

*Presentation to National Academies
Assessment Committee*



Science Engagement & Partnerships Division
Science Mission Directorate, NASA

April 8, 2019

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



Purpose

- Top-level Overview/Background
- Discussion of Operating Model of Science Activation
- Forward Planning: Opportunities for Next Five Years

Overview

SMD Science Activation Desired Outcome:

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



Science Activation Summary

- Baselined in November 2016, a collaborative model leveraging over 200 partnerships through a network of science and community-based institutions using a “multiplier effect” across the U.S. to achieve objectives
- Currently, 24 competitively-selected cooperative agreement awardees enable NASA science experts and content to engage more effectively and efficiently with learners of all ages
- Each agreement uses independent evaluators to validate performance. New community of practice established
- Volunteer networks, such as Solar System Ambassadors and Night Sky Network, mobilized across the U.S.
- Annual SMD funding \$45M for Science Activation activities balanced across NASA science disciplines
- In Year 4 of five-year Baseline period. One five-year Option to be exercised beginning 2021

References

- SMD Decadal Surveys (2010-18)
- A Framework for K–12 Science Education
- Next-Generation Science Standards 2013
- 2013 and 2018 Co-STEM Federal Strategies
- National Science Foundation Science & Engineering Indicators 2014, 2016
- NRC 1996 Scientific Literacy report
- NASA Strategic Plans 2013-2018
- Paperwork Reduction Act (IRBs)
- 2017 American Innovation and Competitiveness Act (P.L. 114-329)

Science Activation Across the Nation

By the Numbers*



52 exhibits
developed and distributed
to curated organizations



79 libraries
selected to receive tailored
science content



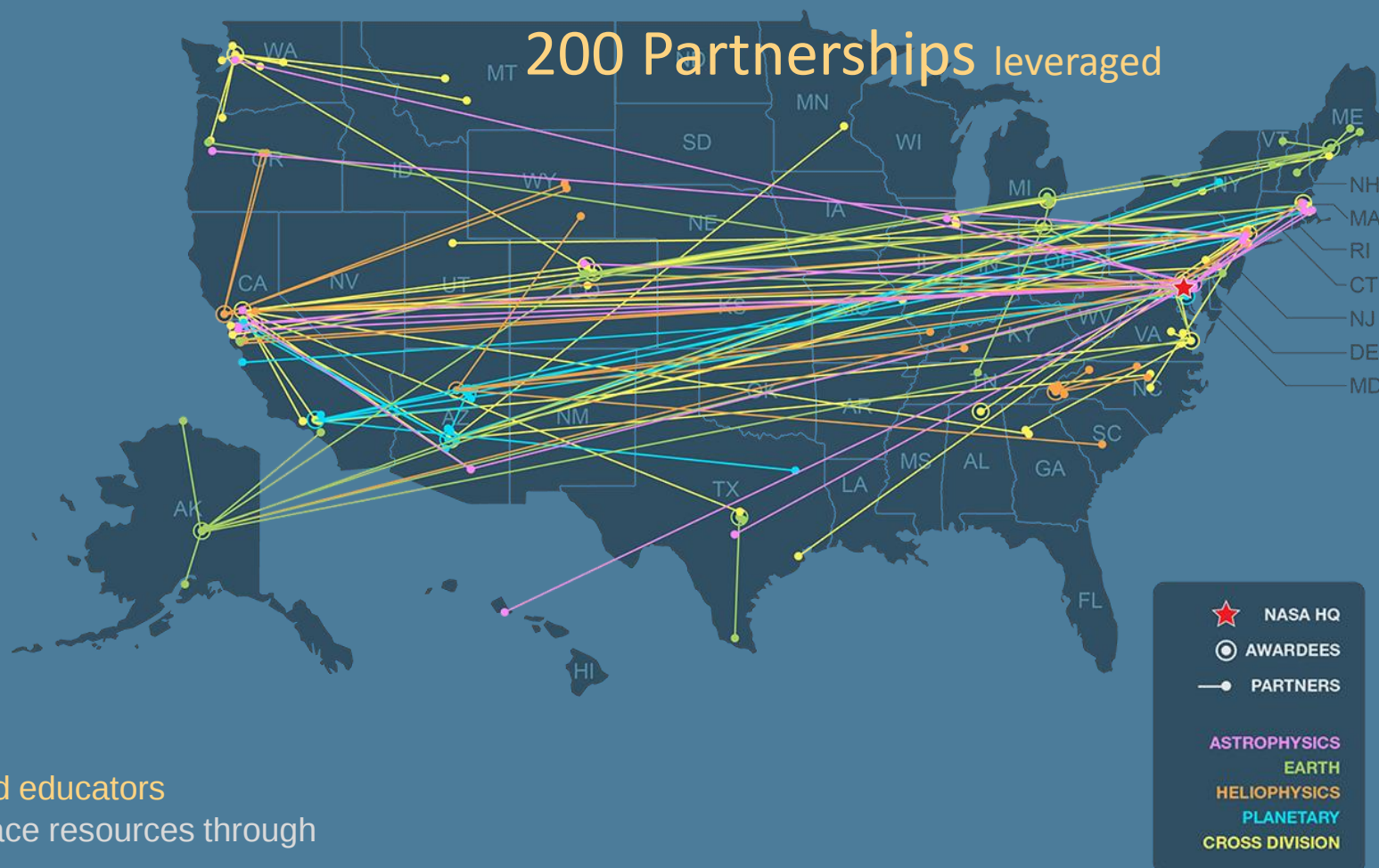
250 hands-on Toolkits
developed and distributed to
science centers and museums



421 subject matter experts



1.9 million registered educators
Received 197 digital Earth and Space resources through
PBS LearningMedia



* Through 2018

SMD Science Activation Model

SMD Assets (Content, SME's, Authentic Experiences)

Heliophysics	→
Astrophysics	→
Planetary	→
Earth	→
Cross-divisional	→

Science Activation Provider(s)

Examples:

- Translate Datasets to useful information for users
- Alignment to education Standards and Decadal Questions
- Enable SMEs to share science with target audiences
- Effective Dissemination
- Open/transparent reporting
- Timely evaluation/relevant assessment
- Development of materials, per Needs Assessments

Outcomes to Meet these SMD Science SciAct Objectives

Enable STEM Education

Improve U.S. Science Literacy

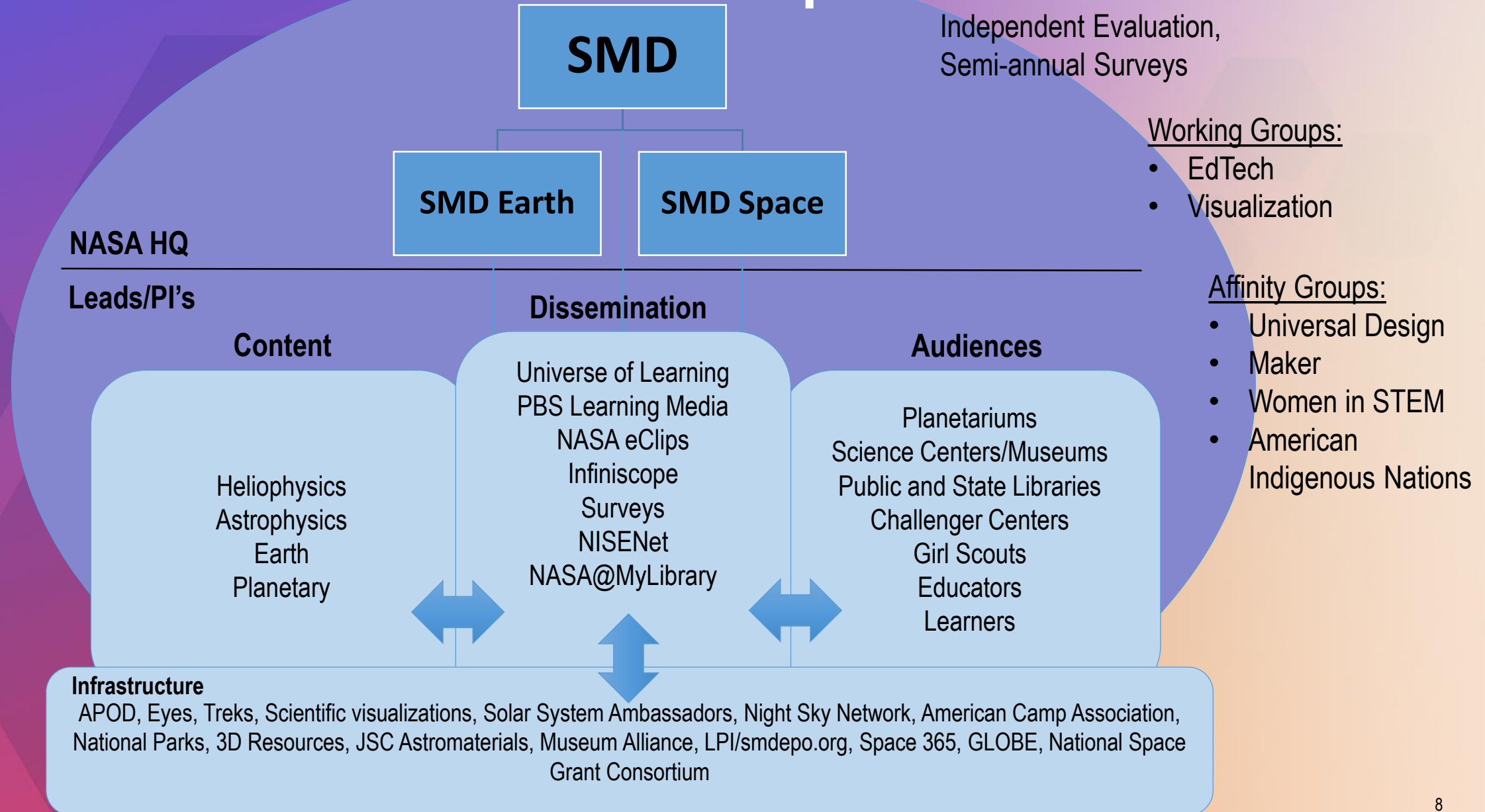
Advance National Education Goals

Leverage Through Partnerships

Evaluation

Partnering Opportunities

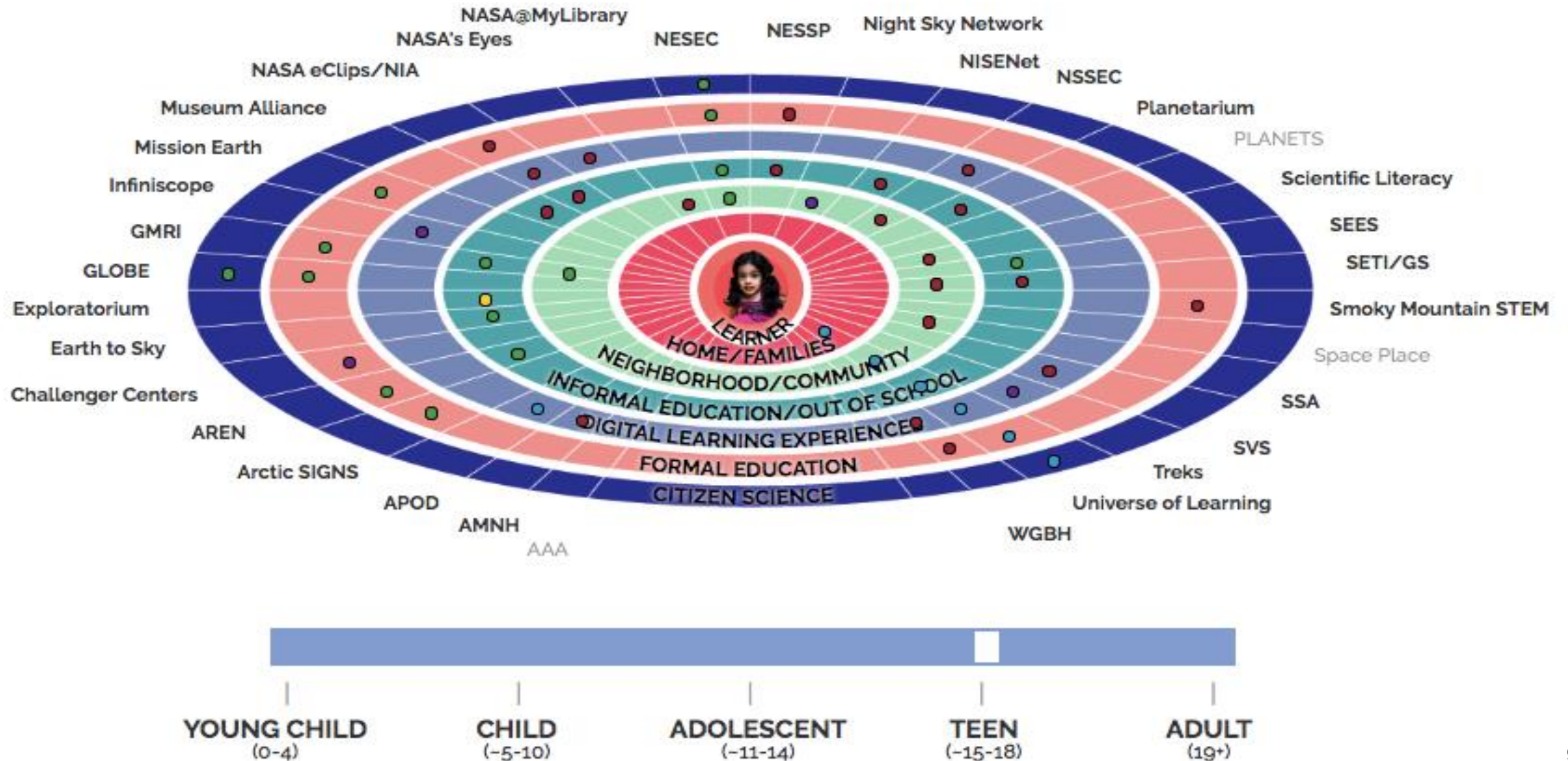
2018 SMD Collective Relationships



● Universe
 ● Solar System
 ● Sun
 ● Earth
 ● All Science

Science Activation Ecosystem

<https://science.nasa.gov/infographic>



Background

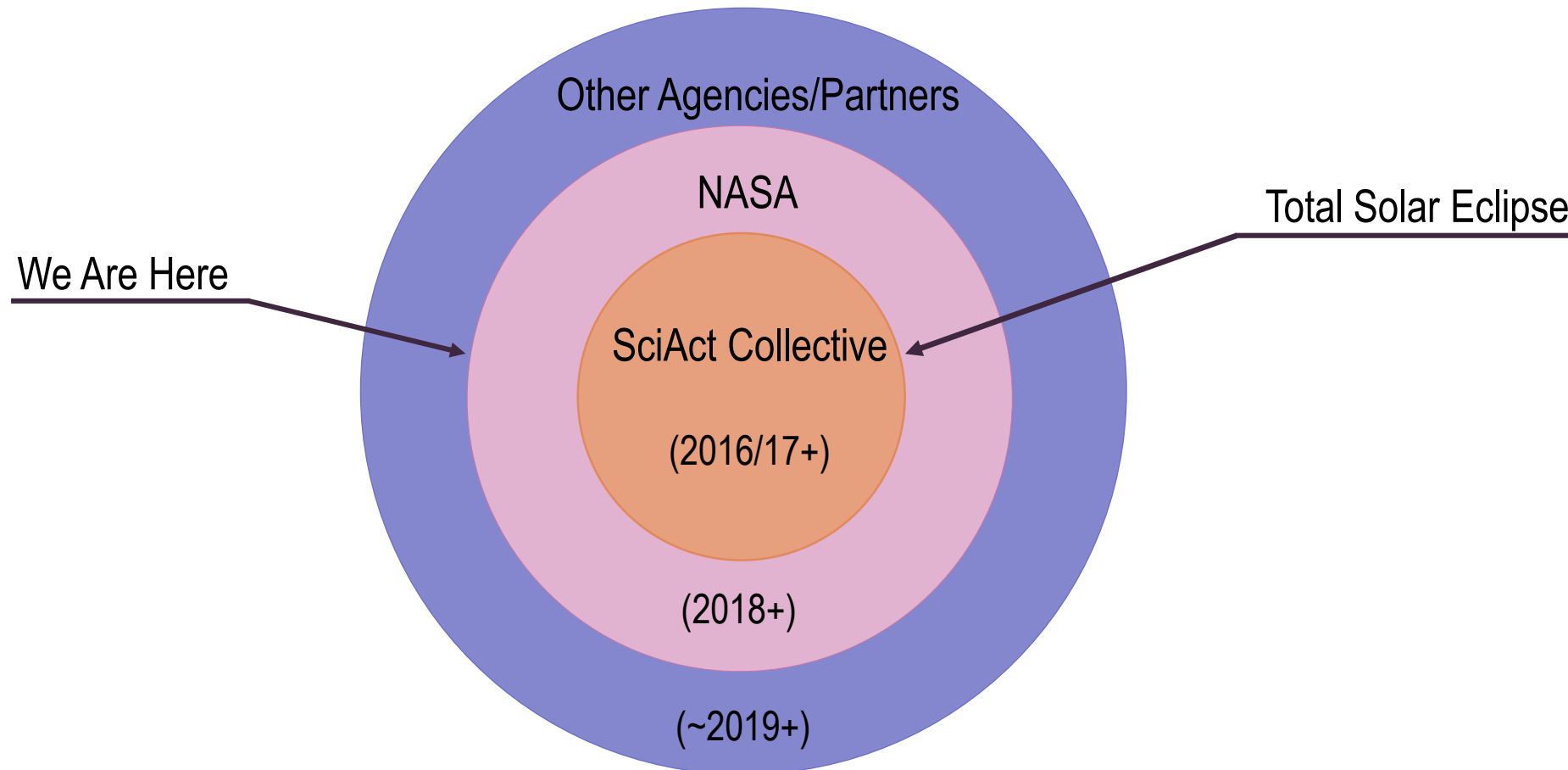
SMD Science Activation

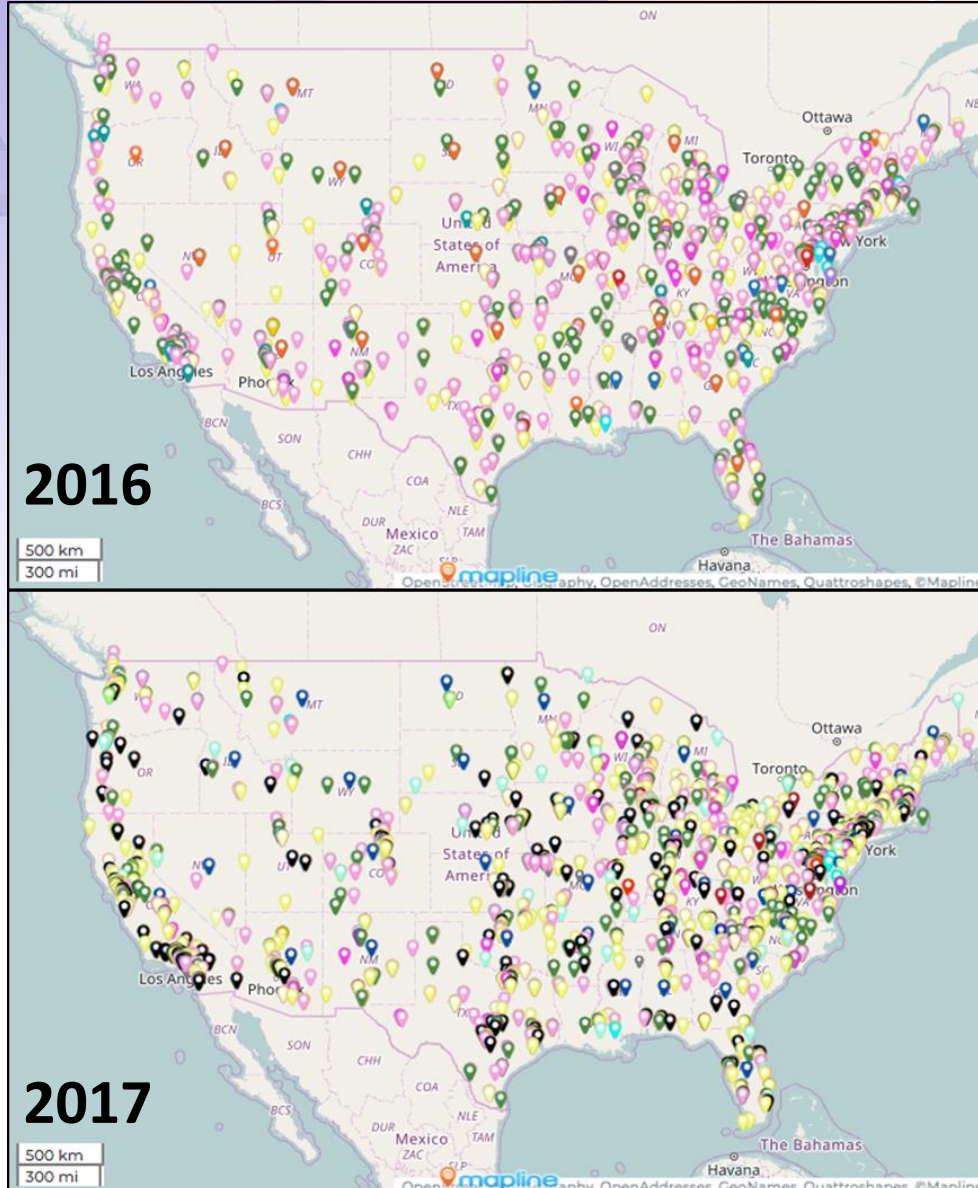
"Education is Local"



History and Perspectives

- Baselined in November 2016, this collaborative model enables over 200 partnerships through a network of science and community-based institutions using a “multiplier effect” across the U.S. to achieve Objectives
- Includes a number of digital learning approaches maximizing SMD’s unique capabilities
- Each agreement uses independent evaluators to validate performance





Comparisons

- 27 original awardees, now 24 due to efforts
 - Completed
 - Inconsistent with new SMD policies
 - Non-performance
- Several awards have been augmented
 - Partial selection to full award
 - Expansion
- “Reach” expanded due to Eclipse relationships, building of trust, partnering
- Metrics: 2018 devoted to finalizing agreements’ measures of success, but also cross-mapping to Top-level Objectives

Operations

SMD Science Activation

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



Operations and Management Tools

- For Science Activation, our experts, content, and authentic experiences are what we uniquely contribute into the education ecosystem. For stronger connections:
 - New Hotline and mapping tools posted on <http://science.nasa.gov/learners>
- Tools include Statements of Collaboration between Institutions and SMD Program Officer in each agreement
- Logic Models
- Evaluation Plans, monitored by Independent Evaluators
- Monthly and Annual reporting
- Quarterly Scorecard to PIs
- Working Groups and Affinity Groups
- Face-to-Face sessions. At least one annually
- Internal community site: <https://smdepo.org>
- Mapping Metrics to Top-Level Objectives
- Examples:
 - Statements of Cross-Collaboration
 - “Triangle” Impact Formats

Updated: As of February 2018		182 Agreements		CROSS COLLABORATION MATRIX																																								
			SCIENCE ACTIVATION AWARDS																				INFRASTRUCTURE												TOTALS									
Institution	PI	Title	AMNH	AREN	ASU	Challenger Center	Explora	GSFC/ NSSEC	IGES	JPL/Mars	Maine/Gulf of Maine Research Institute	NIA	Northern Arizona University	ASU/ NISE Net	SETI Institute /AAA	SETI Institute /GS	ASP	SCC	Space Science Institute	STScI	U Alaska, Fairbanks	U Colorado, Boulder	U Michigan, Ann Arbor	UTexas, Austin	UToledo	U Washington, Seattle	WGBH	Eyes/JPL	Trek/JPL	Night Sky Network	GSFC/ Education	Planetary Thematic	SVS	Wave-length		Museum Alliance	Solar System Ambassadors	JSC/Astro materials	Earth to Sky/NPS	GLOBE				
American Museum Of Natural History	Kinzler	OpenSpace: An Engine for Dynamic Visualization of Earth and Space Science for Informal Education and Beyond						X			X			X			X			X			X					X	X	X						X							10	
AREN/Wayne County Intermediate School District	Bydlowski	AEROKATS and ROVER Education Network (AREN)							X									X				X	X		X	X	X	X					X								X		10	
Arizona State University/Infiniscope	Anbar	NASA SMD Exploration Connection						X		X		X	X	X		X		X	X	X	X			X	X		X	X	X	X	X	X	X		X		X	X			X		22	
Challenger Center for Space Science Education	Bush	CodeRed:My STEM Mission								X	X	X	X												X						X					X							7	
Exploratorium	Semper	Navigating the Path of Totality												X	X				X									X				X					X						6	
Goddard Space Flight Center/NSSEC	Young	Heliophysics Education Consortium: Through the Eyes of NASA to the Hearts and Minds of the Nation	X		X					X	X	X		X		X				X								X	X	X	X	X	X	X	X		X	X		X	X		19	
Institute For Global Environmental Strategies/NESSC	Schwerin	NASA Earth Science Education Collaborative		X								X		X			X		X		X				X	X			X								X			X			11	
Jet Propulsion Laboratory/ImagineMars	Viotti	Imagine Mars			X	X		X					X								X							X	X	X							X	X		X			11	
Maine/Gulf of Maine Research Institute	Peake	Real World, Real Science: Using NASA Data to Explore Weather and Climate	X			X		X				X		X						X						X		X							X		X						10	
National Institute Of Aerospace Associates/NASA eClips	Spears	NASA eClips 4D Multi-Dimensional Strategies to Promote Understanding of NASA Science: Design, Develop, Disseminate and Discover			X	X		X	X		X		X	X	X		X						X					X	X	X	X		X	X			X	X	X	X			20	
Northern Arizona University/PLANETS	Clark	PLANETS (Planetary Learning that Advances the Nexus of Engineering, Technology, and Science)			X	X				X		X									X						X	X		X							X			X			10	
-ASU/NISENet	Martin	NASA Space and Earth Informal Science Education Network (NISE-Net)	X		X		X	X	X		X	X				X				X	X								X	X	X				X	X		X	X		X			18
SETI Institute/AAA	Backman	Airborne Astronomy Ambassadors (AAA)					X					X									X																		X				4	
SETI Institute/GS	Harman	Reaching for the Stars: NASA Science for Girl Scouts			X			X						X				X		X	X											X	X				X	X					10	
-Astronomical Society of the Pacific (ASP)	Gay	CosmoQuest: Engaging Students & the Public through a Virtual Research Facility	X						X			X					X			X			X					X									X				X		9	
Southwestern Community College	Cass	TE: Smoky Mountains STEM Collaborative: Bridging the Gaps in the K-12 to Post-Secondary Education Pathway		X																X									X	X											X		5	
Space Science Institute/NASA@My Library	Dusenbery	NASA@ My Library: A National Earth and Space Science Initiative that Connects NASA, Public Libraries and their Communities			X		X	X	X		X			X	X	X	X				X	X	X					X	X	X	X	X	X				X	X	X			X		22
Space Telescope Science Institute/Universe of Learning	Smith	NASA's Universe of Learning: An Integrated Astrophysics STEM Learning and Literacy Program	X		X					X				X	X	X				X				X	X		X	X	X	X	X	X	X		X	X							18	
University Of Alaska, Fairbanks	Sparrow	Impacts and feedbacks of a warming Arctic: Engaging learners in STEM using NASA and GLOBE assets		X	X				X				X							X							X			X											X		8	
University Of Colorado, Boulder	Duncan	Enhancement of Astronomy and Earth Science Teaching Using High Resolution Immersive Environments	X		X							X						X		X					X					X					X								8	
University Of Michigan, Ann Arbor	Miller	Demonstration of the feasibility of improving scientific literacy and lifelong learning through a just-in-time dissemination process			X															X	X		X																				4	
University Of Texas, Austin/SEES	Baguio	STEM Enhancement in Earth Science		X	X	X			X												X							X	X	X											X		9	
University Of Toledo	Czajkowski	Mission Earth: Fusing GLOBE with NASA Assets to Build Systemic Innovation in STEM Education		X					X		X											X																					4	
University Of Washington, Seattle	Winglee	Northwest Earth and Space Sciences Pipeline (NESSP)		X	X						X	X									X																						5	
WGBH Educational Foundation	Connolly	NASA and WGBH: Bringing the Universe to America's Classrooms	X	X	X		X	X		X	X	X	X				X		X	X				X					X								X			X			16	
TOTALS:			7	7	14	5	4	9	8	6	8	12	7	10	4	6	7	2	14	11	6	6	3	6	4	5	13	13	13	7	7	3	6	3	15	8		9	6					



Objective 2: Improve Science Literacy (Example)

<https://pbslearningmedia.org/universe>

Aim

Improve science literacy by engaging students with authentic scientific practices (i.e., analyzing and interpreting data) in the context of disciplinary core ideas.

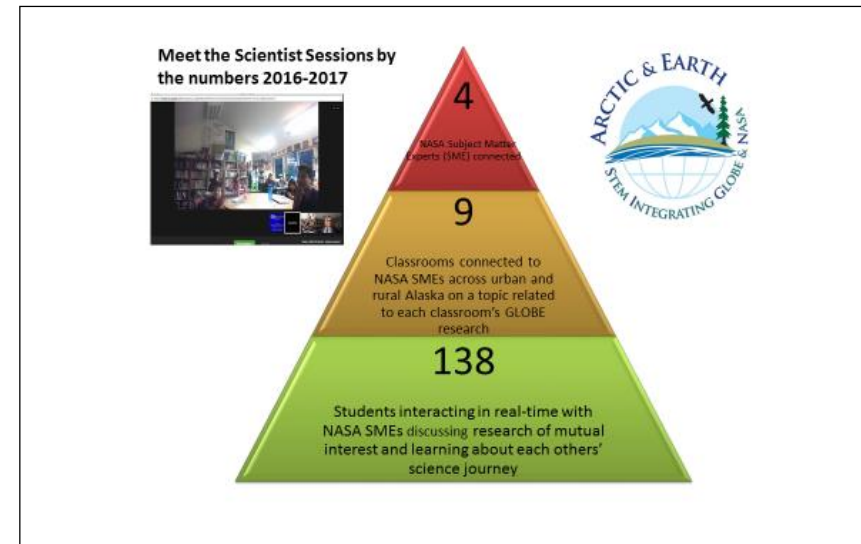
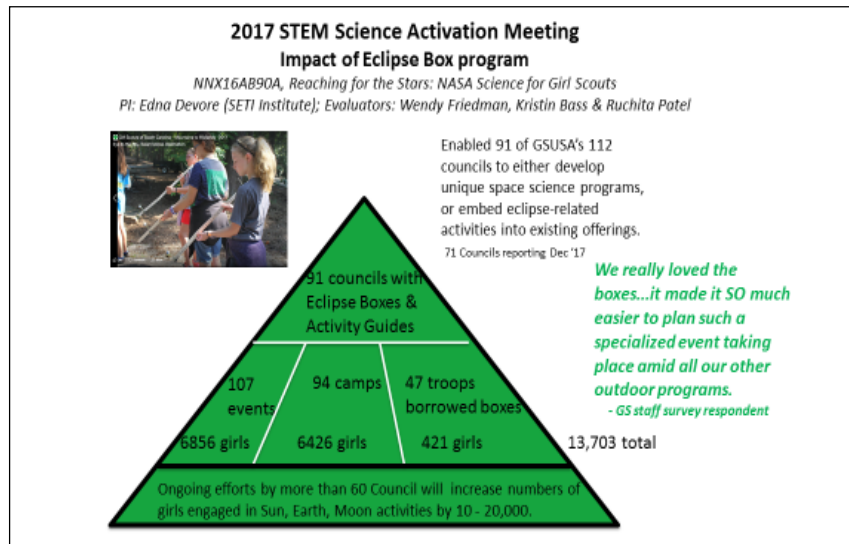
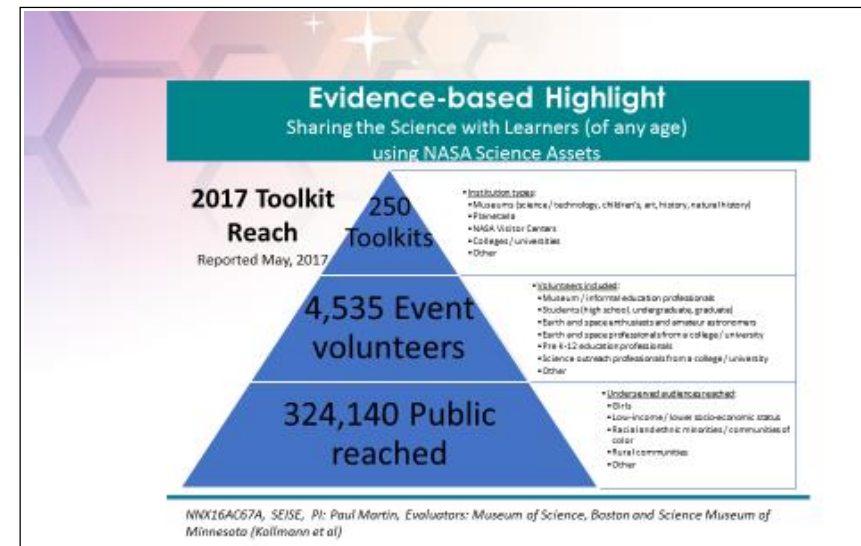
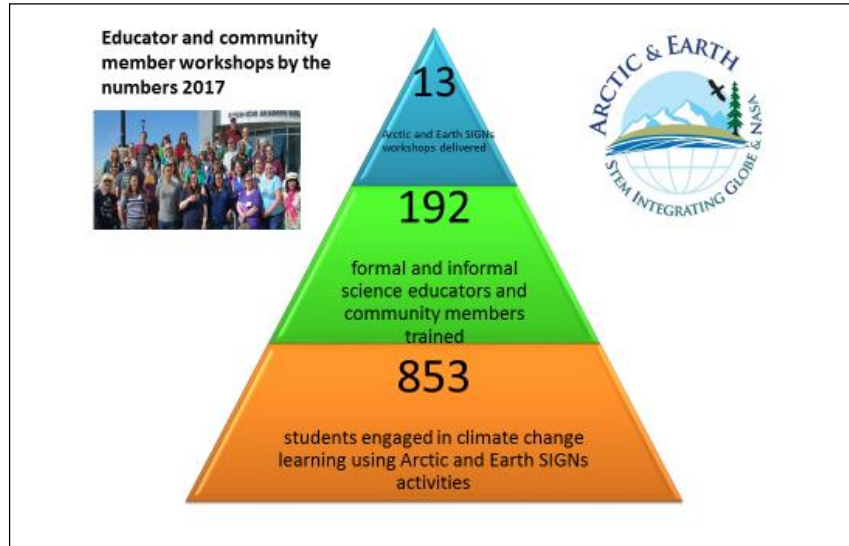
Outcomes

Resources address 67% of the 18 “NASA-applicable” science disciplinary core ideas (DCIs) in the national education standards (NGSS). Twenty (20) resources use digital tools developed specifically to enable student engagement with science practices

Activities (or outputs)

BUAC resources address NASA-relevant national education standards (NGSS) across two-dimensions; disciplinary core ideas (DCIs) and scientific practices:

Impact Examples



Checks and Balances



- Each agreement has an Independent Evaluator, reporting to the PI
 - Independent evaluators have developed their own Community of Practice
 - Participate in affinity conferences and SciAct annual meeting
 - Rely on their advice for collective impact across top-line Objectives
- For products, there is a separate independent review process
- Several of the agreements have additional internal, rigorous review processes e.g. NISENet, WGBH
- Dr. Jon Miller/University of Michigan, performs two U.S. surveys annually

Forward Planning

SMD Science Activation

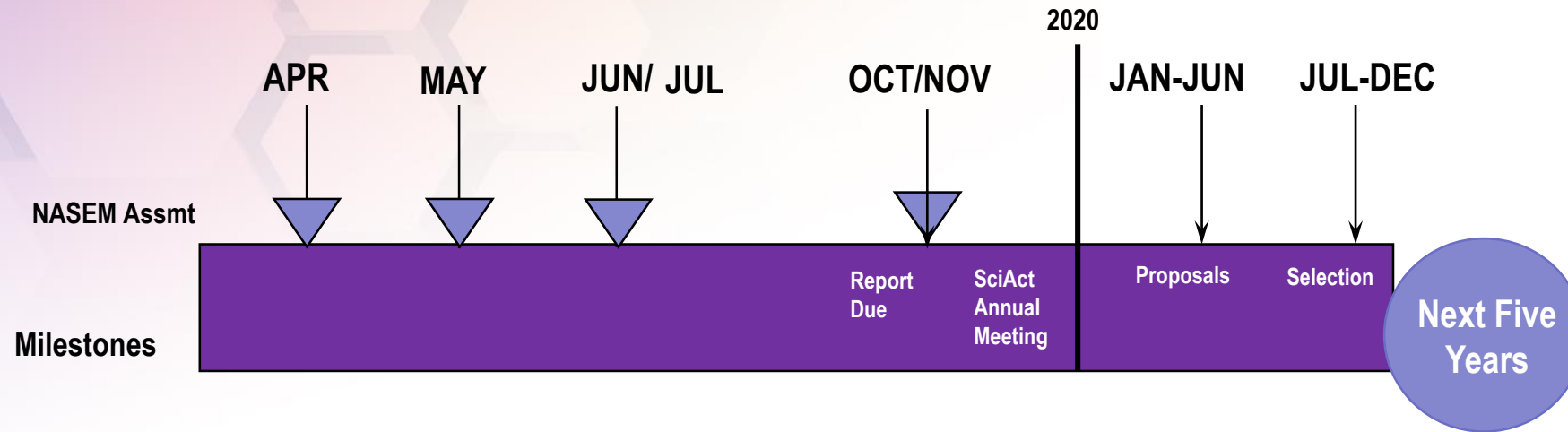
“...solving pressing societal issues will require both a scientifically informed citizenry and a robust scientific and technical workforce.”

Learning Science Through Computer Games and Simulations, p.22



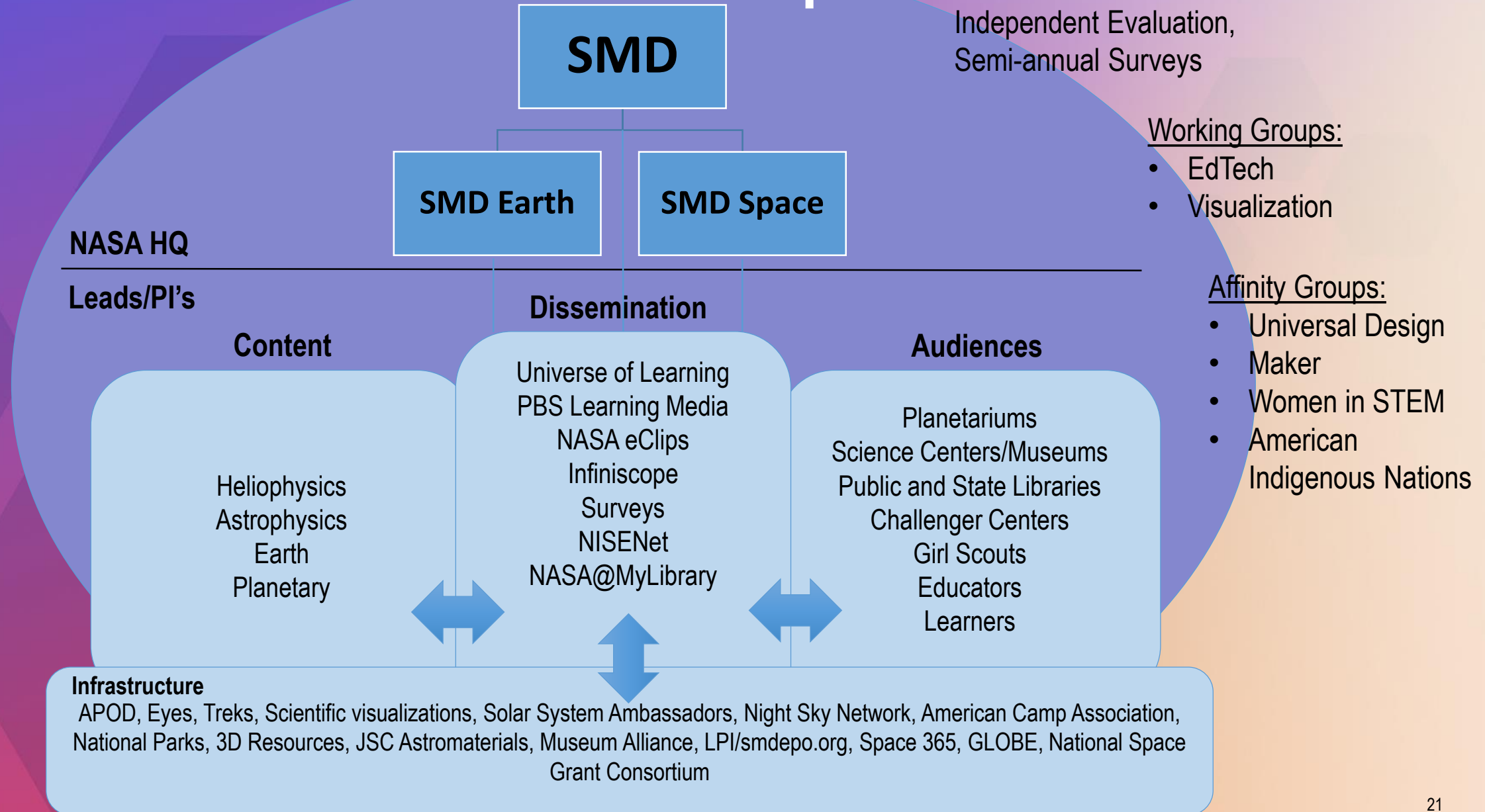
SMD Science Activation Assessment and Planning

FY 2019-20



- Assessment's Findings and Recommendations will inform Science Activation Program for the next five years
 - Discuss at annual meeting this November
 - Issue guidance to PI's early 2020
- Receive updated proposals from current PIs and exercise options
- Use of annual NASA Science solicitation (ROSES) to request proposals to fill identified gaps

2018 SMD Collective Relationships



Use of Real Science Data: Examples

- Digital platforms for learning:
 - WGBH: PBS Learning Media <https://pbslearningmedia.org/universe> and adapted Helioviewer for students <https://student.helioviewer.org/>
 - ASU: Infiniscope <https://infiniscope.org/>
 - AMNH: OpenSpace <https://www.openspaceproject.com/>
 - STScI: ViewSpace <https://viewspace.org/> and <https://projectpanoptes.org/>
 - JPL: Eyes products <https://eyes.nasa.gov/>
 - JPL/SSERVI: Treks products <https://trek.nasa.gov/>
- Citizen Science to engage learners and enhance literacy:
 - Aurorasaurus <http://www.aurorasaurus.org/>
 - GLOBE Observer <https://observer.globe.gov/>

Risks

- Turnover of personnel at all interfaces
- Lack of resources (time, capacity) to work with new interfaces/expand while balancing priority agreement commitments
- Leadership single point failure, flat organization
- ✦ Adaptability

Opportunities

- Collective Impact measures across the ecosystem and Nation to include: Rigor (evidence-based, logic model), Scalability, Underserved learners, Evidence of activity in all 50 States (GPRAMA measure), Enhanced SME Connections (GPRAMA measure)
- Total Solar Eclipse in 2024 (U.S.)
- Build upon current relationships for Long-term impact
- Fill gaps in Ecosystem

Questions?

- Balancing local needs with a National program, is this model scalable?
- If so, how can we better serve communities and the Nation given our unique assets?
- Further, how can SciAct optimize for the next five years?
- Is a balanced program for Learners of All Ages still optimal or is a more targeted approach recommended?
- Should we invest further in:
 - Homeschoolers
 - EdTech
 - STEM Equity
 - Universal Design for Learning
- Partnering at the Macro/Program level or continue organically at the agreement level?

Back-up



SMD Science Activation Program - Summary



External Assessment

National Academy of Science: Board of Science Education and Space Studies Board

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

Risks/Areas of Concern

- More dynamic education environment post ESSA
- Budget uncertainty until restructuring progress is demonstrated. Need \$42M/year to successfully restructure
- Stakeholders disconnecting Science and combining with Education
- Identification of milestones to fill gaps in Formal and Underserved areas

Measurable Achievement

- Progress towards CoSTEM goals by 2020
- Statistical Improvement in applicable S&E Indicators by 2020
- Statistical improvement in scientific literacy surveys by 2020
- Budgets increase reflect progress towards Desired Outcome (Goal is \$50M/year by 2020)

SMD Science Activation Awardees: Cross- Discipline

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)”

Arizona State University– 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 – Lead: Hashima Hasan

SETI Institute - Mountain View, CA. Pamela Harman, 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 – Lead: Lin Chambers

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. Margaret Baguio, 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)”

Space Science – Lead: Hakeem Oluseyi

Arizona State University –Tempe, AZ. Ariel Anbar, Principal Investigator for “NASA SMD Exploration Connection”

Challenger Center for Space Science Education--Washington, DC Denise Kopecky, 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)”

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”

SciAct 2.0 Concept for Discussion

Measures of Success

- Individual agreements' metrics connected to the four macro Objectives
- Cross-cutting (column) measures
- Collective Impact measures (e.g. scalability, meeting underserved, Active 50 states, SME connections)

**"Spark"
Metric(s)**

Strategic Partner Rubric

- Qualitative and Quantitative Weighted Scorecard
- Both from the initial decision and for operational performance