



# SMD Science Education Status to Presentation to the Planetary Science Subcommittee

*“Education is not the filling of a pail, but the lighting  
of a fire...and NASA is the spark”*

Kristen Erickson  
Director, Science Engagement & Partnerships  
Science Mission Directorate  
March 9, 2016

# Science Mission Directorate Organization Reflects Increased Education Focus

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**SMD AA –  
Dr. John M. Grunsfeld**

**SMD  
Deputy Associate Administrator  
for Research**

**– Vacant. D. Pierce, Acting**

- Lead for Research, M. Bernstein
- Director, Science Engagement and Partnerships, K. Erickson
  - Education, **M. Sladek**
  - Communications, **M. Thaller, M. Nagaraja**
- Director, Science Office for Mission Assessments, C. Daniels (LaRC)
- Senior Program Executive for Suborbital Programs, D. Pierce
- Chief Technologist, M. Seablom

*Included in SMD Front Office*

# SMD Science Education Program - Summary



## External Evaluator(s)

Selected through the Office of Education's Blanket Purchase Agreement

BOSE

## Risks/Areas of Concern

- More Dynamic Education environment post Every Student Succeeds Act
- Budget uncertainty until restructuring progress is demonstrated
- Identification of milestones to fill gaps in Formal and Underserved areas

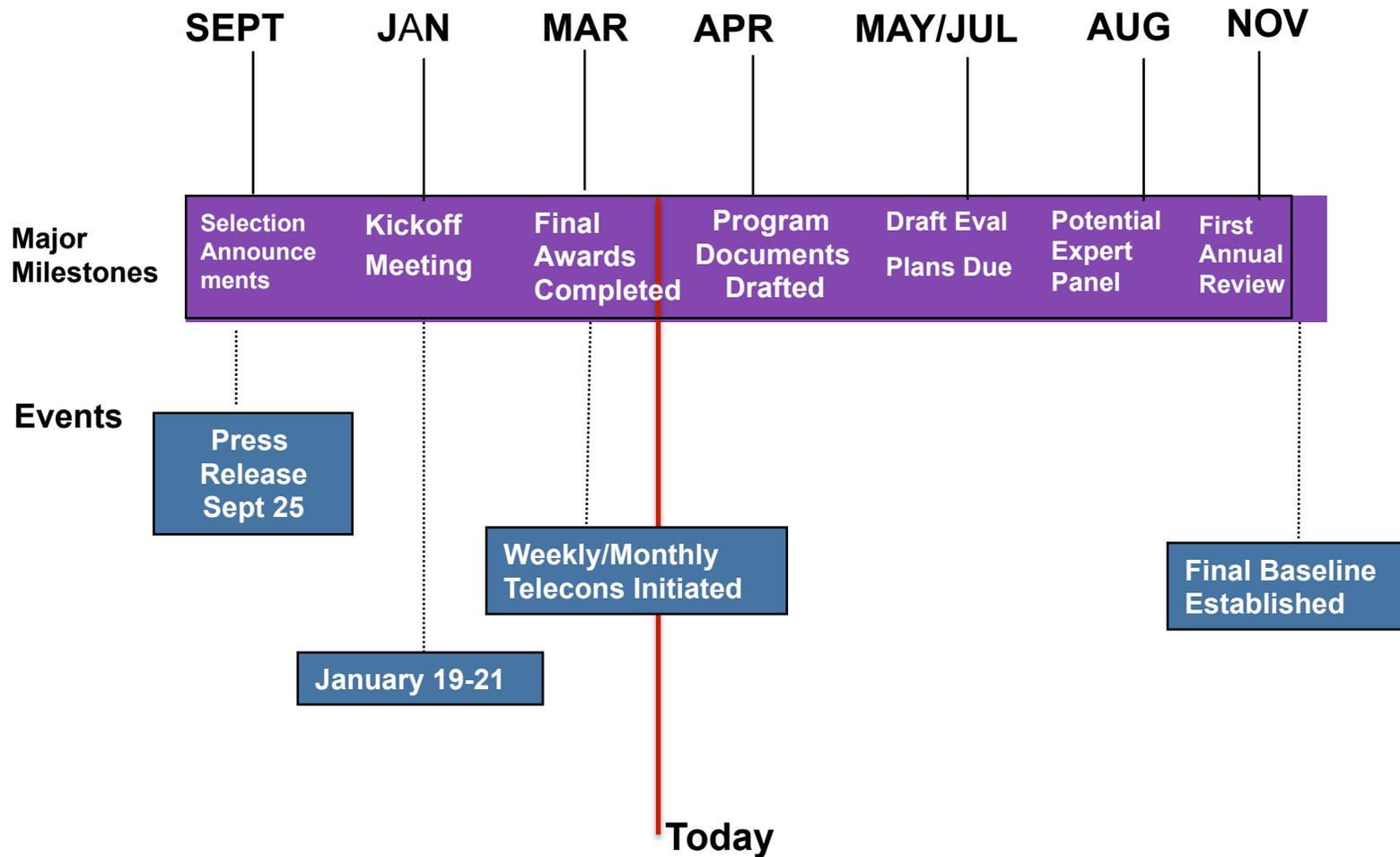
## Opportunities

- Enabling of SMD content and experts into additional areas and venues
- Improved coordination across SMD science education
- Reduction in fragmentation and duplication of efforts
- Increased support of targeted audiences based on needs assessments
- Improvement in the understanding of science literacy

## Measurable Achievement

- Progress towards CoSTEM goals by 2020
- Statistical Improvement in applicable S&E Indicators by 2020
- Statistical improvement in scientific literacy surveys by 202
- Budgets reflect progress towards Desired Outcome

# SMD Science Education Schedule 2016





# Office of Education and SMD - Each Has Unique Role and Leverages!

## NASA Education

- NASA Strategic Objective 2.4 and Education Implementation Framework
- External Coordination with Other Agencies
- External Evaluation for NASA
- Reporting
  - External Reports
  - OEPM
- NASA Internships, Fellowships, and Scholarships (NIFS)
- Educator Professional Development (EPD)
- Internal Competitions
- Leveraged Center Infrastructure

## NASA SMD Supports OEd Processes and Has:

- Science Discipline Subject Matter Experts
- Science and Engineering Content
  - Audience-based
  - Education Technology
- Authentic Experiences
- Relationship Managers
- Leveraged SMD Infrastructure

*Science Culture – Inquiry-based methods best suited to 21<sup>st</sup> Century Learning. Creativity Matters!*

***NASA Inspires Learners of All Ages!***

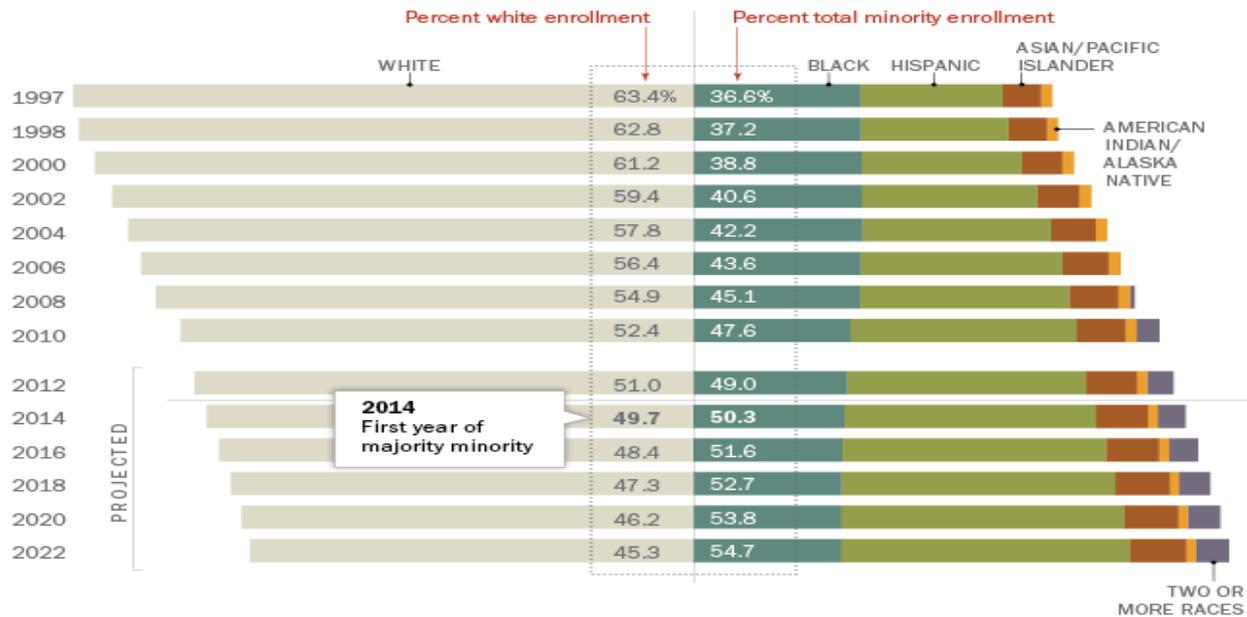


# A Note on Underserved Interests

- We MUST do better. Period.

## Public Schools in the United States Projected to Be Majority-Minority in 2014

Actual and projected share of enrollment in public elementary and secondary schools, by race/ethnicity



Note: Whites, blacks, Asian/Pacific Islander and American Indian/Alaska Native include only non-Hispanics. Hispanics are of any race. Prior to 2008, "two or more races" was not an available category. In 2008 and 2009, some students of both Asian origin and Hawaiian or Other Pacific Island origin were included in the two or more races category. In 2010 and 2011, all students of both Asian origin and Hawaiian or Other Pacific Island origin were included in the two or more races category. In 2008, five states reported enrollment counts for students of two or more races. In 2009, 14 states reported enrollment counts for students of two or more races.

Source: National Center for Education Statistics, U.S. Department of Education.

PEW RESEARCH CENTER



# Opportunities

- **NSF INCLUDES** - Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science Solicitation for 40 five-year grants at ~ \$300K each Deadline: **April 15, 2016**  
[http://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=505289](http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505289)
- **NASA PSD** - For approved extended missions, up to one FTE/year funded to interact with the SE awardees
- **NASA OEd** - For non-exchange of funds: NASA Announcement for High Impact / Broad Implementation STEM Education Partnerships (EDUCATION01SP16) Submissions accepted on a Rolling Basis through **Dec. 31, 2017** <http://go.nasa.gov/1RZwWCi>

# The NASA 2017 Eclipse Education Program



Bringing the Great American Eclipse of 2017 to Audiences across the Nation

C. Young, L. Mayo, C. ng, T. Cline, B. Stephenson

The August 21, 2017 eclipse across America will be seen by an estimated 500 million people from northern Canada to South America as well as parts of western Europe and Africa. Through This "Great American Eclipse" NASA in partnership with Google, the American Parks Network, American Astronomical Society, the Astronomical League, and numerous other science, education, outreach, and public communications groups and organizations will develop the approaches, resources, partnerships, and technology applications necessary to bring the excitement and the science of the August 21st, 2017 total solar eclipse across America to formal and informal audiences in the US and around the world. This effort will be supported by the highly visible and successful Sun Earth Days program and will be the main theme for Sun-Earth Days 2017.

Dance Across America



Eclipse and Event Maps



Tips for Safe Observing



Live Interviews from the Path



Twitter NASA EDGE  
[http://twitter.com/NASA\\_EDGE](http://twitter.com/NASA_EDGE)

Certificates of Participation



Observing Challenges for Amateur Astronomers



Eclipses Through Time



Awesome NASA Science



## SMD's "1%" Policy begins (1993)



Appendix table 7-11

### Correct answers to scientific process questions: 1990–2012

(Percent)

Question	1990 (n = 2,005)	1992 (n = 1,995)	1995 (n = 2,000)	1997 (n = 1,882)	1999 (n = 1,574)	2001 (n = 2,025)	2004 (n = 1,864)	2006 (n = 2,021)	2008 (n = 1,454)	2010 (n = 2,256)	2012
Understanding of scientific inquiry <sup>a</sup>	NA	NA	26	34	32	40	39	41	36	42	33
Components of understanding scientific inquiry scale											
Understanding of probability <sup>b</sup>	61	64	63	62	64	67	64	69	64	66	65
If the first three children are healthy, the fourth child will have illness.	78	80	77	78	78	78	NA	NA	NA	NA	NA
If the first child has illness, the next three will not.	81	83	81	80	82	84	82	86	82	81	82
Each of the couple's children will have the same risk of illness.	70	71	72	71	74	75	73	75	72	75	72
If the couple has only three children, none will have illness.	81	83	79	79	81	84	NA	NA	NA	NA	NA
Understanding of experiment <sup>c</sup>	NA	NA	26	36	34	40	46	42	38	51	34
Understanding of scientific study <sup>d</sup>	18	21	16	23	21	26	23	25	23	18	20

NA = not available, question not asked.

<sup>a</sup> To be classified as understanding scientific inquiry, the survey respondent had to (1) answer correctly the two probability questions stated in footnote b and (2) either provide a theory-testing response to the open-ended question about what it means to study something scientifically (see footnote d) or a correct response to the open-ended question about experiment (i.e., explain why it is better to test a drug using a control group [see footnote c]).

<sup>b</sup> To be classified as understanding probability, the survey respondent had to answer two questions correctly: *A doctor tells a couple that their genetic makeup means that they've got one in four chances of having a child with an inherited illness. (1) Does this mean that if their first child has the illness, the next three will not have the illness? (No) and (2) Does this mean that each of the couple's children will have the same risk of suffering from the illness? (Yes).*

<sup>c</sup> To be classified as understanding experiment, the survey respondent had to answer correctly (1) *Two scientists want to know if a certain drug is effective against high blood pressure. The first scientist wants to give the drug to 1,000 people with high blood pressure and see how many of them experience lower blood pressure levels. The second scientist wants to give the drug to 500 people with high blood pressure and not give the drug to another 500 people with high blood pressure, and see how many in both groups experience lower blood pressure levels. Which is the better way to test this drug? and (2) Why is it better to test the drug this way? (The second way because a control group is used for comparison.)*

<sup>d</sup> To be classified as understanding scientific study, the survey respondent had to answer (1) *When you read news stories, you see certain sets of words and terms. We are interested in how many people recognize certain kinds of terms. First, some articles refer to the results of a scientific study. When you read or hear the term scientific study, do you have a clear understanding of what it means, a general sense of what it means, or little understanding of what it means? and (2) (If "clear understanding" or "general sense" response) In your own words, could you tell me what it means to study something scientifically? (Formulation of theories/test hypothesis, experiments/control group, or rigorous/systematic comparison.)*

NOTE: "Don't know" responses and refusals to respond count as incorrect.

SOURCES: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Public Attitudes Toward and Understanding of Science and Technology (1990–2001); University of Michigan, Survey of Consumer Attitudes (2004); University of Chicago, National Opinion Research Center, General Social Survey (2006–12).



BACK-UP

# SMD Science Education Restructuring



- Background – FY16 Appropriation provides \$37M for NASA Science Education
- Why Restructure? **To further enable NASA science experts and content into the learning environment more effectively and efficiently with learners of all ages.** SMD will no longer have minimum of 1 percent set-asides through our missions, or issue disparate 3-year grants. But we are taking a strategic approach, building on our science-disciplined based legacy, and looking for new approaches given Stakeholder priorities

- Objectives?

- Enable STEM Education
- Improve US Scientific Literacy
- Advance National Educational Goals
- Leverage Through Partnerships

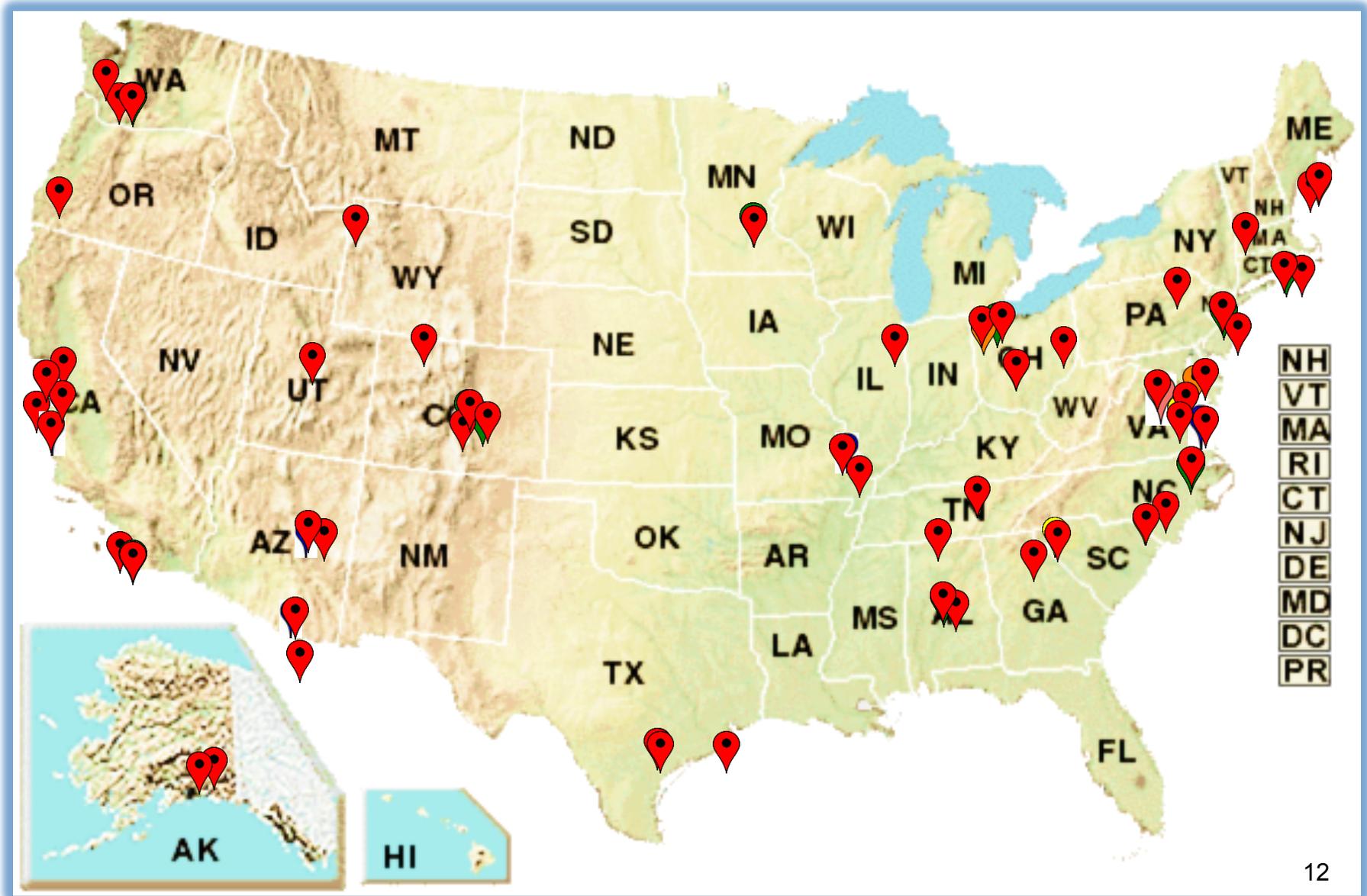


- How? Through the competitive selection of organizations that utilize NASA data, products, or processes to meet education objectives; and by enabling our scientists and engineers with education professionals, tools, and processes to better meet user needs. SME's continue to be funded within the Divisions, where appropriate

- Selections posted at:

<http://www.nasa.gov/press-release/nasa-selects-science-education-partners-for-stem-agreements>

# Map of NASA Science Mission Directorate Science Education Selections, including Co-Is



# SMD Science Education Awardees: Cross- Discipline

Alabama Space Science Exhibit Commission –Huntsville, AL. Scott Harbour, Principal Investigator for “Space Racers: Educating the Next Generation of Explorers about NASA's Missions”

Southern Illinois University, Edwardsville –Edwardsville, IL. Pamela Gay, “CosmoQuest: Engaging Students & the Public through a Virtual Research Facility”

Space Science Institute – Boulder, CA. Paul Dusenbery, Principal Investigator for “NASA@ My Library: A National Earth and Space Science Initiative that Connects NASA, Public Libraries and their Communities”

University Of Washington, Seattle –Seattle, WA. Robert Winglee, Principal Investigator for “Northwest Earth and Space Sciences Pipeline (NESSP)”

Science Museum of Minnesota – Saint Paul, MN. Paul Martin, Principal Investigator for “NASA Space and Earth Informal Science Education Network (SEISE-Net)”

University of Michigan, Ann Arbor –Ann Arbor, MI. Jon Miller, Principal Investigator for “Demonstration of the Feasibility of Improving Scientific Literacy and Lifelong Learning through a Just-in-Time Dissemination Process”

University Of Colorado, Boulder – Boulder, CO. Douglas Duncan, Principal Investigator for “Enhancement of Astronomy and Earth Science Teaching Using High Resolution Immersive Environments”

WGBH Educational Foundation – Boston, MA. Rachel Connolly, Principal Investigator for “NASA and WGBH: Bringing the Universe to America's Classrooms”

American Museum of Natural History - New York City, NY. Rosamond Kinzler, Principal Investigator for “OpenSpace: An Engine for Dynamic Visualization of Earth and Space Science for Informal Education and Beyond”

National Institute of Aerospace Associates – Hampton, VA. Shelley Spears, Principal Investigator for “NASA eClips 4D Multi-Dimensional Strategies to Promote Understanding of NASA Science: Design, Develop, Disseminate and Discover”

# Astrophysics



SETI Institute - Mountain View, CA. Edna DeVore, Principal Investigator for “Reaching for the Stars: NASA Science for Girl Scouts”

SETI Institute –Mountain View, CA. Dana Backman, Principal Investigator for “Airborne Astronomy Ambassadors (AAA)”

Space Telescope Science Institute - Baltimore, MD. Denise Smith, Principal Investigator for “NASA's Universe of Learning: An Integrated Astrophysics STEM Learning and Literacy Program”

# Earth Science

Gulf of Maine Research Institute- Portland, ME. Leigh Peake, Principal Investigator for “Real World, Real Science: Using NASA Data to Explore Weather and Climate”

Institute for Global Environmental Strategies –Arlington, VA. Theresa Schwerin, Principal Investigator for “NASA Earth Science Education Collaborative”

University of Alaska, Fairbanks –Fairbanks, AK. Elena Sparrow, Principal Investigator for “Impacts and Feedbacks of a Warming Arctic: Engaging Learners in STEM using NASA and GLOBE Assets”

University of Texas, Austin –Austin, TX. Wallace Fowler, Principal Investigator for “STEM Enhancement in Earth Science”

University of Toledo –Toledo, OH. Kevin Czajkowski, Principal Investigator for “Mission Earth: Fusing GLOBE with NASA Assets to Build Systemic Innovation in STEM Education”

Wayne County Intermediate School District –Wayne, MI. David Bydlowski, Principal Investigator for “AEROKATS and ROVER Education Network (AREN)”

# Planetary Science



Arizona State University – Tempe, AZ. Linda Elkins-Tanton, Principal Investigator for “NASA SMD Exploration Connection”

Challenger Center for Space Science Education--Washington, DC Robert Piercey, Principal Investigator for “CodeRed: My STEM Mission”

Jet Propulsion Laboratory – Pasadena, CA. Michelle Viotti, Principal Investigator for “NASA Active and Blended Learning Ecosystem (N-ABLE)”

Northern Arizona University—Flagstaff, AZ. Joelle Clark, Principal Investigator for “PLANETS (Planetary Learning that Advances the Nexus of Engineering, Technology, and Science)”

# Heliophysics

Association of Universities for Research in Astronomy, Inc. – Tucson, AZ. Matthew Penn, Principal Investigator for “Geographically Distributed Citizen Scientist Training for the 2017 Citizen CATE Experiment”

Exploratorium – San Francisco, CA. Robert Semper, Principal Investigator for “Navigating the Path of Totality”

NASA Goddard Space Flight Center - Greenbelt, MD. C. Alex Young, Principal Investigator for “Heliophysics Education Consortium: Through the Eyes of NASA to the Hearts and Minds of the Nation”

Southwestern Community College – Sylva, NC. Matt Cass, Principal Investigator for “Smoky Mountains STEM Collaborative: Bridging the Gaps in the K-12 to Post-Secondary Education Pathway”

## Correct answers to factual knowledge questions in physical and biological sciences: 1988–2012

(Percent)

Question	1988 (n = 2,041)	1990 (n = 2,005)	1992 (n = 1,995)	1995 (n = 2,006)	1997 (n = 2,000)	1999 (n = 1,882)	2001 (n = 1,574)	2004 (n = 2,025)	2006 (n = 1,864)	2008 (n = 2,021)	2010 (n = 1,932)	2012 (n = 2,256)
Physical science												
1. <i>The center of the Earth is very hot.</i> (True)	80	79	81	78	82	80	80	78	80	84	84	84
2. <i>The continents on which we live have been moving their locations for millions of years and will continue to move in the future.</i> (True)	80	77	79	78	78	80	79	77	80	78	80	83
3a. <i>Does the Earth go around the Sun, or does the Sun go around the Earth?</i> (Earth around Sun)	73	73	71	73	73	72	75	71	76	72	73	74
3b. <i>How long does it take for the Earth to go around the Sun?</i> (One year) <sup>a</sup>	45	48	46	47	48	49	54	NA	55	52	52	55
4. <i>All radioactivity is man-made.</i> (False)	65	63	73	72	71	71	76	73	70	71	67	72
5. <i>Electrons are smaller than atoms.</i> (True)	43	41	46	44	43	46	48	45	53	54	51	53
6. <i>Lasers work by focusing sound waves.</i> (False)	36	37	37	40	39	43	45	42	45	49	47	47
7. <i>The universe began with a huge explosion.</i> (True) <sup>b</sup>	54	32	38	35	32	33	33	33	33	33	38	39
Biological science												
1a. <i>It is the father's gene that decides whether the baby is a boy or a girl.</i> (True) <sup>c</sup>	NA	NA	65	64	62	66	65	62	64	62	61	63
1b. <i>It is the mother's gene that decides whether the baby is a boy or a girl.</i> (False) <sup>d</sup>	NA	72	NA	NA								
2. <i>Antibiotics kill viruses as well as bacteria.</i> (False)	25	30	35	40	43	45	51	54	56	54	50	51
3. <i>Human beings, as we know them today, developed from earlier species of animals.</i> (True) <sup>b</sup>	46	45	45	44	44	45	53	42	43	46	47	48

NA = not available, question not asked.

<sup>a</sup> Question was asked only of survey respondents who answered correctly that the Earth goes around the Sun. Individuals who responded incorrectly that the Sun goes around the Earth also count as having responded incorrectly to the question on the length of the Earth's revolution around the Sun.

<sup>b</sup> Question was asked of 1,558 survey respondents in 2004 and 1,152 respondents in 2012.

<sup>c</sup> Question was asked of 1,506 survey respondents in 2008.

<sup>d</sup> Question was asked of 515 survey respondents in 2008.

NOTE: "Don't know" responses and refusals to respond count as incorrect.

SOURCES: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Public Attitudes Toward and Understanding of Science and Technology (1988–2001); University of Michigan, Survey of Consumer Attitudes (2004); University of Chicago, National Opinion Research Center, General Social Survey (2006–12).