divisions **submitted by women PIs**
- **No women PIs selected in Astrophysics and Earth Science** for almost 10 yrs
- No data provided on **race/ethnicity** of PIs

Data Collection, Analysis, and Reporting

Participation by Women in Missions (2006-present)



SOURCE: NASA SMD Data Analytics Team

- Across 4 Divisions: **participation of women increased from 10% to 25%**
- Earth Science: **participation of women has remained quite flat**
- Planetary Science: **participation of women is above average**
- No data provided on **race/ethnicity** of mission science teams

Data Collection, Analysis, and Reporting

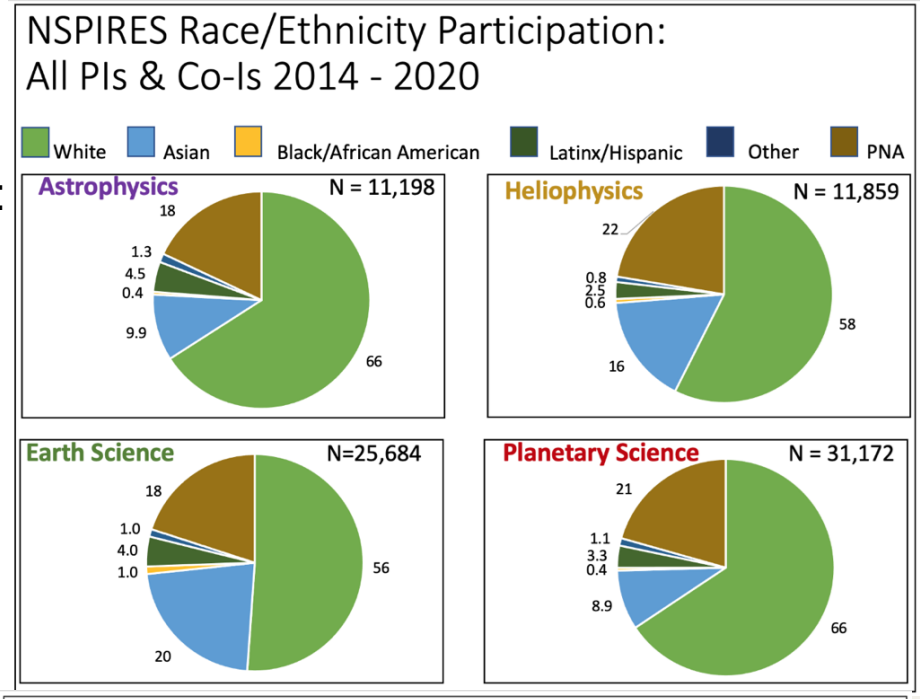
Participation in NASA-funded Research-R&A Grants (self-reported data):

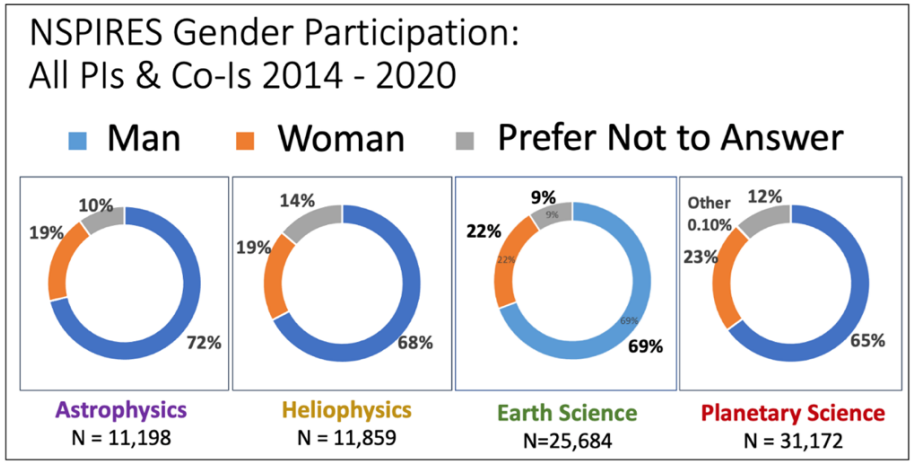
Similar distribution across 4 SMD divisions:

-Women: **19-23%;** Men: **65-72%**
-Asian: **9-20%**
-Black/African American, Latinx/Hispanic, Other: **0.4-5%** (significantly underrepresented)
-PNA: **18-22%** (race/ethnicity); **9-14%** (gender)

The **data** gathered by NASA on the demographics of all proposal teams **are inadequate** to inform NASA about the diversity of space scientists.

Data about **race, ethnicity and disability are lacking** in NASA's analyses for participation in missions.





SOURCE: Office of Chief Scientist, NASA Headquarters

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***NSPIRES: NASA Solicitation and Proposal Integrated Review and Evaluation System**

Recommendation 7

NASA HQ should develop a systematic and transparent process that employs routine monitoring and tracking of proposal submissions and selections, and submit an annual report of these data to the DEIA committee of the NAC as well as make the report publicly available.

This report should include data on dimensions such as funding rates and diversity in team participation in PI-led missions as well as R&A grants; but could also include data on other important dimensions of interest to the Agency.

NASA HQ should seek professional statistical expertise to set in place the needed infrastructure to support robust data collection, monitoring, and reporting including, but not limited to, adequate staffing, data collection standards of practice, monitoring and analytic systems, annual reporting capability, and external partnerships, to overcome the challenges of tracking participation in NASA's earth and space science activities.

Data Collection, Analysis, and Reporting

Current NSPIRES Grant Submission Interface:

- **Compliance-driven language** used for data collection
- Importance of data collection **not made explicit**
- **Not user friendly** for respondents to provide all requested information
- Significant proportion **Prefer Not to Answer** responses
- Users **not regularly requested to update** profile

RECOMMENDATION 8

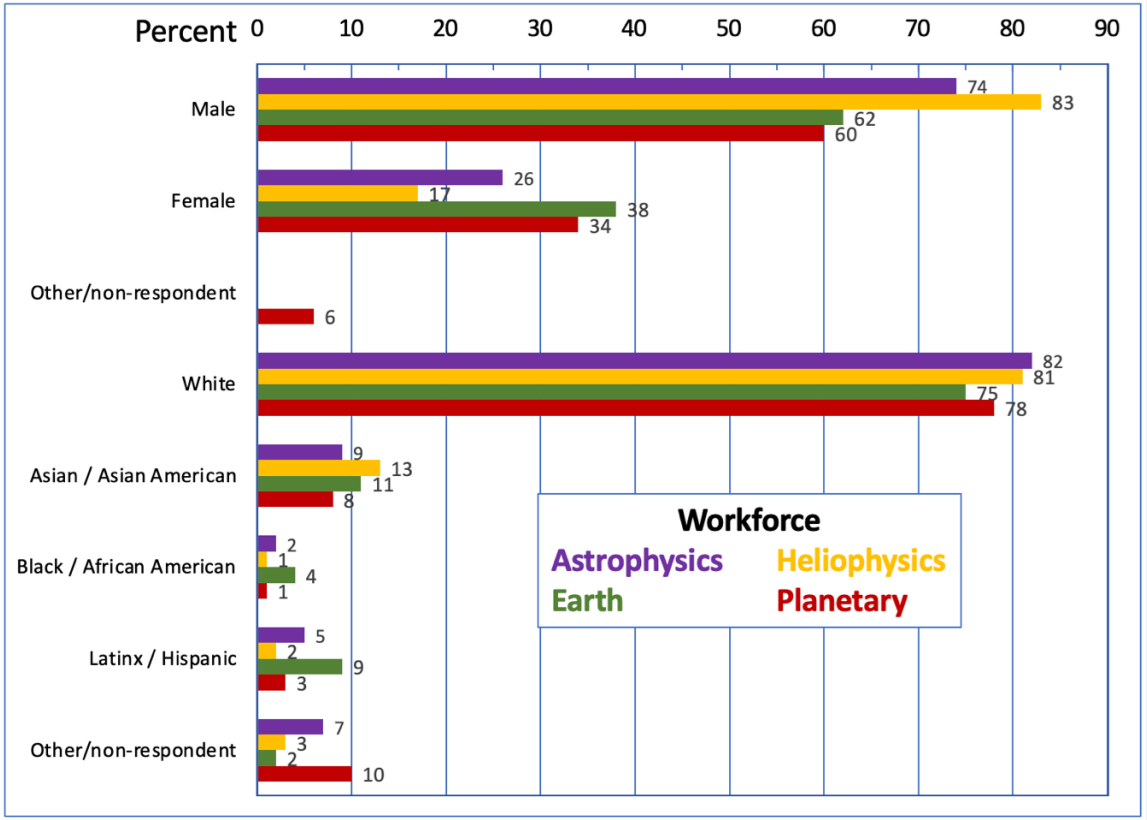
Working with experts in demographics data gathering and analysis, **NASA should review, update and expand** the NSPIRES Personal Profile questions and regularly encourage proposers to update their responses.

Data Collection, Analysis, and Reporting

Demographics of Space Sciences Workforce

- Women: **17-38%**
- Men: **60-83%**

- White: **75-82%**
- Asian: **8-13%**
- Black/African American, Latinx/Hispanic, Other: **1-10%** **(severely under-represented)**



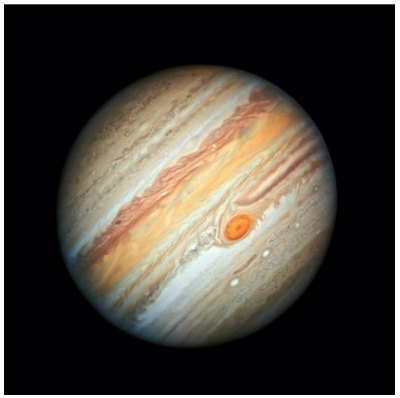
SOURCE: AIP & NSF

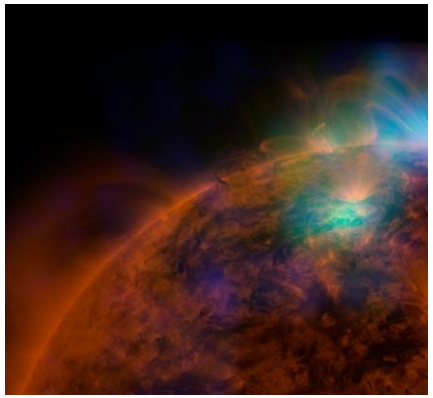
Total size and demographics of U.S. post-PhD workforce in each of the four Divisions of SMD, and degree of the overlap between Divisions, **are poorly quantified.**

Recommendation 9

To regularly assess the state of the profession:

NASA SMD should provide funding for professional organizations (e.g. AIP, AAS, AGU, APS, etc.) to employ the necessary professional expertise in survey methodology and statistical analysis to systematically carry out surveys of the workforce, within and across the four science divisions with competed missions, that informs NASA of the participation of different demographic groups as well as the barriers and opportunities for advancement along entire career pathways in the earth and space sciences.






THEME 3:
Training and Mentoring

Training and Mentoring

Physical Sciences: Undergraduate Training

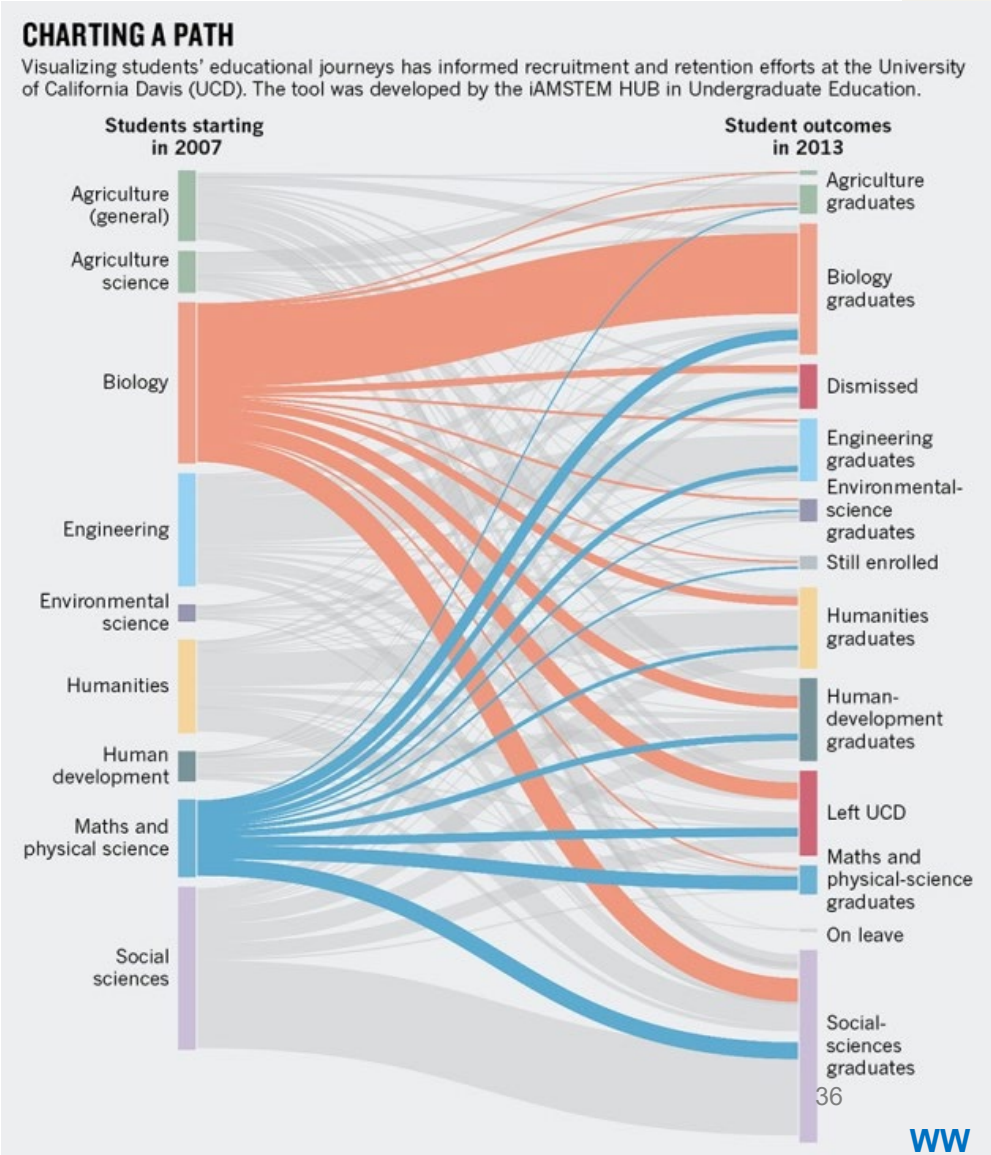
-**main disciplinary pathways** to future NASA mission leadership

-**2% of incoming college students**

-**lose ~90% of students** to other fields before graduation

-retention lowest for **underrepresented populations (4%)**

A major "pinch point" to size and diversity of the pool for future NASA mission leadership.



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Training and Mentoring

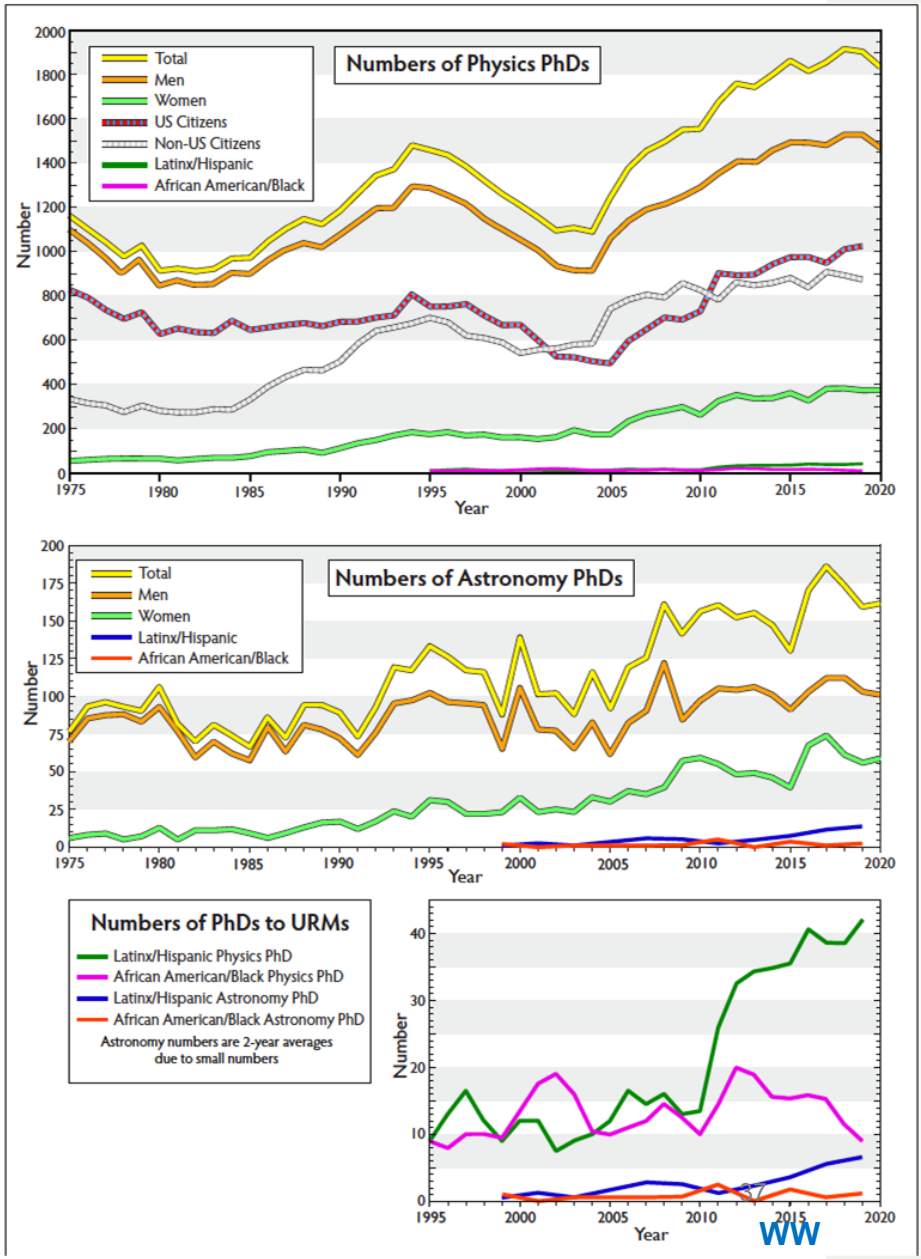
Physics and Astronomy: Graduate Training

Percent of Physics PhDs (2019):

- Women: **19%**
- Latinx/Hispanic Americans- **2%**
- Black/African Americans- **<1%**

Trends in Astronomy PhDs:

- Women: **40%** (2019)
- Latinx/Hispanic Americans- **single digits PhDs/yr**
- Black/African Americans- **~1 PhD/yr**
- Native Hawaiians- **3 total PhDs (in 50⁺ yrs**



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Training and Mentoring

Some Explanations for Low Retention in STEM (including physical sciences):

- **Lack of opportunity and resources** for early and ongoing **authentic research** experiences (e.g., involvement in actual NASA mission-related work)
- **Exclusive culture and environment** of STEM fields (e.g., "weed out" mentality)
- Experiences of **structural racism, sexism** and **implicit bias**
- **Mismatch** between perception of STEM careers and personal identities

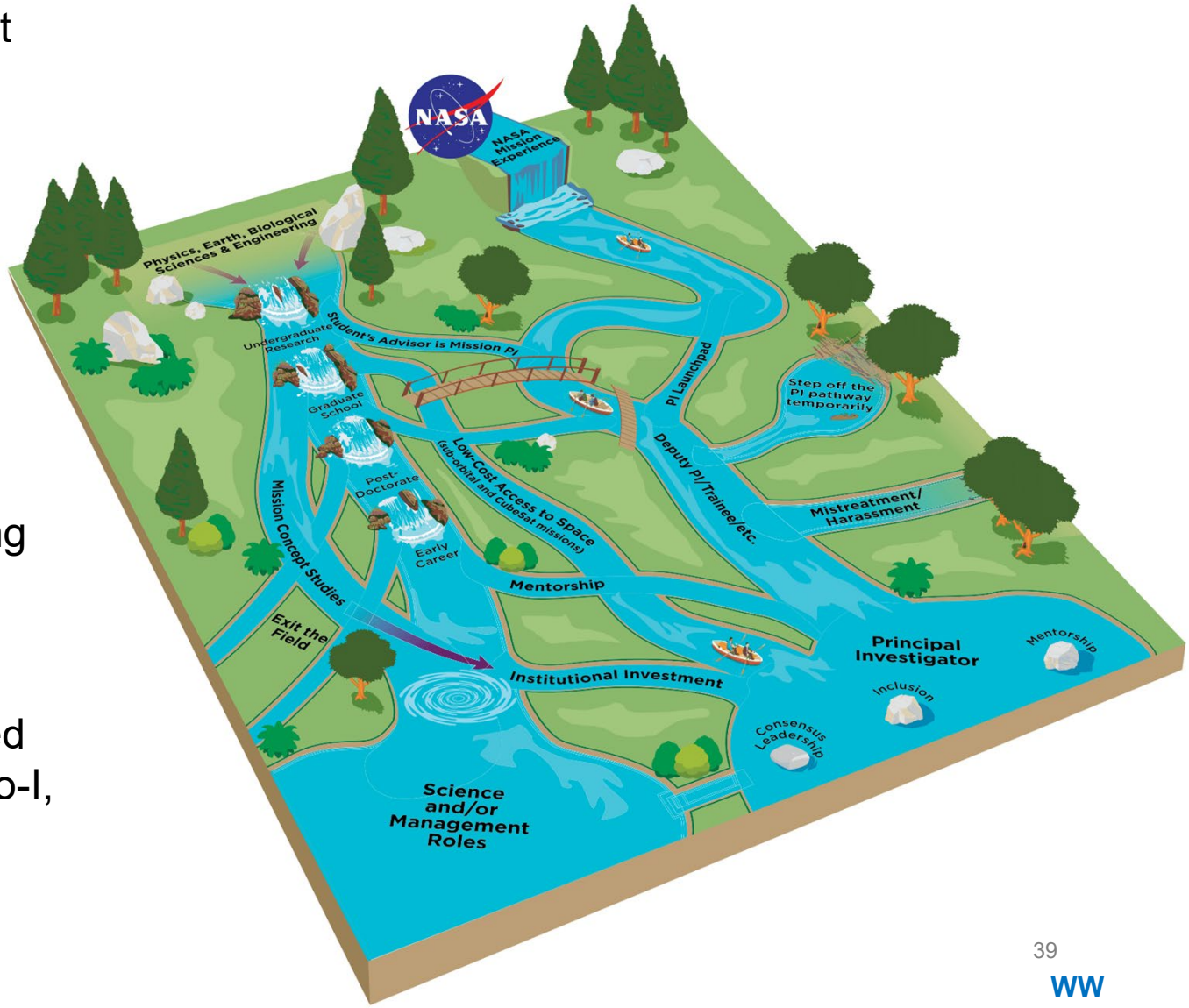
Non-PhD granting academic institutions, Historically Black Colleges and Universities and other Minority Serving Institutions experience **inequitable access to the mission experiences** known to support competed space mission proposal development and submission.

Significant and concerted efforts needed to ensure that the currently small pool of scientists of color in the physical sciences have every opportunity to engage in NASA mission-related work and leadership.

Training and Mentoring

Pathways to Mission Leadership

- Different entry and exit points
- Opportunities and barriers along the paths
- Structural and cultural factors that encourage some people and discourage others along the pathways
- Paths can lead to multiple mission-related roles: PI, deputy PI, Co-I, project scientist, etc.



Training and Mentoring

RECOMMENDATION 10:

NASA should **expand and increase the frequency of training programs**, which are **aimed at encouraging women and historically minoritized communities** to become more involved in mission leadership.

RECOMMENDATION 11:

To engage and train diverse teams at all stages of professional talent development, NASA should offer mission-related research, mentorship, and training opportunities – ideally, integrated into actual NASA missions – through colleges/universities as well as NASA Centers, that should start as early as first-year undergraduates and graduate students (e.g., internships), and extend to the ranks of postdocs (e.g., fellowships), and established scientists (e.g., Participating Scientists).

Training and Mentoring

Expectations for aspiring PIs:

- Experience on flight missions or instrument development
- Networking and management skills
- Familiarization with the potential partner organizations
- Access to professional and social networks of colleagues with mission experience

Mission-related training, experience, and mentorship:

- Limited opportunities on existing missions
- Limited small mission opportunities
- Women and underrepresented groups: less access to mentors, lower quality of mentorship, and lack of access to networks

The expectations for aspiring PIs do not match the current opportunities available to gain the needed experience.

Recommendation 12

PI-led missions present opportunities for aspiring PIs to gain invaluable experiences. **NASA should expand resources (e.g., instructional materials, seminars, workshops) for aspiring PIs** to gain leadership experience and connect with individuals with mission experience for mentorship opportunities.

This may include:

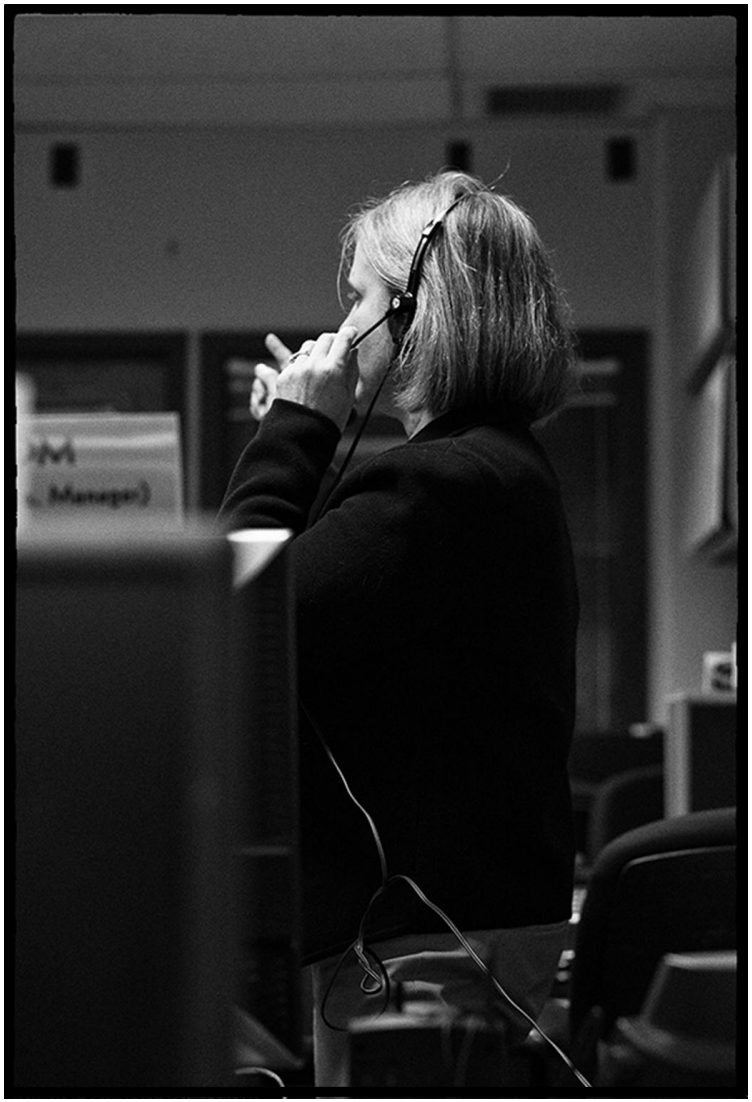
- **Integrating aspiring PIs as mentees in roles on mission teams, including the higher leadership positions**. This could be achieved by including developmental positions in all missions (i.e., competed, non-competed, and instrument investigations), which may require increasing the PI Managed Costs

- **Encouraging aspiring PIs to pursue entry points to mission leadership**, such as proposing to smaller, low-cost mission opportunities, (e.g., suborbital, smallsats and cubesats, instrument development, and hosted payloads)

- **Expanding structured networking opportunities at relevant disciplinary conferences** such as meet-and-greets where aspiring PIs can connect with collaborators and meet existing PIs, and participate in presentations and question and answer sessions led by NASA personnel about the proposal process

Recommendation 13

NASA should evaluate the skills and expertise needed for success as a PI beyond scientific competencies, including abilities leading and managing diverse, equitable, inclusive, and accessible teams. This more expansive set of competencies should be reflected in discussions about PI-ship in instructional materials and other outreach efforts.



THEME 4:
Investments in Pathways for Groups Underrepresented in STEM

Investments in Groups Underrepresented in STEM

Guiding Principles for STEM Pathway Investments

Promote the Development of STEM Identities

- Support meaningful engagement in the practice of STEM disciplines
- Allow for transfer STEM knowledge into action on issues of interest
- Authentic and culturally relevant

Establish Flexible and Relevant STEM Education-to-Career Pathways

- Support gains in the ability to think and work like a STEM professional
- Connect education and workforce opportunities
- Accommodate students' diverse interests and backgrounds

Intentionally Recruit from Historically Underrepresented Groups

- Facilitate targeted recruitment from historically underrepresented groups at all levels
- Actively engage institutions that intentionally educate and serve the professional needs of underrepresented groups (e.g., through investments, partnership and collaboration)

Investments in Groups Underrepresented in STEM

Guiding Principles for STEM Pathway Investments

Provide Access to Diverse Mentorship

- Various forms: formal or informal, sponsorship, peer mentorship, tiered mentorship
- Offer the potential to see oneself through the eyes of an influential role model
- Inclusive and support the development of a sense of belonging in STEM contexts

Foster Career-Life Balance

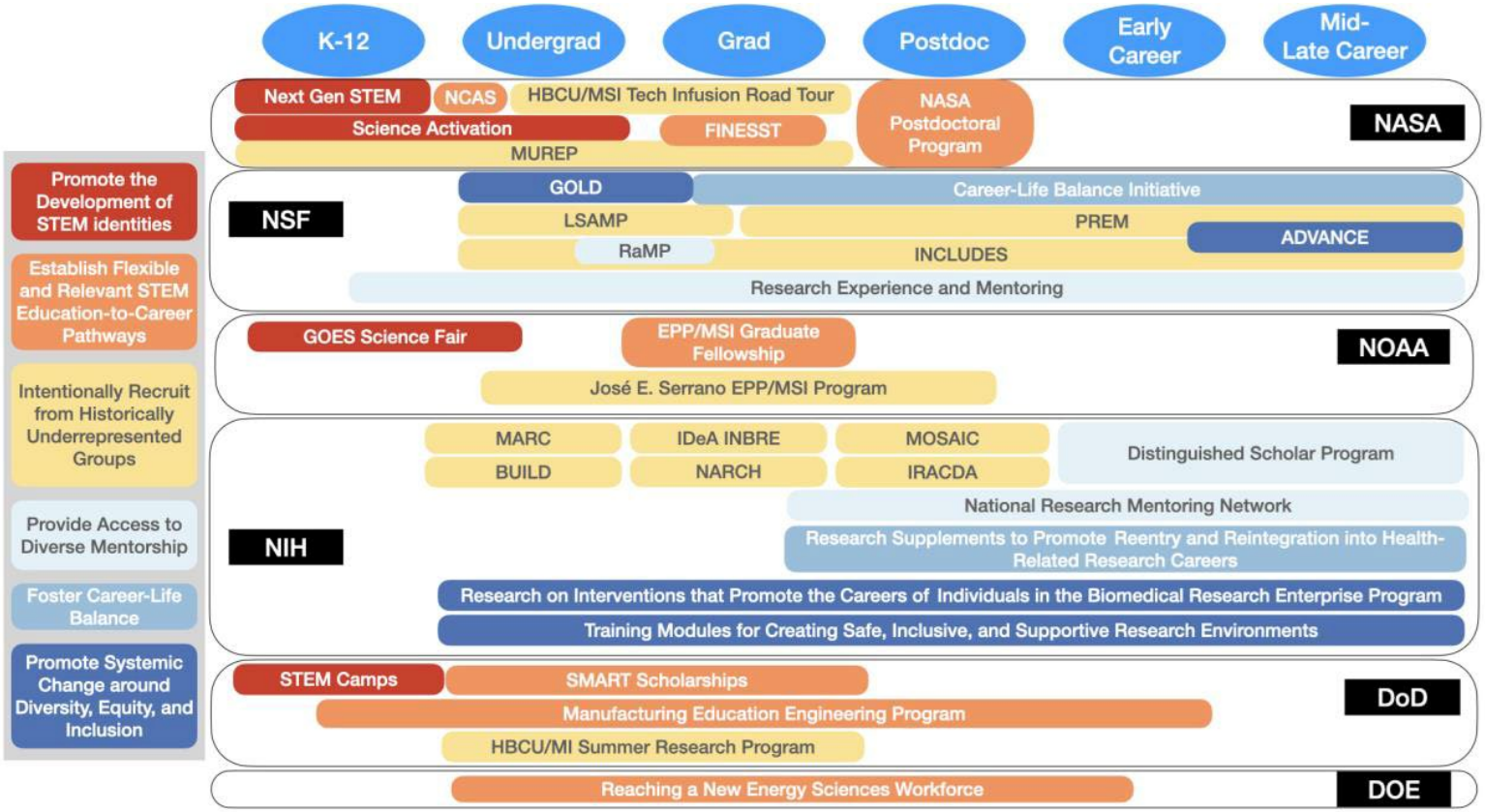
- Focus on minimizing institutional barriers that can undermine performance and promotion due to parental status and other family responsibilities
- Intentional focus on increasing the advancement and retention of women in STEM who are more negatively impacted by work-life imbalance

Promote Systemic Change around Diversity, Equity, and Inclusion

- Focus on transforming institutional and organizational cultures of STEM fields
- Focus on building capacity for broadening participation in STEM fields.
- Focus on addressing the impacts of structural racism, discrimination, and harassment on career advancement

Investments in Groups Underrepresented in STEM

Select Federal Agencies Investments along STEM Pathways



NASA

Many investments: K-graduate years

Fewer investments: post-PhD years

Investments in Groups Underrepresented in STEM

Two different parts of NASA lead STEM engagement efforts:

NASA's Office of STEM Engagement (OSTEM)	NASA SMD's Science Activation Program (SciAct)
• provides opportunities for STEM engagement and the development of research capacity and infrastructure of MSIs (e.g., via MUREP and MIRO)	• provides opportunities for meaningful engagement in science through the efforts of a cooperative network of awardees and by leveraging NASA's infrastructure activities

Further partnership among NASA SMD, OSTEM and MSIs, and leveraging NASA's unique assets, would strengthen participation of underrepresented groups in missions.

Recommendation 14

In order to ensure a vibrant, next generation pool of excellent and diverse talent for leadership in competed space missions:

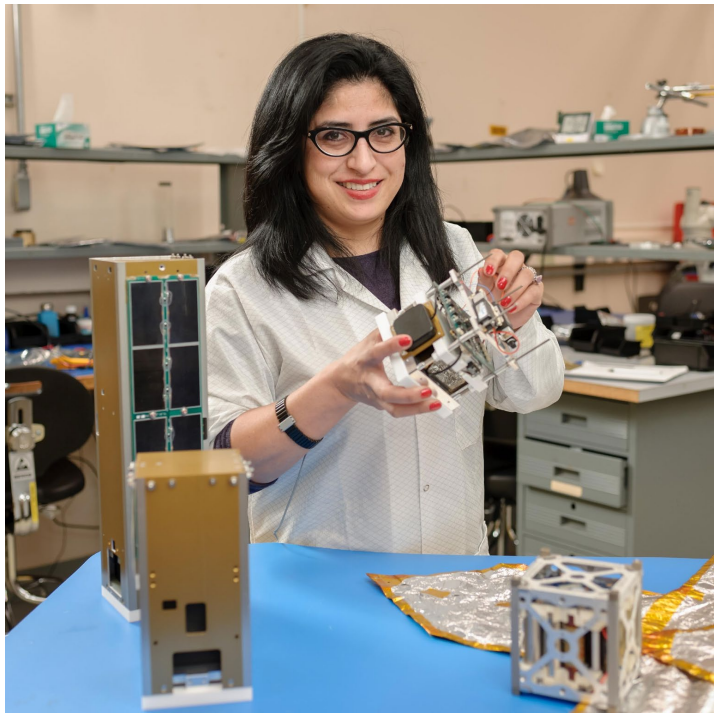
NASA SMD, in collaboration with the Office of STEM Engagement, should provide consistent and adequate funding for STEM initiatives that are explicitly centered on DEIA, address recruitment and retention challenges in the earth and space sciences, and support and expand opportunities for individuals from underrepresented groups.

These investments should reflect a pathways approach spanning the academic and career continuum from post-secondary through post-PhD years in order to establish flexible and robust education-to-career trajectories into the Earth and space sciences workforce, and ultimately into PI-led missions. A systematic process should also be in place to document measurable impacts of these investments.

Recommendation 15

Recognizing the critical role that HBCUs, HSIs, and other MSIs play in educating and employing women and racially minoritized populations in the earth and space sciences workforce,

NASA leadership, specifically the SMD and OSTEM Associate Administrators, should charter a joint team to examine and strengthen the historic and current relationship between the two organizations with respect to investments in MSIs. NASA's investments should also redress the historical inequities in NASA supported research and training at these institutions.



NATIONAL ACADEMIES Sciences Engineering Medicine

Recommendation 15 continued

Specifically, NASA should:

- **Reinvest in talent development programs in partnership with MSIs specifically related to NASA missions**, such as the undergraduate-to-graduate "bridge" type programs previously supported by NASA SMD's MUCERPI program.

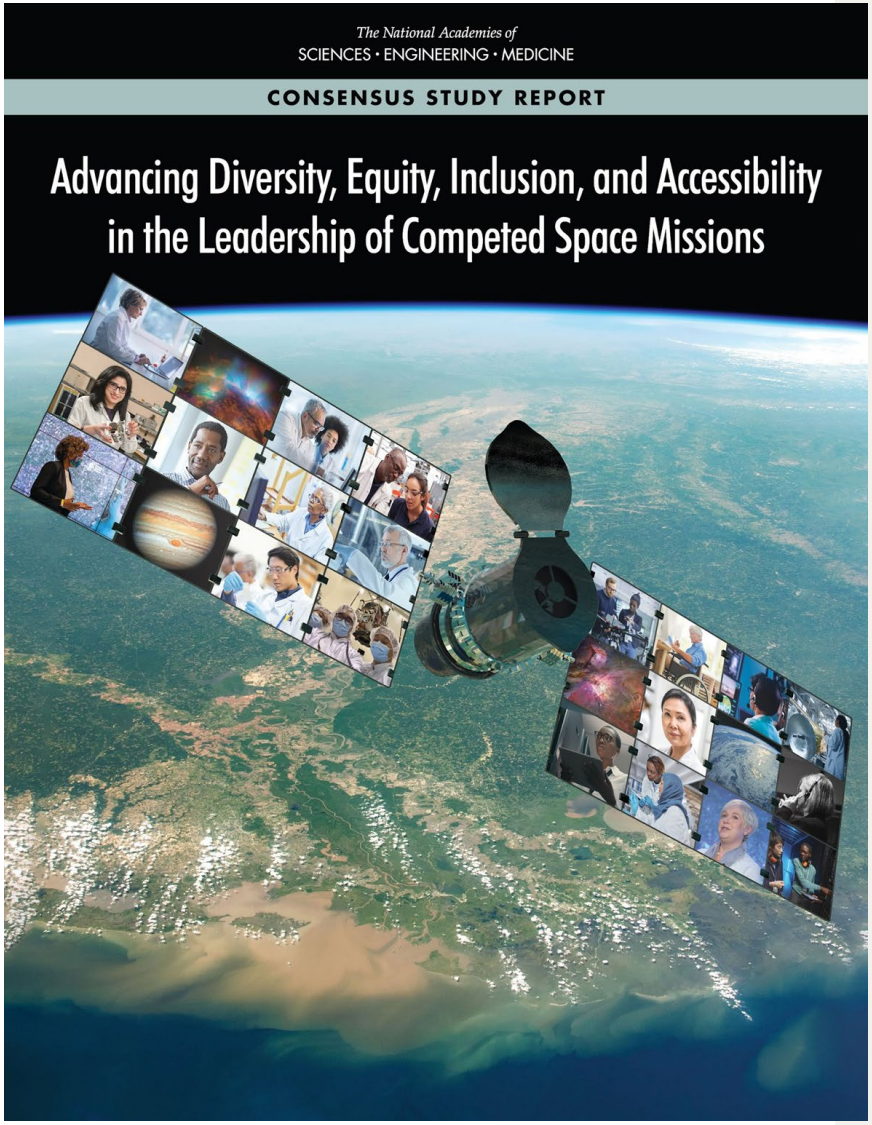
- **Further leverage NASA programmatic assets such as MUREP, MIRO and SciAct** to advance broad access to all of its missions, and further enhance early preparation and research engagement of students and early-career researchers, including underrepresented communities.

- **Provide funding to support mission-related work and activities** (e.g., building and designing instruments for space flight, hosting science team meetings, etc.) **as a means of enhancing research capacity at HBCUs, HSIs, and other MSIs**.

Questions and Discussion

Thank you for your engagement!

A pre-publication copy of the report (free PDF) will be available for download at: nap.nationalacademies.org



Supplemental Material

Proposal Process and Review

- **Scrutiny for sources of bias throughout the AO process is warranted**, and the process would benefit from including DEIA as criteria for evaluation.
- The **lack of a transparent, systematic process** for assessing proposal reviews and the **inadequate infrastructure for collecting demographic data** on proposers **severely limit NASA SMD's ability** to accurately determine the relationship between the current mission proposal process and diversity in the pool of PIs.
- Furthermore, these insufficiencies result in **limited ability to identify barriers in the mission proposal process and consequently the specific kinds of interventions that are needed** to eliminate them.

Proposal Process and Review

- With consideration for the suite of best practices that have been implemented government-wide, **NASA has some analogous, albeit less developed, accountability mechanisms in place for promoting DEIA** compared to other agencies.

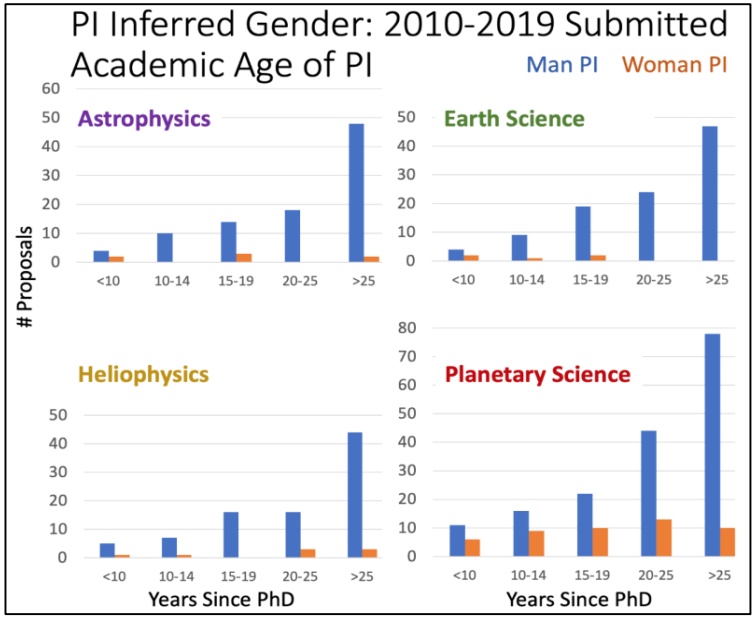
- However, competed missions **do not show robust evidence of positive outcomes** across Divisions that advance NASA's DEIA efforts.

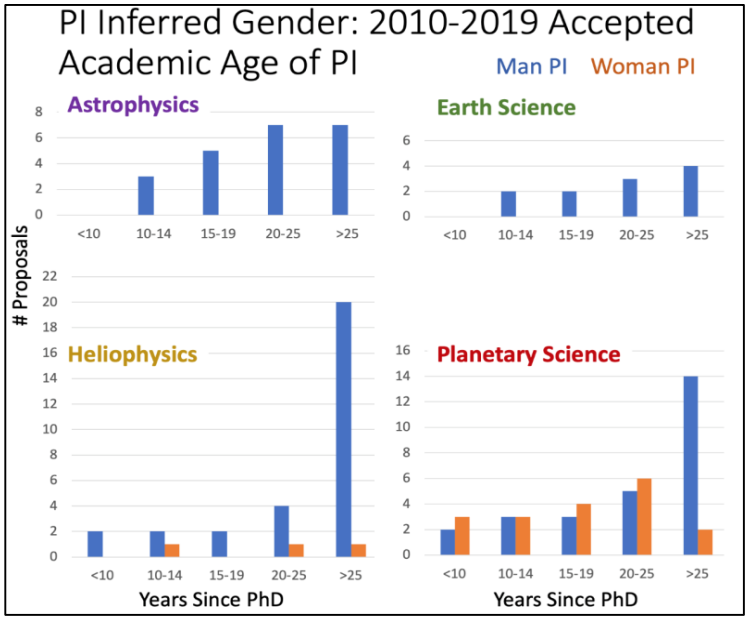
- There appear to be **no established processes and metrics for evaluating the effectiveness.**

The promise of NASA's existing best practices to address diversity, equity, inclusion, and accessibility, both within the agency and PI-led mission opportunities, is limited by the lack of defined metrics to evaluate effectiveness and track progress resulting from these interventions.

Data Collection, Analysis, and Reporting

- Most submitted proposals across Divisions have a PI who completed their PhD >25 years before proposal submission
- Distribution of academic age for PIs of accepted proposals is flatter for Astrophysics and Earth Science, while PIs are predominantly older and male in Heliophysics and Planetary Science.
- Women PIs of mission proposals tend to be younger

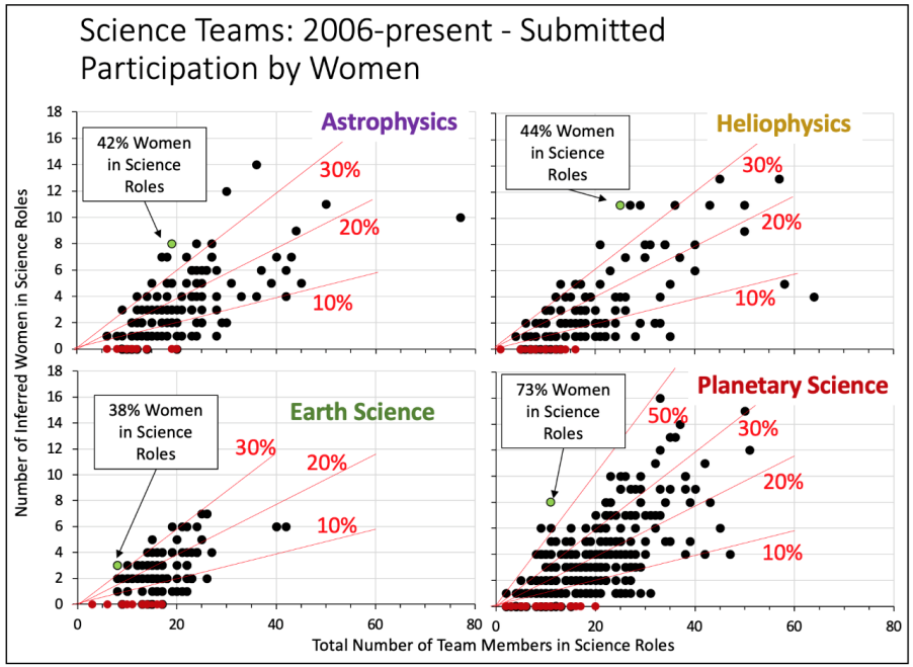




SOURCE: NASA SMD Data Analytics Team

Data Collection, Analysis, and Reporting

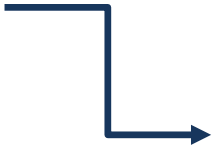
Participation by Women in Missions (since 2006)



SOURCE: NASA SMD Data Analytics Team

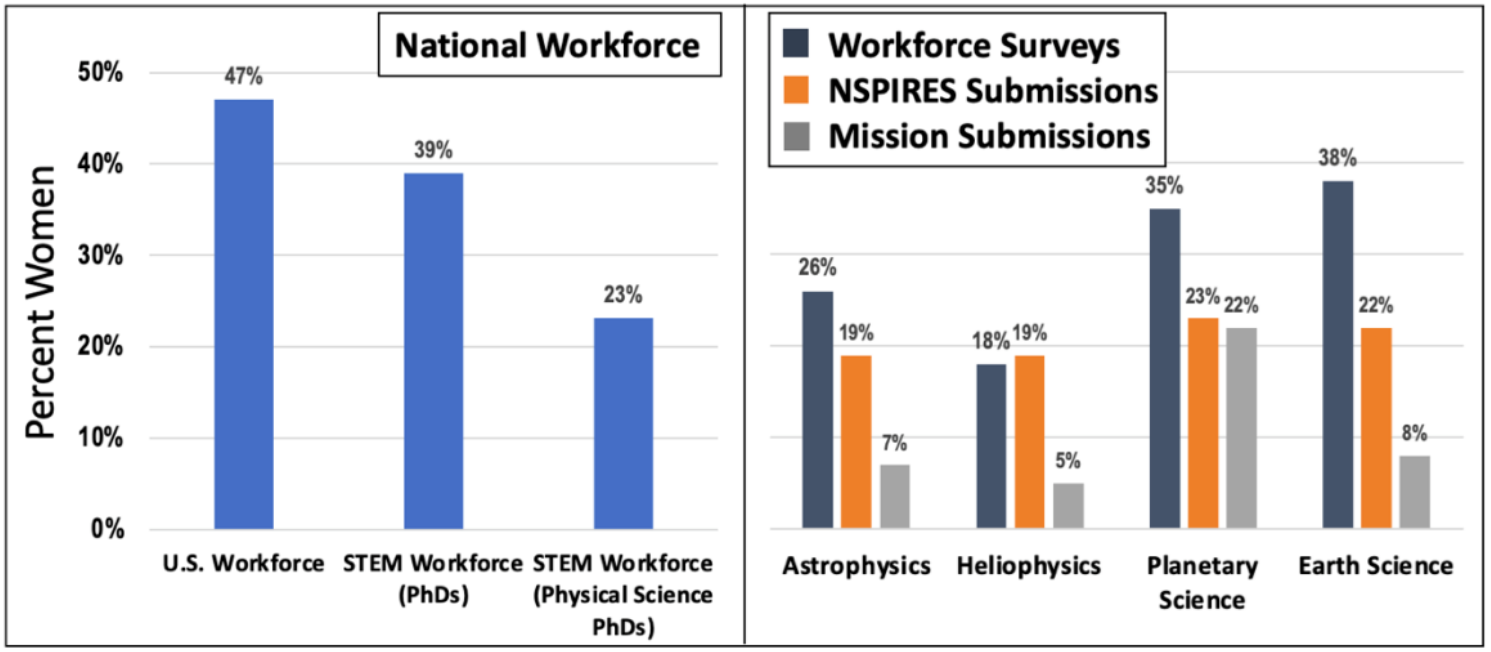
Data Collection, Analysis, and Reporting

- **Further study needed to understand differences** in %women PI proposers (missions and R&A grants) compared to %women physical sciences PhDs in many disciplines.
- **Wide ranges in quality and quantity of demographics data** currently gathered via the workforce surveys and via NASA's NSPIRES system
- Disciplinary categories typically represented in **NSF and AIP workforce surveys not well-aligned** with the interdisciplinary nature of the earth and space science fields



Currently, no strategy and methodology is being employed to effectively gather data on participation in the earth and space sciences along the whole career pathway (undergraduate to professional workforce).

Data Collection, Analysis, and Reporting



Compared to overall U.S. STEM workforce, women are underrepresented:

- Among mission submissions- **PIs of competed mission proposals**
- Among NSPIRES submissions- **PIs of R&A grant proposals**
- Within space sciences sub-fields: **Astrophysics and Heliophysics**

Compared to Physical Sciences PhDs, women are underrepresented:

- Among mission submissions in 3 Divisions **(except Planetary)**
- Among NSPIRES submissions in 2 Divisions: **Astrophysics and Heliophysics**