KSC Parsons 04 19
Brianna Parsons
NASA Kennedy Space Center
Major: Space Systems/Aerospace Engineering
NASA Internships and Fellowships (NIF) Spring Session
Date: 12 04 2019
NASA Intern Final Report - Virtual Reality in STEM Engagement

Brianna R. Parsons
Florida Institute of Technology, Melbourne, FL, 32901

I. Introduction
For this internship, I was a part of the multi-center NextGen STEM (Science, Technology, Engineering, and Mathematics) pilot. Specifically, I worked with the Developing Commercial Crew Program (CCP) Capabilities team that focuses on human spaceflight to the space station with NASA’s commercial partners. Composed of NASA employees and contractors (who are connected to KSC, JSC, and LaRC), they work to ensure that students will experience traditional classroom content and be immersed in emerging technologies in order to explore Commercial Crew missions and launch facilities. This group is in the process of creating educational products and resources to inspire the next generation to pursue STEM and to allow educators to have access to unique and enticing STEM activities. These products include: age-appropriate classroom lessons (including activity sheets and challenges) for kindergarten through twelfth grade; a CCP app and corresponding guide; learning experiences for students as well as educators; and virtual field trips and tours using NASA-created Virtual Reality (VR) videos and a custom VR app. My particular assignment was managing the VR equipment, developing an understanding of how to maximize the use of the equipment, creating documents that explain and convey the operations and procedures concerning the equipment (including lessons learned from equipment use), and training others to utilize the equipment effectively and correctly for conference events and group demonstrations. Over the course of this internship, I helped my team outline and learn essential procedures of operation for the VR equipment, solved technology problems that arose (due to the nature of creating unique products), and encouraged audiences at KSC and various conferences to consider using the CCP VR videos in their classrooms as an opportunity to engage and challenge the next generation to pursue STEM careers.

II. Equipment Management
The purpose of this internship focused on managing the team’s VR equipment (both on-center and abroad) and addressing the overall operation procedures for the equipment; both of these actions will continue to benefit the team as they present and release this information to event audiences. Important aspects of the managing process involve taking inventory and keeping track of the team’s current VR equipment, finding out what new equipment would benefit the team (and incorporating them into the overall inventory), sanitizing the equipment between events and demonstrations, and continuously updating the VR software as new material is created by the team or the software contractor that created the VR app for the team. I also was responsible for creating numerous documents, lists, and procedures that will help the team fully understand and operate their VR equipment efficiently after the conclusion of my internship. Finally, I traveled with the equipment as the team participated in events that could showcase the team’s products and VR software, where I ensured that the equipment would be ready for the events and operate effectively during the events.

A. VR Tools and Equipment
The inventory of the team’s NASA VR equipment at the time of this report is summarized in the following:
- 60 VR headsets: 30 Oculus Go devices with corresponding remotes and 30 Google Expedition devices
- 4 tablets for controlling, running, and viewing the VR app
- 3 routers for wirelessly connecting all the pieces of equipment that are used for the VR app operation
- 2 pairs of speakers that provide an optional, central audio source for events
- Numerous cords and supplemental pieces of hardware for handling, charging, and connecting the devices to one another during preparation or operation
- Miscellaneous, beneficial equipment (e.g. cleaning wipes, receipts and permits for moving the equipment, spare rechargeable batteries, and battery chargers)

The headsets host the client version of the team’s NASA VR app and enable the viewer to watch the team’s VR videos, and the headsets that are in use are connected wirelessly to one router. A tablet also connects to this router and, using the host version of the NASA VR app, controls which videos the headsets can view. This has been helpful during demonstrations and in classrooms to ensure that each member of the audience stays on the app and watches the
team’s videos. Between events and demonstrations, a computer that holds all of the video content (called a content server) can be connected to the router to push software updates to the equipment as new videos and app updates are available.

At the time of this report, the team’s NASA VR app holds six 360-degree virtual field trip videos that were filmed by the team before this internship. The field trips take place at both NASA and commercial facilities in Florida and California that may not be physically accessible for students and educators. The videos provide a tour of various facilities while pointing out the STEM projects that are carried out there as well as the engineering processes that allow for the projects to be supported, which encourages students and the public as a whole to get involved with the educational activities that the team provides and with STEM in general.

B. Documents for Management and Explanation of Operations and Procedures
A major portion of the internship included developing lists and specific instructions for managing the equipment, forming necessary procedures for operating the equipment, and informing the team about the lessons that I learned from resolving problems that were encountered while operating the equipment. Over the course of the internship, I created several documents that explain and describe various procedures for setting up, tearing down, operating, and tracking the equipment as it is used across the NASA centers involved with this team and the events in which the team participates.

The most important document that I made for the team discusses the set-up and tear-down procedures for the individual pieces of VR equipment. Since the team has two sets of equipment that were created by separate companies, two sets of instructions were provided in the document (one for each set of equipment). The instructions include: labeled pictures to ensure that the team understands what each piece of equipment is called and how each works; chronological steps for setting up the equipment, tearing everything down, and packing it all into the provided boxes; and helpful suggestions for each procedure (which vary between the equipment sets).

One document displays the advantages and disadvantages for differing audio sources at events where the team would be showing the VR videos to an audience. It helps the team decide what method for audio provision would be most appropriate for the specific event by juxtaposing the pro’s and con’s for several, viable audio sources. For instance, a smaller audience in a controlled environment (e.g. a classroom) may dictate the use of a pair of speakers to broadcast the videos’ audio, whereas a larger audience in a less-controlled environment (e.g. a school library or an exhibit booth at a conference) may necessitate the use of the VR headset device’s speakers or personal headphones to provide the audio for the virtual tours.

Additionally, I created checkout sheets and feedback surveys that would be useful before or after an event that utilized the team’s VR equipment. For versatility, I created two versions of the checkout sheets for the team. One version is kept in the equipment storage area that allows a team member to “check out” specific pieces of equipment for a specific event, which provides a physical exchange of responsibility for the equipment between those storing the equipment and those using the VR at an event. The other version of the checkout sheet that I provided is an online record that holds several, key details: where each piece of equipment is physically located, whether it is “checked out” or in storage on-center, what the battery levels of the VR devices are (which indicate whether they need to be charged before using them or they are ready for immediate use), and the like. The feedback tools that I created for the team have been specialized for two kinds of public events: for classroom events, where teachers give feedback on how their students felt about the VR and what the teachers thought about continuing to use the team’s educational products on a regular basis; and for training or demonstration events, where audience members provide feedback on how they felt about the VR experiences as well as using or encouraging the use of the VR products in their educational endeavors.

Other documents that I have provided for the team were created for reference purposes. I have compiled a list of updates that have been applied to the VR software over the course of the internship, issues that have been encountered with the team’s VR software and operation, and how those various issues can be resolved. Another document that I have provided has numerous notes about specific equipment operation and the varying problem-resolution processes for the different pieces of equipment. These notes also include answers to some questions that the team wanted addressed over the course of my internship, including: how quickly the equipment that is battery-powered can be recharged and discharge (to aid with preparation for events that may have limited power availability or set-up time), distances that the equipment can be apart from each other and continue to operate effectively, and the technological limits of efficient operation for the equipment (e.g. how many devices can play or update their VR videos at the same time). Finally, I created a generalized descriptive speech that explains the VR equipment and how the NASA VR app works, which can be referred to as events are planned and prepared for.

In order to increase the usefulness of these documents, I made several versions of them available to the team. They are available as Microsoft Word documents that can be emailed between members and as documents located on a
shared Google Drive (which can be moved to the shared Box account by the team members). These variations are included in order to further increase the documents’ availability to the team both on- and off-center.

III. VR Training Events and Demonstrations

Another aspect of this internship comprises the physical management of the equipment by traveling with the team and demonstrating the team’s VR app and videos at several events. The first event to which I traveled with the team was the National Council of NASA Space Grant Directors Spring Meeting in Crystal City, Virginia (near Washington, D.C.). The meeting was a conference for NASA Space Grants from across the country to gather and learn about upcoming educational avenues and products that they may be interested in incorporating into the school systems within their states. The team hosted a breakout session to present and discuss the team’s educational products, which included the NASA VR app. I facilitated a VR demonstration for this session, which included: planning the demonstration portion of the session, handing out the equipment, running the app and VR videos, resolving individual issues as they popped up, making sure the equipment was operated correctly and safely by the audience members, and packing the equipment away once the audience members were finished with the devices.

The next VR demonstrations that I facilitated were in Miami, Florida for the annual Miami-Dade College conference and a middle school visit. The conference invited professors and educators from across the Miami-Dade College campuses (which make up one of the largest colleges in the United States) to learn about STEM activities and opportunities that they can share with their students. I provided information and encouragement pertaining to NASA internships as a whole, using my own internship as an example, and I held two VR demonstrations for the professors to be able to have a preview of the team’s virtual tour videos and understand that these valuable resources would soon be available for the public. The other event that I helped lead was a VR demonstration for a robotics club at a middle school in Miami. The children in the club were deeply invested in learning more about STEM activities and opportunities, and the students as well as the accompanying teacher were inspired by the team’s VR products. As before, I prepared the equipment before the visit; I also handled the devices, ran the software, and addressed issues and questions during and after the event.

The final large-event to which I traveled with the team was the International Technology and Engineering Educators Association (ITEEA) Conference in Kansas City, Missouri. This annual conference allowed educators of all levels to learn more about STEM opportunities and resources that they could incorporate into their classroom curriculum. The team participated in the conference’s exhibit hall and managed a booth that was available to provide personal explanations pertaining to the team’s upcoming products and to host VR demonstrations for the event participants as they stopped by. As with the other events, I prepared the equipment beforehand, handled and distributed the devices during the event, addressed issues with the equipment and audience experiences as they came up, and packed and remained responsible for the equipment at the end of each day of the event.

In between these large events that required travel, I performed demonstrations of the VR app and videos across NASA KSC for the team. These demonstrations were for specific team members before events to ensure that they know how the equipment will work for the event as well as for various audiences that needed or wanted to experience the team’s VR package. A demonstration of note to which I contributed was a team product update for Mike Kincaid, Associate Administrator of NASA’s Office of STEM Engagement. He wanted to learn about and experience the team’s VR videos, and I had the opportunity to prepare and run the equipment for the meeting with him. Another important demonstration that I handled was for a monthly Staff Meeting for the Academic Engagement Division of the Communication and Public Engagement Directorate at NASA KSC. The people of this division, as well as members of the IT directorate who were interested in our VR efforts, were briefed on the team’s educational products and wanted to learn about the team’s VR package, and I was invited to present to the division about the package as well as provide an opportunity for the people to experience the virtual tours for themselves if they desired.

Overall, my personal contribution to the events that the team participated in pertained to the actual equipment used for the events. I managed and performed the pre-event preparation, and I ran the demonstrations of the VR app and equipment for the events and demonstrations that the team scheduled during this internship. Additionally, I provided explanation and clarification pertaining to the audience’s experience with the VR and the equipment whenever needed.

Over the course of this internship, several hundred people received information about and exposure to the team’s products and VR package from events like these. Participants from these events provided several ideas for future additions to the products and VR videos. For example, one proposed idea consisted of creating captions for the VR videos in other languages in order to expand the audience base for the products. For each of the aforementioned events, the audience members provided positive feedback and expressed excitement about learning more about the products from the team as more are created and released for public use, which led to a successful internship.
IV. Conclusion

For this internship session, I was specifically responsible for: scheduling the equipment’s use at events and demonstrations, both at KSC and abroad; traveling with the equipment for conferences and events to support the team’s presentations with VR equipment operation; performing demonstrations of the equipment and its educational advantages; providing documentation and feedback for the team to be able to operate and manage the VR equipment effectively in the future; and helping as needed with providing specific instructions pertaining to handling and utilizing the VR equipment (for the benefit of both the team and event audiences). In between events, I focused on organizing the software, equipment, and documentation for the team to utilize for future events and product demonstrations. Overall, I supported the team’s efforts in operating and managing their VR equipment as well as encouraging audiences across the country to consider the prospect of using the CCP VR videos in their future curriculum and educational endeavors.

Acknowledgments

B. R. Parsons thanks Denise Coleman for her support, guidance, and personal mentoring throughout the internship.

References