

USING VIRTUAL AND IN-PERSON ENGAGEMENT OPPORTUNITIES TO CONNECT K-12 STUDENTS, TEACHERS, AND THE PUBLIC WITH NASA ASTROMATERIALS RESEARCH AND EXPLORATION SCIENCE ASSETS. P.Graff¹, S.Foxworth¹, M.K.Luckey² B.Mcinturff¹, A.Mosie³, S.Runco², N.Todd⁴, K.J.Willis⁵, and R.Zeigler² ¹Jacobs, NASA JSC, Houston, TX 77058, (paige.v.graff@nasa.gov),²NASA JSC, ³GeoControl Systems, Jacobs/JETS, ⁴Oceaneering, Jacobs/JETS, ⁵UTAS, Jacobs/JETS.

Introduction: Engaging K-12 students, teachers, and the public with NASA Astromaterials Research and Exploration Science (ARES) assets provides an extraordinary opportunity to connect audiences with authentic aspects unique to our nation's space program. NASA ARES has effectively engaged audiences with 1) Science, Technology, Engineering and Mathematics (STEM) experts, 2) NASA specialized facilities, and 3) NASA astromaterial samples through both virtual and in-person engagement opportunities. These engagement opportunities help connect local and national audiences with STEM role models, promote the exciting work being facilitated through NASA's Science Mission Directorate, and expose our next generation of scientific explorers to science they may be inspired to pursue as a future STEM career.

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), is located at the NASA Johnson Space Center (JSC) in Houston, TX. ARES 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]. The specialized research laboratories and curatorial facilities enable staff to conduct cutting-edge research and to preserve, protect and distribute NASA's astromaterial samples. ARES staff consists of a diverse portfolio of scientists, engineers, curators, and engagement specialists.

Connecting with STEM Experts: STEM experts involved in NASA science, exploration, and research can help translate challenging concepts through their personal experiences and involvement in NASA science in an authentic and meaningful way. Based on engagement opportunities we have offered, we have found that both in-person and virtual connections with our STEM experts can be an effective way to engage, inspire, and educate students, teachers, and the public.

In-Person Engagements: Our STEM experts have been involved in a variety of Education and Public Outreach (E/PO) events held at venues accessible to the public. Events utilize STEM experts to foster ex-

citement and understanding of NASA science. NASA Space Science Day (NSSD) events are one type of E/PO event that connects STEM experts with students, teachers, and the public. These events target middle school students and their families as they experience hands-on activities and hear from STEM expert guest speakers. NSSD events are often held on university campuses, but sometimes have been held at K-12 school locations in order to accommodate logistic challenges. Mini-NSSD events, an offshoot of the larger NSSD events, are more localized events in which our STEM experts facilitate hands-on activities and share NASA science at a local educational center.

Our STEM experts have also been involved in other E/PO related events designed to highlight NASA science. This includes participating in public events held at partnering organizations such as the Lunar and Planetary Science Institute (LPI) and Space Center Houston. It also includes facilitating pre-event opportunities to help promote awareness of upcoming celestial events. For example, over the past two years, our Science Engagement staff have organized International Observe the Moon Night (InOMN) pre-events next to the Saturn V rocket at Rocket Park at NASA JSC. These pre-events enable our STEM experts to share information about lunar exploration and InOMN festivities with visitors to Rocket Park including the hundreds of Space Center Houston tram visitors.

Virtual Engagement: Virtual engagement opportunities enable connections of our STEM experts with large distributed audiences. Over the past 5-7 years our Science Engagement staff have facilitated numerous webinar events reaching 200 – 500+ live participants from across the nation during any given event. These interactive distance learning opportunities are designed to engage K-12 students and teachers with our STEM experts. One of our most recent webinar events, entitled "Science and Careers at NASA", connected three ARES STEM experts with over 500 students in 13 states. Our experts shared their STEM career journey and their work at NASA JSC. Many of the participating educators are repeat attendees who have indicated that these interactive experiences are extremely valuable engagement opportunities for their students.

Access to NASA Specialized Facilities: The NASA ARES facilities, located onsite at NASA JSC, are unique, state-of-the-art, world-class laboratories.

These specialized facilities are working labs in which valuable research is being facilitated on a daily basis. As working labs, the opportunity to provide access to these facilities must be limited, generally only open to participants in NASA-sponsored activities.

In-Person Engagement: Depending on staff commitments and availability, ARES has been able to accommodate visits to our specialized facilities for VIP special guests, NASA and LPI student interns, and student and teacher groups visiting as part of NASA-sponsored activities. As time and space within these labs is limited, the majority of the visits involve short rotations, with a limited number of visitors in each rotation. Despite the limitations of in-person visits, these engagement opportunities provide unique opportunities to learn from our STEM experts and see the scientific instrumentation and laboratories they use as part of their research.

Virtual Engagement: For the majority of K-12 students and teachers across the nation, the opportunity to visit our specialized facilities in-person is highly unlikely. However, through the power of technology, our staff have recently experimented with providing a virtual visit to our Lunar Curation facility during the “Science and Careers at NASA” webinar. As this was the first time we experimented with bringing our 500+ participants virtually into our lunar lab, we designed this virtual tour to be only one portion of the webinar session. Based on the success of the virtual tour as part of the webinar, we plan to provide future webinars that will include virtual tours of other NASA ARES research and curatorial facilities. This will enable broader access and engagement with our STEM experts who can showcase our specialized facilities and the work facilitated in these laboratories.

NASA Astromaterial Samples: Our NASA astromaterial samples are among one of the most unique assets to share. Our staff bring these unique assets to students, teachers, and the public through in-person and virtual engagement opportunities offered through Education and Public Outreach (E/PO) events, the Lunar and Meteorite Sample Disk Program, and through the future work aimed at developing a virtual interactive public engagement tool.

In-Person Engagement: As previously mentioned, ARES STEM experts have participated in E/PO related events such as NASA Space Science Day (NSSD), mini-NSSD and other E/PO events. In addition to exposing involved audiences to our STEM experts, we frequently bring astromaterial samples to these events. The combination of the STEM experts and astromaterial samples provide an extraordinary means in which to help audiences gain context about the history and evolution of our Solar System. Sharing lunar sam-

ples at events such as International Observe the Moon night provides the perfect context in which audiences can make connections between observations of the Moon and actual lunar samples. This context provides an effective means in which to generate excitement and understanding of the Moon, sample collection, curation, and NASA science.

Educators and their students are also able to get up close and personal to lunar and meteorite samples through the Lunar and Meteorite Sample Disk Program. This program enables authorized certifiers to borrow the 6-inch Lucite Lunar and Meteorite Sample Disks to share with their intended audiences. The opportunity for certified educators to borrow the sample disks enables them to give their students the opportunity to hold a record of the history of our Solar System in their own hands. Paired with standards-aligned activities, the samples help reinforce scientific content and concepts. They also enable a unique and authentic educational experience to occur in the classroom.

Virtual Engagement: Virtual engagement through webinars do allow participating audiences to be exposed to our astromaterials samples, however we are currently investigating the use of augmented reality (AR) applications to enable students, teachers, and the public to explore these samples in an exciting and interactive way. We are working on a proof-of-concept project that takes advantage of existing development of 3D models of lunar and meteorite samples and AR technology used by JPL’s Spacecraft 3D mobile app [4] to allow the interactive exploration of samples using an AR target image.

Conclusions: By engaging educators, students, and the public with ARES assets such as STEM experts, NASA specialized facilities, and NASA astromaterial samples, ARES is able to help connect local and national audiences with STEM role models, promote the exciting and rich work being facilitated through NASA’s Science Mission Directorate, and expose our next generation of scientific explorers to science, research, and exploration they may be inspired to pursue as a future STEM career.

References: [1] Astromaterials Research and Exploration Science, <https://ares.jsc.nasa.gov/> [2] Astromaterials Acquisition & Curation Office, <https://curator.jsc.nasa.gov/> [3] NASA Lunar and Meteorite Sample Disk Program, <https://ares.jsc.nasa.gov/interaction/lmdp/> [4] JPL Apps, <http://www.jpl.nasa.gov/apps/>.