



2023 | NASA SCIENCE ACTIVATION

IMPACT REPORT



Image Credits

Front and back cover:

- This map shows the locations of partner organizations all across the country that work with Science Activation.
- Photos highlight some of the range of activities conducted.

Front cover photos:

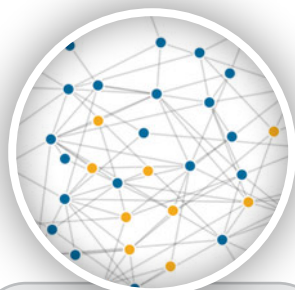
- *Photo top left:* Native Earth | Native Sky
- *Photo top right:* NASA HEAT
- *Photo bottom right:* SEES

Back cover photos:

- *Photo top left:* NISE Network
- *Photo top right:* Planetary ReaCH
- *Photo bottom:* LENE

* See pages 12–13 to learn more about each Science Activation Team.

DASHBOARD



WE COLLABORATE

48

TEAMS

A cooperative network of competitively selected teams and NASA infrastructure activities across the Nation connects NASA science experts, content, and experiences with communities to activate minds and deepen understanding of our world and beyond.



WE LEVERAGE

590

PARTNERS

We extend our reach through strategic partnerships with community-based and audience-based organizations to support institutional, state, and local efforts. These partnerships have more than doubled since 2016.



WE CONNECT

963

SCIENTISTS INVOLVED

NASA and NASA-funded scientists work with Science Activation behind the scenes and directly with learners to share the story, the science, and the adventure of NASA science. The number of scientists involved has increased 90% since 2016.



WE INNOVATE

125

PAPERS PUBLISHED

Our teams use evidence-based solutions to reach and motivate learners of all ages and document those solutions so that others can benefit. Our work has been cited more than 1,125 times to date.

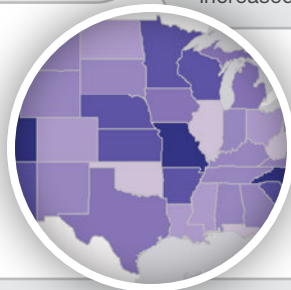


WE ENGAGE

76+ M

LEARNER INTERACTIONS

In 2023, SciAct teams facilitated nearly 65 million learner interactions in the United States and 10 million across the globe, a 45% increase over 2022.

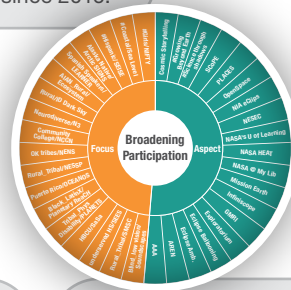


WE REACH

55

STATES & TERRITORIES

The SciAct program reached learners in all U.S. states, DC, and 4 U.S. territories in 2023, as well as 171 other countries around the world. Explore our network in our interactive Reach Map.



WE EMPOWER

100%

OF COMMUNITIES

More than half of SciAct teams focus on broadening participation of underserved communities. All competitively selected teams support underrepresented groups.



A young explorer views the October 14, 2023, partial (annular) eclipse from Houston, TX

INTRODUCTION

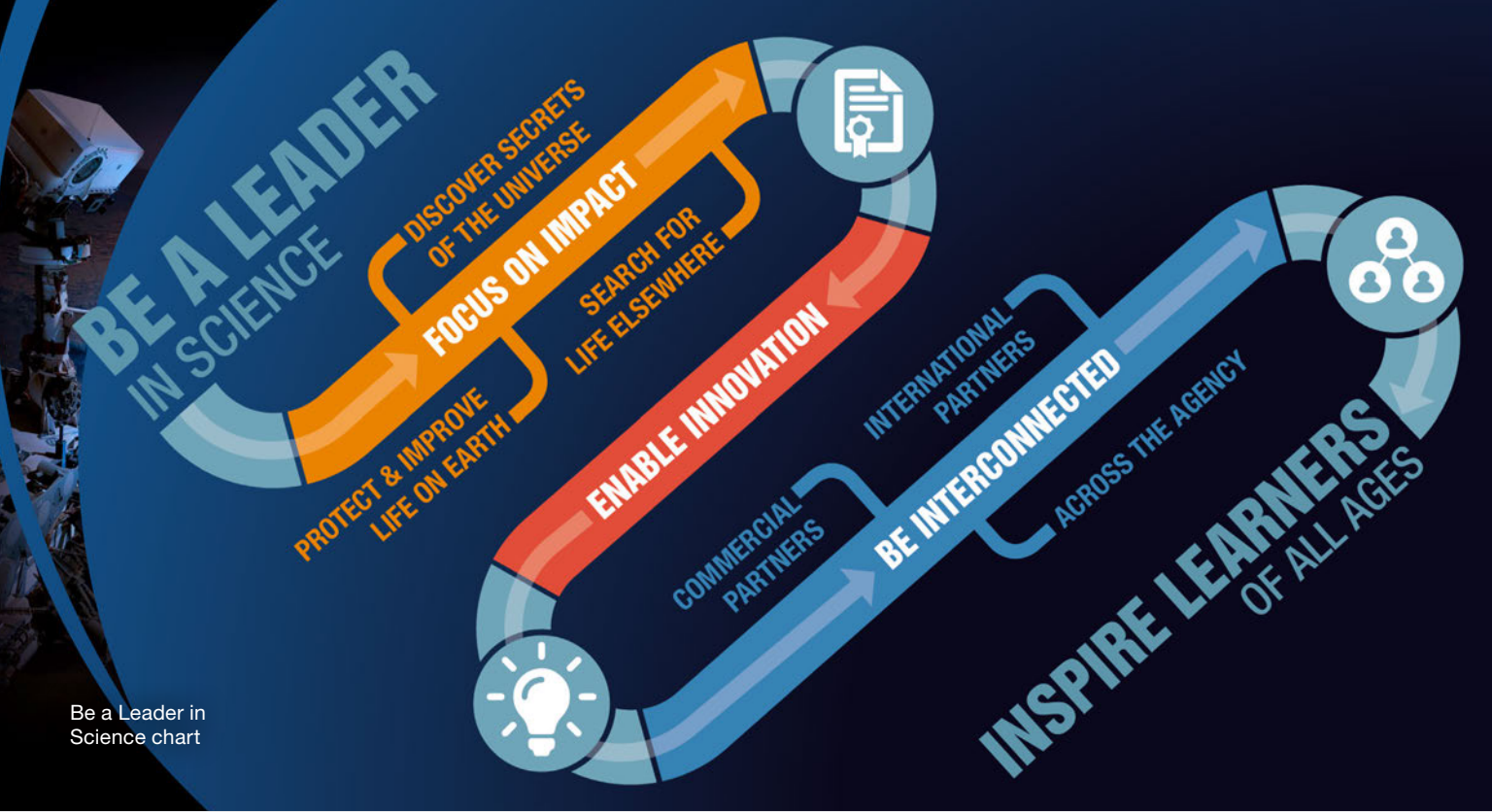
In 2016, the NASA Science Mission Directorate (SMD) launched the Science Activation (SciAct) program to connect NASA Science with diverse learners of all ages in ways that activate minds and promote a deeper understanding of our world and beyond. The ultimate Vision of the SciAct program is

To increase learners' (of all ages) active participation in the advancement of human knowledge.

SciAct is a rigorous, scientifically driven, nationwide program to connect learners of all ages with NASA science effectively and efficiently. This report summarizes the SciAct program's approach, provides a snapshot of the program's 2023 impacts, and illustrates how this ~\$50 million program creates impact and value that far exceed its annual expenditures, improving coordination across NASA Science activities and allowing for the increasingly efficient, effective, and sustainable use of SMD Science discoveries and experts for engaging learners.

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Be a Leader in Science chart

THE SCIENCE ACTIVATION PROGRAM

We Connect A Collective Impact Approach

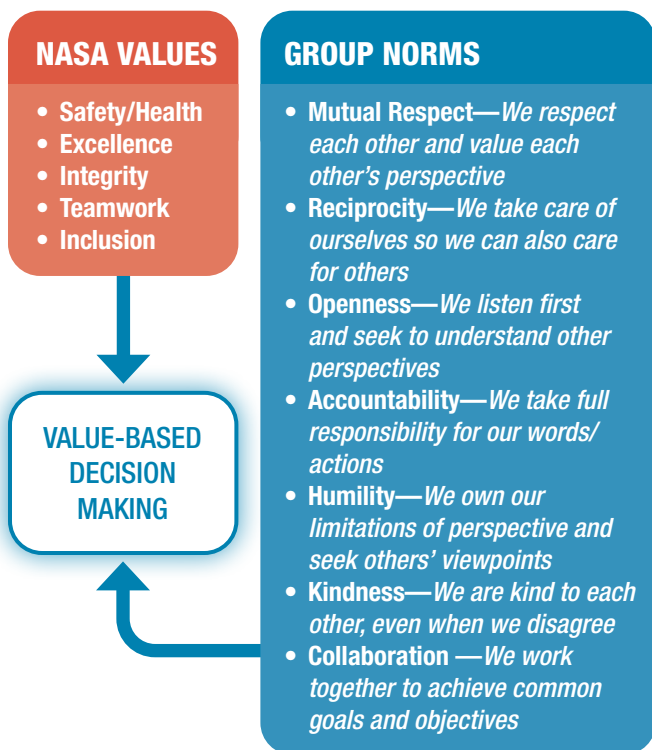
There are many organizations and programs that aim to inspire a passion for STEM in learners, with the hope that they will eventually pursue future careers in science and technology or become informed and critical citizens. According to research conducted by Kania and Kramer (2011)*, a single institution is rarely capable of single-handedly facilitating the entire pathway from learning to career opportunities. However, coordinating across many organizations using a “collective impact” approach can help interlink individual programs, providing the “connective tissue” that is more likely to create pathways to opportunities for learners. But this only works if there is trust across organizations. SciAct has deliberately taken time and engaged in activities to build and nurture those trusted relationships.

* Kania J., Kramer M. (2011) Collective impact. *Stanford Social Innovation Review* 9(4): 36–41.



From “Using a Collective Impact Approach to Support Youth Pathways in Technology,” A Case Example by Rafi Santo, New York University (2019).

<https://digitalllearningpractices.org/resource/using-a-collective-impact-approach-to-support-youth-pathways-in-technology>



Since its inception in 2016, the SciAct program has adopted this collective-impact, network-of-networks approach. A “Backbone team” embedded in NASA SMD is dedicated to supporting the cooperative, nationwide network of competitively selected project teams by coordinating collaboration across key activities and areas. The project teams, made up of community-based learning providers, educators, and experts, uphold a shared set of NASA values and SciAct group norms as they work together to connect diverse learners of all ages with NASA Science experts, exciting NASA content, and authentic science experiences. It is through value-based decision making, relationship and community building, intentional and independent evaluation, efficient coordination of mutually reinforcing activities, and open and continuous communication that SciAct helps create learner pathways to science, technology, engineering, and mathematics (STEM) careers and a more STEM-informed public.

SciAct models value-based decision making. This has been critical to success in adapting to community needs during the annular and total solar eclipses, and other events.

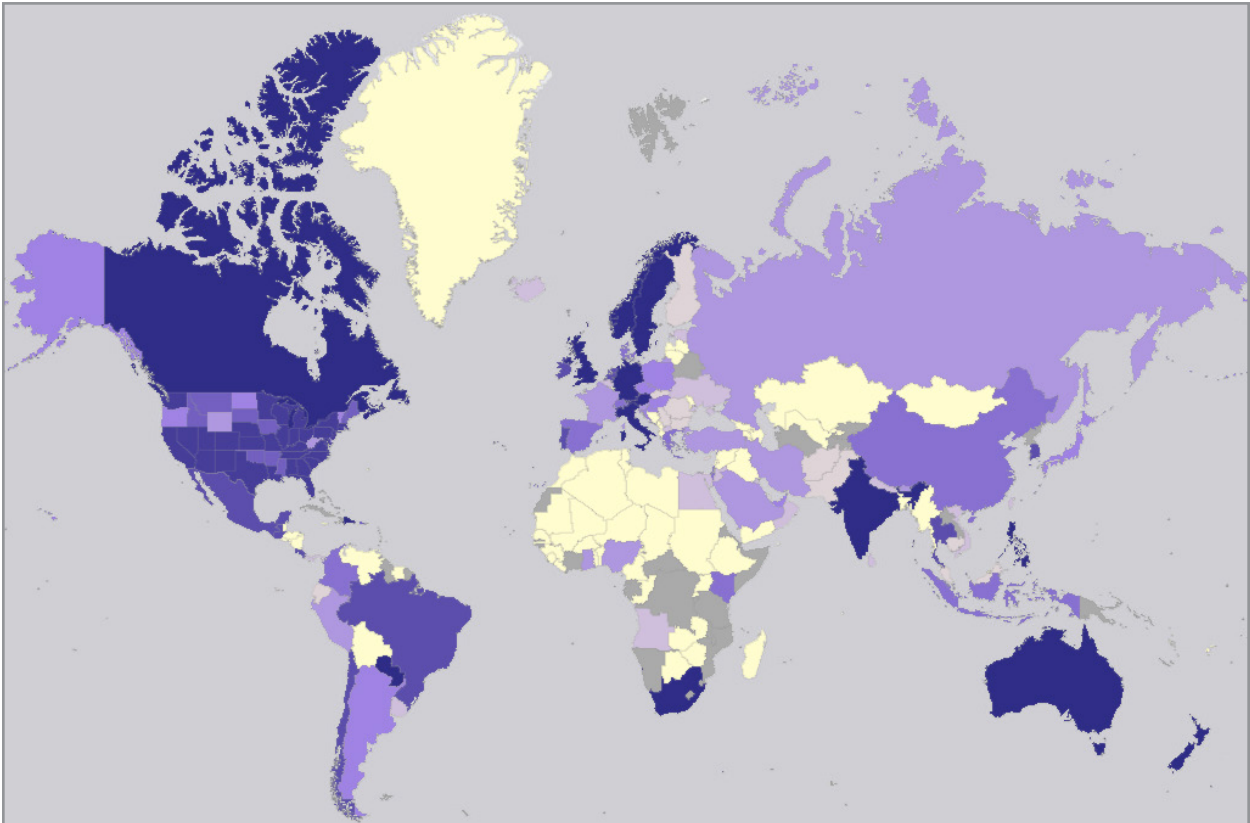
Joining Forces!

The year 2023 brought an exciting new element to the SciAct Annual Meeting. Selected members of the NASA Citizen Science (Cit Sci) community joined the meeting, while hosting an intersecting meeting of their own that focused on a dedicated agenda (see table). The goal was to explore the synergies and connection points between the two communities and determine whether a closer relationship had potential going forward to more positively impact learners through NASA science. Teams on both sides reported success in finding opportunities to work together toward the common goal of inviting more people to participate actively in the advancement of human knowledge. We will build on that potential going forward.

SciAct Theme: Open Science and Data	Intersecting Cit Sci Meeting
DAY 4: 11/16 (THURSDAY)	
Collaboration Time	
Showcase Session: Data and SMEs	Welcome Session
Portfolio Evaluation Panel	NASA Citizen Science Community Meeting
Eclipse Panel	
LUNCH	
Collaboration Time	SciAct Cit Sci Mixer
Panel: Open Science/Cit Sci/SciAct	
Breakouts Across Groups	
Breakouts for Topics of Common Interest	

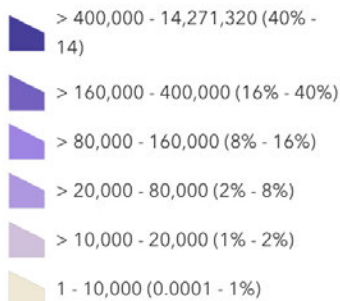
We Reach and Engage Learners Across the Nation and Beyond

As shown in the reach map below, in 2023, SciAct facilitated almost 76 million learner interactions, including 10 million across 171 countries outside the United States. That 45% increase over 2022 is attributed to the October annular solar eclipse as well as preparation for the total solar eclipse to



2023 State Level Reach Map - Reached Per 1M Population

Reach_1



2023 Country Level Reach Map - Reached Per 1M Population

Number



follow 6 months later in April 2024, and it also reflects strengthened engagement with SciAct’s community-based partners.

Science Activation project teams reached and engaged learners in all 50 states, the District of Columbia, Puerto Rico, the Virgin Islands, Guam, and American Samoa in 2023. Total reach in the United States was almost 19% of the U.S. population.

Note the different scales for state vs. country reach on the map above.

We Leverage and Collaborate

590 Partners

SciAct achieves its impressive reach and engagement goals in two primary ways. First, project teams engage in strategic partnerships with community-based and audience-based organizations outside the SciAct program to support existing institutional, state, and local efforts. Leveraging partnerships and collaborating externally amplifies SciAct's impact for learners across the Nation and allows connections in all 50 states, as shown in the partner map below. Each awardee selects and develops those relationships that help them best achieve their objectives and meet the needs of diverse learners. Since the beginning of the SciAct program in 2016, these partnerships have more than doubled, with the teams having worked with 590 active external partners in 2023.

2023 Science Activation Partners Map

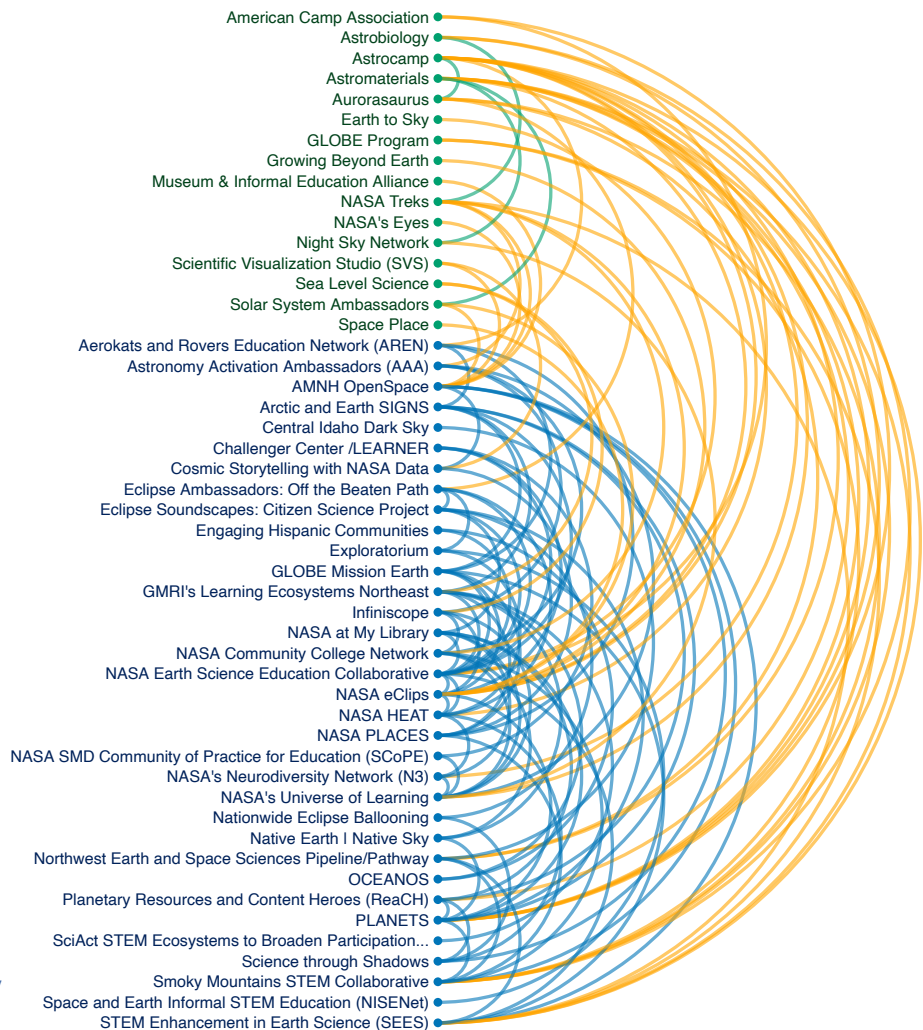


In addition to external partners, the program leverages partnerships and cross-collaborations within SciAct to ensure project teams benefit from each other's assets and expertise as well as those of NASA's infrastructure activities.

NASA infrastructure teams are preexisting, mostly NASA-Center-based activities that provide foundational resources and activities that can be leveraged for learning. For example, before SciAct began, NASA Science already had very effective volunteer networks (e.g., **Night Sky Network**, **Solar System Ambassadors**); it already had a place for makers to find 3D printing files (**NASA 3D Resources**) and astronomy enthusiasts to find images (**Astronomy Picture of the Day**); it already had an expert **Scientific Visualization Studio**; it already had excellent interactives (**NASA Eyes** and **NASA Treks**); it had a long-running partnership with interpreter organizations (**Earth to Sky**); and NASA has long led the interagency Global Learning & Observation to Benefit the Environment (**GLOBE**) Program. Since SciAct began, additional infrastructure has been identified, including the **Astrocamp Community Partners** and the **Astromaterials** curators. All these infrastructure groups have benefited from SciAct connections to reach more learners in a more coordinated way, further leveraging the impact of the taxpayer investment. In addition, there are emerging connections to ongoing citizen science activities (e.g., **Aurorasaurus**). You can learn more about specific infrastructure activities in the teams section later in this document.

Internal cross-collaborations between SciAct teams and between SciAct and infrastructure teams avoid duplication of effort and promote efficiency while leveraging the investment in the expert communities around each type of activity.

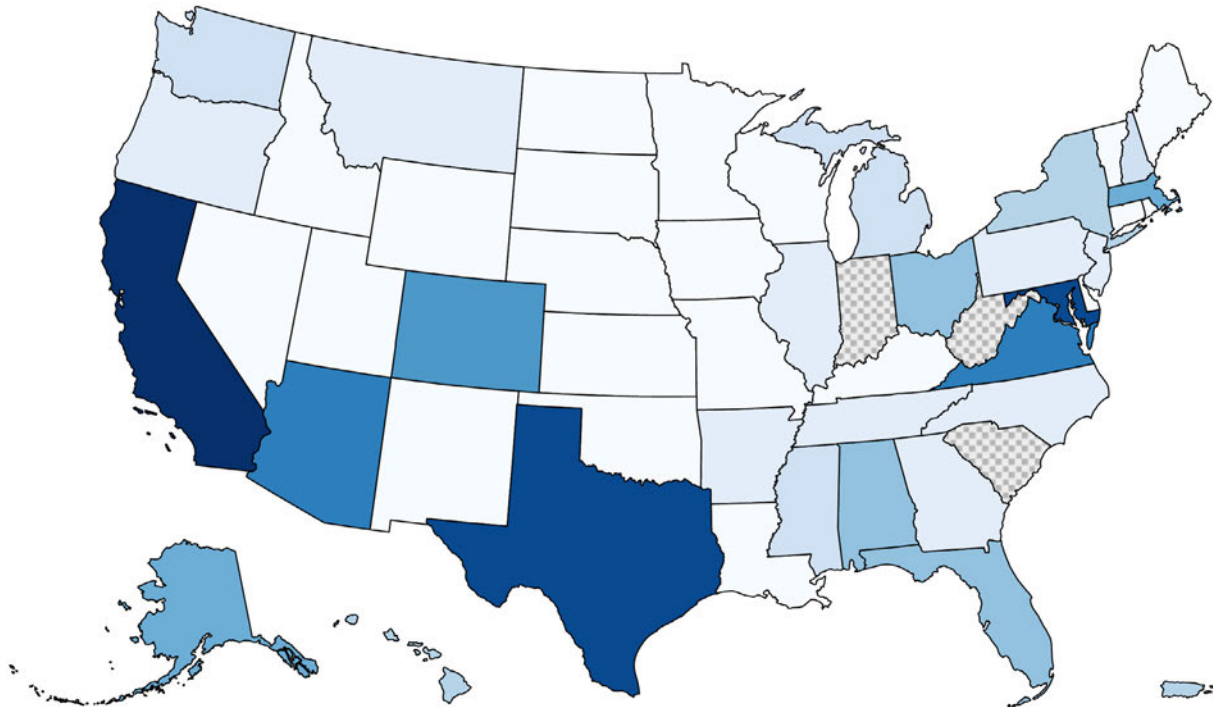
NASA SciAct supports dynamic and deep collaborations among and across SciAct project teams (shown in **blue text**) and infrastructure teams (shown in **green text**).



<https://science.nasa.gov/learners/leverage>

We Inspire Learners and Scientists

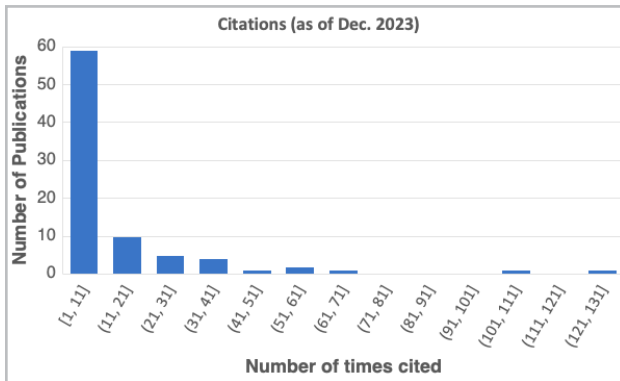
NASA and NASA-funded scientists work with Science Activation teams, both behind the scenes and interacting directly with learners, to share the story and adventure of NASA Science. Throughout 2023, more than 960 subject matter experts (SMEs) from across the United States (see map) participated in and helped produce accurate, compelling, and innovative Science Activation events and products—giving learners the opportunity to learn from and work hand-in-hand with scientists in inspiring and engaging ways. SciAct SMEs include a whole range of experts, from early-career to senior scientists, and across disciplines, to effectively share NASA science with many types of learner audiences.



SciAct works to meet the specific needs and interests of regional and local communities with our community-based teams, but it also leverages major celestial events such as the annular solar eclipse in October 2023, as well as major NASA events such as the Origins, Spectral Interpretation, Resource Identification, and Security–Regolith Explorer (OSIRIS-REx) sample return in September, among other inspiring NASA content that can engage learners of all ages in the advancement of science. The Science Activation Teams and subject matter experts serve as the face of NASA for communities across the country.

We Innovate Evidence-Based Learning Solutions

Since SciAct began, teams have reported 125 peer-reviewed publications—33 in 2023 alone—documenting evidence-based solutions for reaching and motivating learners of all ages so that others can benefit from our lessons learned. To date, these publications have been cited more than 1,100 times, and the portfolio now has an h-index of 18.



To explore the range of SciAct peer-reviewed publications, visit <https://science.nasa.gov/learn/publications>.

SciAct is a learning community that seeks to both share and benefit from relevant expertise, wherever it resides. In 2023, SciAct teams had an active role in presenting and learning in more than four dozen conferences, across formal and informal learning, information science, efforts to broaden participation, and Earth and space science.

We Provide Learning Resources

In September 2023, NASA launched a new website, which includes an updated presence for Science Activation: <https://science.nasa.gov/learn>. As part of that update, a revitalized, searchable catalog of learning resources was made available: <https://science.nasa.gov/learn/catalog>. It currently offers more than 1,100 learning resources from the Science Activation teams, as well as high-quality and evergreen resources from prior NASA science learning projects.

DIVISION/ DISCIPLINE	Astrophysics	Biological/ Physical Science	Earth Science	Heliophysics	Planetary Science
NUMBER OF RESOURCES	224	17	609	204	281

Note: Some resources are relevant to multiple disciplines.

We Empower Broadening Participation

Diversity, equity, inclusion, accessibility, and belonging (DEIAB) are critical values that underscore SciAct's commitment to broadening participation. With half of the personnel in the SciAct portfolio focused on broadening participation within specific communities, they are able to bring forward best practices that all the teams can consider to enhance their own work. Since mid-2021, 15 teams have shared DEIAB expertise with the SciAct community, as summarized in the table below. The rest of the teams will be sharing their expertise as well over the next 2 years. We also leverage SMD attendance at targeted meetings and conferences to further enhance our reach to underserved communities.

DATE	TEAM	TOPIC
June 21	Exploratorium	Latinx Audience Engagement
January 22	Eclipse Soundscapes: Citizen Science	Writing Good Alt Text
February 22	NASA Earth Science Education Collaborative	Designing Digital Resources for Accessibility (508 compliance)
March 22	NASA's Neurodiversity Network	Autism Training (for SMEs and Providers)
April 22	Planetary ReaCH	Co-design Workshop Planning to Enable Better Engagement of Black and Latinx Audiences
May 22	SEISE/NISE Network	Learning from a Learning Community (NISENet)
June 22	SciAct STEM Ecosystems	Equity & Inclusion in STEM Learning Ecosystems
August 22	PLANETS	Promoting Inclusion and Engagement in STEM Learning
September 22	GLOBE Mission Earth	Engaging Multilingual Learners with Data and Other NASA Resources
October 22	Native Earth Native Sky	Working in Collaboration with Native Nations
March 23	NIA NASA eClips	The Value of Including Diverse Voices in Planning and Decision Making
April 23	Arctic and Earth SIGNS	Meaningful Connections with Indigenous Audiences
May 23	NASA's Universe of Learning	Data Sonification
June 23	NASA@ My Library	Community Dialogues to Catalyze STEM Learning in Diverse Communities with Unique Populations
September 23	Eclipse Ambassadors	True Allyship in Action

THANK YOU

We hope you have enjoyed this brief snapshot of the Science Activation program and its 2023 impacts. It is our hope to provide every lifelong learner, student, and educator with the opportunity not only to experience the excitement of scientific discovery, but to become active participants in the advancement of knowledge well into the future. Keep up with our ongoing activities and explore Science Activation resources on our website.

This year, we specifically want to thank Kristen Erickson, who has led the Science Activation community since the planning stages and who retired at the end of 2023 after a four-decade NASA career. She will be missed, but her legacy will continue to live on through the SciAct program and its impacts.

Leadership Team



Kristen Erickson
DIRECTOR



Dr. Lin Chambers
DEPUTY DIRECTOR



Clarence E. Bostic
PROGRAM SPECIALIST



Dr. Rachel Connolly
**SYSTEMS INTEGRATION
AND ANALYSIS LEAD**



Kim Holloway
PROJECT COORDINATOR



Luke Henke
**EINSTEIN EDUCATOR
FELLOW**



Bea Underwood
**ADMINISTRATIVE
OFFICER**



Kenji Nomura
**EINSTEIN EDUCATOR
FELLOW**



Tahira Allen
COMMUNICATIONS LEAD

Science Division Leads



Dr. Hashima Hasan
ASTROPHYSICS



Ursula Koniges
**BIOLOGICAL AND
PHYSICAL SCIENCES**



Amy Chen
**EARTH SCIENCE
GLOBE**



Dr. Trena Ferrell
**EARTH SCIENCE
SCIACT**



Dr. Barry Lefer
**EARTH SCIENCE
RESEARCH AND
ANALYSIS**



Dr. Michael Kelley
PLANETARY SCIENCE



Dr. Nancy Searby
**EARTH SCIENCE
APPLIED SCIENCES**



Dr. Kelly Korreck
HELIOPHYSICS

THE SCIENCE ACTIVATION PROJECT TEAMS

Learn more about each Science Activation project and infrastructure team (new to the report this year and denoted by *) via the following compilation of 2023 two-page snapshots.

PROJECT NAME	NASA SCIENCE MISSION DIRECTORATE DIVISION SUPPORTED	PAGE
AEROKATS and ROVER Education Network (AREN)	Earth Science	14
Astronomy Activation Ambassadors (AAA)	Astrophysics	16
American Museum of Natural History (OpenSpace)	Crosscutting	18
Arctic and Earth STEM Integrating GLOBE & NASA	Earth Science	20
*Astro Camp® Community Partners (ACCP)	Crosscutting	22
*Astromaterials	Planetary Science	24
*Astronomy Picture of the Day	Astrophysics	26
*Aurorasaurus	Heliophysics	28
Central Idaho Dark Sky Reserve STEM Network	Crosscutting	30
Cosmic Storytelling with NASA Data (CosmicDS)	Astrophysics	32
*Earth to Sky	Crosscutting	34
Eclipse Ambassadors Off the Paths	Heliophysics	36
Eclipse Soundscapes: Citizen Science Project	Crosscutting	38
Engaging Hispanic Communities	Crosscutting	40
GLOBE Mission EARTH (GME)	Earth Science	42
Growing Beyond Earth	Biological and Physical Science	44
Learner Engagement Accessing Real-world NASA SMD Expert Resources (LEARNER)	Earth Science	46
Learning Ecosystems Northeast	Earth Science	48
*MIT Media Lab: Supporting NASA Science Activation	Crosscutting	50
NASA Community College Network (NCCN)	Crosscutting	52
NASA Earth Science Education Collaborative (NESEC)	Earth Science	54
NASA eClips 4D	Crosscutting	56
NASA Heliophysics Education Activation Team (NASA HEAT)	Heliophysics	58

PROJECT NAME	NASA SCIENCE MISSION DIRECTORATE DIVISION SUPPORTED	PAGE
NASA Infiniscope	Planetary Science	60
NASA Inspires Futures for Tomorrow's Youth (NIFTY)	Crosscutting	62
NASA SMD Community of Practice for Education (SCoPE)	Crosscutting	64
*NASA Solar System Treks	Planetary Science	66
*NASA's Eyes 3D Visualization Products	Crosscutting	68
NASA's Neurodiversity Network (N3)	Crosscutting	70
NASA's Universe of Learning	Astrophysics	72
NASA@ My Library	Crosscutting	74
National Informal STEM Education (NISE) Network Space and Earth Informal STEM Education (SEISE) Project	Crosscutting	76
Nationwide Eclipse Ballooning Project (NEBP)	Crosscutting	78
Native Earth Native Sky (NENS)	Crosscutting	80
Navigating the Path of Totality	Heliophysics	82
*Night Sky Network	Crosscutting	84
Northwest Earth and Space Science Pathways (NESSP)	Crosscutting	86
Ocean Community Engagement and Awareness Using NASA Observations and Science for Hispanic/Latino Students (OCEANOS)	Earth Science	88
Place-Based Learning to Advance Connections, Education, and Stewardship (PLACES)	Earth Science	90
Planetary Learning that Advances the Nexus of Engineering, Technology, and Science (PLANETS)	Planetary Science	92
Planetary Resources and Content Heroes (ReaCH)	Planetary Science	94
SciAct STEM Ecosystems	Crosscutting	96
Science Through Shadows	Heliophysics	98
Sea Level Education, Awareness, and Literacy	Earth Science	100
Smoky Mountains STEM Collaborative (SMSC)	Crosscutting	102
*Solar System Ambassadors	Crosscutting	04
*Space Place	Crosscutting	106
STEM Enhancement in Earth Science (SEES)	Earth Science	108

* Indicates NASA infrastructure activity, new to the report this year.

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE**
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

AEROKATS and ROVER Education Network (AREN)



PI: Lisa Ogiemwonyi
 INSTITUTION: Wayne RESA

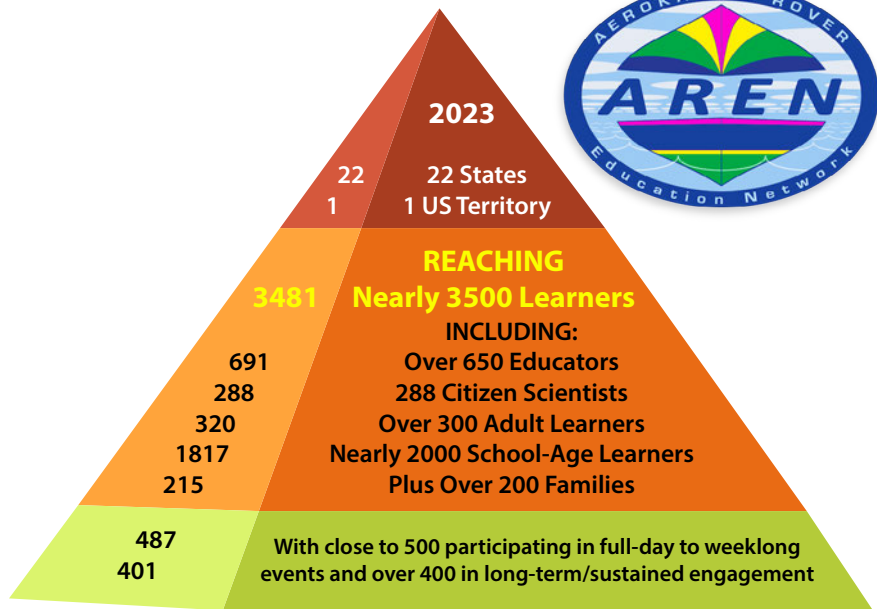
EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

AUDIENCE AGES
0+

- 0-3
- 4-10
- 11-14
- 14-18
- 19-22
- 23-26
- 27-30
- 31-34
- 35-38
- 38-89

AREN introduces learners to NASA technologies, science, and operations concepts. Instrumented kites and mobile surface systems are used to gather local-scale remote sensing and in situ atmospheric information. These tools are used in audiences ranging from preschool to lifelong learners.



“ Audience Quotes

“My students have really enjoyed getting out of the formal classroom and having the opportunity to use remote sensing equipment. This provided an opportunity for some students who do not generally excel in the traditional setting to really jump in and demonstrate their knowledge, skills, etc. in this project.”

“[The students] were able to experience pride in their research findings. One of the students now wants to go to college and continue studying science. My students are an at risk group, so this was huge!”

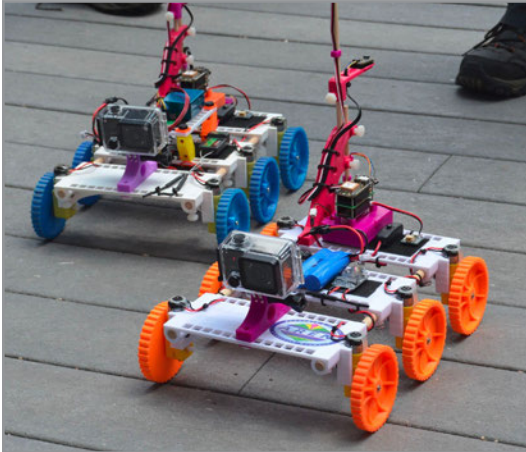
DELIVERY MODELS

- INDEPENDENT/ SELF-DIRECTED
- FACILITATED LEARNING
- GUIDED BY INFORMAL EDUCATORS
- DELIVERED BY FORMAL EDUCATORS
- PEER PROFESSIONAL LEARNING

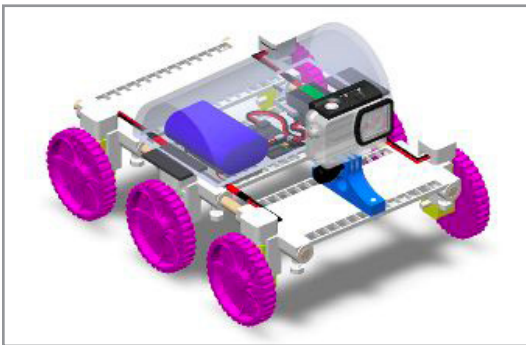
<https://sites.resa.net/aerokats>

★ Key 2023 Accomplishments

- AEROKATS Summer Institute for Remote Sensing
- TerraROVER UHIP2 Development and Workshop



TerraROVER with UHIP



Boston University Engineering Project TerraROVER with Mission Earth

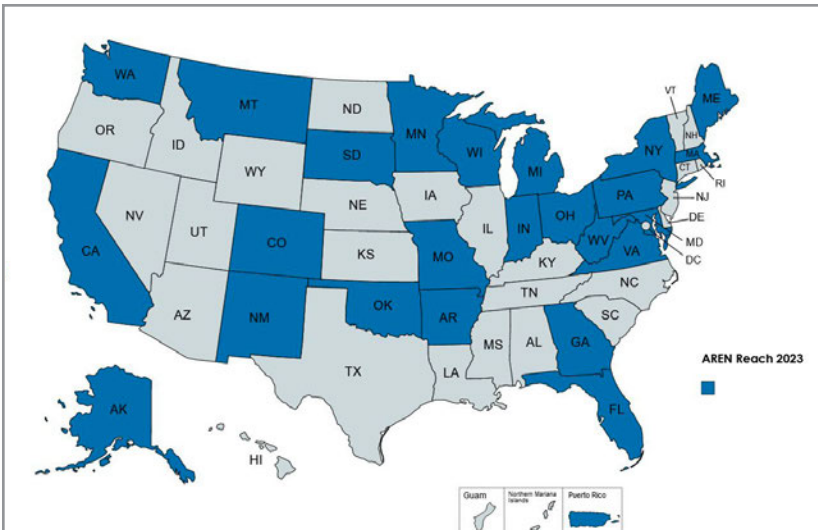
- MiniCam Development and Workshop
- TOWER Kite Development and Workshop (Great Winds Kites)

⚙️ Key Partners Active in 2023

- GLOBE
- SciAct—GLOBE Mission Earth
- America View
- American Kitefliers Association
- Great Wind Kites



Roberts School (MT)



AREN Reach 2023

<https://www.mapchart.net/usa.html>



MiniCam

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

Astronomy Activation Ambassadors (AAA)



PI: Dr. Dana E. Backman

INSTITUTION: SETI Institute, Mountain View, CA

AUDIENCE AGES
11+

11-14

14-18

19-22

23-26

27-31

32-36

37-41

42-99

The AAA project aims to measurably enhance student STEM learning and engagement via professional development (PD) for middle school, high school, and college science teachers, including (1) training in science content and pedagogy delivered through webinars and in-person workshops and (2) weeklong STEM immersion experiences at NASA astronomy research facilities such as the Infrared Telescope Facility (IRTF) on Maunakea in Hawai'i, including participation in nighttime observing sessions. After STEM immersion, participants implement a NASA content-oriented 10- classroom-hour curriculum unit written by AAA staff regarding the electromagnetic spectrum and multi-wavelength astronomy (EMS/MWA). Impact on student STEM engagement is evaluated by WestEd via student surveys, including the Professional Identity Overlap (PIO-1) shared measure.

2016-23 IMPACTS

95
Schools
and Colleges

215
Teachers

22,000+
Students

?ETI
INSTITUTE

EDUCATIONAL SETTINGS

INFORMAL/
OUT OF SCHOOLFORMAL
EDUCATIONCITIZEN
SCIENCE

PROFESSIONAL

“ Audience Quote

“Seeing the observatories and telescopes in person made me realize how much teamwork is involved. The scientists, engineers, and many others must work together to achieve a common goal, the pursuit of knowledge and understanding of our Universe.” —Mary Teren, Georgia high school teacher

DELIVERY MODELS

INDEPENDENT/
SELF-DIRECTEDFACILITATED
LEARNINGGUIDED BY INFORMAL
EDUCATORSDELIVERED BY FORMAL
EDUCATORSPEER PROFESSIONAL
LEARNING

<https://www.seti.org/aaa>

★ Key 2023 Accomplishments

- The C11 cohort of 18 teachers (5 middle school, 8 high school, 5 community college) from 14 states was selected in December 2022 via peer-panel review of applications.
- Two C11 in-person curriculum training workshops were held respectively in Denver (June) and Hilo (July). C11 STEM immersion experiences, focused on the NASA IRTF and other Maunakea observatories plus Hilo astronomy research and public engagement facilities, were held during July–August.
- The first full-scale implementation of an Astronomy Academy with PD for teachers not tracked for STEM immersion was held in Cobb County, GA, during January. The Virtual Astronomy Academy (VAA), an online version of the Astronomy Academy with 185 registrants, was piloted starting in May.
- Upgrades to the Electromagnetic Spectrum/Multi-Wavelength Astronomy (EMS/MWA) curriculum module included (a) a new science case study for the student reader regarding IRTF observations of O₃ in Mars's atmosphere, (b) translation of the Mars O₃ case study into Spanish, and (c) conversion of two science case studies (Pluto stellar occultation and Jupiter mid-infrared images) from approximately 10th-grade to 6th-grade Lexile level.
- A link to the public version of the NASA AAA EMS/MWA curriculum was included in the SMD Back-to-School information broadcast.

✚ Key Partners Active in 2023

- NASA IRTF
- University of Hawai'i
- Gemini Observatory
- Cobb County (GA) Schools



C11 curriculum training workshop

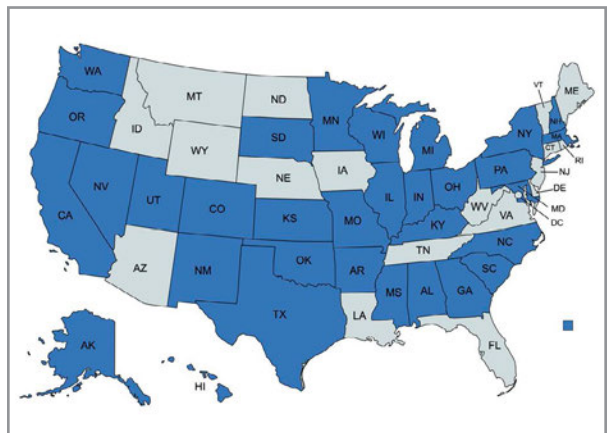


AAAs at NASA IRTF

AAAs inside James Clerk Maxwell Telescope dish



AAAs in IRTF control room



AAA 2016–23 Reach Map

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

American Museum of Natural History (OpenSpace)



PI: Dr. Rosamond Kinzler

INSTITUTION: American Museum of Natural History

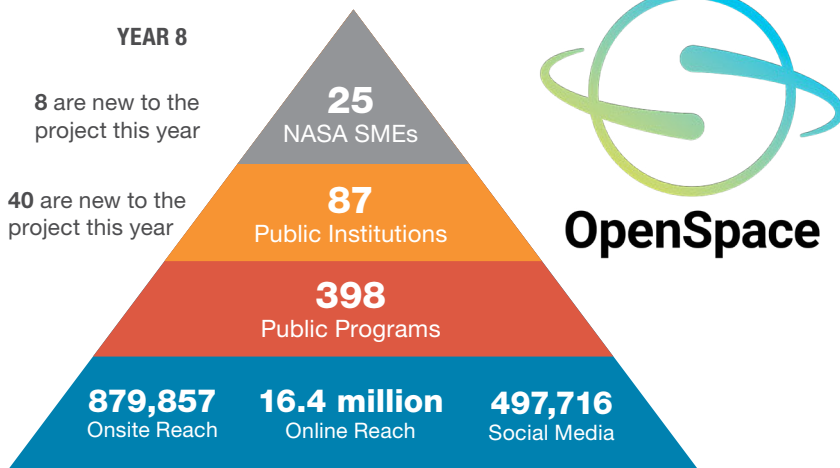
EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

AUDIENCE AGES 6+

- 6-7
- 8-9
- 10-12
- 13-15
- 16-17
- 18-22
- 23-29
- 30-75
- 76-99

OpenSpace is an open-source, interactive data visualization software package that enables exploration of the known universe and portrays our ongoing exploration of space.



TOTAL ACTIVITY, YEARS 1-8

NASA SMEs	Public Institutions	Public Programs	Onsite Reach	Online Reach	Other Online Reach
96	103	985	2,500,086	66,958,312	5,973,262

“ Audience Quotes

“OpenSpace enables me to run a robust planetarium outreach program...on a shoestring budget. I don't know what I'd do without it!”

“It has given so many of our young people the chance to see the universe in a way they would have never experienced otherwise.”

DELIVERY MODELS

INDEPENDENT/ SELF-DIRECTED

FACILITATED LEARNING

GUIDED BY INFORMAL EDUCATORS

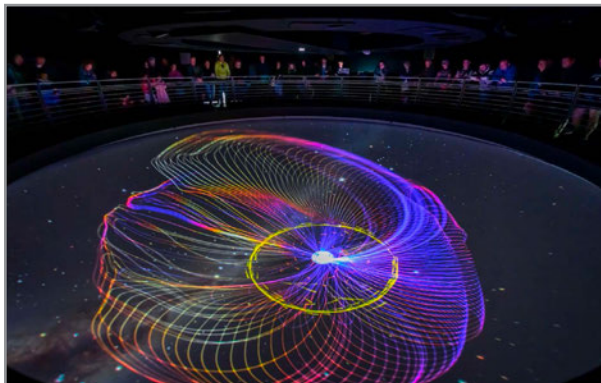
DELIVERED BY FORMAL EDUCATORS

PEER PROFESSIONAL LEARNING

<https://science.nasa.gov/science-activation-team/openspace-project>

★ Key 2023 Accomplishments

- We released 1 major update of OpenSpace software and 4 minor updates.
- We engaged 25 NASA SMEs in public programming, formal education settings, research activities, and collaboration on software development.
- 40 new users successfully installed and/or are using OpenSpace.
- 398 programs and 9 exhibits reached 879,857 people on site at the museum.



Museum visitors view Earth’s magnetosphere in OpenSpace during EarthFest in AMNH’s Big Bang Theater



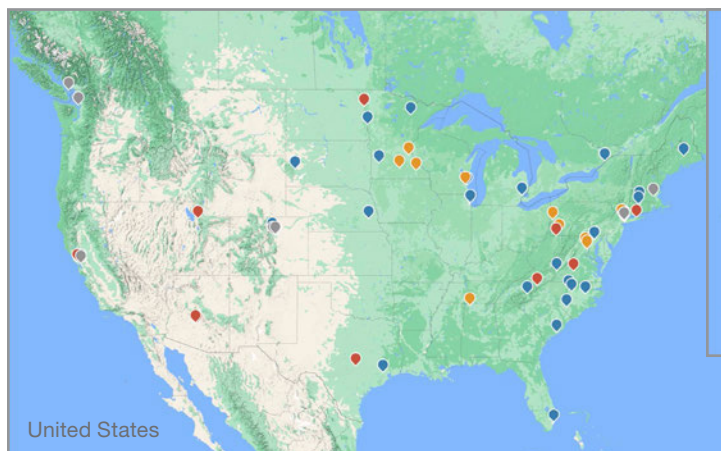
OpenSpace during the Electronic Theater at the 2023 SIGGRAPH Conference

✚ Key Partners Active in 2023

- Adler Planetarium
- American Museum of Natural History
- California Academy of Sciences
- Denver Museum of Nature and Science
- Houston Museum of Natural Science
- Michigan Science Center
- New York University
- North Carolina Museum of Natural Sciences
- University of Utah
- The Elumenati
- Seiler Planetarium



Teen scholars at Denver Museum of Nature & Science work with Dr. Ka Chun Yu to create visualizations in OpenSpace



2023 OpenSpace Users

- 📍 Museums / Planetariums
- 📍 Universities / Research
- 📍 K-12
- 📍 Other Institutions



OpenSpace Reach Maps

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE**
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Arctic and Earth STEM Integrating GLOBE & NASA



PI: Dr. Elena B. Sparrow
INSTITUTION: University of Alaska Fairbanks (UAF)



- EDUCATIONAL SETTINGS**
- INFORMAL/ OUT OF SCHOOL
 - FORMAL EDUCATION
 - CITIZEN SCIENCE
 - PROFESSIONAL

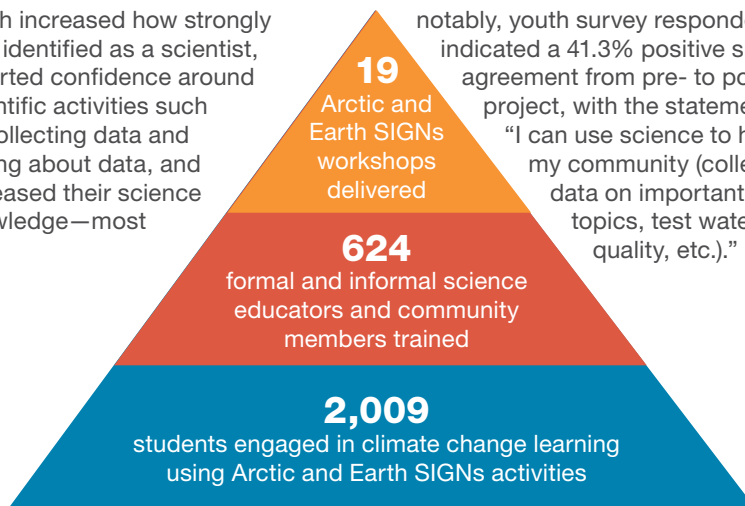
AUDIENCE AGES
0+

0-4
5-10
11-14
14-18
19-22
23-26
27-31
32-36
37-41
42-99

Educators, community members, and youth in mostly rural areas in Alaska and beyond are engaged in STEM, climate learning, and action through interdisciplinary and culturally sustaining ways and multiple knowledge systems: Indigenous, GLOBE, and NASA science and resources.

Youth increased how strongly they identified as a scientist, reported confidence around scientific activities such as collecting data and talking about data, and increased their science knowledge—most

notably, youth survey respondents indicated a 41.3% positive shift in agreement from pre- to post-project, with the statement “I can use science to help my community (collect data on important topics, test water quality, etc.).”



“ Audience Quote

“I appreciate the emphasis on looking at the data. I learned the data tells a story and it’s important to slow down to interpret it. I am getting better at thinking aloud with my students and asking, ‘What is the data telling us? What patterns do we notice?’”

DELIVERY MODELS

INDEPENDENT/ SELF-DIRECTED	FACILITATED LEARNING	GUIDED BY INFORMAL EDUCATORS	DELIVERED BY FORMAL EDUCATORS	PEER PROFESSIONAL LEARNING
----------------------------	----------------------	------------------------------	-------------------------------	----------------------------

<https://science.nasa.gov/science-activation-team/arctic-earth-signs>

★ Key 2023 Accomplishments

- AE SIGNs Conference presentations: team, 26; educators and students, 42, including as part of a GLOBE panel at the 2023 United Nations General Assembly Science Summit.
- First time we hosted the GLOBE NW Regional Student Research Symposium in Alaska: 67 students from across Alaska, Montana, and Washington.
- Maxine Dibert, AE SIGNs/Alaska Interior Native Educators Curriculum writer, elected to the Alaska State House of Representatives.
- Dr. Katie Spellman, AE SIGNs Co-Investigator, named “Faculty Member of the Year” by the student body of the University of Alaska Fairbanks.
- Christina Buffington, AE SIGNs Project Manager, a first-time Principal Investigator (PI) of a project awarded by NASA to advance the GLOBE and NASA SnowEx collaboration from our AE SIGNs.



Climate Change and My Community, Fairbanks, AK



Elder Kenneth Frank teaching



Climate Change and My Community, Juneau, AK

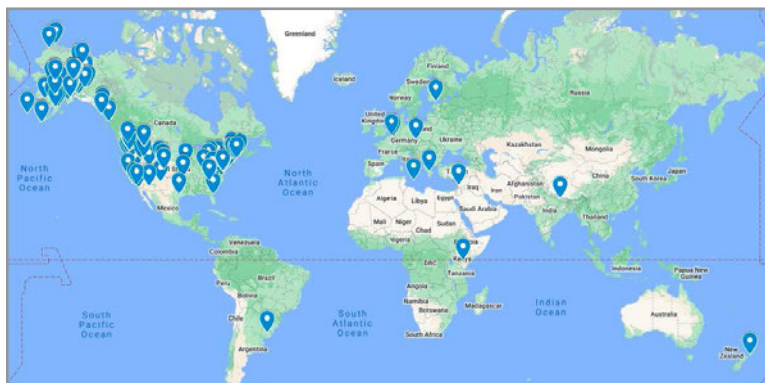


GLOBE Northwest Student Research Symposium, first time hosted in Alaska

✚ Key Partners Active in 2023

- Association of Interior Native Educators
- GLOBE U.S. Partnership; GLOBE Implementation Office
- NASA SnowEx
- NASA Langley Research Center
- Santa Ana Community College–MESA
- UAF Climate Scholars Program
- UAF 4-H ; University of Florida 4-H
- Sealaska Heritage Center

[Link to Arctic and Earth SIGNs Video](#)



Arctic and Earth SIGNs Reach Map 2023

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Astro Camp® Community Partners (ACCP)



PI: Kelly Martin-Rivers
 INSTITUTION: NASA ACCP



EDUCATIONAL SETTINGS



INFORMAL/
OUT OF SCHOOL



FORMAL
EDUCATION



CITIZEN
SCIENCE



PROFESSIONAL

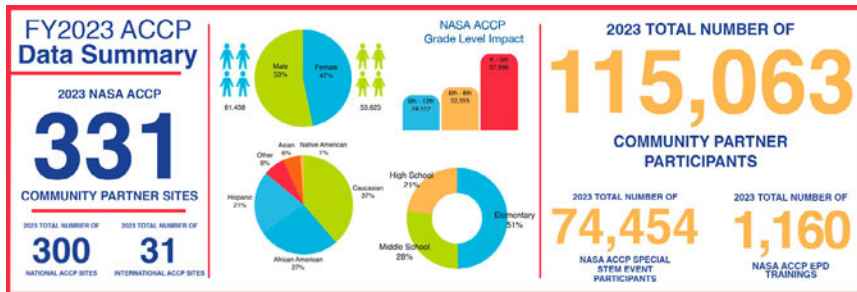
AUDIENCE AGES

5-18



The NASA ACCP program collaborates to empower universities, schools, museums, libraries, and youth service organizations to provide NASA-unique STEM engagement activities and experiences to youth, families, and educators in their own communities.

The NASA ACCP program strives to provide trained community educators/facilitators for all students to have access to authentic NASA science experiences; NASA ASTRO CAMP® methodology; and current STEM activities aligned to Next Generation Science Standards, engineering challenges, and NASA resources highly focused to reach into underserved and underrepresented communities. NASA ASTRO CAMP® provides real-world opportunities for every student to engage and contribute to NASA's science missions, enhances understanding through powerful science career connections, and gives inspiration to lifelong learners so that NASA's future science teams may continue the journey to explore our universe.



“ Audience Quote

“I was amazed by my son’s daily builds and the knowledge he gained daily and I looked forward to learn something new from him. Even though he enjoyed building the robots, I think Astronaut Academy (ACCP) sparked more of his interest. I am happy I sent him and look forward to helping him advance his knowledge in these areas.” —ACCP Parent from Challenger Learning Center of Lake Erie West, OH

DELIVERY MODELS

INDEPENDENT/
SELF-DIRECTED

FACILITATED
LEARNING

GUIDED BY INFORMAL
EDUCATORS

DELIVERED BY FORMAL
EDUCATORS

PEER PROFESSIONAL
LEARNING

<https://www.nasa.gov/stennis/stem-engagement-at-stennis/nasa-accp>

★ Key 2023 Accomplishments

- 74,454 special STEM event participants.
- 115,063 NASA ACCP participants.
 - » An impressive 228% growth.
- 65% ACCP program site growth.
- 78% of 2023 community partner sites are returning partners.
- 94% Online Facilitator’s Guide usage growth.
- 420 NASA ACCP newsletter recipients.
- 1,160 NASA ACCP formal/informal educators trained.
- 10 NASA ACCP Educator Professional Development Facilitator Tag-Ups.
- 39 NASA ACCP Educator Professional Development Sessions.



2023 Demographic Goals

Grade Level

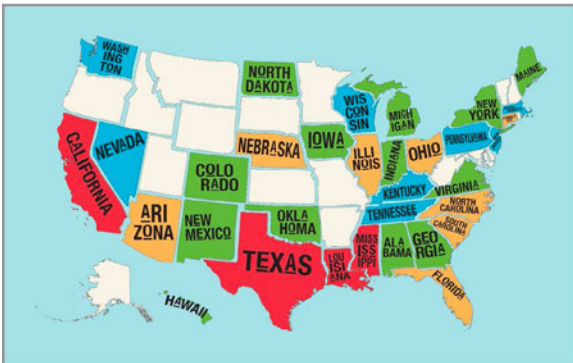
- Elementary (K–5): 57,996
- Middle: 32,555
- High School: 24,512

Race

- White: 43,143
- African American: 30,828
- Native American: 1,300
- Hispanic: 24,285
- Asian: 6,928
- Other: 8,579

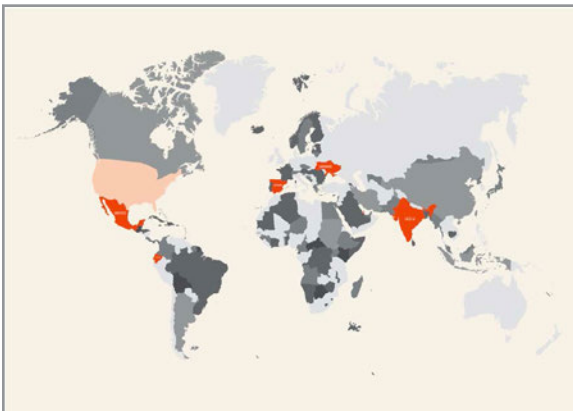
Gender

- Female: 53,625
- Male: 61,438



🧩 Key Partners Active in 2023

- NESSP
- PLANETS
- NASA eClips
- NASA AREN Project
- NASA Neurodiversity
- Network (N3)
- Sonoma University
- Science Through Shadows



ASTROPHYSICS BIOL/PHYS SCIENCES EARTH SCIENCE HELIOPHYSICS PLANETARY SCIENCE

Science Activation

Astromaterials



PI: Paige Graff

INSTITUTION: NASA JSC Astromaterials

EDUCATIONAL SETTINGS



INFORMAL/ OUT OF SCHOOL



FORMAL EDUCATION



CITIZEN SCIENCE



PROFESSIONAL

AUDIENCE AGES

3+

3-5

6-7

8-9

10-12

13-15

16-17

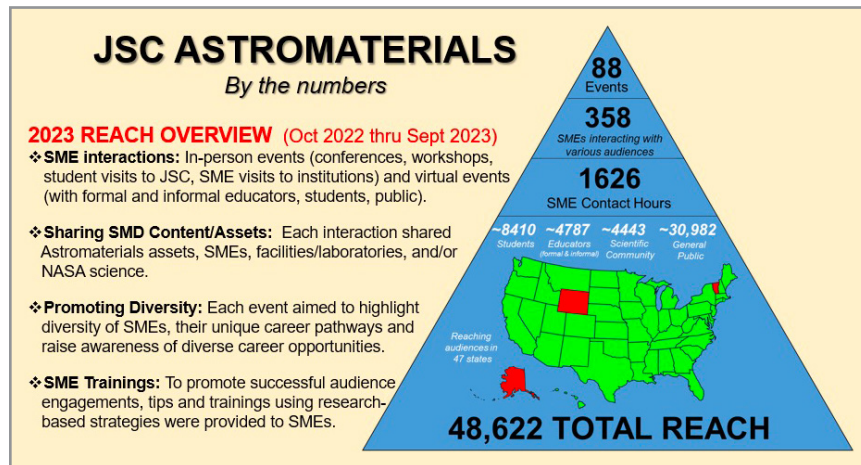
18-22

23-29

30-75

76-99

As an infrastructure team, our goal is to share NASA Johnson Space Center's (JSC's) unique assets, including Astromaterials samples (e.g., Moon rocks), research and curation laboratories, and subject matter experts (SMEs), with learners of all ages across the Nation. These learners include students, educators, the public, the scientific community, and the SMD Science Activation Collective and their target audiences. Areas of synergy with Science Mission Directorate (SMD) science include Earth and planetary content.



Audience Quotes

[Note: We get comments like these from numerous participants.]

"The experiences being told by the speakers were really valuable information for me and will definitely shape my decision-making down the line."
— Career Pathway Webinar Participant (Student)

"Thank you for preparing an awesome webinar. It was informative and kept my students' interest. I have some challenging kids and they were actually shouting out answers for me to type in. I think they also really enjoyed hearing our HS name being called out."
— Webinar Participant (Classroom Educator)

"I continue to be very impressed with the high level of organization of the webinars provided and their excellent informational content. I also wanted to express how impressed I have been with your skills in not only hosting the webinars, but also your ability to meaningfully engage the many individuals and groups who connect into the webinars. I consider participation in these webinars very worthwhile."
— Webinar Participant (SciAct Partner Audience Member)

DELIVERY MODELS

INDEPENDENT/
SELF-DIRECTED

FACILITATED
LEARNING

GUIDED BY INFORMAL
EDUCATORS

DELIVERED BY FORMAL
EDUCATORS

PEER PROFESSIONAL
LEARNING

<https://science.nasa.gov/sciact-team/nasa-astromaterials>

★ Key 2023 Accomplishments

- Actively engaged ~48,622 students, educators, and members of the scientific community and the public across 47 states with our SMEs and unique NASA assets.
- Collaborated with 22 SciAct Teams (including NASA Exhibits Team) and other NASA and non-NASA programs sharing and promoting SciAct/SMD content and NASA assets or contributing to/participating in collaborative team discussions and conference exhibits.
- Created shareable resources that aim to empower and inspire diverse, historically underserved audiences through content that highlights and celebrates a diverse workforce, unique NASA assets (e.g., Antarctic meteorites), and career pathways. These resources and opportunities are designed to increase awareness and excitement and to encourage the pursuit of STEM-related careers.



SMEs sharing career pathways with high school-/college-level students



SEES high school interns visit facilities at NASA JSC and connect with SMEs



Sharing the excitement of NASA's first asteroid sample return mission



SME career hexagon example

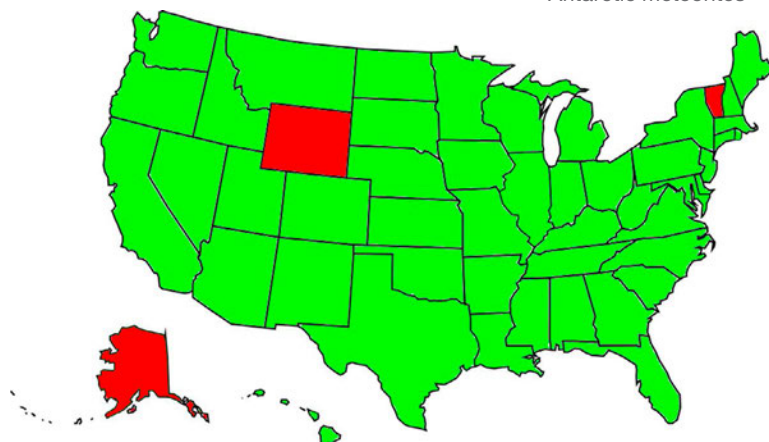


Interacting with Antarctic meteorites

As an infrastructure project, we aim to partner with all teams whose audiences can benefit from our contributions.



Astromaterials Science Activation (video)



Reach map: Through Astromaterials SME interactions and events, we reached audiences in 47 states

ASTROPHYSICS BIOL/PHYS SCIENCES EARTH SCIENCE HELIOPHYSICS PLANETARY SCIENCE

Science Activation

Astronomy Picture of the Day



PI: Robert Nemiroff

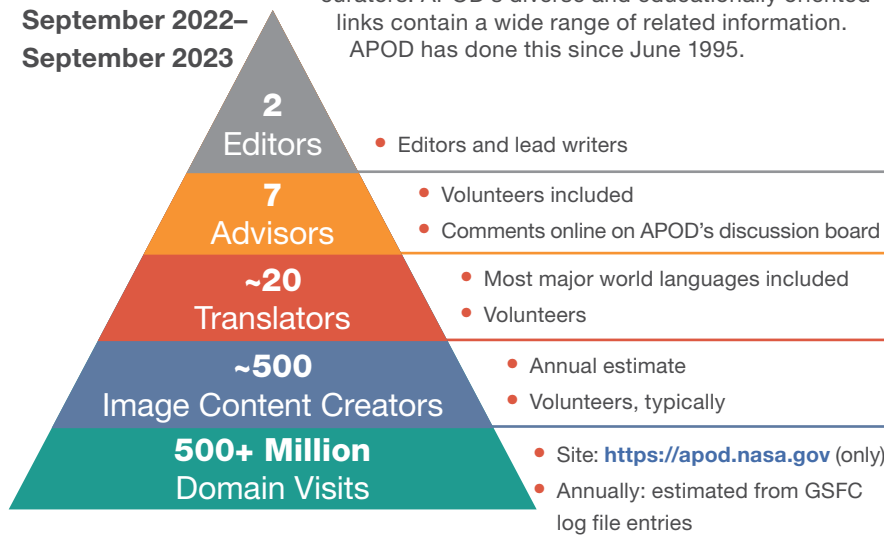
INSTITUTION: Michigan Technological University

AUDIENCE AGES
3+

- 3-5
- 6-7
- 8-9
- 10-12
- 13-15
- 16-17
- 18-22
- 23-29
- 30-75
- 76-99

Conceived as a simply presented inspiration for people with an interest in astronomy and related topics, the Astronomy Picture of the Day (APOD) has become a project demonstrating long-term stability that retains its original premise of simplicity and accessibility while serving a wide range of audiences across the United States and beyond. Each day, APOD showcases a different image captured by a NASA mission, submitted by a volunteer citizen-science contributor, or made available from another public source. Using the image as a hook, APOD then offers an educational description with hyperlinked text, typically written by one of its two professional astronomer curators. APOD's diverse and educationally oriented links contain a wide range of related information. APOD has done this since June 1995.

September 2022–
September 2023



EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL**
- FORMAL EDUCATION**
- CITIZEN SCIENCE**
- PROFESSIONAL**

“ Audience Quote

“When I was a girl my dream was to keep the sky for me. Now I am really busy, but in my lu[n]ch time I can see the sky thanks to your work and I can forget my work and I can dream again.”

—Dorian Lozano (bogksec@colomsat.net)

DELIVERY MODELS

INDEPENDENT/ SELF-DIRECTED FACILITATED LEARNING GUIDED BY INFORMAL EDUCATORS DELIVERED BY FORMAL EDUCATORS PEER PROFESSIONAL LEARNING

<https://apod.nasa.gov>

★ Key 2023 Accomplishments

- One of NASA's most popular websites
- One of NASA's most language-inclusive websites
- One of the most prolific sites on the web for back-linking to NASA and SciAct education and outreach content

Astronomy Picture of the Day

[Discover the cosmos!](#) Each day a different image or photograph of our fascinating universe is featured, along with a brief explanation written by a professional astronomer.

2023 September 19



HH 211: Jets from a Forming Star

Credit: [NASA](#), [ESA](#), [CSA](#), [Webb](#); Processing: [Tom Ray](#) ([DIAS Dublin](#))

Explanation: Do [stars](#) always create jets as they form? No one is sure. As a gas cloud [gravitationally contracts](#), it forms a [disk](#) that can spin too fast to continue contracting into a [protostar](#). Theorists [hypothesize](#) that this spin can be reduced by expelling jets. This speculation coincides with known [Herbig-Haro \(HH\) objects](#), young stellar objects seen to emit jets -- sometimes in [spectacular fashion](#). [Pictured](#) is Herbig-Haro 211, a young star in formation [recently imaged](#) by the [Webb Space Telescope](#) (JWST) in [infrared light](#) and in [great detail](#). Along with the [two narrow beams of particles](#), red [shock waves](#) can be seen as the outflows impact [existing interstellar gas](#). The jets of [HH 211](#) will likely change shape as they brighten and fade over the next 100,000 years, as research into the details of [star formation](#) continues.

Reach statement: Log files from 2005 indicated that, typically, every major university in the United States accessed APOD every day. (APOD's popularity has since increased significantly.)

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS**
- PLANETARY SCIENCE

Science Activation

Aurorasaurus



PI: Dr. Elizabeth MacDonald
INSTITUTION: New Mexico Consortium

Aurorasaurus conducts citizen science by mapping ground-truth reports of the Northern and Southern Lights via their website. In addition, the project connects NASA SMEs with aurora-chasing groups and conducts informal education, translating heliophysics aurora science for students and the public. Aurorasaurus strives toward collaborative engagement that advances scientific research while respecting, empowering, and benefiting communities.

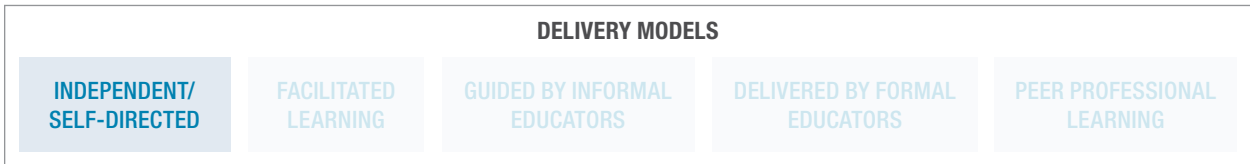


- EDUCATIONAL SETTINGS**
- INFORMAL/ OUT OF SCHOOL
 - FORMAL EDUCATION
 - CITIZEN SCIENCE
 - PROFESSIONAL

“ Audience Quote

“I started aurora chasing when I was just sixteen years old, and was an Aurorasaurus user myself. When I became a college student I became involved as a volunteer. Aurorasaurus introduced me to scientists and aurora chasers who I now call my friends, and this helped me determine my career goals.”

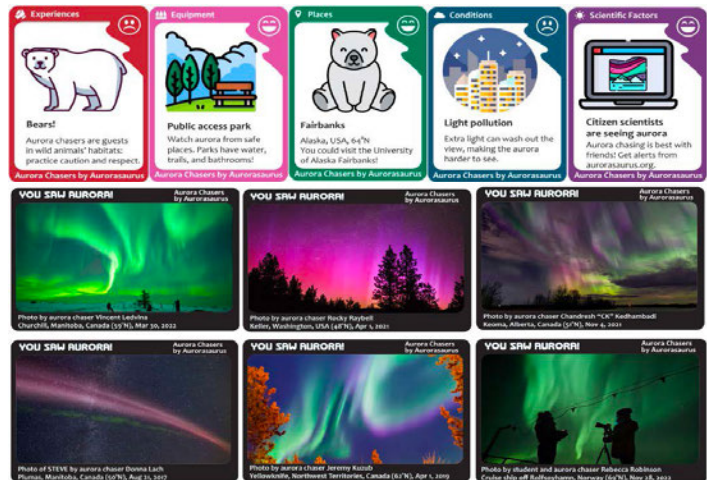
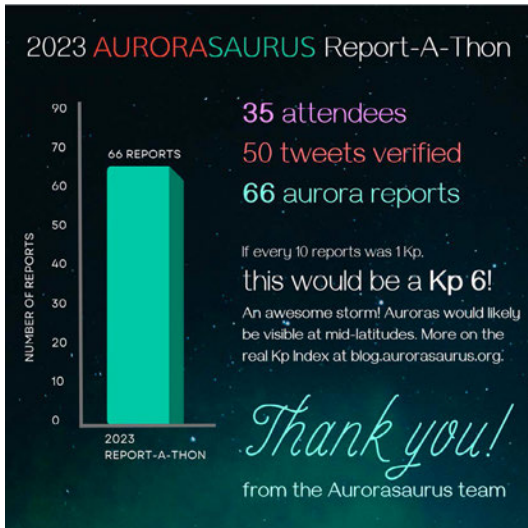
—Vincent Ledvina, aurora citizen scientist, volunteer, and student pursuing a career in space weather



<https://science.nasa.gov/science-activation-team/aurorasaurus>

★ Key 2023 Accomplishments

- Aurorasaurus hosted its first online Report-A-Thon community engagement event with participants from the United States, Canada, and Norway. (This accomplishment relates to Sci Act mid-level objectives [MLOs] 1b and 2a.)
- Aurorasaurus hosted a workshop-style follow-up on the **Equity Compass**, which was introduced in the 2022 SciAct meeting. Attendees included SciAct members. (MLOs 3b and 4a)
- Aurorasaurus released a free, printable collaborative role-playing card game in which students take on the challenge of being aurora chasers. Over the course of the game, they learn about geographic, space weather, community, and other factors central to the practice of aurora citizen science. As we continue to develop “Aurora Chasers” over time, we hope to inspire the next generation of aurora scientists and citizen scientists. (MLOs 1a and 2a)
- Aurorasaurus collaborated with the Heliophysics Big Year: for example, working together to create a lesson plan utilizing handmade, informal publications called “zines” as a STEAM activity. (MLOs 1a, 4a, and 1b)
- Dr. Liz MacDonald and Laura Brandt were coauthors on “Agile Collaboration: Citizen Science as a Transdisciplinary Approach to Heliophysics”, a *Frontiers* **paper** adapted from a Heliophysics Decadal Survey white paper. (MLO 4b)
- Aurorasaurus partnered with Dr. Allison Cawood of SERC and Dr. Heather Fischer of NESEC on a paper submitted to *Citizen Science: Theory and Practice* entitled “Practical Applications of a Participatory Science Project Evaluation Tool: Perspectives from Across Earth and Space Science.” (MLOs 4a and 4b)
- Aurorasaurus navigated changes to Twitter’s API that affected many citizen science projects. (MLOs 1b)



Left: Aurorasaurus held its first Report-A-Thon, engaging citizen scientists in gathering data from the major March and April 2023 storms.

Above: Inspiring the next generation of citizen scientists with the NEW Aurora Chasers card game for ages 11+! Gameplay helps answer the complex but common question, “how can I see the aurora?” Get your free, printable copy at <https://blog.aurorasaurus.org>.

✚ Key Partners Active in 2023

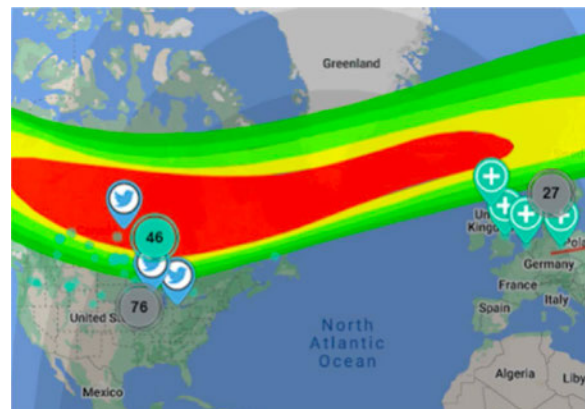
Within SciAct:

- **NASA HEAT** (including **Science Friday**, The University of Alaska Fairbanks Geophysical Institute (**UAFGI**), STEAM Innovation Lab, etc.)
- **Infiniscope** (educational materials page on Infiniscope site)
- Northwest Earth and Space Sciences Pathways (**NESSP**)
- Citizen science partners throughout the larger SMD ecosystem, e.g., the Heliophysics Big Year



Outside of SciAct:

- **Polar Citizen Science Collective**
- **Hurtigruten**
- **Live Aurora Network**



Aurora reports from March 23, 2023, 11 p.m. ET

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Central Idaho Dark Sky Reserve STEM Network



PI: Prof. Brian Jackson
 INSTITUTION: Boise State University

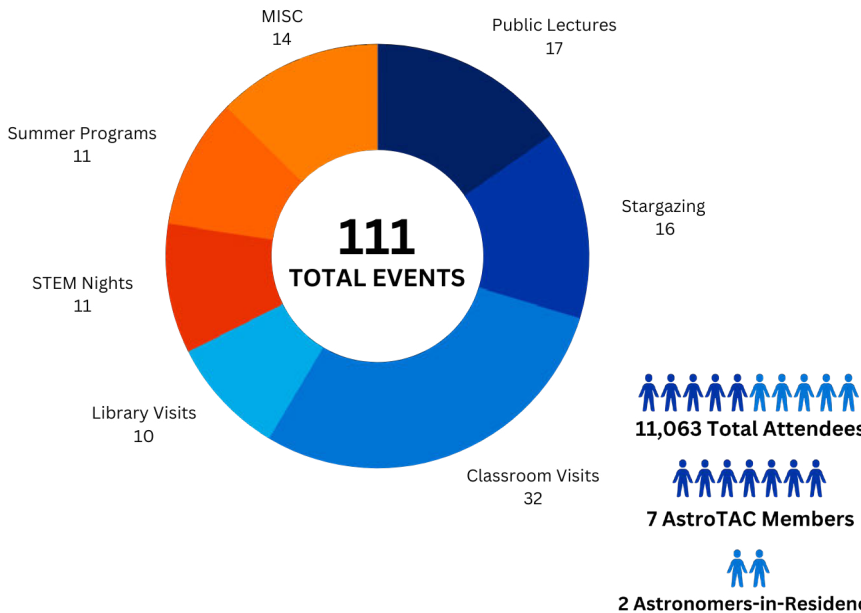
EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

AUDIENCE AGES
0+

- 0-4
- 5-10
- 11-14
- 14-18
- 19-22
- 23-26
- 27-31
- 32-36
- 37-41
- 42-99

The Central Idaho Dark Sky Reserve STEM Network supports STEM engagement efforts throughout the state of Idaho, including student training, curriculum development, teacher support, and light-pollution science.



“ Audience Quotes

“The team did a great job explaining and asked great questions. It was also very student friendly with their attitudes. They did a great job fielding questions as well. The team worked very well with the students.”

“Thank you again for such a wonderful program last night! As I shared, people were so energized by your presentation and eager to share it with others. And of course, the ongoing request: “WHEN WILL SHE BE BACK??” You are such an engaging and informative speaker, and you break down complicated concepts for a general audience so well.”

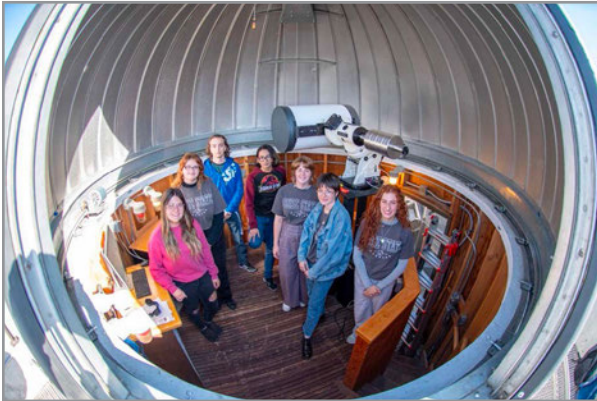
DELIVERY MODELS

- INDEPENDENT/ SELF-DIRECTED
- FACILITATED LEARNING
- GUIDED BY INFORMAL EDUCATORS
- DELIVERED BY FORMAL EDUCATORS
- PEER PROFESSIONAL LEARNING

<https://science.nasa.gov/sciact-team/idaho-dark-sky-stem-network>

★ Key 2023 Accomplishments

- Thousands of attendees at outreach events.
- Detailed lesson plans tailored to state curriculum.
- New light-pollution data collections.
- Numerous press/media engagements and stories.



AstroTAC team at Boise State's Observatory, fall 2023



Astronomer-in-Residence Paint the Night Sky in Stanley, ID, summer 2023



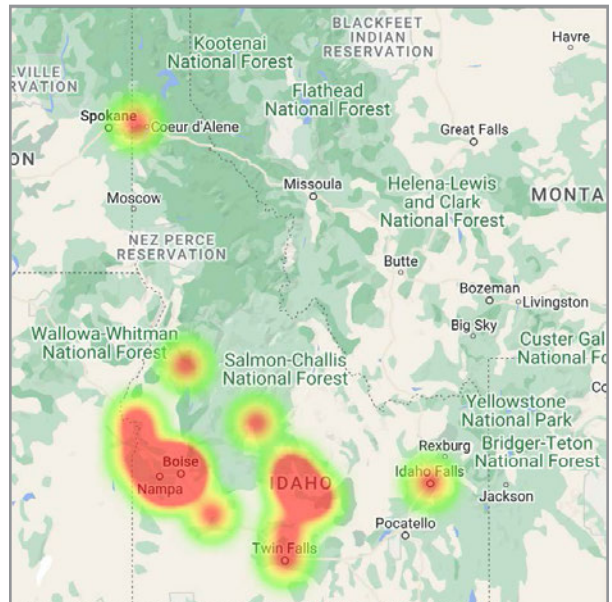
Sunstruck Outreach event at Morley Nelson Elementary School, spring 2023



Boise State Observatory Mural Reveal, designed by AstroTAC Robin Matson, summer 2023

✚ Key Partners Active in 2023

- University of California, Los Angeles (UCLA)
- Idaho Dark Sky Reserve
- Children's Museum of Idaho
- Central Washington University
- Girl Scouts of Silver Sage Council
- Boise Astronomical Society



Based on ZIP codes for all events

<https://www.mapize.com/map/cidsrsn-zip-codes>

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Cosmic Storytelling with NASA Data (CosmicDS)



PI: Dr. Alyssa Goodman
 SCIENCE PI: Dr. Patricia Udomprasert
 INSTITUTION: Harvard University



- EDUCATIONAL SETTINGS**
- INFORMAL/ OUT OF SCHOOL
 - FORMAL EDUCATION
 - CITIZEN SCIENCE
 - PROFESSIONAL



Cosmic Data Stories (CosmicDS) are online resources cocreated with subject matter experts that teach people how to interact with and learn from data. CosmicDS provides a web-based, learner-friendly environment for engaging with data, powered by research-grade software. Different Cosmic Data Stories are targeted to a range of learners: middle school, high school, 2- and 4-year college, out-of-school STEM audiences, and the general public.

MiniDS Page Views 17,000	HubbleDS Pilot Educators 4	New Stories in Progress 5
US States Reached 50	HubbleDS Pilot Students 100	Subject Matter Experts 7

“ Audience Quotes

“This was a lot more visual for my students than my existing Hubble Law activity, and it helps reinforce the concept. I would be interested in more activities like this one!” —community college educator

“I love this concept of self-directed learning with understandable steps, prompts, engagement, and inquiries to ponder after the lab is completed.” —high school student

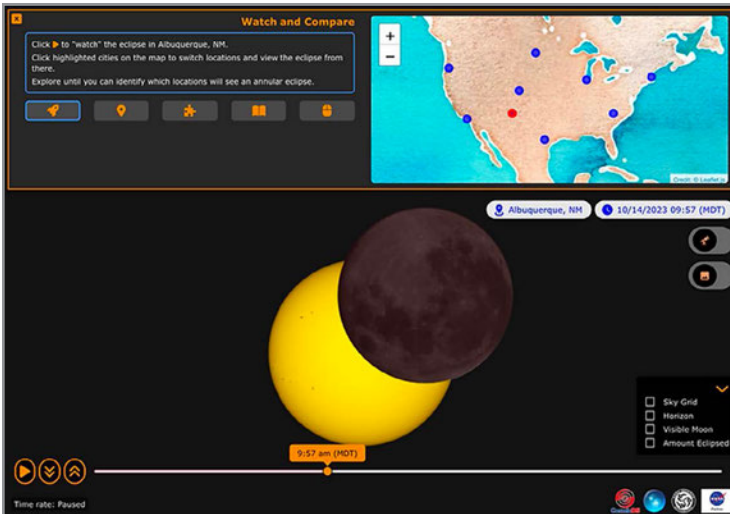
DELIVERY MODELS

INDEPENDENT/ SELF-DIRECTED	FACILITATED LEARNING	GUIDED BY INFORMAL EDUCATORS	DELIVERED BY FORMAL EDUCATORS	PEER PROFESSIONAL LEARNING
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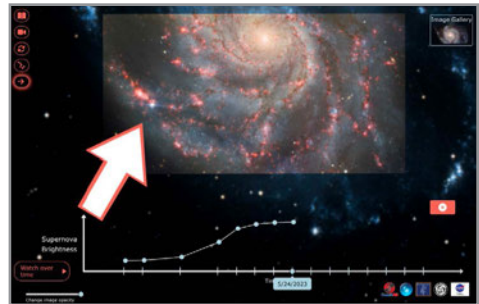
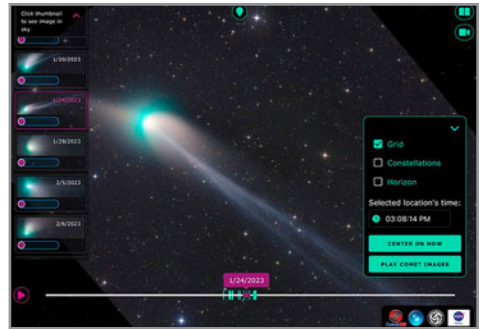
<https://www.cosmicds.cfa.harvard.edu>

★ Key 2023 Accomplishments

- Formatively evaluated Hubble Data Story (HubbleDS) with 4 educators and 100 students.
- Completed iterative development of HubbleDS based on educator and student feedback.
- Developed Educator Dashboard for HubbleDS to track student progress on story.
- Launched 4 Mini Data Stories (MiniDS) to showcase NASA imagery in bite-sized engagements.
- Evaluated Annular Eclipse MiniDS to inform development of Total Eclipse MiniDS for April 2024.



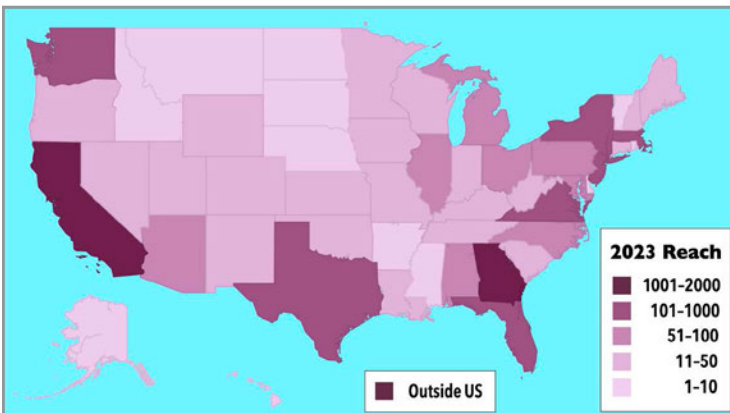
Screenshot from Annular Eclipse Mini Data Story, which allows the user to visualize how the October 14 eclipse would appear from any location



Three images above: Pinwheel Galaxy Supernova, Carina Nebula, and Green Comet Mini Data Stories, which engage learners in understanding how supernovae are discovered, why the James Webb Space Telescope (JWST) “sees” in infrared, and why comets’ tails point where they do

🧩 Key Partners Active in 2023

- Smithsonian Astrophysical Observatory
- SMEs at UCLA, Space Telescope Science Institute (STScI), Smithsonian Astrophysical Observatory (SAO), and University of Florida
- NASA Community College Network
- NASA’s Universe of Learning
- Local high school teachers in the Greater Boston Area



Reach Map

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Earth to Sky



PI: Geneviève de Messières

INSTITUTION: NASA/Science Systems and Applications, Inc.

AUDIENCE AGES
18+



Earth to Sky actively fosters collaborative work on climate and eclipse communication between scientists, interpreters, communicators, and informal educators from NASA, the National Park Service (NPS), the U.S. Fish and Wildlife Service (USFWS), and other place-based organizations.



An Earth to Sky course in Alaska with participants sporting Halloween costumes

This community of practice enriches the experience of millions of visitors to parks, refuges, and other protected areas



Solar viewing of the annular eclipse at Mesa Verde National Park, Colorado.

EDUCATIONAL SETTINGS



INFORMAL/OUT OF SCHOOL



FORMAL EDUCATION



CITIZEN SCIENCE



PROFESSIONAL

Partner Quote: Annular Solar Eclipse

"I spoke to many, many visitors who were just delighted to have been able to experience this at Mesa Verde National Park. The NASA set-up...was great and visitors of all ages learned more about our solar system and physics.... Everyone deserves a big shout-out for making it happen!" —Kayci Cook Collins, Superintendent, Mesa Verde National Park

DELIVERY MODELS

INDEPENDENT/
SELF-DIRECTED

FACILITATED
LEARNING

GUIDED BY INFORMAL
EDUCATORS

DELIVERED BY FORMAL
EDUCATORS

PEER PROFESSIONAL
LEARNING

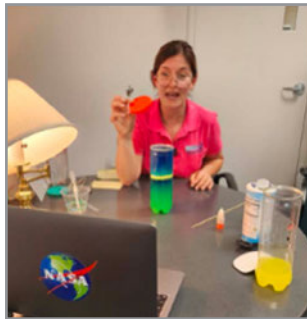
<https://earthtosky.org>

★ Key 2023 Accomplishments

- The Earth to Sky Eclipse program kicked off with an extensive annular eclipse event at Mesa Verde National Park, CO, with 7,000 visitors, as well as personalized engagement to help hundreds of other parks and sites get ready for both the annular eclipse in 2023 and the total eclipse in 2024..
- The Earth to Sky Regional Model accelerated into high gear as five regional teams around the country each led a successful climate communication course for about 20 participants each, specialized to the needs of interpreters and educators in their region.
- Evaluation showed that participants felt ready to bring NASA science to their audiences.
- Professional development for the community of practice of interpreters and informal educators included more than 40 webinars on climate and eclipse topics, as well as outreach at several conferences, including the National Association for Interpretation annual conference in Little Rock, AR.



During an Earth to Sky regional course for Native educators, participants visit Bandelier National Monument



Hands-on ocean activity demonstration during an Earth to Sky webinar



During another Earth to Sky regional course, participants explore a large-format Landsat map of their region



A culturally sensitive eclipse presentation at Bears Ears Education Center

✚ Key Partners Active in 2023

- NASA Earth Science Education Collaborative
- Museum & Informal Education Alliance
- Eclipse Ambassadors Off the Path
- Science Visualization Studio
- Native Earth | Native Sky
- Universe of Learning
- Night Sky Network
- NASA eClips
- NASA HEAT and more!



Earth to Sky Regional Teams

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

Eclipse Ambassadors Off the Paths



PI: Vivian White

INSTITUTION: Astronomical Society of the Pacific



Eclipse Ambassadors partners undergraduates with eclipse enthusiasts and trains them to offer eclipse engagement in 500 communities off the central path of the 2024 total eclipse.

Virtual courses teach partners the safety, science, and social connections necessary to create culturally responsive eclipse engagement opportunities reaching new underserved audiences.

AUDIENCE AGES
18+



202 Community Events Off the Path

- Schools (32%)
- Libraries (21%)
- Parks (16%)
- Community Centers (10%)

514 Eclipse Ambassadors

- In 46 states, PR, DC, and Guam
- 348 in partnerships
- 168 still unpartnered
- Goal of 1,000 by Feb. 14

44,627 People Reached

- Through 200+ events across the country
- See map!



EDUCATIONAL SETTINGS



INFORMAL/ OUT OF SCHOOL



FORMAL EDUCATION



CITIZEN SCIENCE

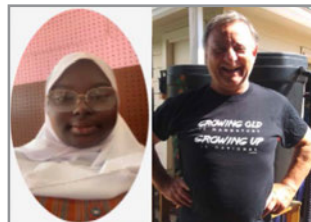


PROFESSIONAL

Participant Quote

“Thank YOU, particularly whoever paired me with Khady, now I have another granddaughter, you guys are awesome!” —Dan

Ambassadors Khady and Dan, right



eclipseambassadors.org

DELIVERY MODELS

INDEPENDENT/
SELF-DIRECTED

FACILITATED
LEARNING

GUIDED BY INFORMAL
EDUCATORS

DELIVERED BY FORMAL
EDUCATORS

PEER PROFESSIONAL
LEARNING

<https://astrosociety.org/education-outreach/amateur-astronomers/eclipse-ambassadors/program.html>

★ Key 2023 Accomplishments

- Trained hundreds of intergenerational partnerships in nearly every state with safety, science, and engagement techniques.
- Presented at 10 conferences, in conjunction with our partners.
- New partners reach Air Force, Land Grants, and Divine Nine.



✦ Key Partners Active in 2023

- SETI Institute
- Space Science Institute
- NASA Community College Network
- Exploratorium
- NASA HEAT
- Heliophysics Big Year
- Astronomical League
- American Astronomical Society



Select images from more than 200 events held by Eclipse Ambassadors

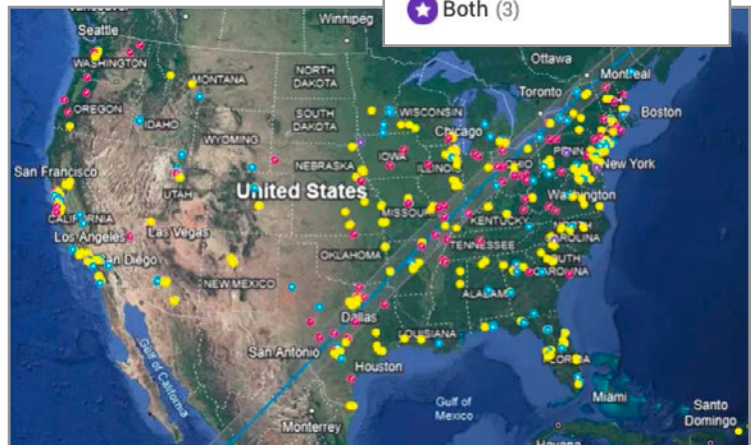


Cultural connections were woven into the training and offered via new resources: bit.ly/worldclipse

- ★ Partnered (345)
- 🔭 Amateur astronomer (79)
- 🎓 Undergraduate student (74)
- 🌟 Both (3)



Eclipse Ambassadors and ASP staff support the Exploratorium in Ely, NV, October 14



514 Ambassadors across the United States

ASTROPHYSICS BIOL/PHYS SCIENCES EARTH SCIENCE HELIOPHYSICS PLANETARY SCIENCE

Science Activation

Eclipse Soundscapes: Citizen Science Project



SCIENCE PI: Dr. Henry "Trae" Winter
EDUCATION PI: MaryKay Severino
INSTITUTION: ARISA Lab, LLC

EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

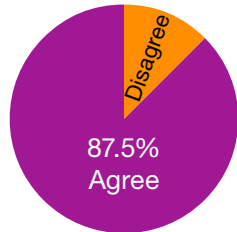
AUDIENCE AGES
12+



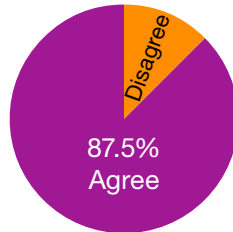
Eclipse Soundscapes (ES) provides learning experiences that utilize subject matter experts (SMEs) and best practices to increase scientific process understanding and address accessibility challenges, specifically those experienced by people who are blind and low-vision (BLV). ES will answer scientific questions about the impact of solar eclipses on ecosystems using soundscapes. For more information, visit <https://EclipseSoundscapes.org>.

STEM Workforce Development:

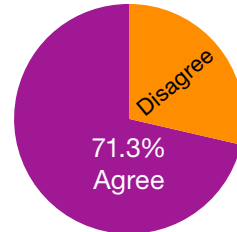
Engaging students in an ES Real World Client project during a New York University (NYU) User Experience/User Interface (UX/UI) course improved their accessibility STEM skills.



Accessibility was a huge part of my decision-making process when it came to UX/UI decisions for ES.



I practiced implementing accessible design into a project's development process while working on ES.



In the future when I look at how something is designed, I will ask myself how easy it would be for people with disabilities to use it.

NYU Student Quotes

"Keeping people with disabilities in mind helps not only them but everyone. The amount of impact that each design decision has on the experience is tremendous."

"This class has given me an understanding of why accessibility is so important and the implications it can have for people with disabilities. It has also made me more aware of how to create an inclusive environment for everyone, regardless of any disabilities or impairments they may have."

DELIVERY MODELS

INDEPENDENT/ SELF-DIRECTED FACILITATED LEARNING GUIDED BY INFORMAL EDUCATORS DELIVERED BY FORMAL EDUCATORS PEER PROFESSIONAL LEARNING

<https://eclipsesoundscapes.org>

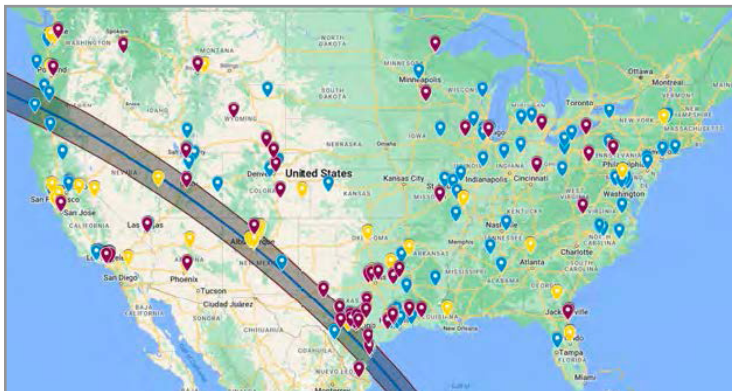
★ Key 2023 Accomplishments

- ES project management and SciAct community involvement.
- Increased accessibility awareness/knowledge in future STEM workforce.
- 16 ES articles/publications/media features.
- Citizen scientist experience (ES Roles) finalized and deployed.
- Ongoing accessibility testing and improvements.
- Over 2,000 learners engaged by ES SMEs in interactive eclipse-related STEM events.
- Participation by 725 ES citizen scientists in NASA Science activities surrounding and during the October 2023 annular eclipse.
- Interactions between ES SMEs and over 1 million learners in virtual and in-person eclipse events throughout 2023.
- Open science data plan and procedures co-developed with soundscape ecology SME Dr. Will Oestreich.
- ES formal education materials with supports for English Learners (ELs) co-developed with education SMEs.

ES Participation
Roles Video
SCAN -->



Providing Accessible STEM Learning and NASA Science Engagement Opportunities



Roles and locations of 725 participants who completed ES roles in 2023

- | | | |
|---|--|--|
|  <p>Apprentice
459
Online eclipse learning</p> |  <p>Observer
192*
Eclipse day qualitative data collection</p> |  <p>Data Collector
74**
Eclipse week quantitative data collection</p> |
|---|--|--|

Apprentice Role Quote

“The apprentice training made me a more knowledgeable host for our eclipse viewing party!”

Observer Role Quote

“I may have enjoyed the “Earth” observations more than the eclipse itself.”

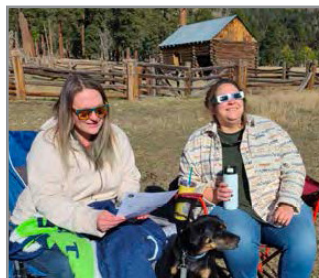
Data Collector Role Quote

“Before attending the training, I did not give much thought to the AudioMoth as anything other than a tool to collect data. Then I saw how the ES team is also committed to accessibility and expanding the eclipse experience beyond just the sense of sight. It was a reminder to myself of how I am including or excluding patrons of my library.”

* Location of participant, not of collection.

** 133 more annular eclipse data cards expected. Location of participant, not of collection.

Leveraging Partnerships to Broaden ES Participation



Developing and Improving ES Facilitator Model with NPS

Collaborated with Valles Caldera National Preserve to beta-test ES facilitator model to collect a variety of data from one location: Rangers participated as data collectors and then invited annular eclipse day park visitors to participate as ES observers by providing ES observer fliers with eclipse glasses.



AudioMoth made tactilely accessible with bump dots

Increasing BLV Accessibility

Collaborated with National Federation of the Blind and others to continuously review and improve the accessibility of ES roles.

✚ Key Partners Active in 2023

- | | |
|--|---|
| • Regine Gilbert, New York University | • SciStarter |
| • National Federation of the Blind | • NASA@ My Library |
| • National Eclipse Ballooning Project | • Texas Master Naturalists |
| • North Carolina State University | • Infiniscope and SCoPE |
| • StarNet Library Network (SEAL) | • SME Dr. L. Fuller, University of Texas at San Antonio |
| • Randall Davey Audubon Center and Sanctuary | • GLOBE Observer |

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Engaging Hispanic Communities



PI: Paul Martin
 INSTITUTION: Arizona State University

- EDUCATIONAL SETTINGS**
- INFORMAL/ OUT OF SCHOOL
 - FORMAL EDUCATION
 - CITIZEN SCIENCE
 - PROFESSIONAL

AUDIENCE AGES
3+

3-5
6-7
8-9
10-12
13-15
16-17
18-22
23-29
30-75
76-99

Engaging Hispanic Communities in Authentic NASA Science is cocreating opportunities for Hispanic/Latino families to learn about NASA science and meet subject matter experts and role models. Activities include developing and disseminating resources to engage Hispanic/Latino communities in NASA science; building capacity to use best practices in diversity, equity, accessibility, and inclusion; and leveraging local partnerships and national networks.

Comunalidad is a concept developed by Oaxacan scholar Jaime Martinez Luna. We use comunalidad as a framework for actively sustaining a community with diverse forms of human expression, including STEM (after Hawkins and Vera 2021, fig. 2).



“ Audience Quote

“I’m excited about the process of community engagement and finding novel approaches to this work. I’m glad to take this path together and learn from each other.” —a community connector

DELIVERY MODELS

INDEPENDENT/ SELF-DIRECTED	FACILITATED LEARNING	GUIDED BY INFORMAL EDUCATORS	DELIVERED BY FORMAL EDUCATORS	PEER PROFESSIONAL LEARNING
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<https://science.nasa.gov/sciact-team/engaging-hispanic-communities>

★ Key 2023 Accomplishments

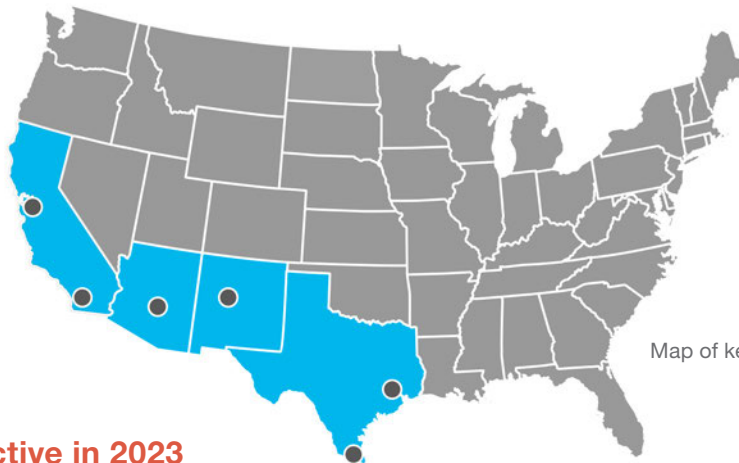
- Six sites in California, Arizona, New Mexico, and Texas are developing relationships with local Hispanic/Latino communities and with each other, creating a community of transformation that shares learning and strategies to innovate and transform practice.
- We are cocreating local goals, priorities, and STEM engagement activities, focusing on culturally and geographically relevant Earth and space science.
- We have refined our evaluation plan to focus on both process and outcomes and to elevate the experience and expertise of all partners.
- By learning and advancing best practices among our team, we are centering and contributing to national goals for diversity, equity, accessibility, and inclusion in Earth and space science.



¡Celebremos las ciencias! event



Project meeting



Map of key partner sites

✚ Key Partners Active in 2023

STEM education and community-based organizations are cocreating learning experiences at six sites in the southwestern United States:

- San Francisco Bay area, CA: Lawrence Hall of Science, Bay Area Community Resources, and Hayward Promise Neighborhoods
- San Diego metro area, CA: Fleet Science Center and San Ysidro STEM Committee
- Mesa/Phoenix metro area, AZ: Arizona State University, Arizona Science Center, Mesa Arts Center, and Patchwork Community Inclusion
- Albuquerque, NM: Explora, STEM-NM, Horizons Albuquerque, and Future Focused Education
- Brownsville, TX: Children's Museum of Brownsville, community connector Anthony McWilliams, and industry partner Reybotics
- Houston, TX: Children's Museum of Houston and Community Family Centers

ASTROPHYSICS BIOL/PHYS SCIENCES **EARTH SCIENCE** HELIOPHYSICS PLANETARY SCIENCE

Science Activation

GLOBE Mission EARTH (GME)

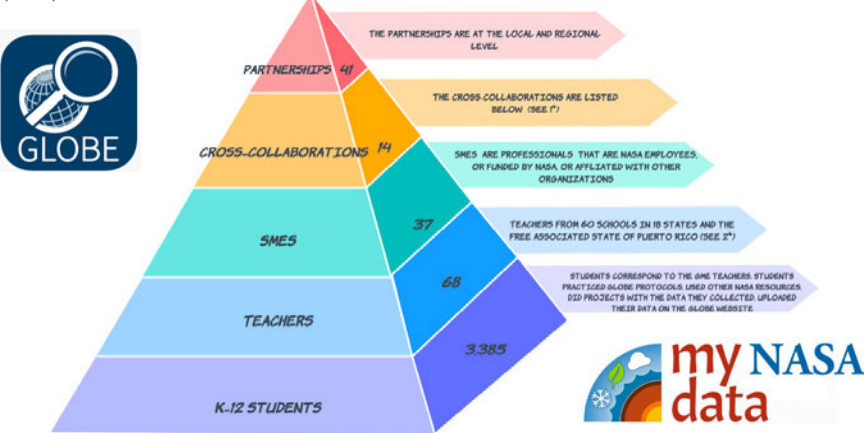


PI: Dr. Kevin Czajkowski
 INSTITUTION: University of Toledo, OH
 INDEPENDENT EVALUATOR: Dr. Nektaria Adaktylou, West Virginia University

AUDIENCE AGES
0+

0-4
5-10
11-14
15-18
19-22
23-26
27-30
31-34
35-38
39-99

GLOBE Mission EARTH is a collaborative of multiple institutions across the United States formed to increase the involvement in the GLOBE Program (<https://www.globe.gov>) and to incorporate NASA assets into citizen science and K-16 student learning with a focus on reaching underserved students. GME partners include the following: NASA's Langley Research Center (LaRC), Hampton, VA; Boston University (BU), Boston, MA; Tennessee State University (TSU), Nashville, TN; WestEd/University of California at Berkeley (UCB), Berkeley, CA; and Institute of Earth Observations (IEO), Palmyra Cove, NJ. GLOBE Mission EARTH is funded by NASA Cooperative Agreement Notice (CAN) #NNX16AC54A.



1* Aerokals and Rovers Educational Network (AREN), Arctic and Earth SIGNs (STEM Integration of GLOBE and NASA), Gulf of Maine Research Institute (GMRI), NASA's Neurodiversity Network (N3), NASA Earth Science Education Collaborative (NESEC), Place-based Learning to Advance Connections, Education and Stewardship (PLACES), Planetary Learning that Advances the Nexus of Engineering, Technology, and Science (PLANETS), STEM Enhancement in Earth and Space Science (SEES), SMD Community of Practice for Education (SCoPE), Solar System Ambassadors (SSA).

2* RI, MA, CA, NM, PR, AR, I, N, VA, GA, AL, WV, LA, OR, TX, NY, OH, MI, FL.

EDUCATIONAL SETTINGS



INFORMAL/ OUT OF SCHOOL



FORMAL EDUCATION



CITIZEN SCIENCE



PROFESSIONAL

“ Audience Quote

“I’ve always had a passion for like the environment, like try bettering myself and my family and what we can do to help. So combining my passions has been such a cool thing and so being able to program and wire this terra rover, to do stuff to help my environment and make an impact on the world I’m living in, has been like the coolest thing.” —H. Komaiha, GME Student, Crestwood High School, Dearborn Heights, MI

DELIVERY MODELS

INDEPENDENT/ SELF-DIRECTED	FACILITATED LEARNING	GUIDED BY INFORMAL EDUCATORS	DELIVERED BY FORMAL EDUCATORS	PEER PROFESSIONAL LEARNING
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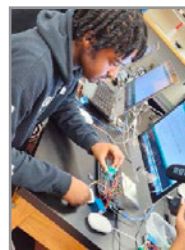
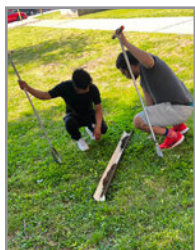
<https://www.globe.gov/web/mission-earth>

★ Key 2023 Accomplishments

- Engaged 3,385 K–12 students from 60 schools in authentic research experiences.
- Engaged 75 teachers in professional learning experiences; 68 teachers implemented GME in their classrooms.
- Mentored 203 students who completed 107 projects that were presented at local science fairs, the International Virtual Student Symposium (IVSS), regional Student Research

Symposia (SRS), and the American Geophysical Union (AGU) with support from 37 subject matter experts.

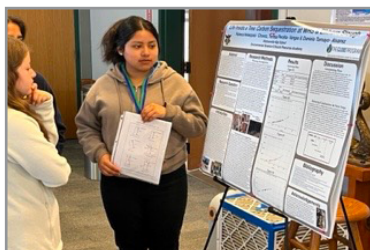
- Tennessee State University spearheaded the Historically Black Colleges and Universities (HBCU) Informal Education Institution Collaborative engaging vulnerable populations in relevant GLOBE projects.
- Worked with 14 Science Activation projects (Cross-Collaborations): AREN, Arctic Signs, NIA, NESEC, PLACES, HEAT, etc.
- Developed 41 partnerships with local and regional groups.



Doing GLOBE

Building sensors to collect aerosols data

Students Presenting Their Research



Pacific Student Research Symposium



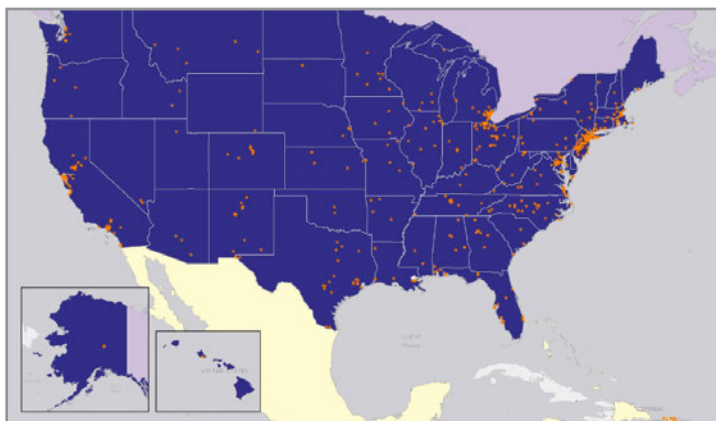
GLOBE Annual Meeting

✚ Key Partners Active in 2023

- American River Conservancy
- Birmingham Southern College
- Blue Hill Observatory
- Chabot Space and Science Center
- Dataspire
- Deep South Center for Environmental Justice
- Detroit Green Door Initiative
- Earth Heart Farms
- Elkhorn Slough National Estuarian Research
- Lawrence Hall of Science
- Los Angeles Unified School District Office of Outdoor Environmental Education
- New Mexico Public Education Department
- Toledo Zoo
- U.S. Naval Academy
- West Atlanta Watershed Alliance
- Xavier University of Louisiana
- Xcite Learning Project



Public Engagement



Reach of GLOBE Mission Earth in the United States in 2022

- ASTROPHYSICS
- BIOL/PHYS SCIENCES**
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Growing Beyond Earth



PI: Dr. Carl Lewis
 INSTITUTION: Fairchild Tropical Botanic Garden



Growing Beyond Earth is a classroom-based citizen science project designed to advance NASA research on growing plants in space. It includes a series of plant experiments conducted by students in a Fairchild-designed plant habitat similar to the Vegetable Production System (Veggie) on the International Space Station. We provide equipment, training to teachers, and coordination of experiments in middle and high schools.



- 450 Schools
- 49 States, 8 Countries
- 250+ Plant Cultivars Tested
- 80,000 Students Engaged

EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

“ Audience Quote

“Two of the greatest lessons I have learned over the course of my time with GBE are: First, science and continuing to experiment is truly remarkable and forever impacts our lives. Secondly, I was taking every day as a new opportunity for change and along the way learned how to work in a team and GBE has truly shown that I can not only work alone but how to work with my fellow scientists (peers) to change the world.” —GBE high school student participant

DELIVERY MODELS

- INDEPENDENT/ SELF-DIRECTED
- FACILITATED LEARNING
- GUIDED BY INFORMAL EDUCATORS
- DELIVERED BY FORMAL EDUCATORS
- PEER PROFESSIONAL LEARNING

<https://science.nasa.gov/sciact-team/growing-beyond-earth>

★ Key 2023 Accomplishments

- The project is now in 450 classrooms across 19 time zones.
- All program materials, including teacher and student trainings, are offered in both English and Spanish.
- The project tested new technology that allows students to use computer coding to control and measure environmental factors within the plant habitat.
- We created a Teacher Ambassador Program.



Student setting up a new experiment in a GBE system



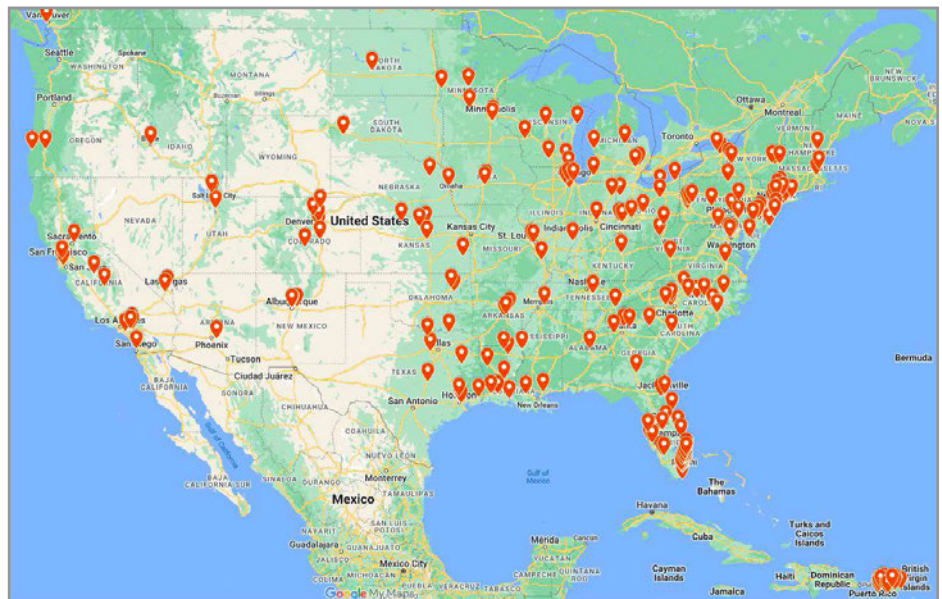
Student recording weekly plant measurements



NASA plant research team members Dr. Gioia Massa and Trent Smith

✚ Key Partners Active in 2023

- Space Agriculture Lab Analysis Database (SALAD)
- SMEs at NASA KSC
- MARSFarm (manufacturing and distribution partner)
- MN Associates



2023–24 Growing Beyond Earth U.S. school sites

ASTROPHYSICS BIOL/PHYS SCIENCES EARTH SCIENCE HELIOPHYSICS PLANETARY SCIENCE

Science Activation

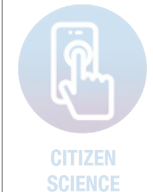
Learner Engagement Accessing Real-world NASA SMD Expert Resources (LEARNER)



PI: Dr. Lance Bush
 INSTITUTION: Challenger Center



EDUCATIONAL SETTINGS



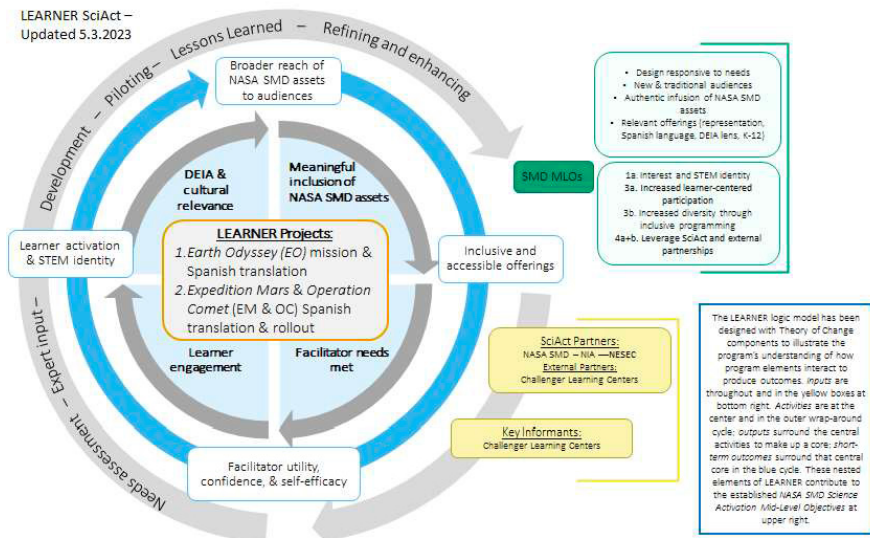
AUDIENCE AGES
10-15

10-12

13-15

Challenger Center is developing and implementing the following:

- A new, participatory simulation program called Earth Odyssey, featuring NASA Earth Science.
- Spanish versions of two existing participatory simulations focused on NASA Planetary Science, Expedition Mars, and Operation Comet, developed under our SciAct 1.0 project.
- Subject matter expert videos integrated into all missions and into a web page for students to learn more about careers.



“ Audience Quote

“This is hands-down the most creative and the most comprehensive STEM content of all our missions.”
 –Challenger Learning Center staff

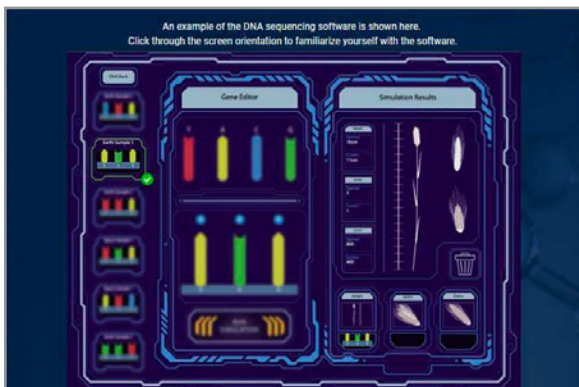
DELIVERY MODELS				
INDEPENDENT/ SELF-DIRECTED	FACILITATED LEARNING	GUIDED BY INFORMAL EDUCATORS	DELIVERED BY FORMAL EDUCATORS	PEER PROFESSIONAL LEARNING

<https://science.nasa.gov/science-activation-team/challenger-center>

★ Key 2023 Accomplishments

- Developed engaging and flexible content aligned with our Needs Assessment results from our Center network.
- Developed interactive software tools for learners to explore STEM concepts alongside hands-on lab experiments. We included new content in this Earth Odyssey mission that has not been previously explored in other missions, including genetic mutations, DNA sequencing, hydroponics, changing ocean temperatures and their impact on marine life, erosion and weathering, climate and weather patterns, severe weather tracking, and software debugging.
- Incorporated diversity, equity, inclusion, and accessibility (DEIA) instructional approaches to our software and STEM content.
- Recorded SME orientation videos to provide career connections for our learners.

Below are images of our interactive tools that learners will use to engage with our simulated mission:



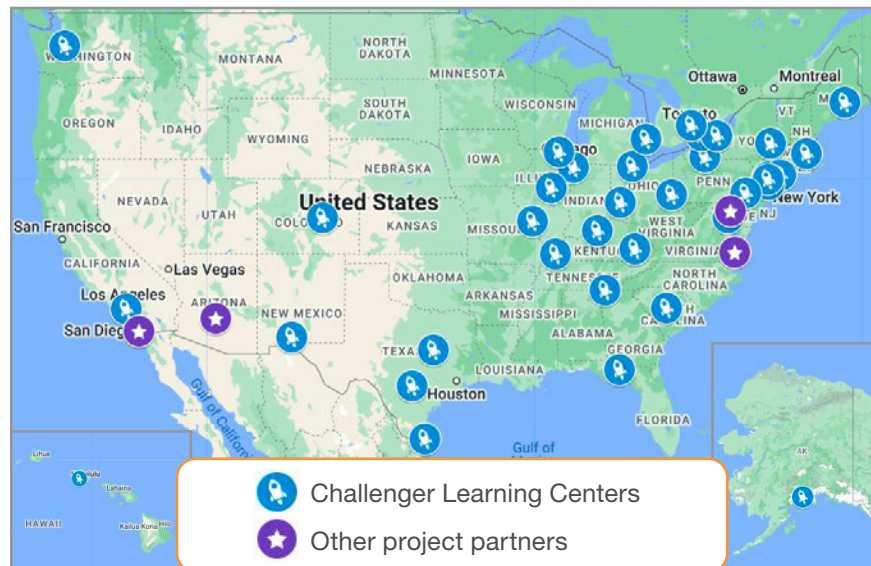
Biology Team DNA Sequencer Tool



Geology Team Severe Weather and Erosion Tool

✦ Key Partners Active in 2023

- 7 Challenger Center Collaboration Teams
- National Institutes of Aerospace (NIA)
- NASA Earth Science Education Collaborative



Reach map

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE**
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Learning Ecosystems Northeast

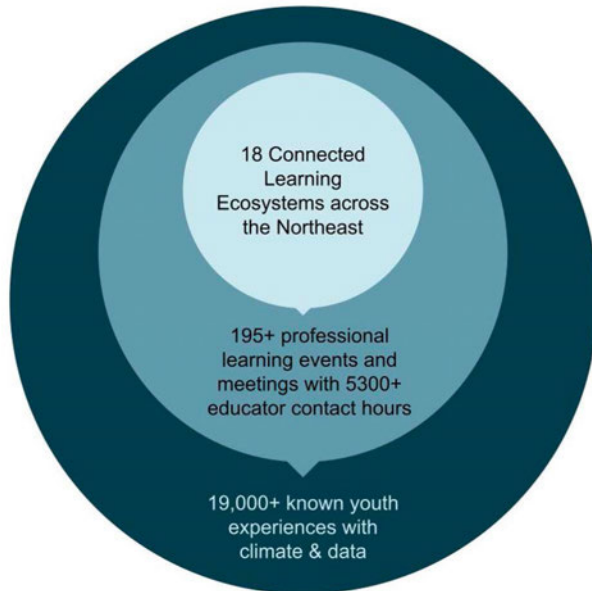


PI: Leigh Peake

INSTITUTION: Gulf of Maine Research Institute

CO-I INSTITUTIONS: AAA Lab, Stanford University; Education Development Center; Gateway Community Services; Maine State Library; University of Maine Cooperative Extension; and Wabanaki Youth in Science

Learning Ecosystems Northeast (LENE) is creating Connected Learning Ecosystems (CLEs) across Maine and the Northeast focused on supporting informal and formal educators to create linked NASA-powered explorations of local climate change impacts and thereby lift youth STEM interest and agency.

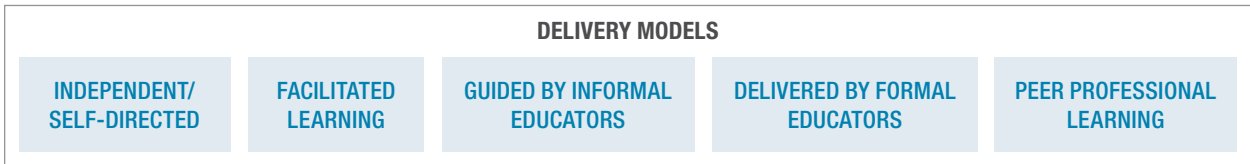


- EDUCATIONAL SETTINGS**
- INFORMAL/ OUT OF SCHOOL
 - FORMAL EDUCATION
 - CITIZEN SCIENCE
 - PROFESSIONAL

“ Audience Quote

“Through this project I have had access to professional development, educational opportunities for my students, funding, camaraderie and so much more. I have had the opportunity to forge relationships with professionals in my area and as an educator who is a department of one, these relationships have kept me afloat, when the daily grind might otherwise have pulled me under. More than that these relationships have revolutionized what I do with students. This community was exactly what I was looking for, thank you.”

—Sherri Calhoun, teacher, Ashland District School, MSAD #32



<https://science.nasa.gov/science-activation-team/gmri>

★ Key 2023 Accomplishments

- 12 Connected Learning Ecosystems (CLEs) across the Northeast continue to thrive and meet regularly! 4 more are in the recruiting phase.
- The Wabanaki CLE held 4 multi-day convenings and 9 virtual meetings with Indigenous Knowledge Sharers and western educators.
- A CLE serving Immigrant and Refugee communities is developing 2 branches: youth programming and educator best practices for supporting diverse youth.
- The program created dozens of **data-rich climate learning experiences** for in- and out-of-school contexts, including new locally relevant STEM kits and library program guides.
- We made big strides in making NASA assets locally relevant through resources, speaker series, and direct 1:1 support.
- The program funded 5 implementation awards for local data/climate learning experiences designed and implemented by educators in the Maine CLEs.
- We issued 11 3-year awards (2023–25) to science centers to launch their CLEs and support data-rich climate learning in and out of school in their regions.
- The Science Center Community of Practice (CoP) met 10+ times and held a 3-day professional learning convening.
- The Eval Team collected and analyzed 116 surveys of CLE members, 27 Summer Meetup surveys, 13 Science Center Meetup surveys, 19 project partner surveys, 6 Butterfly Project surveys, 17 project partner interviews, 18 interviews with CLE participants, and 7 Butterfly Project interviews.



LENE educators investigate climate impacts on local tree species and collect data for the GLOBE Tree Height project



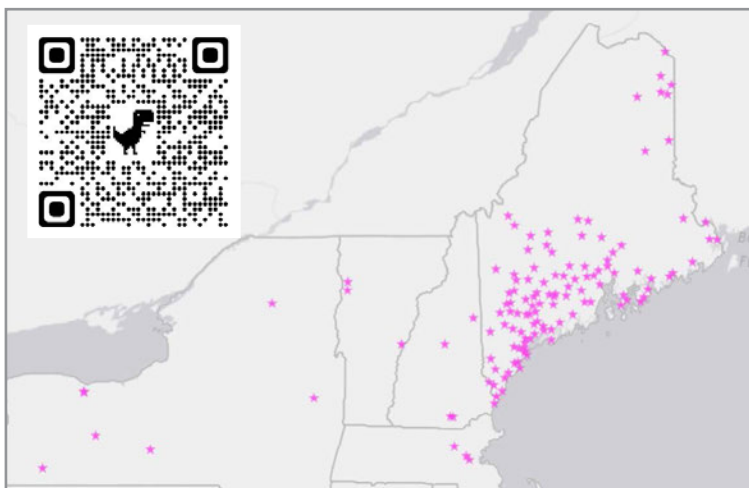
Science Center CoP meets to support one another in developing local CLEs



Shawn Laatsch, NASA SME and Director of Versant Planetarium, provides background knowledge about the eclipse

⚙️ Key Partners Active in 2023

- The Children's Museum at Saratoga
- Cumming Nature Center
- Discovery Museum (Acton, MA)
- ECHO, Leahy Center for Lake Champlain
- Maine Discovery Museum
- Montshire Museum of Science
- Mount Washington Observatory
- Sciencenter
- Seacoast Science Center
- Shelburne Farms
- Squam Lakes Natural Science Center
- The Wild Center



2021 reach map

ASTROPHYSICS BIOL/PHYS SCIENCES EARTH SCIENCE HELIOPHYSICS PLANETARY SCIENCE

Science Activation

MIT Media Lab: Supporting NASA Science Activation



PI: Dr. Maria Zuber
 SCIENCE PI: Dr. Rachel Connolly
 INSTITUTION: Massachusetts Institute of Technology (MIT)

AUDIENCE AGES
23+



Bringing Strategic Insight and Capacity-Building to the SciAct Program

The success of the SciAct portfolio lies in a balance between cohesion and coordination, with individual projects engaging their audiences in a diverse range of contexts, but collectively embracing a shared vision and understanding of NASA's goals and outcomes (NASA, 2020). MIT's systems integration and analysis role within SciAct improves NASA's understanding of the complex interactions and outputs of the SciAct Program through data analysis efforts that deliver actionable insights. MIT accomplishes this goal through a range of activities aligned with its deep expertise in digital learning, data science, and human networking.

The outcomes of MIT's efforts include improved collaboration across the network, offering professional tools to funded teams and increasing the overall efficiency and impact of NASA's SciAct Program as an interconnected socio-technical system or "STEM ecosystem."



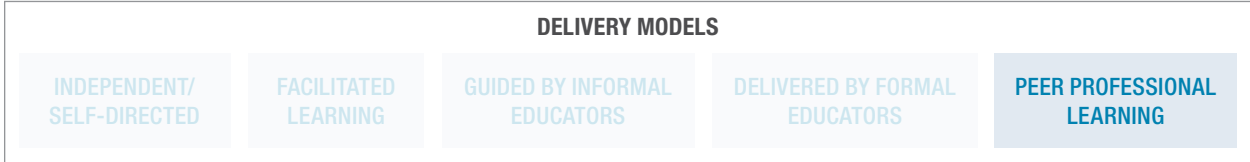
EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

“ Audience Quote

“We just call them the ‘glue.’” —a SciAct team member

DELIVERY MODELS



<https://science.nasa.gov/sciact-team/mit-media-lab>

★ Key 2023 Accomplishments

- Launch of updated SciAct Educational Resource Catalog.
- Climate Data Tools Initial Needs Assessment Completion and AGU presentation.
- SciAct Publications Toolkit.
- Cocreation of Climate Futures Workshop (a GRC preconference workshop).

✚ Key Partners Active in 2023

- My NASA Data
- Earth to Sky
- GLOBE Mission Earth
- Gulf of Maine Research Institute
- NASA Science Visualization Studio
- Aerokats & Rover Education Network (AREN)

Catalog: Learning and Educational Activities and Resources from NASA Science

This catalog of learning resources draws from NASA science content. You can search this collection using key words and/or the drop down filters to pinpoint resources to use with your audience of learners.

Filters

SUBJECT

MATERIAL TYPE

EDUCATIONAL USE

Informal Education

Formal Education

Professional Learning


FACILITATION LEVEL

LEARNER LEVEL

LANGUAGE

LEARNING TIME

MATERIALS COST




Light & Color: Exploring Visible Light Activity Guide

This activity introduces learners to the visible-light spectrum and color mixing. Your event's attendees may explore visible light by observing it with diffraction grating glasses to see how it can be broken up into its component colors (red, orange, yellow, green, blue, and violet).

Go to Resource

Audience: .

Topic: The Universe



Max Goes to the Moon

Award winning astronomer-author Jeff Bennett's book, "Max Goes to the Moon" read out loud. The dog Max and his middle school owner, Tori, train to go into space. Nice cartoon drawings, brought to life. Each part of the story has a box of hints for parents (or teachers) designed to help them answer questions that kids may have while hearing the story.

Go to Resource

Audience: .

Topic: Earths Moon



Initial Co-Design of Earth and Climate Data Tools for Learners







Dr. Rachel Connolly, MIT
 Dr. Jacob Foster, STEM Learning Design
 Priscilla Baltezar, MIT
 Kate Haley Goldman, HG&Co

AGU Annual Conference
 Dec 12, 2023





- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

NASA Community College Network (NCCN)

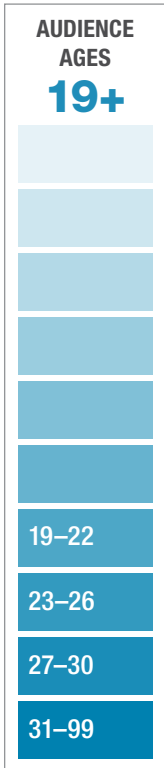


PI: Dr. Simon Steel
 INSTITUTION: SETI Institute



The NASA Community College Network is a platform and program that enables NASA science and NASA subject matter expertise to enhance the teaching of astronomy and space science in community colleges.

- EDUCATIONAL SETTINGS**
- INFORMAL/ OUT OF SCHOOL
 - FORMAL EDUCATION
 - CITIZEN SCIENCE
 - PROFESSIONAL



“ Audience Quotes

“I just want to say thank you so much. I have really appreciated these meetings, and the opportunity to connect with colleagues as a department of one on my campus, like I’m sure many of you are. I hadn’t realized quite how else isolated I felt until I was able to join the group. So thank you all.” –CC instructor

“I think community colleges are very important. I wanted to reach out to students who aren’t necessarily at their local state university.” –SME



<https://nccn.seti.org>

★ Key 2023 Accomplishments

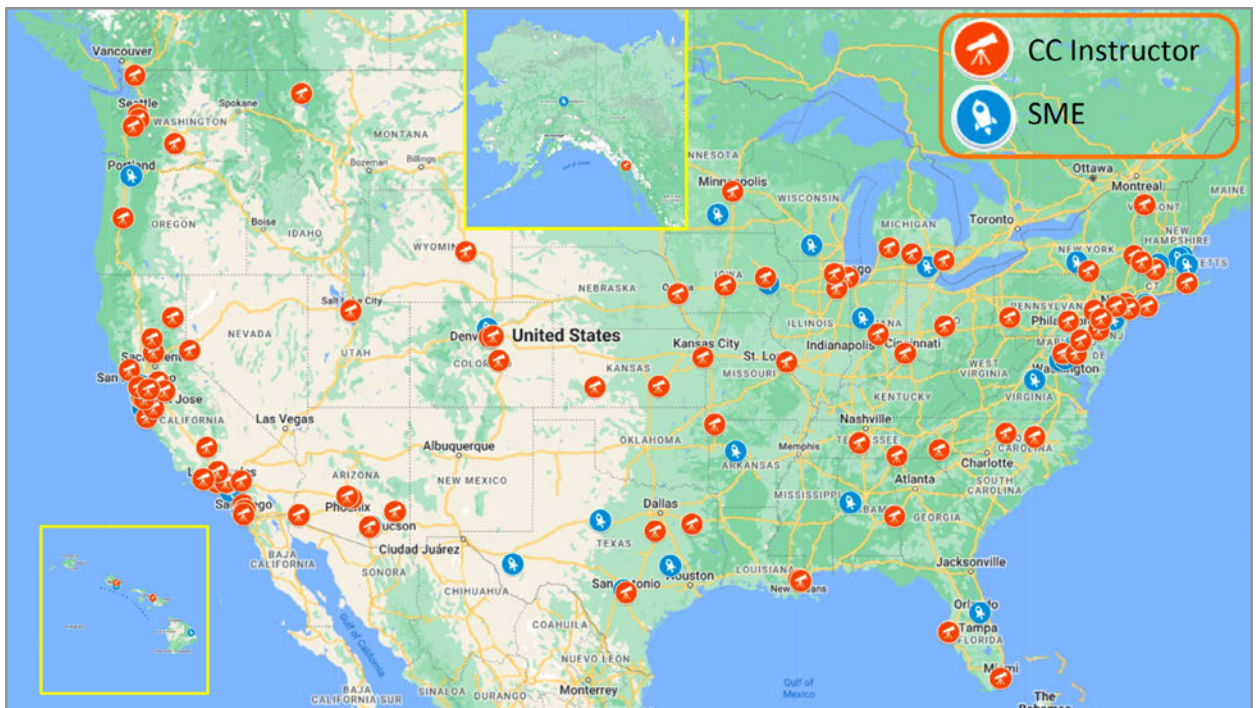
- NCCN now hosts 148 community college instructors (CCIs) representing 144 unique community colleges across 36 states.
- This includes 68 Minority-Serving Institutions (MSIs).
- We have 94 SMEs from 73 unique centers or institutions around the Nation.
- The network curated 14 resources, including labs developed by SciAct partners (Cosmic Data Stories and SCoPE seed-funded Planet Patrol citizen science project).
- Over 400 educators, in addition to community college instructors, made use of the NCCN Resource Database.
- We held 10 professional development webinars for both SMEs and CCIs in 2023.
- A comprehensive WestEd program review showed that over 90% of CCIs felt the program helped them find new resources for their courses, gave them new information, and helped them find new opportunities for their students.



SME presentation, AZ Western College



Presence at the NASA booth, SACNAS



NCCN reach map

ASTROPHYSICS BIOL/PHYS SCIENCES **EARTH SCIENCE** HELIOPHYSICS PLANETARY SCIENCE

Science Activation

NASA Earth Science Education Collaborative (NESEC)



PI: Theresa Schwerin

INSTITUTION: Institute for Global Environmental Strategies

EDUCATIONAL SETTINGS



INFORMAL/OUT OF SCHOOL



FORMAL EDUCATION



CITIZEN SCIENCE



PROFESSIONAL

AUDIENCE AGES **3+**

3-5

6-7

8-9

10-12

13-15

16-17

18-22

23-29

30-75

76-99

The program enables broad participation in authentic NASA Earth STEM experiences by lifelong learners through three interconnected areas:

- Citizen science with GLOBE Observer
- Science investigations with NASA assets
- Strategic partnerships and collaborations



Citizen Science Contributions

- 91K+ volunteer hours
- 264K+ GLOBE Observers registered
- 1.1M+ observations (clouds, trees, land cover, mosquito habitats)
- 1.22M+ satellite matches to GLOBE Cloud observations

Science Research and Investigations

- 30 peer-reviewed articles in science and education publications;
 - » 4 with citizen scientist authors
- 200+ subject matter experts (SMEs) connected with learners
- 7,900+ learners participated in 1,900+ projects
- 796+ Girl Scout Troops
 - » 4,800+ individual scouts selected GLOBE Observer for their *Think Like a Citizen Scientist Journey*
- 45 camps in
 - » 18 states engaged
 - » 54,000+ learners

Strategic Partnerships

- 29 partners
- 100+ collaborators working with international, national, and local organizations and projects

Audience Quotes

"We appreciate that NESEC is always happy to share resources, participate in webinars, and provide supports necessary to share [their] resources with our audience. The partnership addresses the need for training and support, rather than just 'dumping' resources on folks." —2023 NESEC Partner survey

"Professors and research advisors at my institution think it is incredible to have gotten to do a NASA internship as a high schooler—the work you all do to make this available to students is impactful and inspires a real love for research." —SEES Earth System Explorer high school intern and peer mentor

"To see so many Hispanic[s] in NASA, it not only makes us feel proud, but is a source of inspiration that they too can one day achieve their own dreams." —Parent with Hispanic families' group from North Carolina visiting NASA Langley Open House

DELIVERY MODELS

INDEPENDENT/
SELF-DIRECTED

FACILITATED
LEARNING

GUIDED BY INFORMAL
EDUCATORS

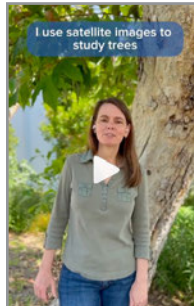
DELIVERED BY FORMAL
EDUCATORS

PEER PROFESSIONAL
LEARNING

<https://science.nasa.gov/science-activation-team/nesecc>

★ Key 2023 Accomplishments

- Engaged participation in all 50 states, DC, and Puerto Rico, as well as over 105 countries.
- Published 4 peer-reviewed scientific papers; one paper includes student citizen scientist authors.
- Connected over 60 scientists and engineers to learners.
- Held 3 international GLOBE data challenges: 2022 Trees Challenge, Where Is the Water, and NASA Moon Trees Quest.
- Launched the GLOBE Eclipse tool for the October 14 annular eclipse.
- Engaged citizen scientist volunteers through GLOBE Observer Connect monthly virtual events, social media, and blogs.
- Led 3 GLOBE Student Research Campaigns engaging learners and educators in studying Earth system phenomena related to air quality, trees, and mosquito habitats.
- Led SEES Earth System Explorers (ESEs) 8-week virtual internship. Mentored 47 high school interns and oversaw a peer-mentor track for 17 ESE alumni. Interns presented their research at international conferences, including the AGU Bright STaRS Poster Session, the GLOBE International Virtual Science Symposium, and the Regeneron International Science and Engineering Festival.
- Established high-impact partnerships to broaden participation, including Texas Master Naturalists (>80 Eclipse Educators), Eclipse Libraries (>150 U.S. public libraries), and Civil Air Patrol (190 teams). NESEC is fostering these partnerships to engage their communities in GLOBE citizen science for the 2023 and 2024 solar eclipses.
- Grew from 31 to 45 camp partners in 18 states reaching >20,000 learners. Established a cohort of 7 camp directors that are working with camp-to-school partnerships during the 2023–24 school year.
- Conducted over 200 events reaching >60,000 through webinars; workshops; presentations at science and education conferences; outreach events; and direct connections to learners, educators, and classrooms.



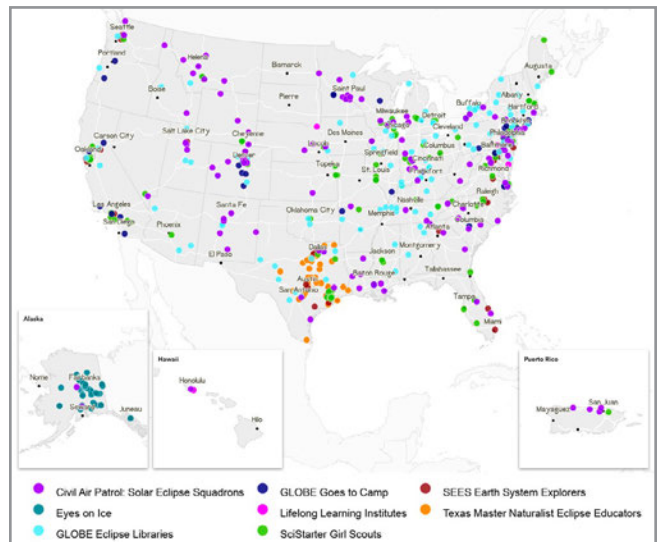
From left to right: Families wowed by the demonstration of a cloud in a bottle at the International Balloon Fiesta

Video reel of NASA scientist Erika Podest explaining the importance of tree height observations for the NASA Moon Tree Quest

Campers taking observations as part of GLOBE Goes to Camp

✚ Key Partners Active in 2023

- NASA GSFC
- NASA LaRC
- NASA JPL
- Oregon State University
- SciStarter
- AMS Project Atmosphere
- Accenture
- Camp Discovery
- Polar Citizen Science Collective
- EPSCoR Projects (NM, PR, VT, WY)
- University of South Florida
- Los Angeles Public Library
- Fresh Eyes on Ice—University of AK
- SEES—University of Texas at Austin
- Texas Master Naturalists
- NC Arboretum
- Civil Air Patrol
- USDA Forest Service
- NASA Next Gen STEM
- GLOBEPlus Post
- Eclipse Soundscapes



Map showing where our strategic partners enabled broader U.S. participation in NESEC experiences during 2023

<https://nsec.strategies.org>

ASTROPHYSICS BIOL/PHYS SCIENCES EARTH SCIENCE HELIOPHYSICS PLANETARY SCIENCE

Science Activation

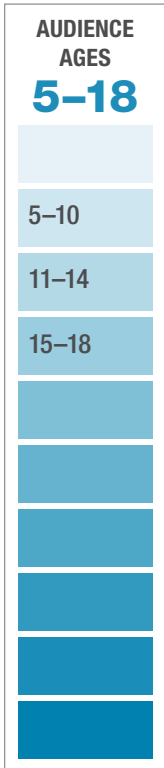
NASA eClips 4D



PI: Shelley Duguid Spears
 INSTITUTION: National Institute of Aerospace (NIA)

EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL



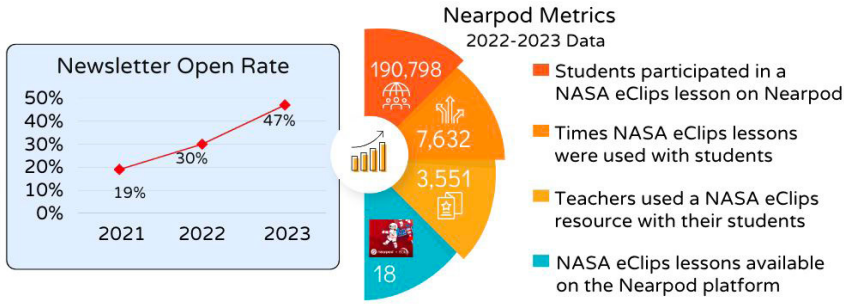
NASA eClips increases STEM literacy through the lens of NASA by bringing together engaging standards-based videos and resources with educational best practices for the national K-12 formal and nonformal educational communities. NASA eClips introduces learners to STEM concepts and provides educators with engaging resources and tools to support teaching and learning.

8 conference exhibits and presentations directly interacting with 580+ educators

Points of Interaction
 NOVEMBER 2022 - OCTOBER 2023

- 15.5 million lifetime video views via website and YouTube channel!
- 13.7% increase in Facebook followers!

85 NASA Spotlite Student Producers creating 26 videos for other students



Audience Quotes

"The NASA eClips team provides unparalleled outreach opportunities; effective and timely professional learning experiences; award-winning resources that align with standards and science content; and engaging learning opportunities. The team is responsive to the needs of our educators and learners."

"I LOVE seeing Universal Design for Learning (UDL) in all NASA eClips newsletters. It shows how much the organization values equitable access and engagement in science education. I always share the newsletters with educators and learners around the world as they provide a great example of firm goals and flexible means and help educators see how to make rigorous and complex science content accessible to all learners."

DELIVERY MODELS

- INDEPENDENT/ SELF-DIRECTED
- FACILITATED LEARNING
- GUIDED BY INFORMAL EDUCATORS
- DELIVERED BY FORMAL EDUCATORS
- PEER PROFESSIONAL LEARNING

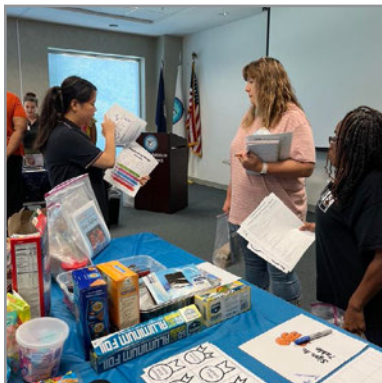
<https://nasaclips.arc.nasa.gov>

★ Key 2023 Accomplishments

- Mentored 2 cohorts of interns (6 students) in science education and communication.
- Co-developed NASA Spotlite Design Challenges with NASA HEAT and Fairchild Tropical Botanic Garden.
- Increased reach by 1,000 educators/students/community members through 41 events.
- Increased learners' sense of STEM-belonging through NASA Spotlite production, as indicated by statistically significant data.



SciAct Collaborations increase outreach impact and leverage assets (NASA HEAT, PLANETS, REACH, NESEC, NASA eClips)



Science Communication Interns lead workshop participants through an engineering activity



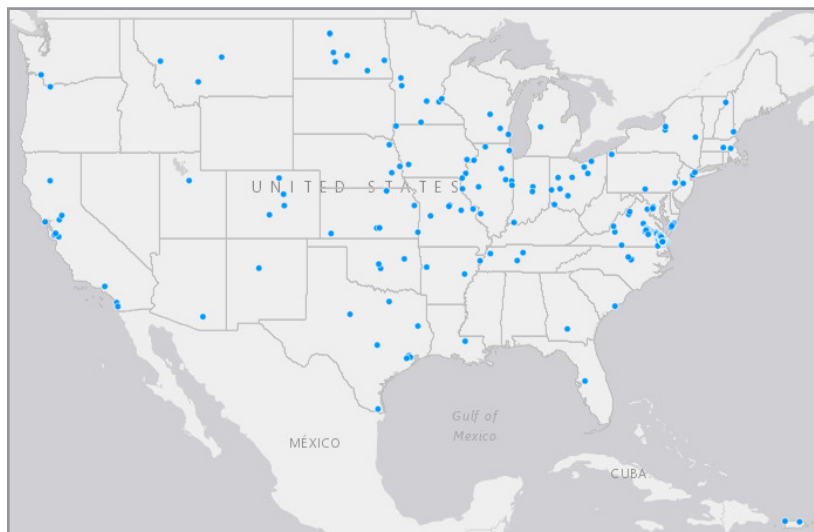
Interviewing subject matter expert Erika Blumenfeld at NASA's Johnson Space Center for NASA eClips and Ask SME videos

Our Active STEM Ecosystem



- Professional Educational Organizations
- Schools and School Districts
- Higher Education
- Professional Educational Organizations
- Nonformal Educational Groups
- Dissemination Networks
- SciAct Collaborations

NASA eClips and GLOBE collaborate to deliver NASA Tools for Literacy Professional Development for all Richmond Public School media center specialists



eClips project reach during 2023

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS**
- PLANETARY SCIENCE

Science Activation

NASA Heliophysics Education Activation Team (NASA HEAT)



PI: Dr. Michael S. Kirk

INSTITUTION: NASA Goddard Space Flight Center

AUDIENCE AGES
10+



NASA HEAT offers educational guidance and resources designed for educators, communicators, and learners of all ages. These resources aim to enhance understanding about our Sun, its impact on Earth, and the entire solar system. Recognizing the importance of heliophysics education, NASA HEAT has integrated heliophysics concepts into various disciplines through a Framework for Heliophysics Education that includes a searchable database of carefully curated materials. Moreover, NASA HEAT is actively contributing to NASA’s involvement in the upcoming 2023 and 2024 solar eclipses. They are accomplishing this by creating educational products and training materials, leveraging the excitement surrounding eclipses to humanize heliophysics and ensure that it is accessible to everyone.



EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

“ Audience Quote

“I learned that the aurora is actually caused by plasma. Also, other planets have auroras too!” —a 4-H youth in the post assessment after attending NASA Helio Club



DELIVERY MODELS

- INDEPENDENT/ SELF-DIRECTED
- FACILITATED LEARNING
- GUIDED BY INFORMAL EDUCATORS
- DELIVERED BY FORMAL EDUCATORS
- PEER PROFESSIONAL LEARNING

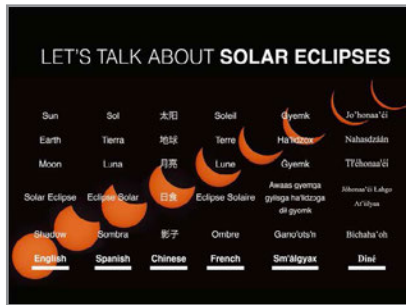
<https://science.nasa.gov/learn/heat>

★ Key 2023 Accomplishments

- GSFC tested the Framework for Heliophysics Education (FHE) with educator-created lessons for students in grades 5–12 (N=395 in 17 classes). Results indicated enhanced understanding of Sun-Earth connection and increased STEM identity ($p < 0.001$), using activities from FHE’s Heliophysics Resource Database containing 150+ resources.
- GSFC and Maryland 4-H collaborated on NASA Helio Club, a 6-lesson module for middle schoolers aligned with Next Generation Science Standards, aimed at inspiring young scientists and enhancing their understanding of the Sun’s influence on Earth.
- The American Association of Physics Teachers (AAPT) carried out a series of 10 virtual workshops for 218 educators throughout the year focused on heliophysics-driven conceptual educational packages called “Digi Kits.”
- The Indigenous Education Institute (IEI) hosted a speaker series, “A Sense of Place: Indigenous Perspectives on Earth, Water, and Sky,” with five virtual events. Each had 400–600 attendees, representing over 100 tribes.
- The University of Alaska Fairbanks (UAF) continued to work on Indigenous language translations, including an aurora lexicon. Based on a gap analysis conducted by NASA HEAT, UAF and IEI are continuing lexicon development to fill a need for cultural knowledge about basic heliophysics concepts.
- GSFC engaged audiences in the annular solar eclipse in Albuquerque on October 14, 2023. Additional resources to support eclipse participation across the country included My NASA Data lessons; art-infused, hands-on activities; and an online training for NASA personnel, via the SATERN portal, also made available to the public. The training aimed to enhance participants’ ability to discuss eclipse and NASA science at events in their communities.



AAPT and the NASA HEAT Space Physics Ambassador Program train educators, who in turn impact thousands of students



NASA HEAT developed a multilingual postcard with solar eclipse vocabulary; this was one of 12 eclipse products created

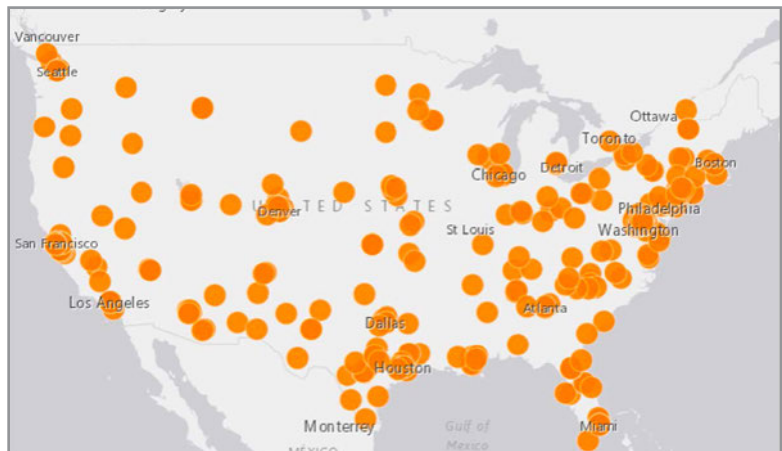


The UAF team teaches students about the Sun and Earth’s aurora during a portable planetarium visit in remote Alaska

The NASA HEAT Annular Solar Eclipse Training public version was downloaded by 590 users, and 452 users completed the SATERN version (274 took Required; 178 took Additional)

🔧 Key Partners Active in 2023

- NASA Goddard Space Flight Center (GSFC)
- American Association of Physics Teachers (AAPT)
- University of Alaska Fairbanks (UAF)/ University of Alaska Museum of the North (UAMN)
- Indigenous Education Institute (IEI)
- Oregon State University STEM Research Center (OSU)



Reach map: annular solar eclipse training downloads by ZIP code

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

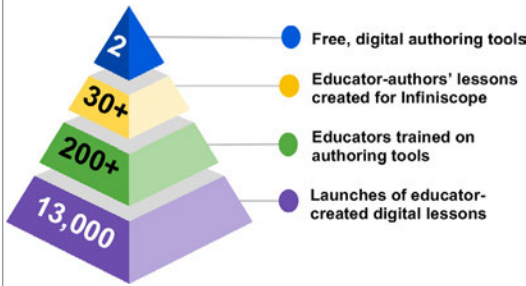
NASA Infiniscope



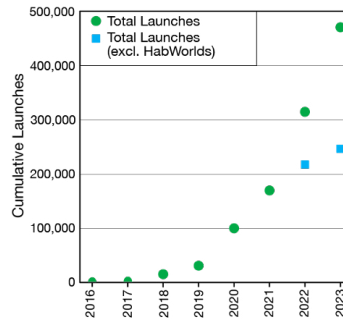
PI: Dr. Ariel Anbar
 INSTITUTION: Arizona State University

Infiniscope

Infiniscope brings NASA science to learners nationwide through interactive digital experiences that inspire curiosity, guide discovery, and encourage exploration. Powered by new creator tools and an open-source intelligent tutoring platform co-developed with the Open Learning Initiative, Infiniscope serves a growing community of expert educators using and creating innovative experiences to advance authentic STEM learning.



Growing use of our digital experience authoring tools: Tour It and the simplified author tool for Torus



Steady growth in Infiniscope experience use, especially in the HabWorlds course

EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

“ Audience Quote

“Infiniscope is very engaging & students love getting into it! It enhances what we do in the class and is more user friendly than a lot of content we’re required to use.”

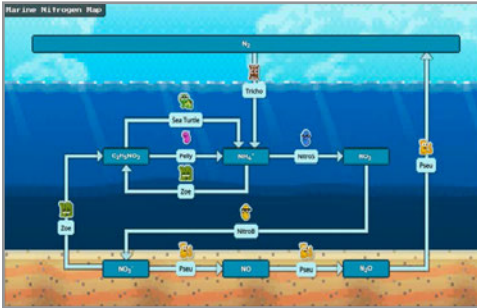
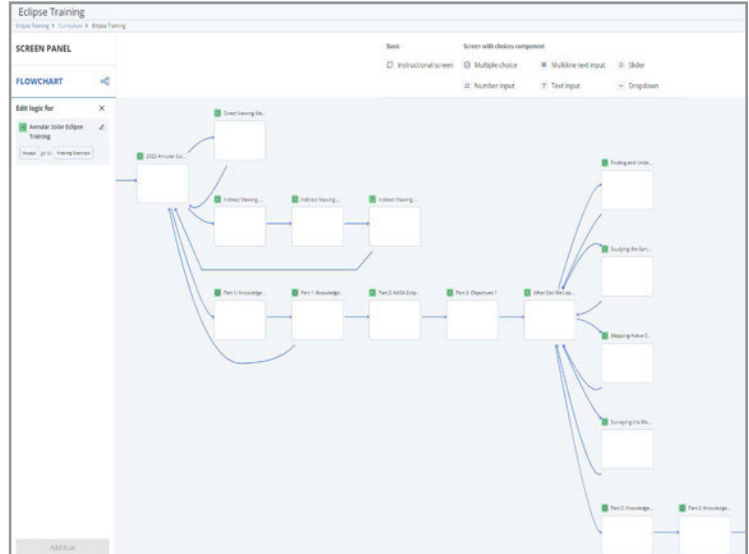
DELIVERY MODELS

- INDEPENDENT/ SELF-DIRECTED
- FACILITATED LEARNING
- GUIDED BY INFORMAL EDUCATORS
- DELIVERED BY FORMAL EDUCATORS
- PEER PROFESSIONAL LEARNING

<https://infiniscope.org>

★ Key 2023 Accomplishments

- Simple Author tool for the new Torus platform released and pilot-tested.
- First educator-created learning experiences by K-12 educators.
- Multiple new experiences released on the Torus platform.
- Other Science Activation teams using Infiniscope tools.

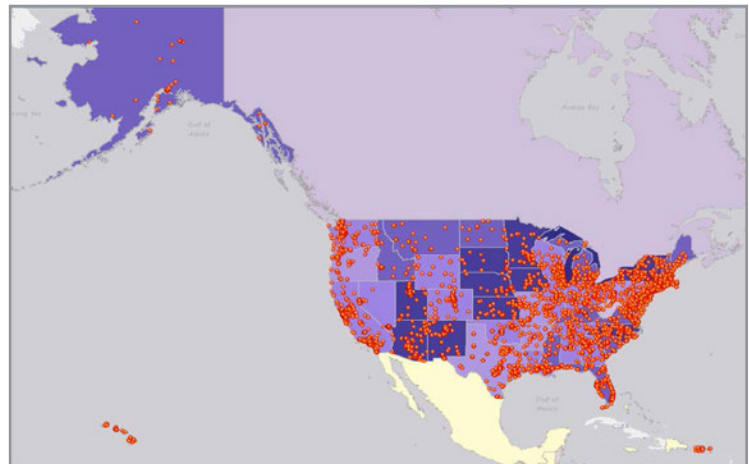
New experiences released (left) include: “Nitrogen Tales” (top), a nitrogen cycle story told through the lens of how to feed a sea turtle; “Our Changing Oceans: Shell Shocked” (middle), about how changing ocean chemistry affects oyster larvae; and “Volcanic Voyages” (bottom), an experience designed by an Infiniscope community member using the new Simple Author tool (above). This experience served as a pilot for the training program and use of the tool.

🧩 Key Partners Active in 2023

- Carnegie Mellon University
- Kamehameha Schools



Learn more about Infiniscope Tools and Impact.



Reach map from live map

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

NASA Inspires Futures for Tomorrow's Youth (NIFTY)



PI: Katie Hessen, M.S.

INSTITUTION: Twin Cities PBS



NASA Inspires Futures for Tomorrow's Youth

AUDIENCE AGES

0+

0-4

5-10

11-14

14-18

19-22

23-26

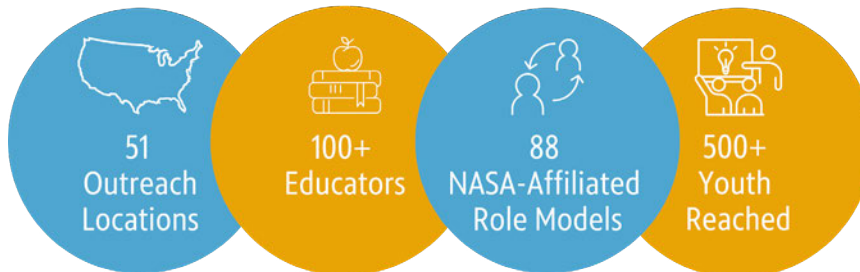
27-30

31-34

35-38

39-99

NASA Inspires Futures for Tomorrow's Youth (NIFTY) is designed to broaden participation of diverse youth (ages 9-14) in STEM studies by providing opportunities to interact with and learn from NASA STEM professionals. Role models help youth to learn about NASA missions and careers and provide personal sources of inspiration! NIFTY trained 100+ educators from 51 outreach locations, equipping them with strategies that promote gender equity and cultural responsiveness in their teaching methods. NIFTY recruited and trained 88 role models from NASA Centers and facilities, providing them with effective strategies to engage youth in STEM. Each role model was thoughtfully paired with an outreach location, amplifying the outreach and impact of NIFTY.



EDUCATIONAL SETTINGS

INFORMAL/
OUT OF SCHOOLFORMAL
EDUCATIONCITIZEN
SCIENCE

PROFESSIONAL

“ Educator Quote Regarding Role Model Interaction

“This went very well! They will never forget this. The fact that a person of her stature would spend time with them personally was powerful. She has a true talent for warming up a group of people by talking about basic things like family and shared experiences. When she discussed some of the educational barriers she ran into as a young girl, my students were somewhat stunned and I think that led them to be more introspective. She followed up with the speech about how they can overcome things too. That had huge value.”

DELIVERY MODELS

INDEPENDENT/
SELF-DIRECTEDFACILITATED
LEARNINGGUIDED BY INFORMAL
EDUCATORSDELIVERED BY FORMAL
EDUCATORSPEER PROFESSIONAL
LEARNING

<https://science.nasa.gov/learners/science-activation-team/nifty>

★ Key 2023 Accomplishments

- 100+ informal educators at 51 Outreach Locations engaged over 500 youth, ages 9–14, and their families from July to November 2023 in NASA-themed programming that included hands-on activities and at least one in-person or virtual role model interaction.
- 88 NASA-affiliated role models recruited from NASA Centers and facilities were trained in role model strategies for engaging youth in STEM.
- The NIFTY Project Team conducted a review of research literature to create a guide titled

Role Model Strategies: Encouraging Youth to Consider STEM Careers.

1. Make a personal connection to create an inclusive learning space.
2. Share your whole self.
3. Share your STEM Journey.
4. Show diversity of people in STEM.
5. Encourage learning from setbacks.
6. Communicate how your work impacts people, your community, and the world.
7. Show how STEM is creative and collaborative.
8. Provide resources for support and guidance.



Role model Alexandra Matiella Novak of Johns Hopkins University Applied Physics Laboratory with the youth of Latinas Leading Tomorrow



Role model Ruby Patterson of Johnson Space Center with the youth of Girlstart



Virtual role model Jordyn-Marie Dudley of Johnson Space Center with the youth of YMCA of Greater Rochester



Map of 51 NIFTY outreach locations

🧩 Key Partners Active in 2023

- Space Science Institute’s STAR Net
- National Girls Collaborative Project
- Langley Research Center

ASTROPHYSICS BIOL/PHYS SCIENCES EARTH SCIENCE HELIOPHYSICS PLANETARY SCIENCE

Science Activation

NASA SMD Community of Practice for Education (SCoPE)



PI: Dr. Meenakshi Wadhwa
 INSTITUTION: Arizona State University

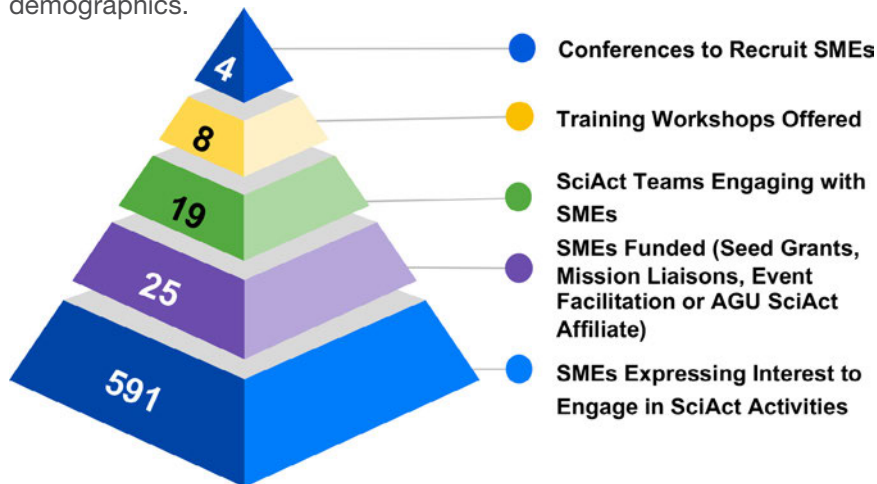
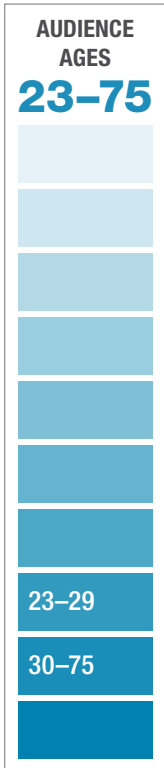


NASA SCoPE
 CONNECTING SMES AND SCIACT

EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

The NASA SCoPE project facilitates connections between NASA subject matter experts (SMEs), including early-career scientists, and NASA Science Activation teams with emphasis on training, seed-grant support, and broadening participation across all demographics.



Pyramid diagram (above) represents all of the activities of the NASA SCoPE project and the engagement of SMEs and SciAct from fall 2022 through fall 2023

“ Audience Quote

“Before I knew about SCoPE, I wanted to participate in outreach, but it seemed very intangible to me. I didn’t know how to make connections that would lead to positive outcomes for both myself and a community/ specific audience. SCoPE opened my eyes to different types of education outreach, and made them feel more tangible to me through grant funding opportunities and partnerships between scientists and communities that were brought together by SCoPE’s team.” —anonymous SME participant

DELIVERY MODELS

- INDEPENDENT/ SELF-DIRECTED
- FACILITATED LEARNING
- GUIDED BY INFORMAL EDUCATORS
- DELIVERED BY FORMAL EDUCATORS
- PEER PROFESSIONAL LEARNING

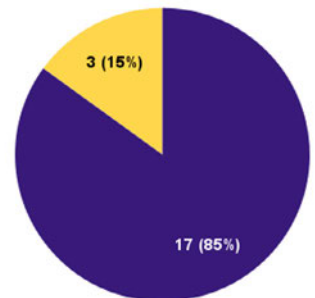
<https://scope.asu.edu>

★ Key 2023 Accomplishments

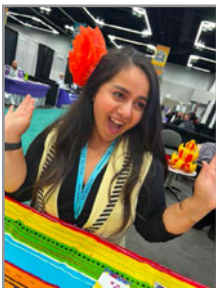
- 10 individuals selected in 2023 for SCoPE seed grants.
- Four individuals selected as Mission Liaisons representing OSIRIS-REx, Lunar Trailblazer, Parker Solar Probe, and Perseverance.
- 10 SMEs funded as AGU SciAct Affiliates, all from marginalized communities.
- Heliophysics Big Year program web pages created to support SMEs engaging in eclipse events.
- New asynchronous training modules and monthly Savory Sessions launched to support activities.



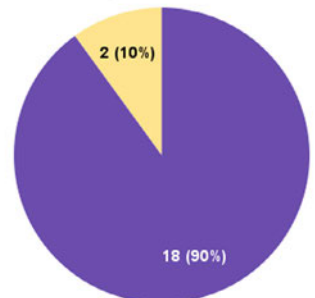
Number of SMEs Funded by Representation



Purple = 85% Historically Marginalized
Yellow = 15% Included Individuals



Number of SME's Funded by Career Stage



Purple = 90% Early Career
Yellow = 10% Middle Career

Conference activities are the predominant mechanism used by the SCoPE team to meet and connect with new and diverse SMEs. Activities and conference venues are chosen and designed to specifically engage early-career SMEs and those from marginalized communities.

✚ Key Partners Active in 2023

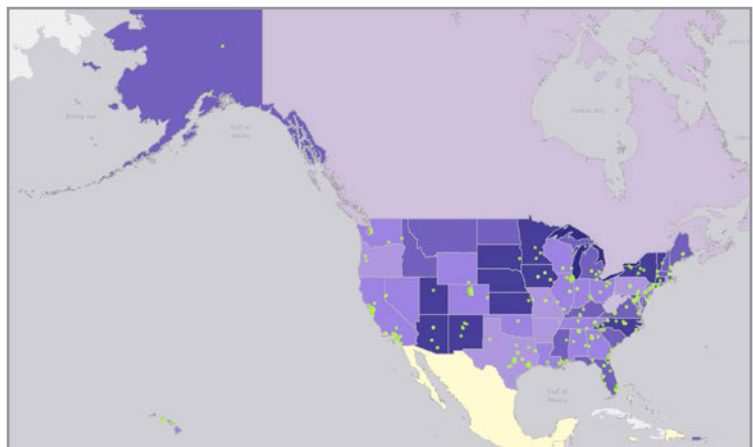
- American Astronomical Society
- AGU Sharing Science Committee
- AbSciCon



Meet the Seed Grant Awardees

Meet the AGU SciAct Affiliates

See the SCoPE Impact



Reach map screenshot from live map

ASTROPHYSICS BIOL/PHYS SCIENCES EARTH SCIENCE HELIOPHYSICS PLANETARY SCIENCE

Science Activation

NASA Solar System Treks



ENGINEERING LEAD: Emily Law
INSTITUTION: NASA JPL

SCIENCE LEAD: Brian Day
INSTITUTION: NASA SSERVI

EDUCATIONAL SETTINGS



INFORMAL/
OUT OF SCHOOL



FORMAL
EDUCATION



CITIZEN
SCIENCE



PROFESSIONAL

AUDIENCE AGES
5+



Solar System Treks supports STEM engagement as a SciAct infrastructure project, providing data visualizations, interactive learning tools, and subject matter expertise. We also actively support the planetary science and mission planning communities, as well as NASA commercial and international partners.

2023 By the Numbers (as of October)

Portals Online:

- Planets (3)** • Mercury, Venus, Mars
- Moons (12)** • Moon, Phobos, Europa, Ganymede, Titan, Dione, Enceladus, Iapetus, Mimas, Phoebe, Rhea, Tethys
- Asteroids (3)** • Vesta, Bennu, Ryugu
- Dwarf (1)** • Ceres

Users	125,145	Searches	4,512,988
Views	3,336,313	Size of Views	1,749 GB
Downloads	6,825	Size of Downloads	142 TB
Data Storage	35.440 TB	Pipeline Storage	~30 TB
Ancillary Storage	3.751 TB	Common Infrastructure	~20 TB

“ Audience Quotes

“Thank you so much for making my class so amazing. My students were so grateful about this opportunity and they said they learned so much. I think the solar trek is mind blowing and thanks for all you are doing for humanity.”

—M. Haghan, NASA Community College Network Instructor

“I have been going on your website and it has really opened my eyes to the world of astronomy. I just wanted to say you are doing a fabulous job. I hope you can do even more research so that we can have a better study of our solar system.”

—B. McClure, a space explorer

“You have an amazing tool. I think the possibilities are endless.” —Carrie Olsen, NASA NextGen STEM Project Manager

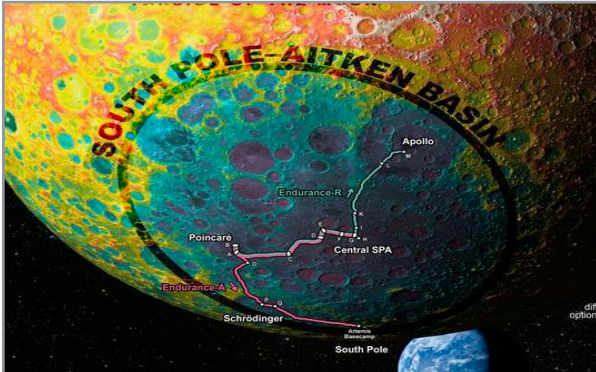
DELIVERY MODELS

INDEPENDENT/SELF-DIRECTED FACILITATED LEARNING GUIDED BY INFORMAL EDUCATORS DELIVERED BY FORMAL EDUCATORS PEER PROFESSIONAL LEARNING

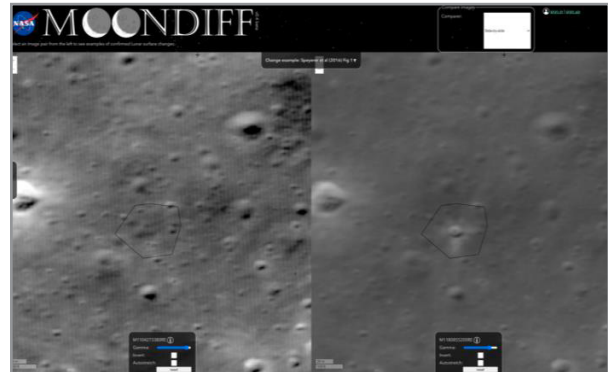
<https://trek.nasa.gov>

★ Key 2023 Accomplishments

- Began two new SCoPE partnerships.
- Initiated a new partnership with Colorado Space Grant in the Great Lunar Expedition for Everyone program.
- Enhanced our student outreach, including in Navajo and Hawaiian schools.
- Partnered with the National Park Service, NASA HEAT, and SSERVI to conduct an eclipse program at Petroglyph National Monument.
- Performed site and traverse analyses for Endurance and Lunar-VISE.



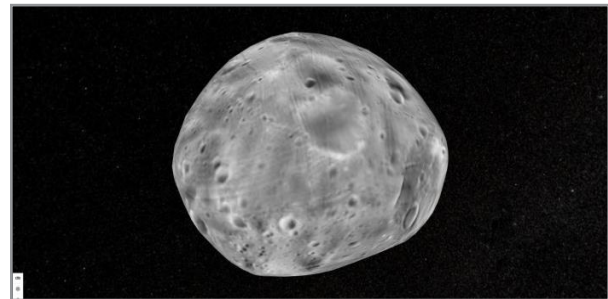
Released two new Moon Trek guided tours for Endurance-A and Lunar Trailblazer



Released the new MoonDiff and started development of the new VIPER Rocks citizen science portals



Released new Ganymede Trek portal, complementing Juice mission and providing key comparison for Europa



Completed initial release of new Phobos Trek portal in partnership with JAXA and SETI in advance of MMX mission

✚ Key Partners Active in 2023

- | | | |
|----------------------------------|---|--------------------------------|
| • NASA AAA | • California State Parks | • JAXA (Japan) |
| • NASA Astromaterials | • USGS | • KIGAM (S. Korea) |
| • NASA eClips | • SETI | • ASI (Italy) |
| • NASA HEAT | • NSF NOIRLab | • AEM (Mexico) |
| • NASA Community College Network | • Cal Academy of Science | • MastCam-Z (Perseverance) |
| • NASA Night Sky Network | • Lewis Center for Educational Research | • VIPER |
| • NASA Solar System Ambassadors | • Cal State University Los Angeles | • LRO |
| • NASA SCoPE | • Gallup McKinley County Schools | • Lunar Trailblazer |
| • Infiniscope | • KSC Swamp Works | • Lunar-VISE |
| • OpenSpace | • Planetary Missions Program Office | • Martian Moons Explorer (MMX) |
| • Colorado Space Grant | • Amateur Astronomy Selenology Project | |
| • National Park Service | • International Observe the Moon Night | |

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

NASA's Eyes 3D Visualization Products



PI: Jon Nelson
 INSTITUTION: NASA's Jet Propulsion Laboratory

AUDIENCE AGES
5+

- 5+
- 5-10
- 11-14
- 14-18
- 19-22
- 23-26
- 27-99

Since 2010, NASA's Eyes has created a real-time web-based interactive visualization to encompass all missions and the ISS, using the same trajectories mission planners use, to help the public "follow along" on desktop or mobile. The NASA charter tasks us with reaching the largest possible audience, and data has shown that there is an opportunity to grow NASA's Eyes digital footprint by improving both the user experience and search engine optimization (SEO) across our sites and mobile devices.

Anytime, any place, any device, in space.



EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

DELIVERY MODELS

- INDEPENDENT/ SELF-DIRECTED
- FACILITATED LEARNING
- GUIDED BY INFORMAL EDUCATORS
- DELIVERED BY FORMAL EDUCATORS
- PEER PROFESSIONAL LEARNING

<https://eyes.nasa.gov>

★ Key 2023 Accomplishments

- 43+ million page views.
- Top 5 ranked nasa.gov website.
- Webby Award Winner for Best Data Visualization.
- Earth Information Center (EIC) at Headquarters.
- Psyche Launch viewing: 1.8 million visits.
- Annular Eclipse viewing: 3+ million visits.
- Comicon Viewing: 10 thousand visitors.
- Explore JPL: 25 thousand visitors.
- Twitch Social: 250 thousand viewers.
- OSIRIS-REx Capsule landing: 1.3 million visits.
- Lucy flyby of Dinkinesh viewing: 1 million visits.
- Integrated into Web Modernization CMS for SMD.
- Collaborations with the California Science Center, Chabot Space, the Museum of Science and Industry, and the Natural History Museum.



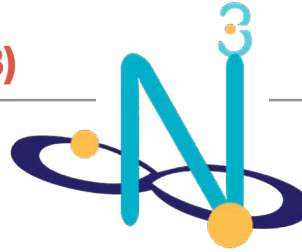
✚ Key Partners Active in 2023

- Solar System Ambassadors
- Museum Alliance
- Web Modernization
- NASA+

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

NASA's Neurodiversity Network (N3)



PI: Prof. Lynn Cominsky
 INSTITUTION: Sonoma State University

NASA's Neurodiversity Network (N3) is providing a pathway to NASA participation and STEM employment for neurodiverse learners, with a focus on autistic learners.

AUDIENCE AGES
6-22



EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

“ Audience Quote

“I’m beyond thankful for being able to do this internship. I really hope more and more organizations will start recognizing that we neurodiverse individuals do have the abilities to do a lot of great things, and if we are given a bit more support and understanding, we really can perform very well.” —N3 intern

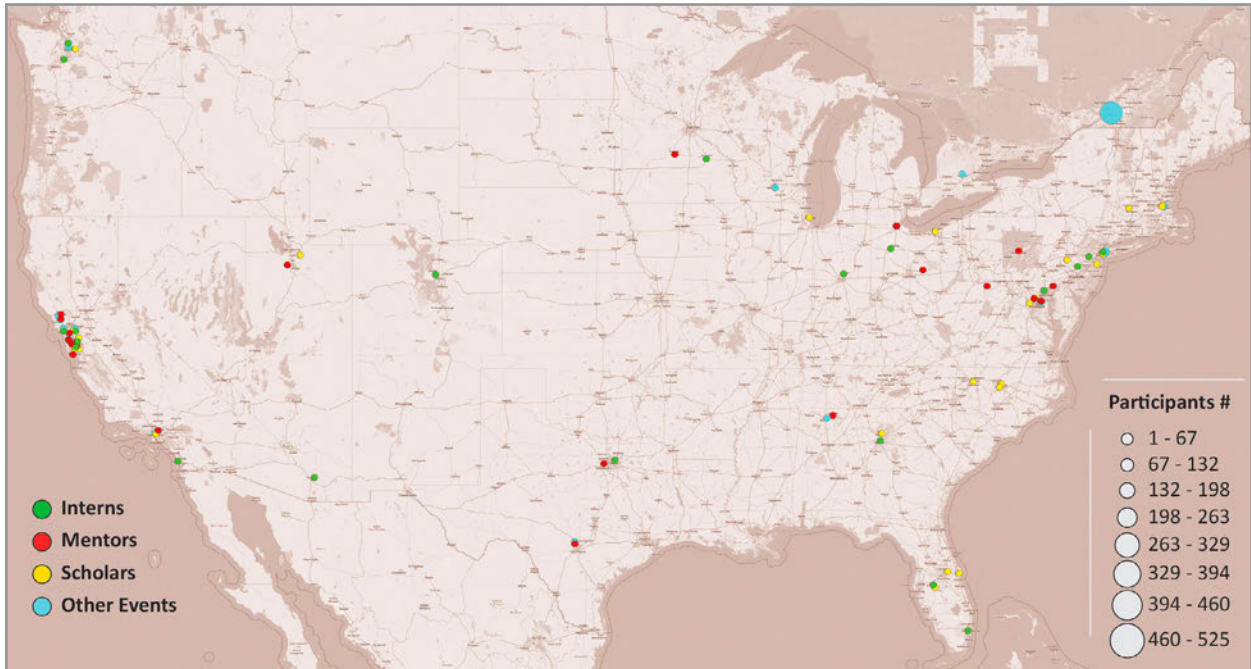
DELIVERY MODELS

INDEPENDENT/ SELF-DIRECTED	FACILITATED LEARNING	GUIDED BY INFORMAL EDUCATORS	DELIVERED BY FORMAL EDUCATORS	PEER PROFESSIONAL LEARNING
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<https://science.nasa.gov/science-activation-team/nasa-neurodiversity-network>

★ Key 2023 Accomplishments

- Piloted Solar Science activities at 4 autism-focused high schools, then engaged in co-design process.
- 21 summer interns were supported by 21 SME mentors, engaging in research projects in astronomy (8), Earth science (4), planetary science (4), heliophysics (2), and space technology (3).
- Started N3 Scholars program to expand our reach (26).
- Prototype Solar Science activities tested, run in middle school summer museum camps; co-design conducted with participants and staff.
- Training in best practices for working with autistic learners for SciAct, mentors, and other groups.



Reach map for 2023 N3 Interns, Scholars, Mentors, and other events

⚙️ Key Partners Active in 2023

- EDC
- NYSCI
- WestEd
- Orion Academy
- Stanbridge Academy
- Anova Center for Education
- Oak Hill School

<http://n3.sonoma.edu>



Sun Spotter design at Oak Hill (L) and Stanbridge (R)

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

NASA's Universe of Learning



PI: Dr. Denise Smith

PI INSTITUTION: Space Telescope Science Institute

CO-I INSTITUTIONS: Caltech/IPAC, Center for Astrophysics | Harvard and Smithsonian, NASA's Jet Propulsion Laboratory

AUDIENCE AGES
10+

10–12

13–15

16–17

18–22

23–29

30–75

76–99

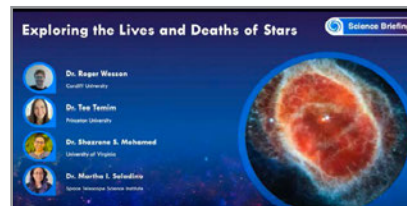
NASA's Universe of Learning (UoL) provides direct access to discoveries, data, and experts of NASA Astrophysics. We combine these assets with best practices in learning to create a range of resources from captivating videos to tools for working with data. We partner with organizations to incorporate these into community programs and professional learning experiences. Subject matter experts ensure the scientific integrity of our work and provide a human connection to science.

19 NASA's Universe of Learning Projects: *Examples of Nationwide Reach for Year 8*

- 128 Girls STEAM Ahead with NASA webinar participants (50% increase from last year)
- 378 educators attending Science Briefings (24% increase from last year)
- 406 ViewSpace informal education venues
- 35K+ users engaging in ViewSpace interactives
- 753 U.S.-based subject matter experts in the SME database (27% increase from last year)
- 2,100 Exoplanet Watch participants (300% increase from last year)
- 830 submissions for Astrophoto Challenges
- 3,884 cities with MicroObservatory users (200% increase from last year)
- 4,513 National Science Olympiad participants in 48 events



1,140 subject matter experts in the SME database: 753 U.S.-based SMEs across 42 states, with 227 institutions and 78 missions represented



Science Briefing for informal educators: "Exploring the Lives and Deaths of Stars." Image: JWST Southern Ring Nebula in mid-infrared light

EDUCATIONAL SETTINGS

INFORMAL/
OUT OF SCHOOLFORMAL
EDUCATIONCITIZEN
SCIENCE

PROFESSIONAL

“ Audience Quote

"Thank you so much for such incredible educational resources for the public! I am a retired educator but am doing outreach now as a Solar System Ambassador and I find the UoL presentations to have been an amazing combination of hard science and educational content." —Science Briefing Informal Educator participant

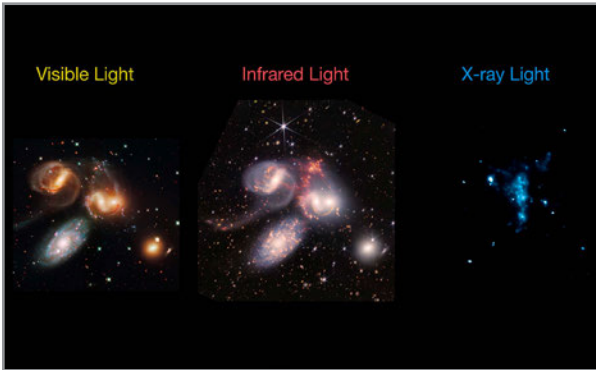
DELIVERY MODELS

INDEPENDENT/
SELF-DIRECTEDFACILITATED
LEARNINGGUIDED BY INFORMAL
EDUCATORSDELIVERED BY FORMAL
EDUCATORSPEER PROFESSIONAL
LEARNING

<https://universe-of-learning.org>

★ Key 2023 Accomplishments

- Enabling facilitators to support their communities:** We create resources that provide an easy and informed entry point to NASA Astrophysics for diverse communities. Select resources include the new Girls STEAM Ahead with NASA’s “Stars” facilitation guide and activities, rural audiences’ exposure to exoplanets through the Discover Exoplanets traveling exhibit, the adaptation of resources to support local needs through the Informal Learning Network, the opportunity to learn about dark energy and dark matter in the context of the new Euclid mission through “Exploring the Mystery of Our Expanding Universe” from Teachable Moments, and “Shedding Light on the Universe: The Euclid Space Telescope” video from ViewSpace.
- Incorporating and enabling exploration of NASA data:** The power of NASA missions is the variety of data that are collected. We strive to create learning pathways or packages to get learners excited about science and develop STEM identity. For example, astronomers and visualization specialists from across several institutions used data from NASA’s Hubble Space Telescope, Spitzer Space Telescope, Chandra X-ray Observatory, and James Webb Space Telescope to create a curated package for sight, sound, and touch of a compact group of galaxies known as Stephan’s Quintet. In the NASA’s Astrophoto Challenges, learners created their own images and received feedback from scientists and other experts. Year 8 challenges’ featured objects were Messier 16, the Eagle Nebula (specifically the “Pillars of Creation”), and Messier 74, the Phantom Galaxy.

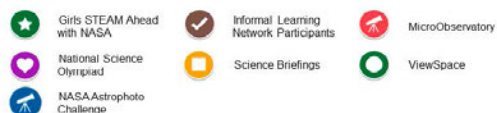
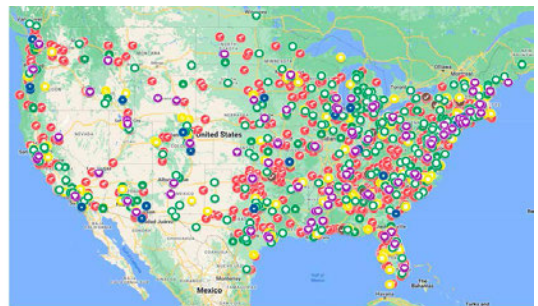
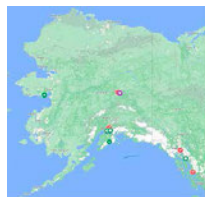


Stephan’s Quintet curated package: 3D visualization and sonification paired with 2D images of the galaxy group; not shown: tactile display table

- Enabling connections between SMEs and learners:** Subject matter experts provide a direct link to current NASA Astrophysics research, which enables rapid incorporation of science results into learning products, ensures the accuracy and currency of science content, and connects learners to the people behind the science who can act as role models. We increased the total number of U.S.-based SMEs in the database to 753 by engaging SMEs through a winter American Astronomical Society (AAS) workshop and booth. Additional efforts to support SMEs in engaging with learners include providing training opportunities through the speaker toolkit and expanding the process to batch-match SMEs to the Night Sky Network audience.

✚ Key Partners Active in 2023

- Association of Science and Technology Centers
- National Girls Collaborative Project
- National Science Olympiad
- Smithsonian Affiliations
- Smithsonian Astrophysical Observatory (SAO) Science Education Department



Year 8 reach map (January–October 2023)

NASA’s Universe of Learning Overview—YouTube

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

NASA@ My Library



PI: Anne Holland

INSTITUTION: Space Science Institute

AUDIENCE AGES
3+

3-5

6-7

8-9

10-12

13-15

16-17

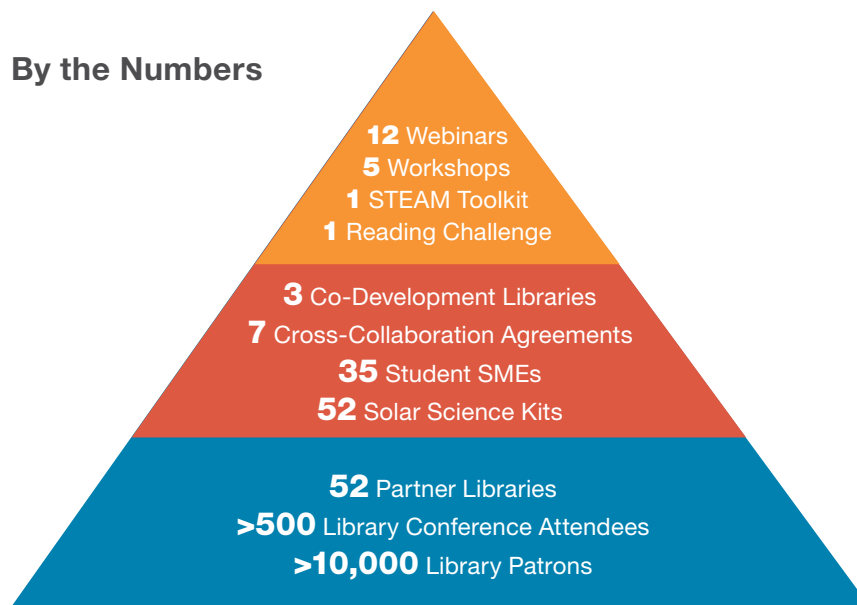
18-22

23-29

30-75

76-99

NASA subject matter experts and library staff, along with our partners, will increase and enhance NASA STEAM learning opportunities for library patrons throughout the Nation, including geographic areas and populations currently underrepresented in STEM education and professions (with a focus on Spanish-speaking individuals).

By the Numbers**EDUCATIONAL SETTINGS**INFORMAL/
OUT OF SCHOOLFORMAL
EDUCATIONCITIZEN
SCIENCE

PROFESSIONAL


Audience Quote

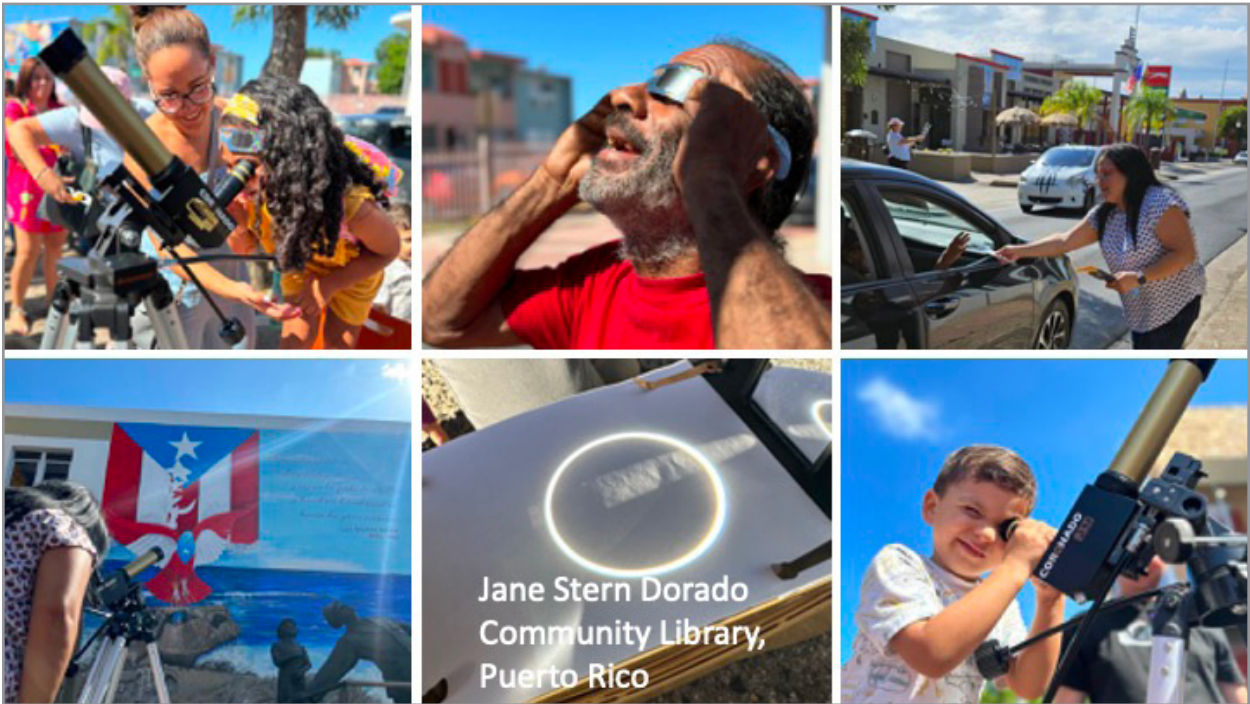
“(Programs and training) provided a great way for folks who don’t normally patronize the library to come over and get acquainted and find out about our programs. STEM programs occur monthly here, and activities like this bring awareness of the Library’s role in education to people who don’t always even know we exist.”

DELIVERY MODELSINDEPENDENT/
SELF-DIRECTEDFACILITATED
LEARNINGGUIDED BY INFORMAL
EDUCATORSDELIVERED BY FORMAL
EDUCATORSPEER PROFESSIONAL
LEARNING
<https://science.nasa.gov/science-activation-team/nasa-at-my-library>

★ Key 2023 Accomplishments

Supplement (began September 2022 and includes carry-over work from NASA@ My Library 2.0):

- Funds received from SMD to support eclipse activities in libraries, in partnership with the Gordon and Betty Moore Foundation, funded the Solar Eclipse Activities for Libraries (SEAL) program and supported in-person trainings for public library staff across almost all 50 states and 4 U.S. territories (remainder will be reached in 2024).
- 52 bilingual English-Spanish kits were distributed to public libraries in 18 different states to support Solar Science activities.



⚙️ Key Partners Active in 2023

- Education Development Center
- Lunar and Planetary Institute
- Partner and State Libraries
- Embry Riddle
- Old Dominion
- SciAct Cross Collaborations

Student SME Python Coding Video



ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

National Informal STEM Education (NISE) Network Space and Earth Informal STEM Education (SEISE) Project



PI: Paul Martin

INSTITUTION: Arizona State University

NISE
NATIONAL INFORMAL
STEM EDUCATION
NETWORK

AUDIENCE
AGES
3+

3–5

6–7

8–9

10–12

13–15

16–17

18–22

23–29

30–75

76–99

The National Informal STEM Education (NISE) Network Space and Earth Informal STEM Education (SEISE) project leverages a robust network of hundreds of museums across the United States to advance the NASA Science Mission Directorate vision for education. The NISE Network utilizes NASA assets and subject matter experts to create compelling learning experiences to share the story, science, and adventure of NASA's scientific explorations of planet Earth, the solar system, and the universe beyond.

EDUCATIONAL
SETTINGSINFORMAL/
OUT OF SCHOOLFORMAL
EDUCATIONCITIZEN
SCIENCE

PROFESSIONAL

“ Audience Quote

“I think that the most valuable thing about participating in the PLC [Earth & Space project-based professional learning community] was the opportunity to network with other professionals and learn about their projects. All of the feedback and discussion I think strengthened each person's project and, at least for me personally, helped to spark some ideas for the future.” —NISE Network Space and Earth project-based professional learning community participant

DELIVERY MODELS

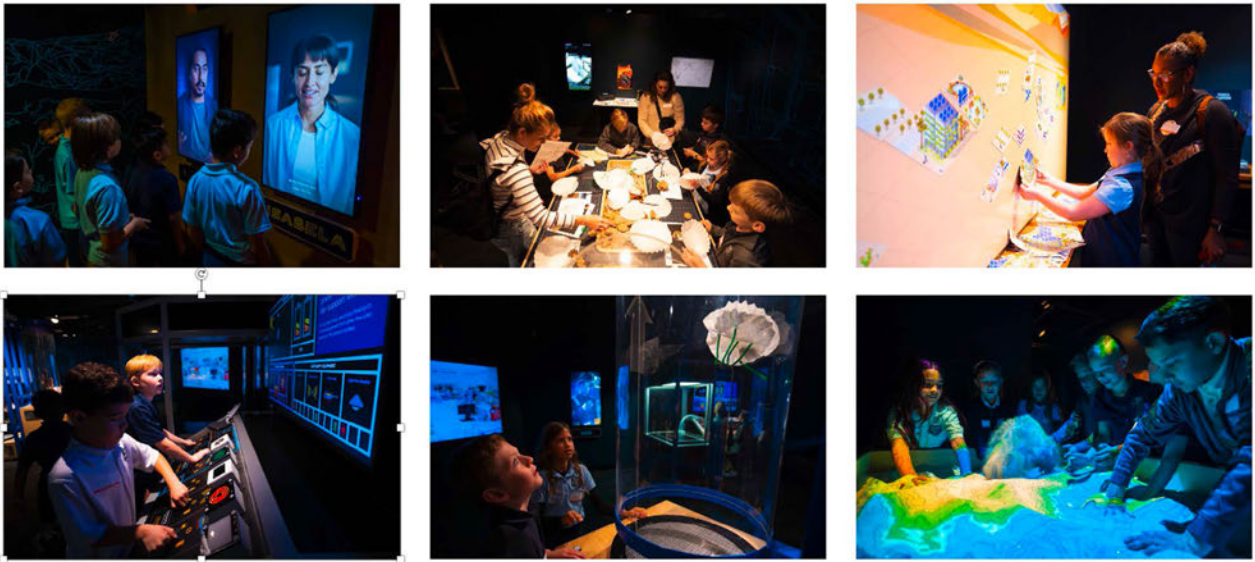
INDEPENDENT/
SELF-DIRECTEDFACILITATED
LEARNINGGUIDED BY INFORMAL
EDUCATORSDELIVERED BY FORMAL
EDUCATORSPEER PROFESSIONAL
LEARNING

<https://science.nasa.gov/science-activation-team/nise-network>

★ Key 2023 Accomplishments

- Installed Mission Future: Arizona 2045 at the Arizona Science Center. This immersive exhibition integrates authentic Earth and space science, imaginative storytelling, and hands-on activities to explore what central Arizona and space exploration might be like 20 years in the future.
- Partners nationwide celebrated the annual solar eclipse in October 2023.
- NISE Network team and partners continue to broaden participation in Earth and space science through the Sun, Earth, Universe exhibitions and Explore Science Earth & Space toolkit activities.

Mission Future: Arizona 2045 Exhibition



Images from the Arizona Science Center

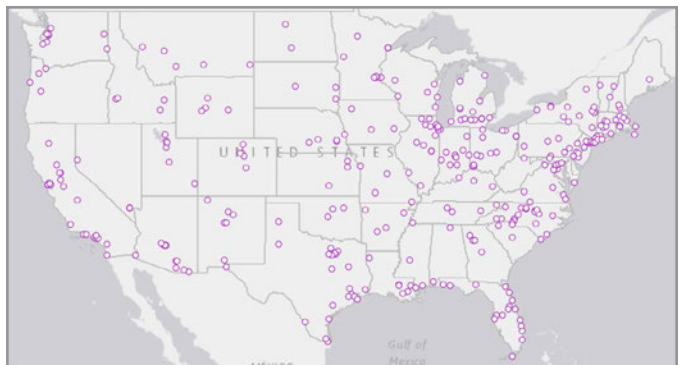
✚ Key Partners Active in 2023

- Arizona State University, Tempe, AZ
- Children’s Creativity Museum, San Francisco, CA
- Museum of Life and Science, Durham, NC
- Museum of Science, Boston, MA
- Sciencenter, Ithaca, NY

NISE Network Partner Organizations



Not pictured: Guam, U.S. Virgin Islands, and American Samoa museum partners



ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

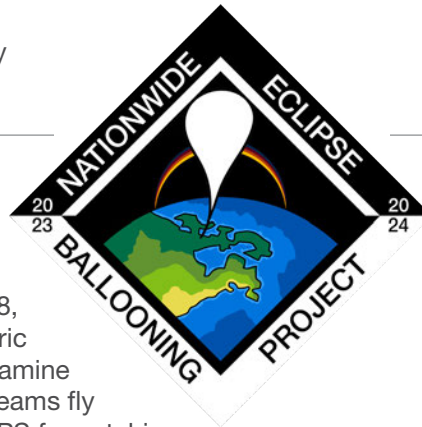
Science Activation

Nationwide Eclipse Ballooning Project (NEBP)



PI: Dr. Angela Des Jardins

INSTITUTION: Montana State University



AUDIENCE AGES

16-75



NEBP engages college teams from across the country to learn and take part in stratospheric ballooning campaigns during the October 14, 2023, annular and April 8, 2024, total solar eclipses. Atmospheric Science teams fly radiosondes to examine atmospheric changes. Engineering teams fly live-streaming cameras, precision GPS for catching gravity waves, and individual experiments. The project has a goal of 50% involvement of students who are historically underrepresented or underserved in STEM.

9
Regional
Pods

53
TEAMS

32%
are
MSIs

15%
are
CCs

17
SMEs

37
States

750
Students

29
Technical
Lessons

15+
Career
Lessons

100%
will do
outreach

EDUCATIONAL SETTINGS

INFORMAL/
OUT OF SCHOOLFORMAL
EDUCATIONCITIZEN
SCIENCE

PROFESSIONAL

“ Audience Quote

“I’ve been truly impressed by the unwavering commitment demonstrated by our team members. While not everyone can attend every event, the workload has been effectively distributed among numerous team members, especially considering the extensive hours of preparation involved. We are a team of proactive and dedicated individuals who get things done.” –NEBP team mentor

DELIVERY MODELS

INDEPENDENT/
SELF-DIRECTEDFACILITATED
LEARNINGGUIDED BY INFORMAL
EDUCATORSDELIVERED BY FORMAL
EDUCATORSPEER PROFESSIONAL
LEARNING

<https://science.nasa.gov/science-activation-team/nationwide-eclipse-ballooning-project>

★ Key 2023 Accomplishments

- The primary focus of NEBP in 2023 was preparing, both technically and logistically, for the October 14, 2023, annular solar eclipse.
- We held in-person workshops in each of the nine Pods in late spring 2023 and have worked hundreds of hours remotely to make the NEBP experience a life-changing one for all the students.



Students prepare for the October 14, 2023, annular solar eclipse. Above left: Engineering team. Above right: Atmospheric Science team. Below: View of Earth and the eclipsed Sun from 80,000 feet in altitude above Nevada on October 14.

✦ Key Partners Active in 2023

- NASA Space Grant
- NASA Balloon Program Office
- Marissa Saad, Saad Educational Services
- Jie Gong, GSFC
- June Wang, SUNY Albany
- Matt Bernards, Idaho Space Grant
- Jamey Jacobs, Oklahoma State U.
- Mary Bowden, U. of Maryland
- Sean Bailey and Suzanne Smith, U. of Kentucky
- Eric Kelsey, Plymouth State U.
- Jani Pallis, U. of Bridgeport
- James Flaten, Minnesota Space Grant
- Rick Eason and Andy Sheaff, U. of Maine



QR code to NEBP website



- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Native Earth | Native Sky (NENS)



**NATIVE EARTH
NATIVE SKY**



PI: Dr. Kathryn “Kat” Gardner-Vandy
INSTITUTION: Oklahoma State University

**EDUCATIONAL
SETTINGS**



INFORMAL/
OUT OF SCHOOL



FORMAL
EDUCATION

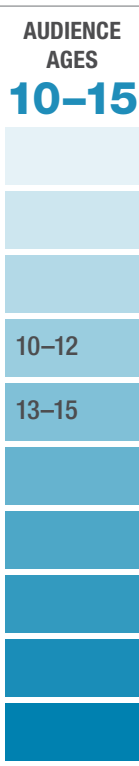


CITIZEN
SCIENCE



PROFESSIONAL

Native Earth | Native Sky (NENS) cocreates culturally relevant Earth and sky STEM curricula with three Native American Nations in Oklahoma. We interweave stories, language, and culture into formal classroom Earth and space curricula in an effort to increase Native American participation in STEM careers. Year 2 of NENS has focused on finalizing Choctaw Nation of Oklahoma curricula, preparing for curriculum development with the Chickasaw Nation, and presenting at conferences.

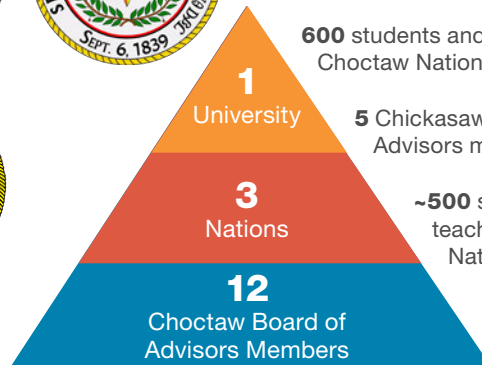


By the Numbers

600 students and **10** teachers in Choctaw Nation

5 Chickasaw Board of Advisors members

~500 students and **10** teachers in Chickasaw Nation in 2024



“ Audience Quote

“My passion is earth, sun and moon. So, finding and seeing a lesson about that and with a cultural aspect attached was very meaningful. I love STEM and seeing all the hands-on activities paired with it is helpful and useful. It can also expand into math, and I loved that these lessons can be used for more than just science.” —participant at NENS Teacher Professional Development Workshop at Choctaw Nation Cultural Center (July 2023)

DELIVERY MODELS

INDEPENDENT/
SELF-DIRECTED

FACILITATED
LEARNING

GUIDED BY INFORMAL
EDUCATORS

DELIVERED BY FORMAL
EDUCATORS

PEER PROFESSIONAL
LEARNING

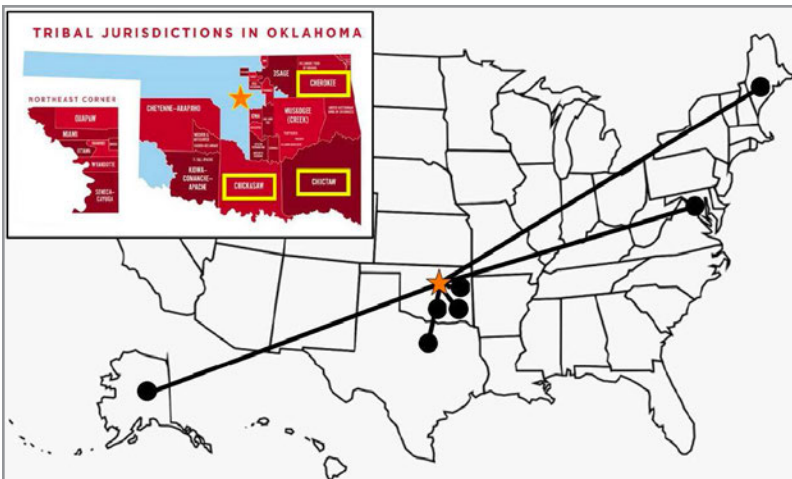
<https://education.okstate.edu/research/centers/native-earth-native-sky/index.html>

★ Key 2023 Accomplishments

- NENS focused on curriculum development and implementation with the Choctaw Nation of Oklahoma (CNO) in Year 3.
- We focused on four Choctaw stories and the lessons we created in collaboration with our CNO Board of Advisors.
- We held a summer camp for middle school students in June and a teacher professional development workshop in July, both at the Choctaw Cultural Center in Calera, OK.
- From that, we supplied 10 teachers within CNO with lesson supplies to teach our curriculum and gather feedback and data for our team.
- We also had presentations at the School Science and Mathematics Association convention and the National Science Teacher Association convention.
- We are now in the development stage of curriculum building with the Chickasaw Nation of Oklahoma.
- Relationship building with Cherokee Nation of Oklahoma has continued as we prepare for Year 4.



CNO teacher professional development participants and Co-I Stephanie Hathcock in lesson plan exploration



⚙️ Key Partners Active in 2023

- Choctaw Nation of Oklahoma
- Chickasaw Nation of Oklahoma
- Cherokee Nation of Oklahoma
- OSU Center for Sovereign Nations
- Texas Christian University
- University of Alaska
- Gulf of Maine Research Institute
- Boeing



Camp participant shows her nature journal entry at the Choctaw Cultural Center



NENS Camp participants end the day outside together at the Choctaw Cultural Center

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Navigating the Path of Totality



PI: Dr. Robert Semper
 INSTITUTION: Exploratorium



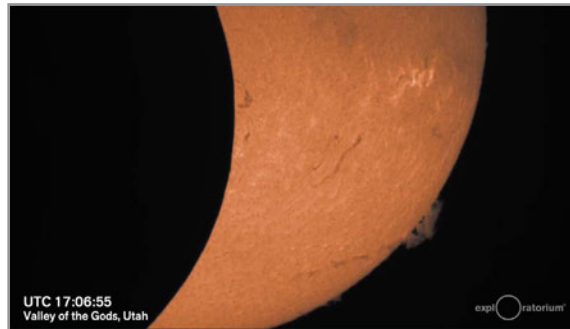
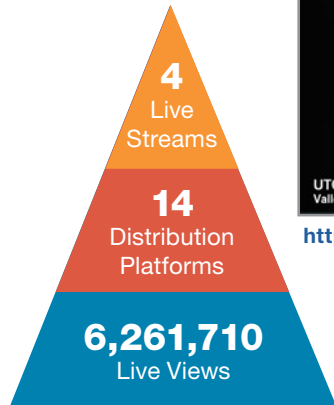
EDUCATIONAL SETTINGS

- INFORMAL/OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

AUDIENCE AGES
3+

- 3-5
- 6-7
- 8-9
- 10-12
- 13-15
- 16-17
- 18-22
- 23-29
- 30-75
- 76-99

Navigating the Path of Totality is a public education program that takes advantage of dramatic solar eclipse events to engage the public's interest in the Sun and NASA's Heliophysics System Observatory through live telescope and program streams, on-demand videos, and social media postings in both English and Spanish. The live field broadcast locations provide the unique opportunity create relevance through highlighting local culture and traditional knowledge.



<https://www.exploratorium.edu/video/live-telescope-view-annular-eclipse-wsonification-valley>

2023 Results: Live stream served as a base experience for people in many settings on and off the path.

“ Audience Quote

“From the beginning you are exposed to the place, the culture, the content, and that makes a connection with what is going on.”



DELIVERY MODELS

- INDEPENDENT/SELF-DIRECTED
- FACILITATED LEARNING
- GUIDED BY INFORMAL EDUCATORS
- DELIVERED BY FORMAL EDUCATORS
- PEER PROFESSIONAL LEARNING

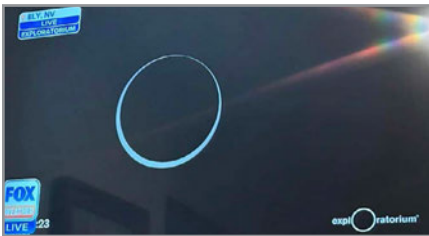
<https://science.nasa.gov/sciact-team/exploratorium>

★ Key 2023 Accomplishments

- Launched redesigned website and app.
- Produced 56 social media posts.
- Navajo Resources created
 - » 1 poster on cultural protocols.
 - » 4 videos in Diné on cultural knowledge.
- Produced 4 live streams of annular eclipse.



2023 Production: Valley of the Gods, UT



Nationwide Reach

8 On-Demand Videos in Spanish, English, including

- “Different Kinds of Eclipses”
- “99% is not 100%”
- “Time for Renewal,” “Eclipse Knowledge,” and “Eclipse Phrases” (in Diné)

Live streams available on eclipse day:

- 3-hour telescope-only feed from Utah
- 3-hour telescope-only feed from Nevada
- 1-hour English educational program
- 1-hour Spanish educational program

Social Media

- Facebook, Instagram: 56 posts over one year

✚ Key Partners Active in 2023

- Indigenous Education Institute
- Edu, Inc. (Evaluation)
- NASA HEAT
- Eclipse Ambassadors
- NISE Net

<https://www.exploratorium.edu/eclipse>

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

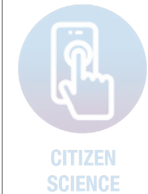
Night Sky Network



PI: Vivian White
 INSTITUTION: Astronomical Society of the Pacific



EDUCATIONAL SETTINGS



AUDIENCE AGES

3+

- 3-5
- 6-7
- 8-9
- 10-12
- 13-15
- 16-17
- 18-22
- 23-29
- 30-75
- 76-99

The Night Sky Network (NSN) is a coalition of nearly 400 astronomy clubs across the United States who volunteer their time, telescopes, and extensive experience to share the skies and NASA resources with their communities.

397 Clubs **5,723 Events** **224,568 Visitors**

Clubs in 47 states, plus Puerto Rico. Missing MS, SD, and AK

Find an astronomy club near you:
bit.ly/findnsn

In parks, libraries, schools, and on sidewalks across the country, you'll find amateur astronomers sharing their love of space

Communities across the country benefit from having knowledgeable members to share NASA's inspiration



2023 Engagement Pin—it moves!

“ Audience Quote

“This was our second event since the pandemic, and the attendance is coming back! It was down from average last year, but this year we were much closer. We were treated to clear skies both nights.”

—Astronomy at the Beach with the University Lowbrow Astronomers

DELIVERY MODELS

INDEPENDENT/
SELF-DIRECTED

FACILITATED
LEARNING

GUIDED BY INFORMAL
EDUCATORS

DELIVERED BY FORMAL
EDUCATORS

PEER PROFESSIONAL
LEARNING

<https://nightsky.jpl.nasa.gov>

★ Key 2023 Accomplishments

- NSN held 10 science webinars and 2 enrichment webinars.
- We added 59 public events to the NASA HEAT calendar of eclipse events for October 2023.
- We sent 125 eclipse kits to clubs hosting eclipse events (not all publicly accessible, e.g., schools).
- NSN is now on the new Web Mod Stargazing site!



Annular eclipse viewing with Brazosport Astronomy Club
(Credit: Emily Hanson/The Facts)



Warren Rupp Observatory partnered with the Independent Living Center serving children with disabilities



When clouds rolled in for the Lowcountry Stargazers, “Fortunately, the Night Sky Network’s Solar System educational kit and a simple Orrery were a hit with families”



Creating a Comet with the Lima Astronomical Society at the monthly meeting

🧩 Key Partners Active in 2023

- APOD
- Universe of Learning
- American Astronomical Society
- Astronomical League



397 clubs across the United States offer public engagement opportunities

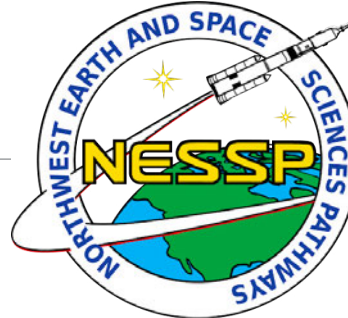
ASTROPHYSICS BIOL/PHYS SCIENCES EARTH SCIENCE HELIOPHYSICS PLANETARY SCIENCE

Science Activation

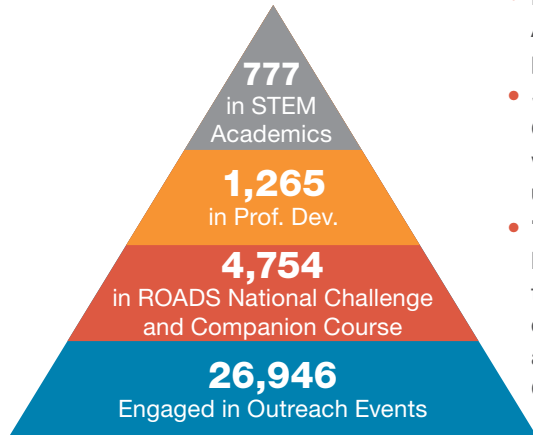
Northwest Earth and Space Science Pathways (NESSP)



PI: Dr. Darci Snowden
 INSTITUTION: Central Washington University



NESSP uses NASA-related STEM activities to increase underserved and underrepresented students' aspirations toward STEM careers. NESSP also works closely with stakeholders to identify and address the unique challenges in underserved and rural communities and strives to make participants feel like they are part of the NASA community.



- Held **185** events with **40 to 80%** underrepresented participants.
- Held **56** events with **over 80%** underrepresented participants.
- Held **60** events with **over 60%** American Indian/Alaska Native participants.
- **~36%** of ROADS National Challenge participants were **historically underserved**.
- **79%** of educators and learners engaged in short-term activities were in **rural, distant, or remote locales** according to the National Center for Education Statistics.

EDUCATIONAL SETTINGS

- INFORMAL/OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

“ Audience Quote

“Students want to be a part of something that is happening now. They want to contribute and also prepare to complete high school and be ready for college/careers. Project Artemis is a perfect example of a mission that is happening right now. Artemis ROADS, I felt, did an awesome job showing students that if they put their mind and effort into their work, they could plan and complete a difficult project from start to finish.”

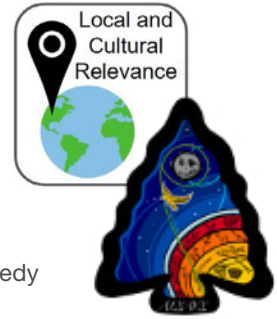
DELIVERY MODELS

INDEPENDENT/ SELF-DIRECTED	FACILITATED LEARNING	GUIDED BY INFORMAL EDUCATORS	DELIVERED BY FORMAL EDUCATORS	PEER PROFESSIONAL LEARNING
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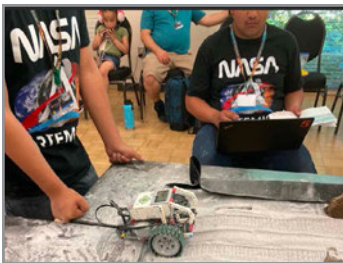
<https://science.nasa.gov/science-activation-team/nessp>

★ Key 2023 Accomplishments

- NESSP engaged over 34 thousand participants nationwide!
- 1,406 students participated in the Artemis Rover Observation And Drone Survey (ROADS) Challenge with 9 Mission Objectives, while 3,348 students engaged in the Artemis ROADS Companion Course with 5 units.
- NESSP hosted in-person final challenge events for the ROADS Challenge, marking the first time since COVID.
- 51 students and 13 educators from the Artemis ROADS National Challenge visited Kennedy Space Center.
- Most events collecting demographic data had at least 60% underrepresented participants.
- NESSP worked with partners to develop the Artemis ROADS II Challenge, emphasizing local and cultural relevance in Mission Objectives and Companion Course lessons.



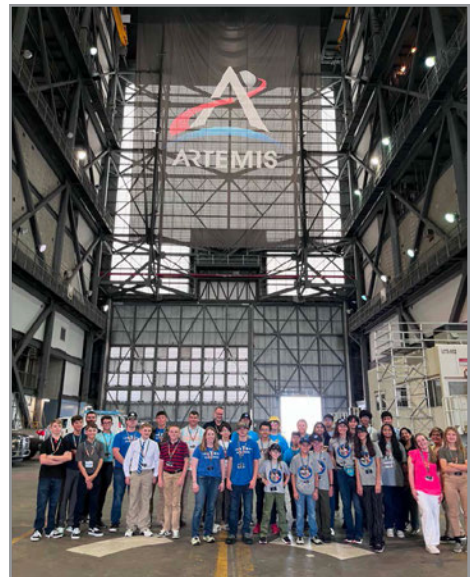
Culturally relevant mission patch example from Artemis ROADS II



Students prepare to test their lunar rover wheels in regolith simulant



ROADS participants line up their rover on the Shackleton crater challenge map



ROADS students and educators in the Vehicle Assembly Building (VAB) at Kennedy Space Center



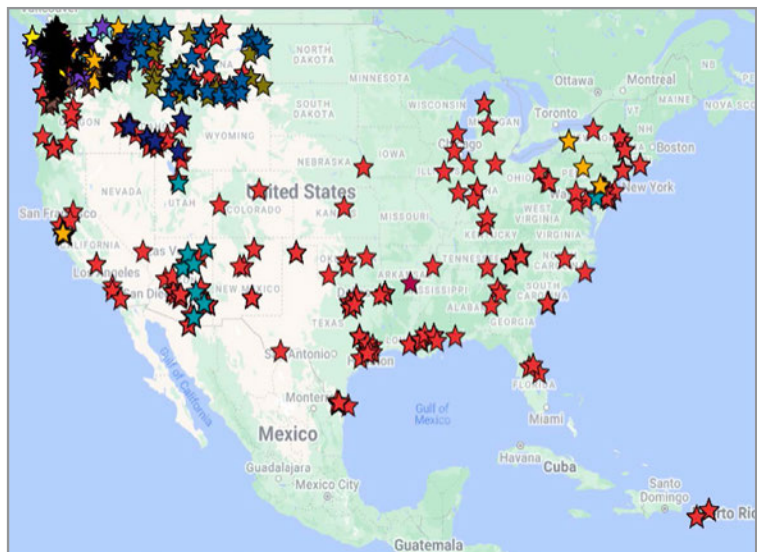
Students examine their plant experiment

✚ Key Partners Active in 2023

NESSP extends its reach through its partnerships with other Science Activation Teams:

- SEES: Texas Space Grant Consortium
- ASTRO CAMP Community
- Aurorasaurus
- Idaho Dark Sky STEM Network
- Smokey Mountain STEM Collaborative
- NASA Trek

A ROADS participant at the Texas final challenge event led by a SciAct partner



- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE**
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Ocean Community Engagement and Awareness Using NASA Observations and Science for Hispanic/Latino Students (OCEANOS)



PI: Dr. Juan L. Torres-Pérez

INSTITUTIONS: NASA's Ames Research Center, University of Puerto Rico at Mayagüez, Inter American University of Puerto Rico, University of Miami, EcoExploratorio Science Museum of Puerto Rico, Sociedad Ambiente Marino, and Taller Ecológico de Puerto Rico



OCEANOS is a 4-year project (2022-25) that aims at closing the gap between NASA technologies and underrepresented minorities by providing training opportunities to Hispanic/Latino (e.g., Puerto Rican) students through summer internship experiences focused on NASA Earth observations (EO), remote sensing, ocean color, and coastal ecosystems characterization led by a network of Puerto Rican subject matter experts.

The project's main goal is to improve capacity and awareness among first-generation Hispanic/Latino students on the availability of NASA EO for ocean color and coastal parameters. The students will have the opportunity to participate in a real-life oceanographic course, build their own do-it-yourself water-quality instruments, get trained on NASA's award-winning NeMO-Net application for coral reefs characterization, and present projects results to community members and national audiences.



EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

“ Audience Quote

“It has been a privilege to participate in this internship! I would not have liked this to be any different. It turned out to be an unforgettable Summer full of adventures and new knowledge. You definitely did an awesome job. I miss you already!”

DELIVERY MODELS

- INDEPENDENT/ SELF-DIRECTED
- FACILITATED LEARNING
- GUIDED BY INFORMAL EDUCATORS
- DELIVERED BY FORMAL EDUCATORS
- PEER PROFESSIONAL LEARNING

<https://www.nasa.gov/oceanos>

★ Key 2023 Accomplishments

- Successful summer 2023 internship in Puerto Rico!
- Continued collaborations with SCoPE-sponsored SMEs and NASA Citizen Science projects (FjordPhyto).
- Two other projects (PRO OCEANOS II and Beach Profiling) that were accepted for SCoPE support to improve educational modules for 2024 internship.
- Aid for NASA Ames Research Center Communications Specialist in upgrading OCEANOS web page.
- OCEANOS team joined by Workforce Fellow (Interamerican University).
- Four undergraduate and two graduate students (University of Puerto Rico) fully supported by OCEANOS.
- NeMO-Net team working on the Spanish version with new datasets collected in Puerto Rico simultaneously with OCEANOS internship.
- AGU 2023 Fall Meeting abstract accepted.
- OCEANOS team members' attendance at the CitSci 2023 meeting.



Tropical marine ecosystems field experience



Monitoring reef health in Culebra, PR



DIY water-quality instruments



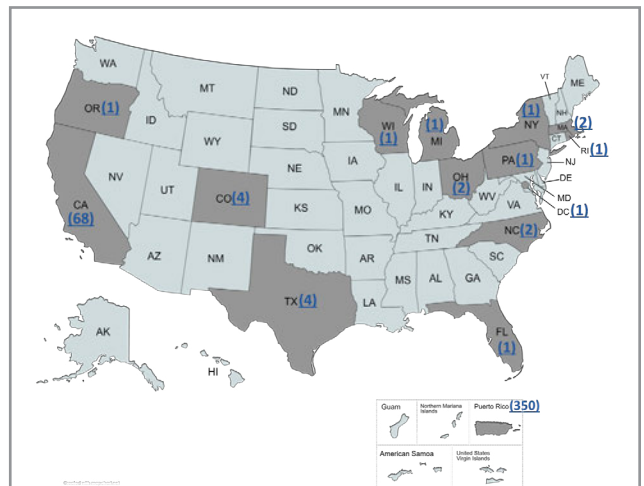
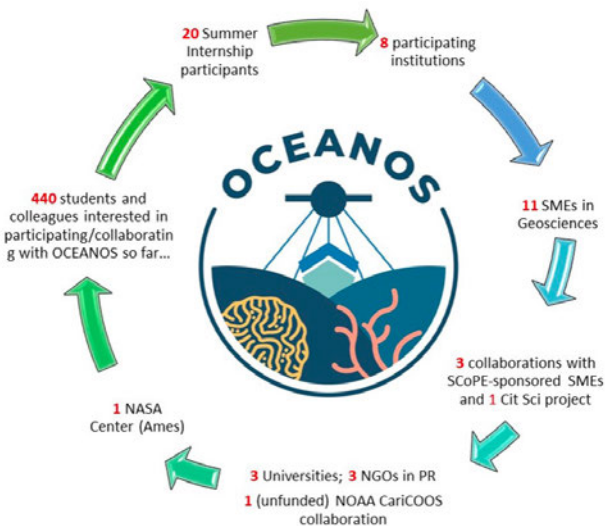
Water-quality analysis with DIY and bio-optical instruments



Reef characterization with NeMO-Net



Summer 2023 internship closeout



Updated reach map for OCEANOS (does not include visitors to web page/social media pages)

ASTROPHYSICS

BIOL/PHYS SCIENCES

EARTH SCIENCE

HELIOPHYSICS

PLANETARY SCIENCE

Science Activation

Place-Based Learning to Advance Connections, Education, and Stewardship (PLACES)



PI: Kirsten R. Daehler
INSTITUTION: WestEd

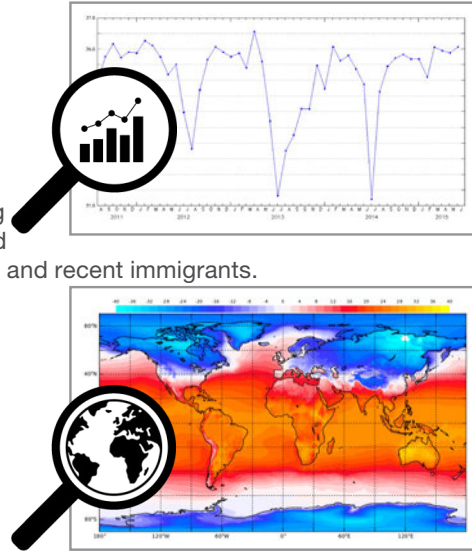


AUDIENCE AGES
10+

- 10-12
- 13-15
- 16-17
- 18-22
- 23-29
- 30-75
- 76-99

NASA PLACES is developing professional learning to support data-rich Earth science learning—especially supporting educators who work with youth that bring a diversity of cultures, languages, and meanings of “place” to their understanding of science, including students who are underrepresented in STEM, such as Indigenous youth and recent immigrants.

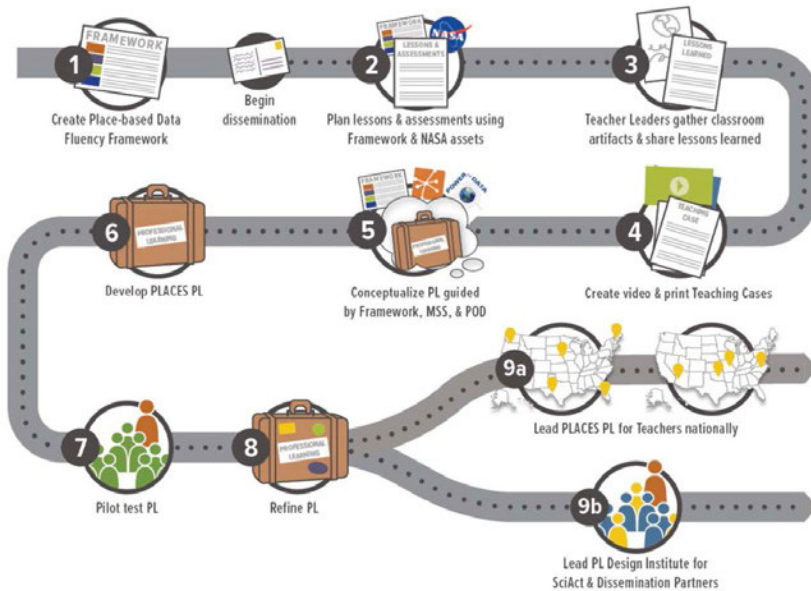
We draw on NASA datasets, images, and other assets to increase “data fluency”—the ability and confidence to make sense of and use data and data tools. This means knowing when, how, and why to use data for a specific purpose, such as solving problems and communicating ideas grounded in evidence.



EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

Roadmap for developing, testing, and disseminating PLACES Professional Learning nationally



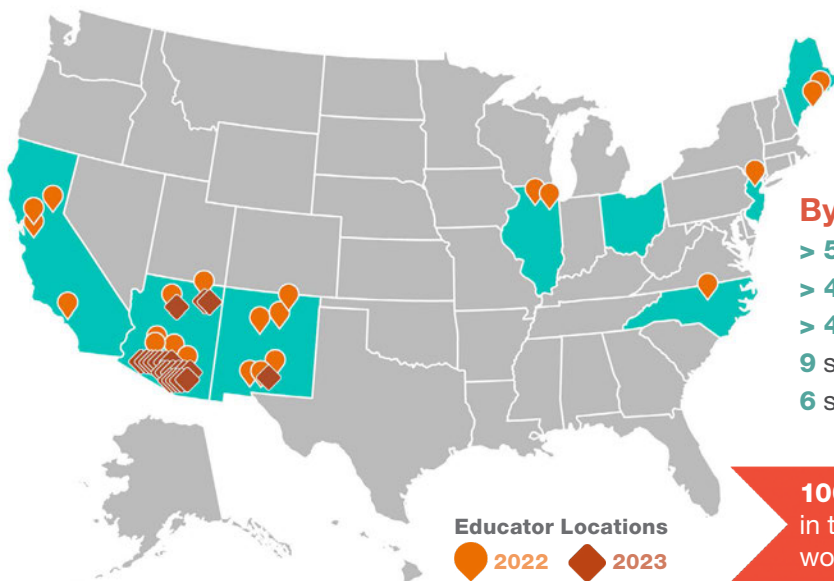
<https://science.nasa.gov/sciact-team/places>

★ Key 2023 Accomplishments

- Developed principles for place-based and data-rich instruction and completed work with 19 case writers from six states.
- Recruited 24 middle and high school Earth science educators to participate in yearlong pilot of PLACES professional learning.
- Developed PLACES professional learning materials, including data-rich STEM Investigations, Teaching Cases, and Data Biographies.
- Pilot-tested PLACES Summer Institute and supported fall Communities of Practice.
- Shared project findings and lessons learned—such as findings from the national landscape analysis and approaches to centering voices—at the American Educational Research Association (AERA), the American Geophysical Union (AGU), and the General Services Administration (GSA).



Photos from PLACES summer professional learning



By the Numbers

- > 5,000 youth impacted
- > 40 educators involved
- > 44 institutions collaborating
- 9 subject matter experts contributing
- 6 site coordinators supporting

100% of educators who participated in the PLACES professional learning would recommend it to a colleague.

✚ Key Partners Active in 2023

- | | | | |
|-------------|------------------------------------|----------------------------------|-------------------------------------|
| • Dataspire | • The Concord Consortium | • Globe Mission Earth | • Northern Arizona University (NAU) |
| • WestEd | • Gulf of Maine Research Institute | • NASA's Langley Research Center | |



Science Activation

Planetary Learning that Advances the Nexus of Engineering, Technology, and Science (PLANETS)



PI: Joëlle LeMer
 INSTITUTION: Northern Arizona University



PLANETS is an out-of-school-time (OST) program for educators and youth in grades 3–8 that provides STEM learning with NASA planetary science and engineering, particularly for underserved audiences using principles of diversity, equity, inclusion, and accessibility (DEIA). We especially intend to better serve Indigenous learners, multilingual learners, and learners experiencing physical and/or sensory disabilities.

AUDIENCE AGES

6+

6–7
8–9
10–12
13–15
16–17
18–22
23–29
30–75
76–99

11,562 ▲ **123%**
 youth vs. 2022

4,079 ▲ **21%**
 OST educators vs. 2022

4,468 ▲ **280%**
 families vs. 2022

4,643
 rural educators

Unit Downloads

Remote Sensing 811 ▲ **40%**
 vs. 2022

Water in Extreme Environments 517 ▲ **12%**
 vs. 2022

Space Hazards 572 ▼ **10%**
 vs. 2022

PLANETS@Home 356 ▲ **84%**
 vs. 2022



EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- HOME/FAMILY
- CITIZEN SCIENCE
- PROFESSIONAL

“ Audience Quote

“I believe [the PLANETS program facilitators] were heavily invested in understanding how to make sure the curriculum will meet youth where they are to make sure it is ingrained in culture, language, and physical abilities and they took our feedback to heart to make the most of this experience.” —OST educator

DEIA Experts and Co-Design Team Members

- 5 Indigenous learners
- 4 multilingual learners
- 5 diversability experts
- 9 subject matter experts

DELIVERY MODELS

INDEPENDENT/ SELF-DIRECTED	FACILITATED LEARNING	GUIDED BY INFORMAL EDUCATORS	DELIVERED BY FORMAL EDUCATORS	PEER PROFESSIONAL LEARNING
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<https://www.planets-stem.org>

★ Key 2023 Accomplishments

- Key partners and collaborators indicated that they perceived the PLANETS partnership as healthy, particularly PLANETS’ leadership, collaborative benefits, and ownership of processes and outcomes.
- The Co-Design teams collaborated on edits to Remote Sensing and Space Hazards units for DEIA, science content, and additional NASA assets.
- The Research and Beta Test teams studied the implementation of the optimized Remote Sensing unit with 11 educators across the United States in after-school and summer programs.
- PLANETS dissemination included 7 conferences and 4 working sessions.



Beta Test Activity Summer Camp 2023



PLANETS team at Partner Working Group 2023



Outreach table at National Afterschool Association, Orlando, FL, March 2023



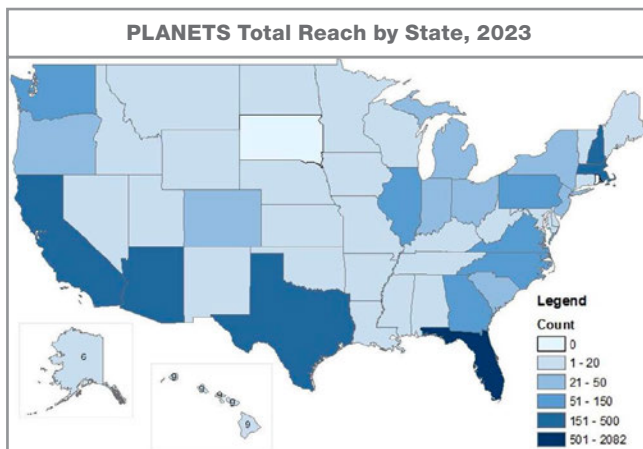
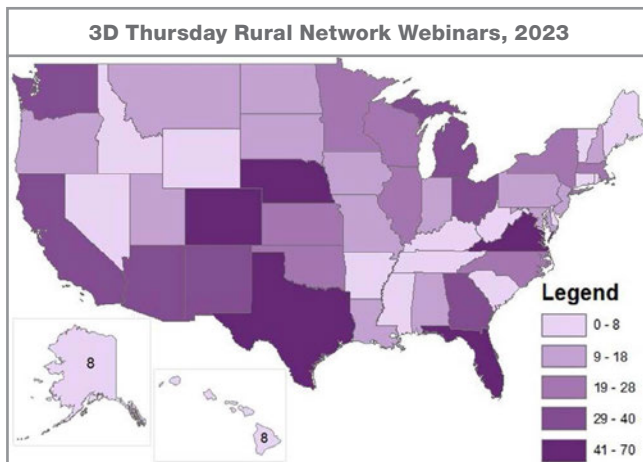
Joëlle LeMer, PI of PLANETS, assisting OST educators in working session, Orlando, FL

✚ Key Partners Active in 2023

- Museum of Science STEM Curricula Pre-K–8
- United States Geological Survey (USGS) Astrogeology Science Center
- WestEd Science and Engineering



Visit our website to learn more



Science Activation

Planetary Resources and Content Heroes (ReaCH)



PI: Andy Shaner
 INSTITUTION: Lunar and Planetary Institute



EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

AUDIENCE AGES
11+



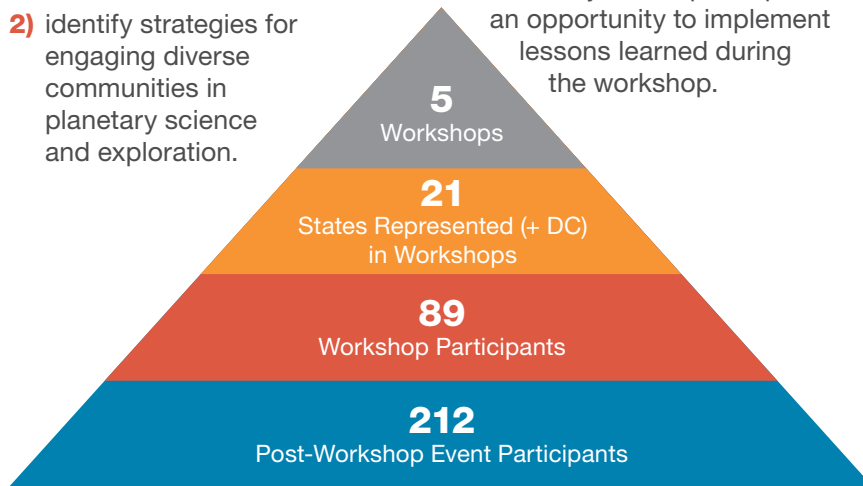
Planetary ReaCH conducts workshops for planetary science subject matter experts (SMEs).

Working alongside local informal educators, SMEs

- 1) explore ways to create and sustain authentic partnerships with diverse communities and
- 2) identify strategies for engaging diverse communities in planetary science and exploration.

Planetary ReaCH

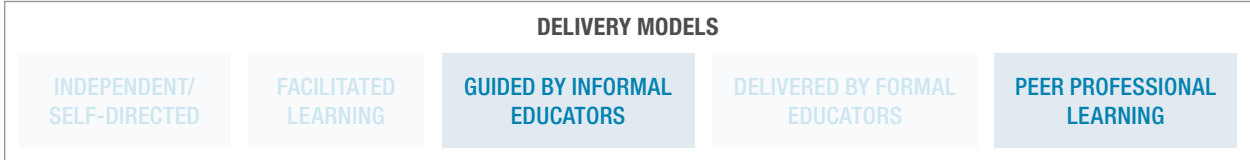
A post-workshop public event held within a local, diverse community allows participants an opportunity to implement lessons learned during the workshop.



“ Audience Quote

“I absolutely loved the whole idea of being able to directly connect with NASA scientists and [local] museum staff. Also, it was so great to have group discussions framed by the concept of the issues facing Black and LatinX children and communities in STEM.” —SME workshop participant

DELIVERY MODELS



<https://www.lpi.usra.edu/planetary-reach>

★ Key 2023 Accomplishments

- Adopted workshop objectives and outcomes.
- Affirmed 2-day workshop timeframe.
- Narrowed scope of workshop content to match 2-day timeframe.

⚙️ Key Partners Active in 2023

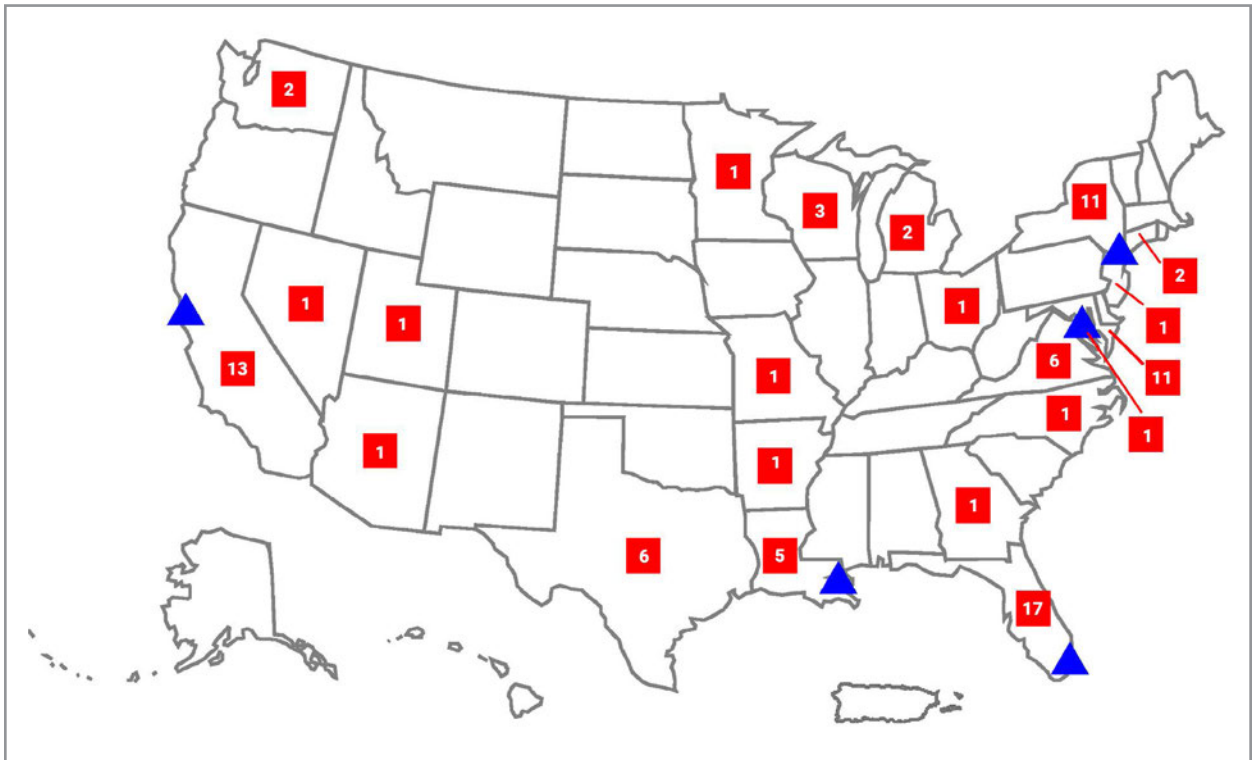
- Lower Eastside Girls Club (New York City)
- NASA Community College Network
- OpenSpace/American Museum of Natural History
- Pérez Art Museum Miami
- Texas Alliance of Boys & Girls Clubs



Participants in the New York, NY, workshop discuss definitions and examples of bias and implicit bias



A participant (right) in the Mountain View, CA, workshop engages a family during the public event following the workshop



A total of 89 SMEs and informal educators from 21 states and Washington, DC, participated in ReaCH workshops in FY23. Workshop locations are identified by blue triangles. Red squares identify the residential states of workshop participants and include the number of participants from the state.

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

SciAct STEM Ecosystems



PI: Dr. Rae Ostman
 INSTITUTION: Arizona State University



AUDIENCE AGES
3+

3-5

6-7

8-9

10-12

13-15

16-17

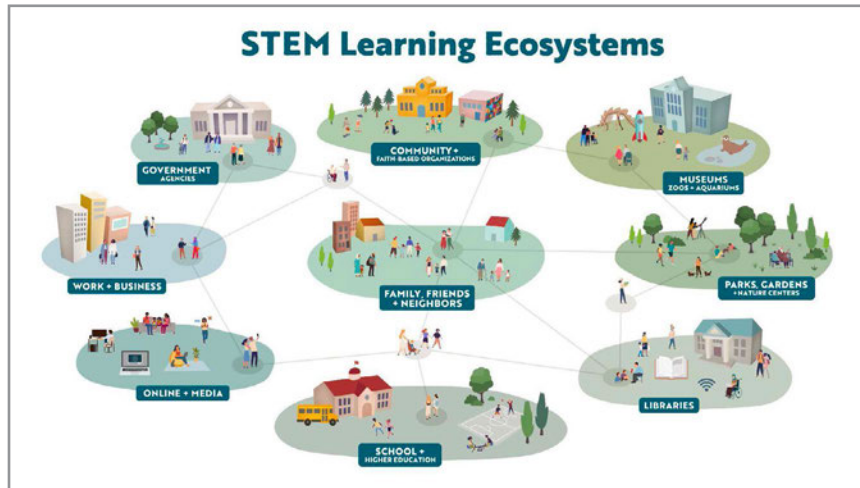
18-22

23-29

30-75

76-99

SciAct STEM Ecosystems works across the NASA SciAct community to strengthen collaborations and support professional learning related to principles and practices of STEM learning ecosystems. Project findings and resources can help SciAct teams and partners broaden participation and connect communities with authentic STEM learning experiences.



EDUCATIONAL SETTINGS



INFORMAL/
 OUT OF SCHOOL



FORMAL
 EDUCATION



CITIZEN
 SCIENCE



PROFESSIONAL

“ Audience Quote

“The first thing to do is understand your community and what they need. Then you show the people in decision-making capacities what you can do and what you have. We all as experts think we know best, but those communities know their needs better.” —educator and subject matter expert

DELIVERY MODELS

INDEPENDENT/
 SELF-DIRECTED

FACILITATED
 LEARNING

GUIDED BY INFORMAL
 EDUCATORS

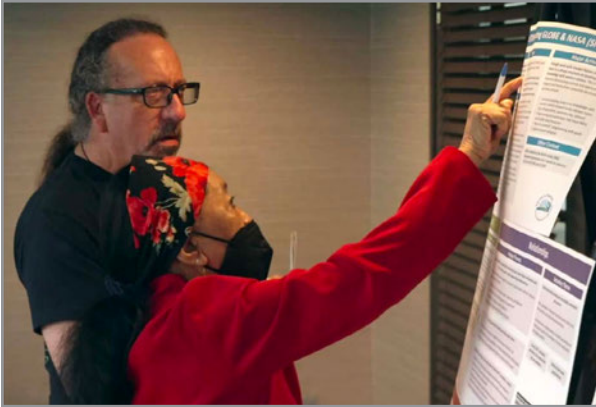
DELIVERED BY FORMAL
 EDUCATORS

PEER PROFESSIONAL
 LEARNING

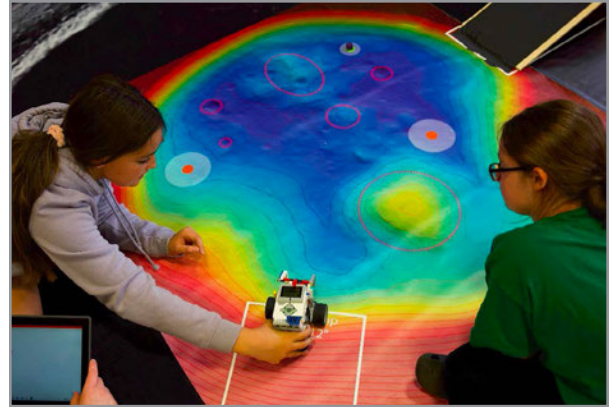
<https://science.nasa.gov/science-activation-team/stem-ecosystems>

★ Key 2023 Accomplishments

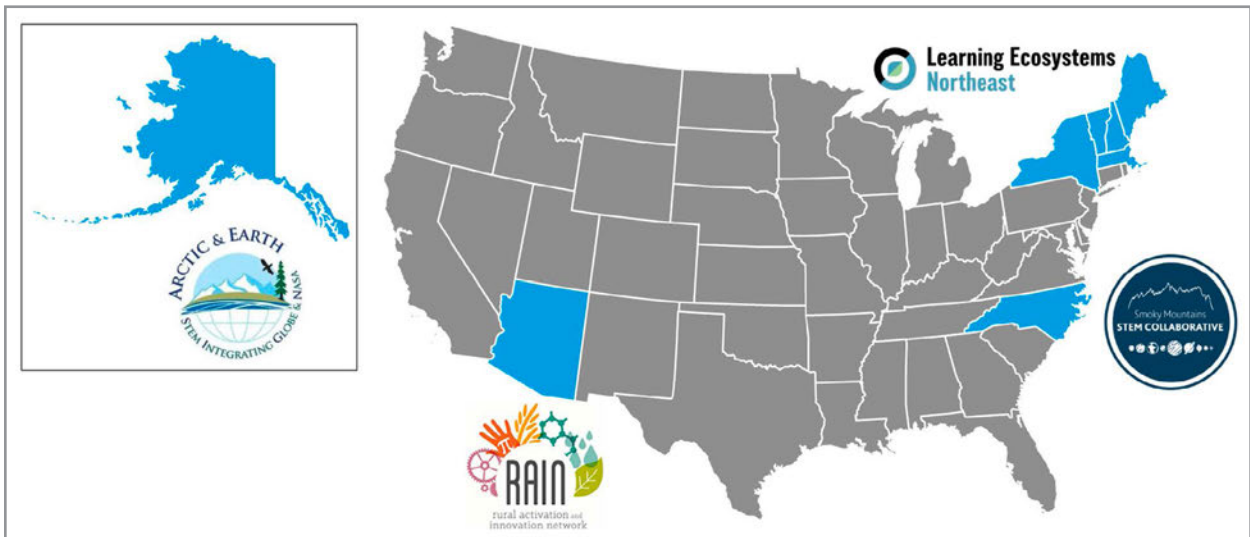
- Completed our inquiry into the principles and practices of STEM learning ecosystems that are intentionally designed to broaden participation.
- Made substantial progress in documenting our four case studies.
- Planned an in-person meeting that will bring many SciAct teams together in Tempe, AZ, in January 2024.



Team meeting, April 2023



Learning ecosystem event, May 2023



✚ Key Partners Active in 2023

- Arizona State University
- University of Alaska Fairbanks and Arctic and Earth SIGNs
- Southwestern Community College and Smoky Mountains STEM Collaborative
- Arizona Science Center and Rural Activation and Innovation Network
- Gulf of Maine Research Institute and Learning Ecosystems Northeast
- Museum of Science, Boston

ASTROPHYSICS BIOL/PHYS SCIENCES EARTH SCIENCE HELIOPHYSICS PLANETARY SCIENCE

Science Activation

Science Through Shadows



PI: Dr. Douglas Duncan
 SCIENCE PI: Dr. John Keller
 INSTITUTION: Fiske Planetarium, Univ. Colorado Boulder

AUDIENCE AGES
6+

- 6-7
- 8-9
- 10-12
- 13-15
- 16-17
- 18-22
- 23-29
- 30-75
- 76-99

Our goals are to

- 1) leverage networks to disseminate NASA information to large audiences of adults and students, with special attention to communities traditionally underrepresented in STEM;
- 2) prepare Americans for the 2023 and 2024 solar eclipses;
- 3) use these eclipses to build understanding of heliophysics and the importance of studying the Sun;
- 4) show how ground-based citizen science occultation measurements are used in asteroid studies;
- 5) use the missions New Horizons, OSIRIS-REx, Lucy, and Psyche to teach about solar system origins;
- 6) interest students, including those from underserved communities, in STEM careers; and
- 7) pioneer advanced evaluation techniques.



EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

“ Audience Quotes

“We are a very small library in the path of totality for the April eclipse and near 80% partial eclipse in October. We would love to share these.”

“Excellent Spanish version!”

DELIVERY MODELS

- INDEPENDENT/ SELF-DIRECTED
- FACILITATED LEARNING
- GUIDED BY INFORMAL EDUCATORS
- DELIVERED BY FORMAL EDUCATORS
- PEER PROFESSIONAL LEARNING

<https://science.nasa.gov/science-activation-team/science-through-shadows>

★ Key 2023 Accomplishments

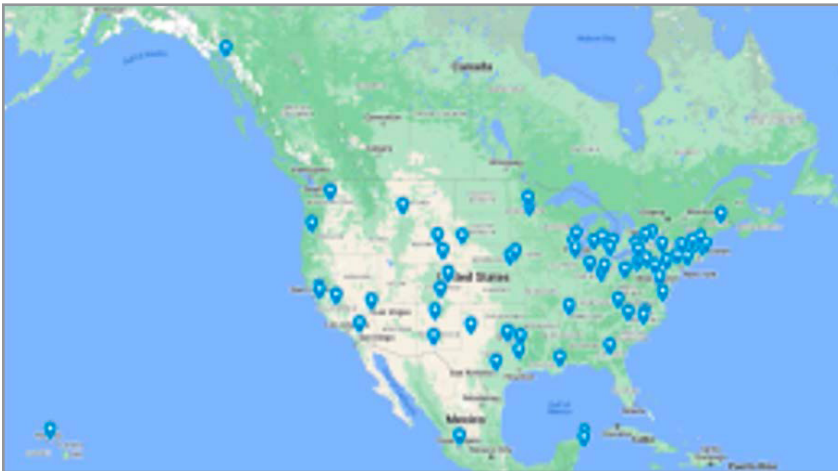
- Produced and released three full-dome and flat-screen eclipse videos in English and Spanish to hundreds of planetariums, libraries, and schools, accumulating ~40 thousand views on YouTube alone (as of September 2023).
- Worked with underserved high school students to teach documentary video-making techniques.
- Completed first occultation video featuring a NASA Lucy mission occultation campaign.
- Supported summer interns working to add occultation and eclipse resources to OpenSpace.



Student eclipse balloon teams



Students make dry ice comets; with photogrammetry, they will image and digitize them and add the imagery into videos



Reach map: all full-dome downloads as of September 2023

🔗 Key Partners Active in 2023

- NASA Astrocamp Consortium
- Michigan Science Center
- Chabot Science Center
- Houston Museum of Science
- American Museum of Natural History
- NASA Eclipse Ballooning Project



- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE**
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Sea Level Education, Awareness, and Literacy



PI: Dr. Benjamin D. Hamlington
 INSTITUTION: NASA's Jet Propulsion Laboratory



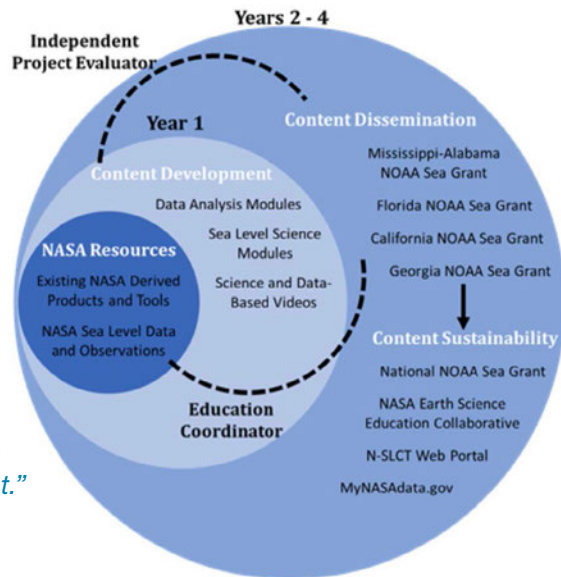
- EDUCATIONAL SETTINGS**
- INFORMAL/ OUT OF SCHOOL
 - FORMAL EDUCATION
 - CITIZEN SCIENCE
 - PROFESSIONAL

AUDIENCE AGES
8+

- 8-9
- 10-12
- 13-15
- 16-17
- 18-22
- 23-29
- 30-75
- 76-99

In this project, we leverage and extend the impact of NASA's significant investments into the global sea level observing network and research, as well as the science translation and dissemination expertise of National Oceanic and Atmospheric Administration (NOAA) Sea Grant to foster the activation of NASA sea level change science. We focus on educating juvenile and adult formal, informal, and nonformal audiences on past, present, and future sea level rise in coastal communities that are highly affected.

SEA LEVEL CHANGE Observations from Space



“You can’t stop the floods, you can’t stop the rains. You can only learn how to adapt.”
 —Shirley Sessions, mayor of the City of Tybee Island, Georgia

DELIVERY MODELS

- INDEPENDENT/ SELF-DIRECTED
- FACILITATED LEARNING
- GUIDED BY INFORMAL EDUCATORS
- DELIVERED BY FORMAL EDUCATORS
- PEER PROFESSIONAL LEARNING

<https://science.nasa.gov/sciact-team/seal>

★ Key 2023 Accomplishments

- Held kickoff meeting in January at NASA JPL.
- Engaged in sea level outreach in Tuvalu as part of the United Nations Rising Nations Initiative.
- Created sea level backpacks to distribute at the 28th Conference of the Parties.
- Presented program objectives at Sea Grant and Georgia Climate Change meetings.
- Developed evaluation plan.
- Held NASA Sea Level Change Makers Camp in Georgia.
- Held teacher workshop in Mississippi.
- Entered into cross collaboration with Gulf of Maine Research Institute Learning Ecosystem Northeast.

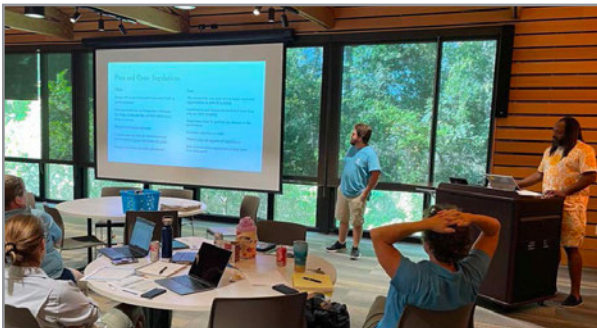
NASA Observations and Research Supporting Sea Level Change Education and Community Awareness



Ben Hamlington leads sea level outreach in Tuvalu



NASA Sea Level Change Makers Camp participants



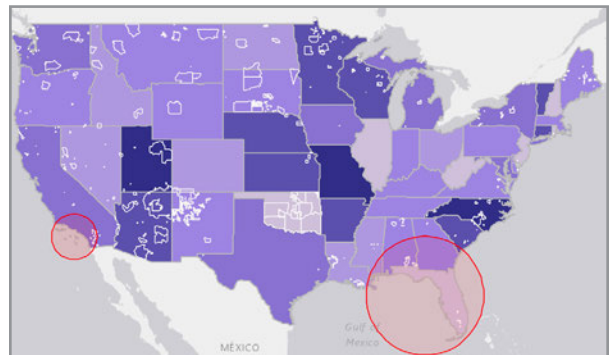
Marine Education Center Teacher Professional Development participants



Poster presented at the National Sea Grant Assembly Meeting

✚ Key Partners Active in 2023

- CA, GA, FL, and MS-AL Sea Grant Programs
- Climate Science Alliance
- Dauphin Island Sea Lab's Discovery Hall Program
- Georgia Institute of Technology
- University of Georgia
- University of Southern Mississippi's Marine Education Center



Hands-on programming along the Gulf of Mexico and the southern California and southern Atlantic coasts, as well as web content publicly available nationwide.

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Smoky Mountains STEM Collaborative (SMSC)



PI: Matthew Cass

INSTITUTION: Southwestern Community College

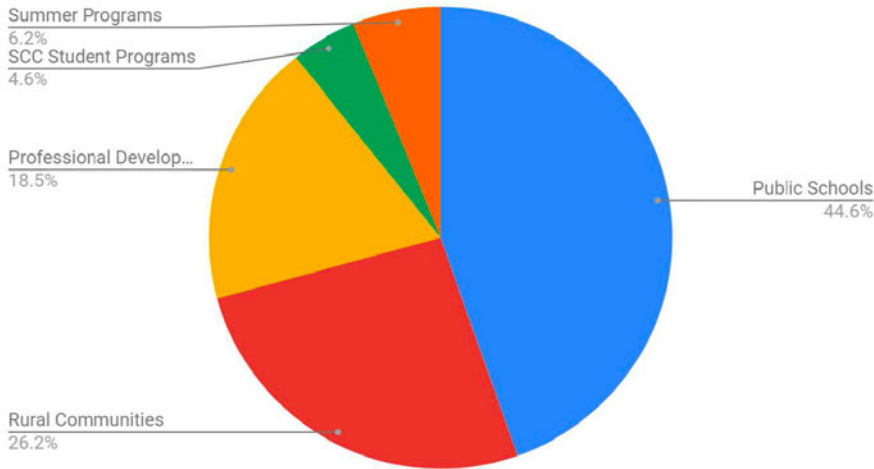


- EDUCATIONAL SETTINGS**
- INFORMAL/ OUT OF SCHOOL
 - FORMAL EDUCATION
 - CITIZEN SCIENCE
 - PROFESSIONAL

- AUDIENCE AGES**
- 6+
 - 6-7
 - 8-9
 - 10-12
 - 13-15
 - 16-17
 - 18-22
 - 23-29
 - 30-75
 - 76-99

We work with learners from a diverse population, including enrolled members of the Eastern Band of the Cherokee Indians and many first-generation college students. These learners are underrepresented not only in STEM fields, but higher education in general. Our continuing mission is to expand and engage the region's public schools, tribal schools, community colleges, and universities in a cohesive, learner-centered STEM ecosystem that leverages subject matter experts (SMEs) and science centers to achieve NASA's mission to help learners of all ages "do" science in their own communities.

2023 Engagement by Number of Opportunities - 65 Events



“ Audience Quote

“I got to see when he first came, when it was just STEM Camp, and then as it transformed into a full-fledged Astro Camp...how much enjoyment that it brought him...being involved with it from the other side, as a counselor, has been very rewarding.” —Jennifer Dall on the growth of Astro Camp participants over the life of the project

- DELIVERY MODELS**
- INDEPENDENT/ SELF-DIRECTED
 - FACILITATED LEARNING
 - GUIDED BY INFORMAL EDUCATORS
 - DELIVERED BY FORMAL EDUCATORS
 - PEER PROFESSIONAL LEARNING

<https://science.nasa.gov/science-activation-team/smsc>

★ Key 2023 Accomplishments

- STEM career fair and research expo (college + community).
- Annular (partial) eclipse event (college + community).
- Summer camp + SCOPE success (Astro Camp).
- 2023 Space Apps Challenge (community + Pisgah Astronomical Research Institute [PARI]).
- Earth to Sky Academy (Randi Neff + Great Smoky Mountains NP [GSMNP]).
- 12 NASA Ambassadors in Community K–12 Schools across western North Carolina.
- Personnel: Leadership training (Matt Cass, Rural Education Program).



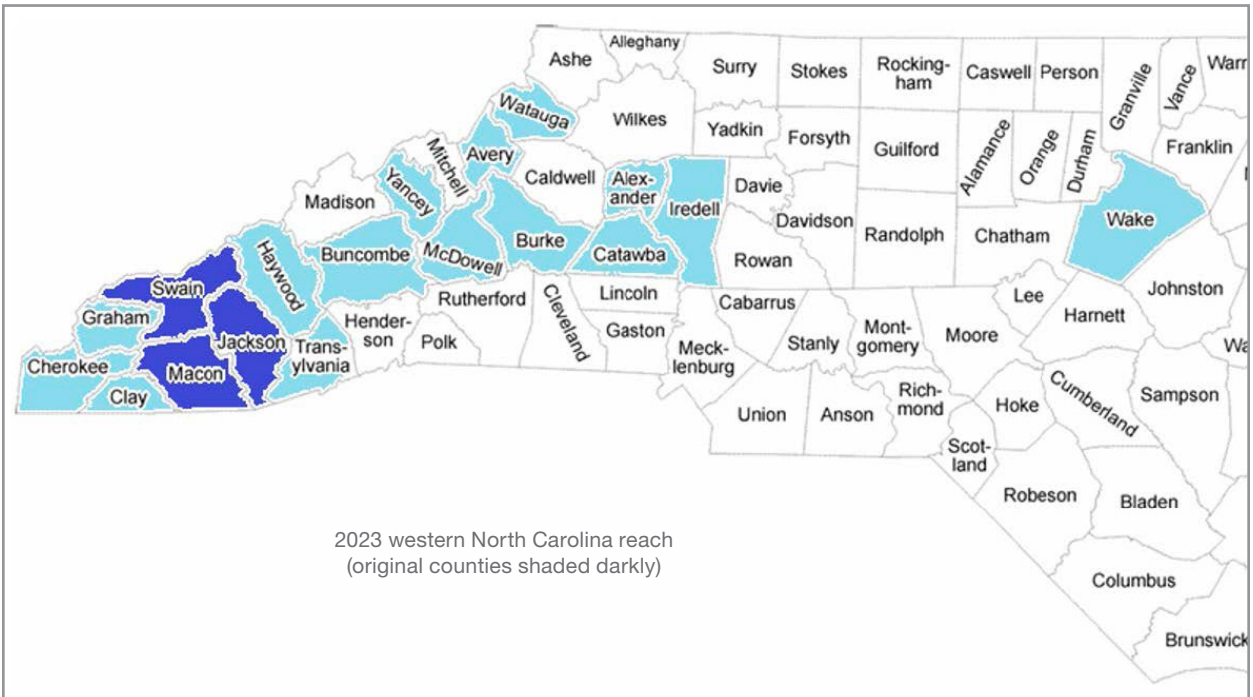
Annular eclipse activities
(Photo credit: Alex Lewis)

⚙️ Key Partners Active in 2023

- Pisgah Astronomical Research Institute
- Appalachian State University
- Fontana Regional Library
- Public school districts
- WNC STEM Leaders
- The Science House
- Great Smoky Mountains NP
- STEM West
- Western Carolina University
- Boys & Girls Club of the Plateau



Space Apps at PARI
(Photo credit: Alex Lewis)



- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Solar System Ambassadors

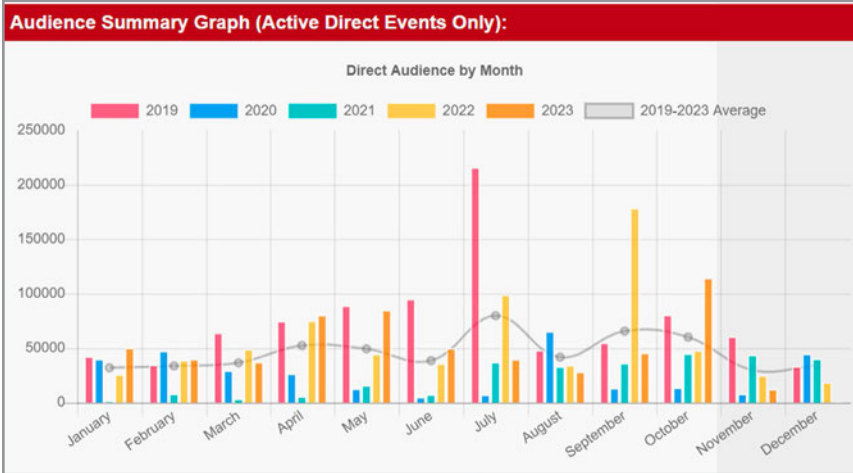


PI: Kay Ferrari
 INSTITUTION: NASA's Jet Propulsion Laboratory

AUDIENCE AGES
3+

- 3-5
- 6-7
- 8-9
- 10-12
- 13-15
- 16-17
- 18-22
- 23-29
- 30-75
- 76-99

The Solar System Ambassadors Program is a public engagement effort accomplished by space enthusiast volunteers across the Nation who communicate NASA's exciting discoveries and plans for future exploration of the solar system and beyond to general public audiences. Ambassadors become an extended part of each mission's team and an important interface between the NASA community and the populace at large.



Number of Events: 3,773
 Direct Participants (indicated in graph above): 596,077
 Indirect Participants (media, print, virtual): 34,412,763

- EDUCATIONAL SETTINGS**
- INFORMAL/ OUT OF SCHOOL
 - FORMAL EDUCATION
 - CITIZEN SCIENCE
 - PROFESSIONAL

“ Audience Quote

“We are truly inspiring our younger generation. When I am asked about Solar System Ambassadors, I proudly pull out my SSA badge and explain who we are, what we do, and how we benefit society.” —SSA Paul Yun

DELIVERY MODELS

- INDEPENDENT/ SELF-DIRECTED
- FACILITATED LEARNING
- GUIDED BY INFORMAL EDUCATORS
- DELIVERED BY FORMAL EDUCATORS
- PEER PROFESSIONAL LEARNING

<https://solarsystem.nasa.gov/ssa>

★ Key 2023 Accomplishments

In addition to their usual events, SSAs also supported...

- Explore JPL
- Psyche launch viewing
- Annular eclipse viewing
- International Observe the Moon Night



Moon event for blind students in Iowa



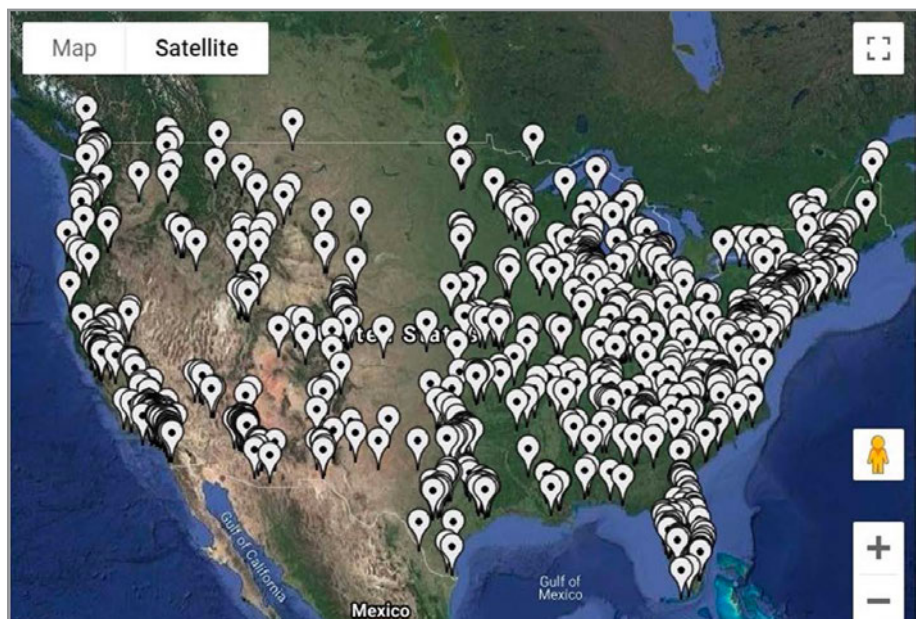
Star Party for Maui fire victims



Annular eclipse viewing in Minnesota

✚ Key Partners Active in 2023

- Eclipse Ambassadors
- MIE Alliance
- Universe of Learning
- Night Sky Network
- NASA@ My Library
- NASA eClips
- NASA Space Place
- NASA HEAT
- OpenSpace
- Planetary ReaCH
- NASA SCoPE
- SEES



SSA U.S. reach map

- ASTROPHYSICS
- BIOL/PHYS SCIENCES
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE

Science Activation

Space Place

Space Place

Explore Earth and Space!



PI: Jessica Stoller-Conrad
 INSTITUTION: NASA's Jet Propulsion Laboratory

AUDIENCE AGES
5-14



NASA Space Place has been the source of NASA science content for kids since 1998. One of the first NASA sites to also offer content in English and Spanish across all SMD themes, Space Place has grown to become the #4 most visited NASA website, generating more than 33 million page views annually. (Metrics are from calendar year 2022.)



- EDUCATIONAL SETTINGS
- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL

“ Audience Quote

“Sending a huge thank you for this incredible, free resource! It’s exactly the science/data/researched backed resource that teachers need to help students.... It’s also very engaging for students.”

—Melissa Kristiansen, grade 4 teacher, Departure Bay Eco School, Nanaimo, British Columbia

DELIVERY MODELS

- INDEPENDENT/ SELF-DIRECTED
- FACILITATED LEARNING
- GUIDED BY INFORMAL EDUCATORS
- DELIVERED BY FORMAL EDUCATORS
- PEER PROFESSIONAL LEARNING

<https://spaceplace.nasa.gov>

★ Key 2023 Accomplishments

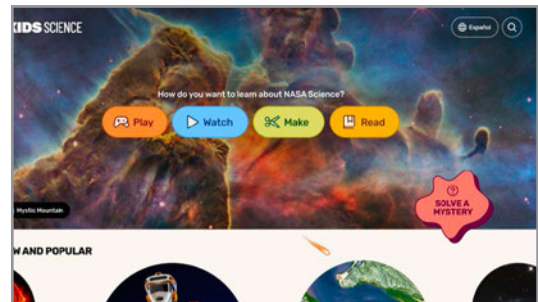
- Began offering our videos with Spanish voice-overs on YouTube and on our website.
- Published multiple Space Place art challenge prompts in English and in Spanish.
- Began consolidation of content in advance of web modernization efforts.
- Completed design research project for the new NASA Kids Science website, which is planned to launch in 2024.
- Represented Space Place at Explore JPL.



Kids coloring at the Space Place booth at Explore JPL, April 2022



Entry for the February 2022 Space Place Valentine Art Challenge, submitted by Emilia, age 8



Home page design for the new NASA Kids Science Microsite, which is slated to launch in 2024

✚ Key Partners Active in 2023

- NASA eClips
- NASA HEAT
- Solar System Ambassadors

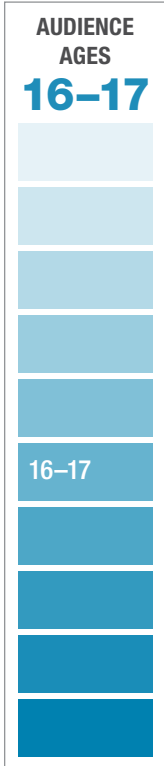
ASTROPHYSICS BIOL/PHYS SCIENCES **EARTH SCIENCE** HELIOPHYSICS PLANETARY SCIENCE

Science Activation

STEM Enhancement in Earth Science (SEES)

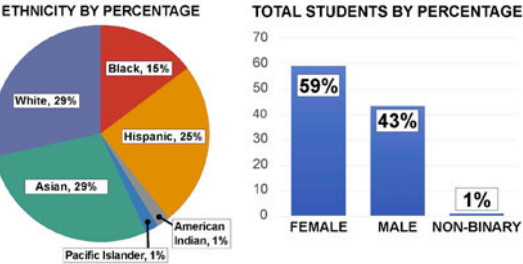


PI: Margaret Baguio
INSTITUTION: University of Texas Center for Space Research



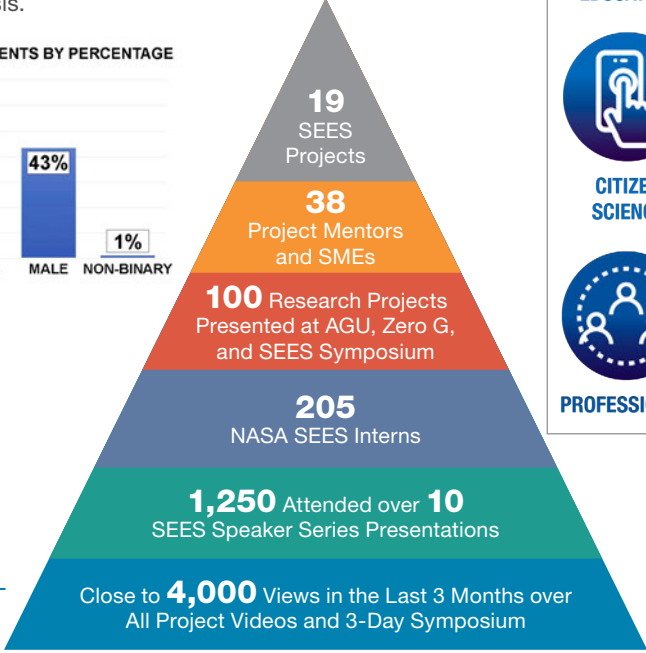
The STEM Enhancement in Earth Science (SEES) project addresses the national need to increase the number of high school students, particularly underrepresented minorities and those from underserved areas, who will pursue STEM college degrees. In 2023, we partnered with institutions, organizations, NASA subject matter experts, and Science Activation partners to identify NASA missions, data from NASA’s fleet of Earth observing satellites, mission planning, and citizen science projects as a catalyst for the virtual high school intern program.

The interns analyzed and visualized data, learned about careers from subject matter experts, explored career choices from University experts, and conducted virtual tours of NASA facilities. Content knowledge, coupled with hands-on experiences, allowed the interns to gain experiences in authentic research through field investigation and data analysis.



EDUCATIONAL SETTINGS

- INFORMAL/ OUT OF SCHOOL
- FORMAL EDUCATION
- CITIZEN SCIENCE
- PROFESSIONAL



“ Audience Quote
“I loved the community that we built. Everyone was so so supportive, and I loved how we were able to combine all our strengths to form a well-rounded, strong team. The internship was the most connected and welcomed I have felt ever during a summer program.”

DELIVERY MODELS

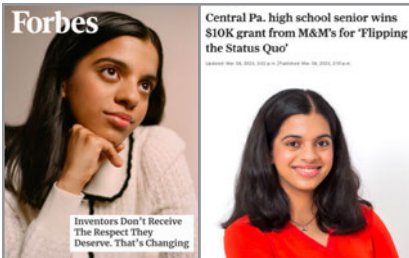
INDEPENDENT/ SELF-DIRECTED	FACILITATED LEARNING	GUIDED BY INFORMAL EDUCATORS	DELIVERED BY FORMAL EDUCATORS	PEER PROFESSIONAL LEARNING
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★ Key 2023 Accomplishments

- 3,000 applications/1,800 completed.
 - » Selected 105 for onsite projects.
 - » 100 for virtual projects.
 - » 170 contact hours.
- 41% underrepresented, 20% underserved.
- 58 research projects presented at SEES Symposium.
- 116 attending AGU in person, 98 virtually (some multiple submissions).
- 16 SEES Zero G experiments.

⚙️ Key Partners Active in 2023

- GLOBE Mission EARTH
- NASA Earth Science Education Collaborative (NESEC)
- Astromaterials Research and Exploration Sciences (ARES)
- Northwest Earth and Space Sciences Pathways (NESSP)



2022 NASA SEES intern Neha Shukla was featured in *Forbes* magazine and won a \$10,000 grant for her social-distancing invention



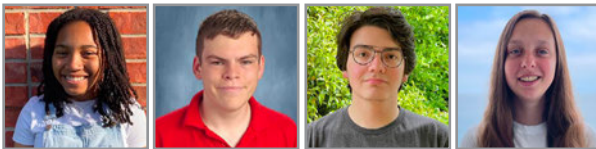
2019 NASA SEES intern Shreya Ramachandran, founder of The Grey Project, was featured in the Earth Day issue of *People* magazine



2022 SEES intern Caydence Palmer is the first high school student featured on the cover of *AISES Winds of Change* magazine



SEES interns actively engaged in authentic, challenge-driven engineering with prototype satellite ZQube to develop compact, research payloads that are tested in microgravity within 6 months of inception on board the Zero-G parabolic aircraft



2023 NASA SEES interns (L to R) Londyn Franklin, Aaron Kingslien, Landry McRoy, and Zoe Zlatic were selected to fly on Zero-G aircraft with experiments



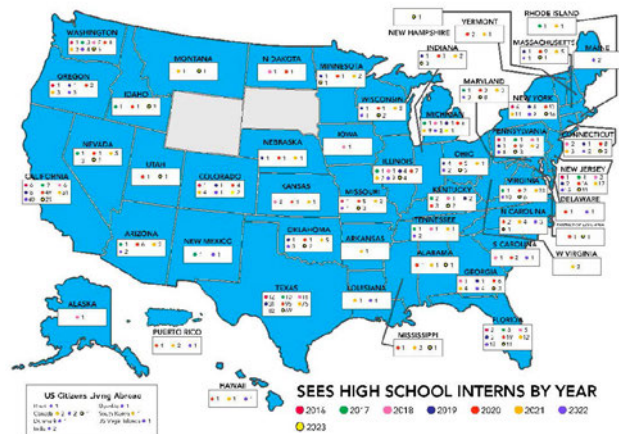
12 NASA SEES interns receive VIP invitations to OSIRIS-REX reveal event at NASA's Johnson Space Center



Poster created by 2023 Mars Rover Team and QR code to their presentation



Watch the Mars Rover Team presentation

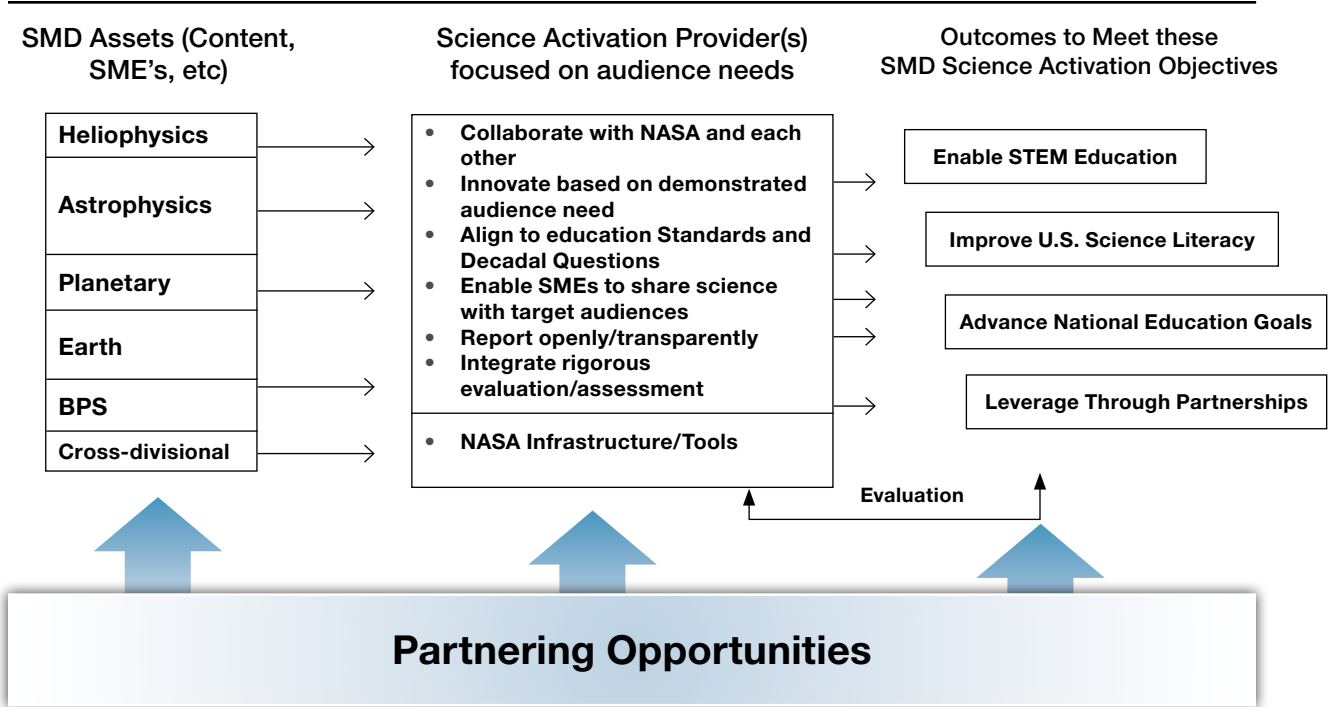


Read more about SEES in the news

APPENDIX

Science Activation Model and Mid-Level Objectives

SMD Science Activation Model



SCIENCE ACTIVATION DESIRED OUTCOME/VISION STATEMENT:

To further enable NASA science experts and content into the learning environment more effectively and efficiently with learners of all ages.

OBJECTIVES:

Mid Level Objectives:

Enable STEM Education	Inspire participants' interest in STEM and the development of their identities as science learners.
	Provide opportunities for participants to engage with the disciplinary content related to NASA science and engineering.
	Increase number of and frequency with which NASA SMD assets are used by learners across the US.
Improve U.S. Scientific Literacy	Advance participants' understanding of the process of science using NASA SMD assets.
Advance National Education Goals	Increase participation in learner-centered experiences based on NASA SMD assets.
	Increase the diversity of participants reached by Science Activation through intentional, inclusive programming.
	Engage participants in learning experiences that promote development of skills for STEM careers.
Leverage Efforts through Partnerships	Leverage internal mechanisms to support sharing and learning across the Science Activation portfolio.
	Utilize external partners to leverage reach and effectiveness of the Science Activation portfolio.

NASA SMD assets = science content and data, space and airborne platforms, and scientific and technical personnel.

RECENT PORTFOLIO EVALUATION ACTIVITIES

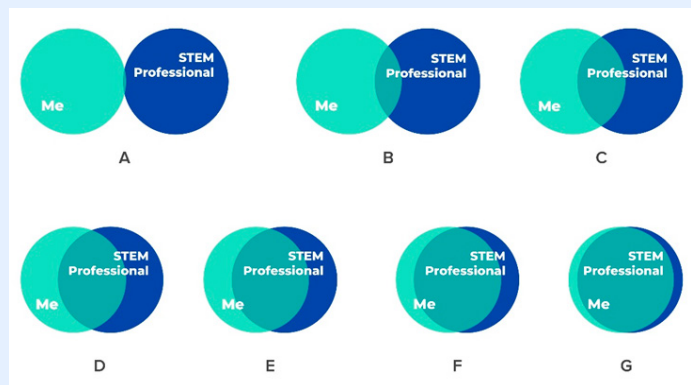
Recommendation for Shared Measurement

One of Pacific Research and Evaluation's (PRE) core tasks as portfolio evaluators is to explore the feasibility of possible shared measurement of mid-level objectives (MLOs) across the portfolio. PRE began with efforts to explore shared measurement for MLO1a, which was a priority across many SciAct teams. PRE's goal was to recommend a measure for use across as many qualifying SciAct projects as possible that can help generate meaningful data exploring the extent to which MLO 1a is being achieved. Since July of 2022, PRE has encouraged use of the [Single-Item Measure for Assessing STEM Identity, STEM Professional Identity Overlap \(STEM PIO-1\)](#) as a shared measure for MLO 1a. Specifically, PRE asks projects to use the below text and imagery on all applicable retrospective pre/post surveys with learners aged to the fifth grade level or higher.

A STEM professional is a person who uses science, technology, engineering, or mathematics in their everyday work.

PRE: Think back to the time just before this program began, and select the picture that best describes the overlap of the image you had of yourself and your image of what a STEM professional was.

POST: Select the picture that best describes the overlap of the image you currently have of yourself and your image of what a STEM professional is.



Since the recommendation was made, the STEM PIO-1 measure has been in active use by at least six project teams and implemented at least 10 times. Additional project teams have confirmed intent to integrate the measure into future activities. All projects who have provided retrospective pre/post data have reported increases in the extent to which learners identify as a STEM Professional.

Throughout this process, PRE has gathered valuable information about opportunities and limitations surrounding shared measurement. More work is planned to see whether additional shared measures can apply to other MLOs in 2024 and beyond.

Shared Learning Sessions to Review Understanding and Operationalization of MLOs

Between May to October of 2023, PRE held a series of Shared Learning Sessions to further explore each of the MLOs. The goal of these sessions was to facilitate discussion around how MLOs are being defined and operationalized across projects and to share measurement tools as relevant.

Sessions were well attended with repeat engagement from participants. Across all sessions, all SciAct projects were represented at least once. As a starting point for each conversation, PRE prompted participants to reflect on questions such as how MLOs are being interpreted and defined within projects, what projects like or feel can be improved about MLOs, or what they feel the MLO is encouraging projects to change or measure.

Findings from Shared Learning Sessions were documented in session-specific summary reports. These documents provide insights on the ways MLOs were commonly being interpreted and measured, elements of MLOs that projects believed were going well, suggestions for improving MLOs, and any added or emergent considerations specific to a given MLO. These insights will be used to fine tune the MLOs for future years. Recurring themes that emerged across Shared Learning Sessions are summarized below.

1) MLOs are structured in a way that allows for broad interpretation.

- Projects like the variety of ways that MLOs can be understood and operationalized.
- Projects seek greater understanding of SciAct's intended audience(s).

2) The terminology and phrasing in MLOs suggest a preference for documenting outputs over outcomes.

- Projects commonly interpret success to be defined as measurable evidence of project outputs.
- Projects seek clarity on establishing baselines for measuring success.
- Projects desire guidance in how to quantify use of NASA SMD assets.

3) Though projects focus efforts on select MLOs, individual team members are mindful of how progress towards one MLO may contribute to the advancement of other MLOs.

- Project size and complexity drives MLO selection.
- Projects primarily view MLOs as being nested within one another.
- Projects continue to question the extent to which shared measurement can or should be implemented.

NASA SciAct Leverages Partnerships

- AEROKATS and ROVER Educational Network
- Arctic and Earth SIGNS
- Astronomy Activation Ambassadors
- Central Idaho Dark Sky
- Cosmic Data Stories
- Eclipse Ambassadors
- Eclipse Ballooning
- Eclipse Soundscapes
- Exploratorium
- GLOBE Mission Earth
- Infiniscope
- Learning Ecosystem Northeast (GMRI)
- NASA eClips
- NASA HEAT
- NASA Neurodiversity Network
- NASA PLACES
- NASA's Universe of Learning
- NASA@My Library
- Native Earth | Native Sky



- NCCN
- NESEC
- NESSP
- NIFTY
- NISENet
- OCEANOS
- OpenSpace
- Planetary ReaCH
- PLANETS
- Engaging Hispanic Communities
- Science through Shadows
- SEES
- Smoky Mountain STEM
- SciAct STEM Ecosystems
- Growing Beyond Earth
- Challenger Center's LEARNER
- NASA SCoPE
- Sea Level Science



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