Purpose

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

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

SMD

SMD Earth

SMD Space

NASA HQ

Leads/PI's

Content

Heliophysics
Astrophysics
Earth
Planetary

Dissemination

Universe of Learning
PBS Learning Media
NASA eClips
Infiniscope
Surveys
NISENet
NASA@MyLibrary

Audiences

Planetariums
Science Centers/Museums
Public and State Libraries
Challenger Centers
Girl Scouts
Educators
Learners

Infrastructure

APOD, Eyes, Treks, Scientific visualizations, Solar System Ambassadors, Night Sky Network, American Camp Association, National Parks, 3D Resources, JSC Astromaterials, Museum Alliance, LPI/smddep.org, Space 365, GLOBE, National Space Grant Consortium

Independent Evaluation,
Semi-annual Surveys

Working Groups:
• EdTech
• Visualization

Affinity Groups:
• Universal Design
• Maker
• Women in STEM
• American Indigenous Nations
Science Activation Ecosystem

https://science.nasa.gov/infographic
Background
SMD Science Activation
“Education is Local”
We Are Here

Total Solar Eclipse

SciAct Collective

(2016/17+)

(2018+)

(~2019+)

NASA

Other Agencies/Partners

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
<table>
<thead>
<tr>
<th>Institution</th>
<th>PI Name</th>
<th>Title</th>
<th>SCIENCE ACTIVATION AWARDS</th>
<th>INFRASTRUCTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Museum Of Natural History</td>
<td>Krizner</td>
<td>Stem Space Flyer: A Bridge To Dynamic Visualization Of Earth And Space Science For Elementary Education And Beyond</td>
<td>X X X</td>
<td>X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Kowal</td>
<td>CodeRed: My STEM Mission</td>
<td>X X X</td>
<td>X X X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Martin</td>
<td>Mission Earth: Fusing GLOBE and NASA Assets</td>
<td>X X X X X</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Bydlowski</td>
<td>Stem Space Flyer: A Bridge To Dynamic Visualization Of Earth And Space Science For Elementary Education And Beyond</td>
<td>X X X</td>
<td>X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Martin</td>
<td>Mission Earth: Fusing GLOBE and NASA Assets</td>
<td>X X X X X</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Bydlowski</td>
<td>Stem Space Flyer: A Bridge To Dynamic Visualization Of Earth And Space Science For Elementary Education And Beyond</td>
<td>X X X</td>
<td>X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Martin</td>
<td>Mission Earth: Fusing GLOBE and NASA Assets</td>
<td>X X X X X</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Bydlowski</td>
<td>Stem Space Flyer: A Bridge To Dynamic Visualization Of Earth And Space Science For Elementary Education And Beyond</td>
<td>X X X</td>
<td>X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Martin</td>
<td>Mission Earth: Fusing GLOBE and NASA Assets</td>
<td>X X X X X</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Bydlowski</td>
<td>Stem Space Flyer: A Bridge To Dynamic Visualization Of Earth And Space Science For Elementary Education And Beyond</td>
<td>X X X</td>
<td>X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Martin</td>
<td>Mission Earth: Fusing GLOBE and NASA Assets</td>
<td>X X X X X</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Bydlowski</td>
<td>Stem Space Flyer: A Bridge To Dynamic Visualization Of Earth And Space Science For Elementary Education And Beyond</td>
<td>X X X</td>
<td>X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Martin</td>
<td>Mission Earth: Fusing GLOBE and NASA Assets</td>
<td>X X X X X</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Bydlowski</td>
<td>Stem Space Flyer: A Bridge To Dynamic Visualization Of Earth And Space Science For Elementary Education And Beyond</td>
<td>X X X</td>
<td>X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Martin</td>
<td>Mission Earth: Fusing GLOBE and NASA Assets</td>
<td>X X X X X</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Bydlowski</td>
<td>Stem Space Flyer: A Bridge To Dynamic Visualization Of Earth And Space Science For Elementary Education And Beyond</td>
<td>X X X</td>
<td>X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Martin</td>
<td>Mission Earth: Fusing GLOBE and NASA Assets</td>
<td>X X X X X</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Bydlowski</td>
<td>Stem Space Flyer: A Bridge To Dynamic Visualization Of Earth And Space Science For Elementary Education And Beyond</td>
<td>X X X</td>
<td>X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Martin</td>
<td>Mission Earth: Fusing GLOBE and NASA Assets</td>
<td>X X X X X</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Arizona State University</td>
<td>Bydlowski</td>
<td>Stem Space Flyer: A Bridge To Dynamic Visualization Of Earth And Space Science For Elementary Education And Beyond</td>
<td>X X X</td>
<td>X</td>
</tr>
</tbody>
</table>
Objective 2: Improve Science Literacy (Example)  

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

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.

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

[https://pbslearningmedia.org/universe](https://pbslearningmedia.org/universe)
Impact Examples

Educator and community member workshops by the numbers 2017

- 13
  - Educator and community
  - member workshops delivered

- 192
  - formal and informal science educators and
  - community members trained

- 853
  - students engaged in climate change
  - learning using Arctic and Earth SONGS
  - activities

2017 STEM Science Activation Meeting
Impact of Eclipse Box program

NASA/SSC: Resolving the State: NASA Educator for Girls Seeds
Pt. Ado Brewer (NIU Institute); Evaluators: Wendy Friedman, Krista Rehworn & Rochelle Pohit

- We really loved the boxes...it made it so much easier to plan such a specialized event taking place amid all our other outdoor/programs.
  - 65 ref/serve represent

- 117 events
- 427 camps
- 447 tunnels
- 4356 girls
- 4326 girls
- 421 girls

- Engaging efforts by more than 100 girls in science activities by 30, 20,000.

Evidence-based Highlight
Sharing the Science with Learners of All Ages
using NASA Science Assets

2017 Toolkit
Reach
April 27, 2017

- 250
  - Toolkits

- 4,535 Event
  - volunteers

- 324,140 Public
  - reached

Meet the Scientist Sessions by
the numbers 2016-2017

- 4
  - Classroom connected to
  - Web Kids across office and
  - real data on a topic-related
  - to each classroom's GLOBE
  - project

- 9
  - Students interacting in real-time
  - with NASA SMEs discussing research of mutual
  - interest and learning about each others'
  - science journey

- 138
  - Students participating

17
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
• 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

SMD

SMD Earth

SMD Space

NASA HQ

Leads/PI's

Content

Heliophysics
Astrophysics
Earth
Planetary

Dissemination

Universe of Learning
PBS Learning Media
NASA eClips
Infiniscope
Surveys
NISENet
NASA@MyLibrary

Audiences

Planetariums
Science Centers/Museums
Public and State Libraries
Challenger Centers
Girl Scouts
Educators
Learners

Infrastructure

APOD, Eyes, Treks, Scientific visualizations, Solar System Ambassadors, Night Sky Network, American Camp Association, National Parks, 3D Resources, JSC Astromaterials, Museum Alliance, LPI/smdepo.org, Space 365, GLOBE, National Space Grant Consortium

Independent Evaluation,
Semi-annual Surveys

Working Groups:
- EdTech
- Visualization

Affinity Groups:
- Universal Design
- Maker
- Women in STEM
- American Indigenous Nations
Use of Real Science Data: Examples

• Digital platforms for learning:
  • WGBH: PBSLearningMedia [https://pbslearningmedia.org/universe](https://pbslearningmedia.org/universe) and adapted Helioviewer for students [https://student.helioviewer.org/](https://student.helioviewer.org/)
  • ASU: Infiniscope [https://infiniscope.org/](https://infiniscope.org/)
  • AMNH: OpenSpace [https://www.openspaceproject.com/](https://www.openspaceproject.com/)
  • STScI: ViewSpace [https://viewspace.org/](https://viewspace.org/) and [https://projectpanoptes.org/](https://projectpanoptes.org/)
  • JPL: Eyes products [https://eyes.nasa.gov/](https://eyes.nasa.gov/)
  • JPL/SSERVI: Treks products [https://trek.nasa.gov/](https://trek.nasa.gov/)

• Citizen Science to engage learners and enhance literacy:
  • Aurorasaurus [http://www.aurorasaurus.org/](http://www.aurorasaurus.org/)
  • GLOBE Observer [https://observer.globe.gov/](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”


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)

**Strategic Partner Rubric**

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

11/2018