ENGAGING STUDENTS, TEACHERS, AND THE PUBLIC WITH NASA ASTROMATERIALS RESEARCH AND EXPLORATION SCIENCE (ARES) ASSETS. P.V. Graff[1], S. Foxworth[1], A. Kascak[1], M.K. Luckey[3] B. Mcinturff[1], S. Runco[3], and K.J. Willis[2], [1]Jacobs, NASA JSC, Houston, TX 77058, (paige.v.graff@nasa.gov), [2]Oceaneering Space Systems – Jacobs JETS, NASA JSC, [3]NASA JSC.

Introduction: Engaging students, teachers, and the public with NASA Astromaterials Research and Exploration Science (ARES) assets, including Science, Technology, Engineering and Mathematics (STEM) experts and NASA curation astromaterial samples, provides an extraordinary opportunity to connect citizens with authentic aspects unique to our nation's space program. Effective engagement can occur through both virtual connections such as webcasts and in-person connections at educator workshops and public outreach events. Access to NASA ARES assets combined with adaptable resources and techniques that engage and promote scientific thinking helps translate the science and research being facilitated through NASA exploration, elicits a curiosity that aims to carry over even after a given engagement, and prepares our next generation of scientific explorers.

NASA Astromaterials Research and Exploration Science (ARES): The NASA Astromaterials Research and Exploration Science (ARES) Division [1], a division of the Exploration Integration and Science Directorate (EISD) at the NASA Johnson Space Center (JSC) in Houston, TX houses JSC's physical science teams who perform planetary research and support current and future Earth and planetary missions. ARES is also responsible for the curation of NASA's astromaterial collections [2] including housing and managing the distribution of the NASA lunar and meteorite sample disks [3]. ARES diverse portfolio of scientists, engineers, curators, and science engagement specialists, provides a wealth of assets to share with students, teachers, and the public. Our NASA curation astromaterial samples, displays, and educator resources are among one of the most exciting and powerful assets to share as they provide an opportunity for individuals to hold a record of the history of our solar system in their own hands. Sharing our experts and astromaterial samples through webcasts, educator workshops, and public outreach events has enabled us to engage with millions of interested individuals.

Webcasts: These online distance learning opportunities are designed to engage students, teachers, and the public with our subject matter experts (SMEs). These types of virtual connections have allowed our experts to engage with hundreds, to thousands, to millions of individuals around the world including K-12 classroom audiences and the general public.

Classroom Connection Webinars: Classroom Connection webinars, facilitated by ARES Science Engagement staff, are designed to engage K-12 students and teachers nationwide with subject matter experts. Events are facilitated 3-4 times a year and focus on a broad range of themes designed to share the work being facilitated by ARES staff. In 2015, webinars focused on International Space Station work being facilitated by our Earth Science and Remote Sensing unit as well as ARES involvement with planetary robotic missions such as the Mars Science Laboratory mission and asteroid sample return missions. Each webinar consistently reached a minimum of 500 live participants, with some reaching as many as 1200+ live participants. Feedback from teachers has indicated the overall success of these events and how impactful these engagements are towards enhancing student scientific thinking and critical thinking skills.

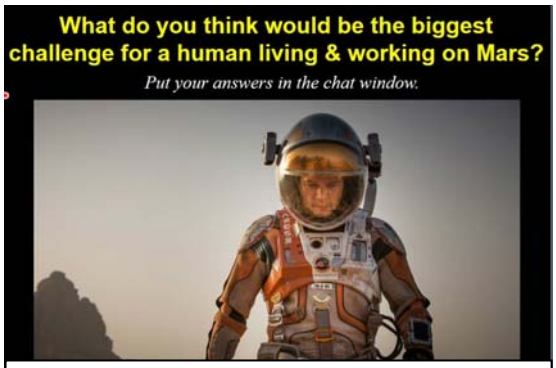

Image 1. Webinars can build on excitement from events such as the release of *"The Martian"*.

Public Webcasts: Over the past year, ARES Staff have also connected with millions of individuals around the world through public webcasts led by NASA Marshall Space Flight Center [4]. These webcasts, focusing on "celestial events" such as the 2015 lunar eclipse, the Perseid meteor shower, and the super blood moon have allowed ARES scientists to share relevant work being done within our laboratory facilities, and have allowed us to also virtually share astromaterial samples, including the lunar and meteorite sample disks. Participants learn about current research being facilitated by scientists; educators within the US learn how they can become certified to borrow the NASA lunar and meteorite sample disks. Each webcast reached millions of people around the world,

exposing them to the powerful science and assets housed within our facilities.

Educator Workshops: ARES Science Engagement staff have led and also partnered with other organizations facilitating educator workshops that highlight our astromaterial collections. ARES houses and manages the distribution of the NASA lunar and meteorite sample disks, which enables teachers to be certified to borrow these invaluable resources to share with students. Training educators with inquiry based curricular materials as part of their certification requirements, along with connecting them with STEM experts and when possible, our curational facilities and other assets, enables an even more powerful experience. This exposure to our unique facilities and assets helps stress the uniqueness and scientific value of NASA's astromaterial collections, NASA's lunar and meteorite sample disks, and the educational value of incorporating this rich science into the classroom.

Image 2. Sharing STEM experts and ARES assets with educators.

Public Outreach Events: Engaging students, teachers, and the public at public outreach events provides an opportunity to interact with individuals in an informal and powerful manner. Our staff has participated in numerous public events showcasing our STEM experts and NASA curation astromaterial samples. Events have included Sky Fest events and other public events held at the Lunar and Planetary Institute in Houston, TX; hosting a pre-event at Rocket Park at NASA JSC in anticipation of International Observe the Moon Night (InOMN); participating in local district wide science night events, and supporting schools hosting NASA Space Science Day Events. Each of these events allows our staff to share science, research, and NASA curation astromaterial samples, along with highlighting a variety of NASA missions that have explored, or continue to explore our solar system.

Promoting Scientific Thinking: To help deepen the impact from engaging students, teachers, and the public with ARES assets during virtual or in-person events, it is important to use tools and techniques aimed at promoting scientific thinking. During virtual events such as webinars, we promote scientific thinking by asking participants open-ended questions that require them to critically think about information that has been shared. Posing thought-provoking questions and providing feedback provides an invaluable way to interact with and keep participants engaged. Feedback from teachers has indicated that they notice students are critically thinking during webinars and that this scientific approach to solving problems is becoming more and more apparent in other work they do.

In order to promote scientific thinking during educator workshops and public outreach events, we primarily utilize inquiry based activities from the recently developed "Rocks, Soils, and Surfaces" curricular unit. This set of activities promotes scientific thinking and stresses the significance of astromaterial samples, along with remote sensing data, in the understanding of the history and evolution of our Moon. One of the easily adaptable activities from this unit, a "lunar rock card activity", is especially useful at public outreach events. This activity enables participants to practice and model lunar geologist skills by examining and classifying images of lunar samples. Participants ranging from 4 years old to adults have engaged in the activity and regardless of age, they consistently discuss and debate as they contemplate how to classify each lunar sample. To further test their knowledge, participants classify actual lunar samples on display. The excitement on their faces when they confidently share their classifications and justification is priceless. The intent of these experiences is to emphasize STEM content and promote scientific thinking, but also to elicit a curiosity that compels participants to further investigate topics they were exposed to once they leave an event.

Conclusions: By engaging educators, students, and the public with ARES assets such as our STEM experts and NASA curation astromaterial samples, we are able to use NASA's unique resources to build knowledge and excitement about our nation's space program. It also prepares the next generation of scientific explorers, as only NASA, while inspiring a pursuit of knowledge and understanding that promotes the relevance of Science Mission Directorate content, research, exploration, and NASA's overall mission.

References: [1] Astromaterials Research and Exploration Science, http://ares.jsc.nasa.gov [2] Astromaterials Acquisition & Curation Office, http://curator.jsc.nasa.gov/index.cfm [3] NASA Lunar and Meteorite Sample Disk Program, http://ares.jsc.nasa.gov/ares/lmdp/index.cfm, [4] NASA Marshall Space Flight Center Archive webcast archives, http://www.ustream.tv/channel/nasa-msfc.