

**NASA Glenn Research Center
Great Lakes Science Center – NASA Visitor Center Education Program
Unsolicited Grant #NNX10AQ21A - PI: Blake Andres
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Period of performance – August 3, 2010 – September 30, 2011
Informal Education Lead/Project Manager/Technical Officer
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PROJECT DESCRIPTION

NASA's Education program works to: foster a science, technology, engineering, and mathematics (STEM) workforce in fields that support NASA's strategic goals; attract students to the disciplines through a progression of education opportunities; and build strategic partnerships between formal and informal education providers.

NASA Glenn Research Center (GRC) Educational Programs Office and the Great Lakes Science Center (GLSC) collaborate to provide relevant educational services and activities; included are valuable education teaching tools, an informational exhibit on past and future space exploration initiatives, participation and personnel support, and the ability to develop staff and update infrastructure/exhibits/materials that will address one or more of the NASA Education Outcomes and align with NASA Education principles and National education standards.

PROJECT GOALS

Glenn Research Center Educational Programs Office will work closely with the Great Lakes Science Center to support one another on numerous events and education content development which will align with the NASA Education Outcomes and with NASA Education principles, and state or national standards/needs.

PROJECT BENEFIT TO OUTCOME

Outcome 2: Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty.

Outcome 3: Build strategic partnerships and linkages with STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission.

PROJECT ACCOMPLISHMENTS

Visitor Center Ticketed Attendance Highlights

- . Total Attendance: 203,697
- . Groups: 45,419, which includes 37,914 youth
- . Free Youth: 28,808

Informal carts, public and school audiences:

Six different informal activities were rolled out last year which engaged visitors either from a cart or free-standing location. Activities including making stomp rockets, using a bicycle wheel gyroscope, vacuum pump, facilitated exploration of the Apollo command module, authentic space shuttle tile and

lunar soil simulant from Glenn Research Center. Over this period nearly 16,000 visitors were impacted by these programs.

Space demonstrations & workshops, public and school audiences:

Primarily presented from our Situation Room theater space, our space demonstrations highlighted how people and objects obey Newton's laws in weightlessness; workshops utilized our STARLAB planetarium. Overall, over 175 demonstrations were presented to over 10,300 visitors.

Teacher programs:

We hosted two teacher open houses last year, one in March that featured the NASA Visitor Center and our annual Evening for Educators in October, for which the Visitor Center was a new addition to GLSC since the 2009 Evening. Both events featured guest speakers from NASA Glenn's ERC; additionally, members of NASA Glenn's microgravity labs conducted teacher workshops at the October event. A total of 150 teachers were reached by these programs.

Space Week:

From July 19-25, GLSC hosted its first Space Week as the new home of the NASA Glenn Visitor Center. During the week, over 13,000 visitors came to GLSC with almost 40% attending one of our special programs. During this week, in addition to running all of our space programming, we also had NASA Glenn speakers or activities on four of the days.. We also offered the NASA photo booth and appearances by Eva. The highlight of Space Week was the appearance of astronaut Mike Foreman who spoke to around 200 people in our Auditorium and followed that by signing autographs.

Pathfinder Launch Abort System:

For six days in early October, the test model for the Orion LAS rocket was on display on our front lawn. Most, if not all, of our 2000 visitors during that period were able to see this artifact. Also, guest engineers from NASA and Lockheed spoke to visiting school groups and other visitors, as well as distributed program-related giveaways and pins.

USA Science and Engineering Weekend:

GLSC was a satellite site for this national event, where we presented our informal programs, space demonstrations and the NASA photo booth. Overall, we impacted close to 500 visitors.

Astronaut Mike Good:

A special appearance day with Mike Good on November 13th featured not only his mission briefing and autograph session, but a special screening of the IMAX film *Hubble*, which he appears in. Over 200 people watched Mike's talk in person, with another 100 watching our video feed in the Situation Room. He was able to meet 100 people in his tightly scheduled autograph session, then introduced and later took Q&A with 215 people at *Hubble*.

Summer Camps:

GLSC offered 8 hands-on science summer camps in 2010 for children in K-8 that focused on space, engineering, or technology, serving 313 children at our downtown location and 138 children at our Laurel School locations. Camp titles included:

- Amusement Park Science—Experiment with friction, inertia and momentum. Use design and engineering skills to create miniature models of your favorite rides. Enjoy a day gathering data and riding rides at Cedar Point Amusement Park.

- Astronomy: to Infinity and Beyond—Learn about stars, comets, meteors, black holes and more. Spend time in our STARLAB Portable Planetarium and learn how to navigate the summer sky. Take a field trip to NASA Glenn Research Center!
- Awesome Astronauts—Learn about the planets, sun and moon. Build and launch a rocket and train to become an astronaut! Plus explore the STARLAB Portable Planetarium!
- Extreme Engineering—Explore the exciting world of engineering by designing and making projects that solve real-world problems. Learn about extreme engineering projects, build a structure to survive the forces of nature and design a city of the future.
- Junior Engineer—What do engineers do? Explore various types of engineering, learn about the structure of bridges and buildings, illuminate a light bulb, design an airplane, and create your own city and more!
- Materials Science—Use the field of physics, chemistry and engineering to create polymers, explore thermodynamics and perform impact tests. Explore GLSC's traveling exhibition, *Strange Matter*. Enjoy a field trip to the Materials Park in Geauga County and tour local industries.
- Planet Patrol—How many moons does Jupiter have? What planet has the most extreme weather? Explore these and other questions as you learn about the eight planets in our solar system. View the night sky in our STARLAB Portable Planetarium. Take a field trip to NASA Glenn Research Center!
- Science Explorer—This session is one GIANT science experiment! You'll enjoy discovering the fields of engineering, chemistry, physics, astronomy, biology and more! Perform a variety of our favorite experiments and learn about the different branches of science.

GLSC offered a camp for girls to explore the topics of space, engineering, and technology.

- 33 girls in grades 2-5 participated in Girls Only: Science that Sparkles.

Great Lakes Science Center offered half-day preschool summer camps in 2010 to ignite a passion for life-long learning in children ages 3-4. We had 15 preschool children register for our Sun, Moon and Stars camp at GLSC.

- Sun, Moon and Stars—Explore the night sky and learn about planets, constellations, comets and more! Hear stories about the sky and experience our STARLAB Portable Planetarium!

Twenty local high school students participated in a week-long summer camps to explore VEX Robotics and Aerospace.

- VEX Robotics—Learn the basis of robotics and programming using the VEX Robotics Design System. Working in groups, students will design and build a robot using electric motors, gears, chains, sprockets and sensors. The robot will compete in a variety of challenges using a remote control and programmed microcontroller.
- Aerospace—Students will learn about the basic principles of flight and aerodynamics. Design, build and test a model aircraft in our wind tunnel exhibit! Students will enjoy a behind-the-scenes tour of NASA Glenn Research Center and explore microgravity through in-house experiments.

See individual Project Descriptions and accomplishments below.

PROBLEMS ENCOUNTERED

Problems encountered with the overall grant – The proposal was submitted late, followed by an incomplete grant package and cage code assignment, which delayed the awarding of the grant to August 2010.

PROJECT PARTNERS TECHNICAL POINT OF CONTACT INFORMATION AND ROLE OF PARTNERS IN PROJECT EXECUTION

- Blake Andres – Principal Investigator (andresb@glsc.org)
- Dante Centuori – Director of Creative Productions; directs the Visitor Experiences Department and oversees all education activities in the exhibit galleries and demonstration areas. Responsibilities include directing the development and implementation of Visitor Center program, including workshops, demonstrations and public programs for education groups and general visitors.

PROJECT DESCRIPTION/GOALS

Integration of Program with MC2STEM High School

Carolyn Hoover
Education Programs Office
Glenn Research Office

GLSC is the host site for the freshman class of Cleveland Metropolitan School District's **MC2STEM** High School, one of the district's new and innovative schools that focuses on a STEM curriculum. The school is also a partner with NASA Glenn, having embedded professionals from Glenn working with the 9th graders on their projects both at GLSC and at GRC. Having this school onsite together with the CMSD-GRC partnership gives us tremendous potential to enhance the experiences both for the Visitor Center and for Cleveland students. As they advance in their studies, we foresee returning Junior and Senior students collaborating with us to interact with the public and facilitate activities here at GLSC where they started as freshmen. The Visitor Center would provide a specific opportunity for MC²STEM High School students to not only present but also create activities.

PROJECT ACCOMPLISHMENTS

MC2 STEM High School Tours of NASA Glenn

Student groups of approximately 50 students from MC2 STEM High School will visit NASA Glenn on two separate days. Tours will focus on the students' capstone study of communication. The afternoon workshop, facilitated by NASA Glenn's Aerospace Education Specialist, will engage students in a NASA education lesson supporting the communications theme. This is a full-day event for the students.

MC2 STEM High School Job Shadowing

Seven MC2 STEM High School students shadowed NASA Glenn employees for 1.5 hours during the morning of December 9, 2010. Students left the Center impressed with what they had seen and heard, and noted that they would like to return for a visit on another date.

PROJECT DESCRIPTION

ISS Downlinks
Carolyn Hoover
Education Programs Office
Glenn Research Center

GLSC worked with NASA GRC and its Education group to secure a live downlink opportunity during Expedition 25/26 to the ISS. Although only the students in the theater with the live downlink will have an opportunity to communicate with the crew, we will send the video out to overflow areas and possibly over video conferencing to allow passive participation by a broader range of schools.

PROJECT ACCOMPLISHMENTS

The Educational Programs Office at NASA Glenn and Cleveland's Great Lakes Science Center (GLSC) partnered to host an ISS Expedition 26 Downlink featuring Station Commander Scott Kelly and flight engineers Catherine Coleman and Paolo Nespoli (Italy). Students from the greater Cleveland area were invited to submit questions to be asked of the astronauts during the live 20-minute question and answer session with astronauts. James Free, Deputy Center Director of NASA Glenn, moderated the question and answer session to be broadcast on various screens throughout the Science Center. The downlink was held on December 28 - one of the GLSC "free" Tuesdays.

Special student guests in attendance: 6 SEMMA Scholars and Lori Scott (Director) from the SEMMA site at Cuyahoga Community College, and 20 students and Dessie Sanders (teacher) from Michael R. White Elementary School in Cleveland.

**NASA Foundations of Influence, Relationships, Success and Teamwork (FIRST) Museum
Rocketry Kit**

Administered by NASA FIRST & Cleveland Natural History Museum
Type of Agreement: Purchase Order
Education Programs Office
Glenn Research Center

Project Description:

The NASA FIRST Developmental Program has partnered with the Educational Programs Office and the Cleveland Natural History Museum to develop a thematic teaching kit on Rocketry that will include a guide for teachers, children's books and a variety of models, reference materials, games, videos and more. Each kit meets a variety of National Education Standards. Initially ten kits will be developed for distribution to NASA Education partners.

Project Goals:

Equip educators with context-rich resources to support curricular needs and STEM standards; used to inspire student interest in STEM disciplines and careers. The percentage of the educators who use these resources is an important measure of their utility, effectiveness, and relevance.

Project Benefit To Outcome:

Outcome 2: Percentage of elementary and secondary educators who obtain NASA content-based education resources or participate in short-duration education activities and use NASA resources in their classroom instruction.

Project Partners:

Cleveland Natural History Museum

Project Accomplishments:

The FIRST team created a Rocketry Kit that was presented to the members of the GRC Directors Leadership Team. FIRST team members will work with the Informal Project Manager to disseminate kits to museums, libraries, and the Informal community. The GLSC has already committed to receiving one kit.

Educator Resource Center Labor/Travel/Professional Development Conference

Contract with Paragon TEC Inc.,
Project Manager: Monica Boyd, Paragon TEC
Education Programs Office
Glenn Research Center

Project Description:

This cross-cutting element will provide contractor support to oversee the implementation of each activity proposed and be responsible for ensuring evaluation data is planned/collected and aggregated. Work will be done under the direction of the GRC Education Programs Office. Additionally, this item will support the continued development of GLSC and ERC staff in the K-12 and informal 6-state service region. In order for our local workshops to have accurate information and for our staff to update content for our support materials, we feel it absolutely necessary to provide our staff with appropriate professional development experiences. By enhancing their knowledge, the content they deliver will be of even greater value to our workshop attendees. This will include attendance at National conferences.

Project Goals:

Result in deeper content understanding and confidence in teaching STEM disciplines. The percentage of the educators who use these resources is an important measure of their utility, effectiveness, and relevance

Project Benefit To Outcome:

Outcome 2: Percentage of elementary and secondary educators who obtain NASA content-based education resources or participate in short-duration education activities and use NASA resources in their classroom instruction.

Project Accomplishments:

- The Science Central Educator Resource Center hosted two workshops for 34 pre-service educators, who learned about NASA resource materials, including the NASA Central Operation of Resources for Educators (CORE), and how to access them; they were also given a tour of the Educator Resource Center.
- The Educator Resource Center at the University of Cincinnati hosted a workshop for six pre-service math and science educators. The workshop was entitled "Computer Tools for Education." They learned about finding teaching materials from the NASA portal along with the teacher guides, multimedia resources and other NASA resources.
- Central Michigan University's Educator Resource Center (ERC) Starlab presenters utilized a portable planetarium to provide programs to 258 pre-K – 12th grade students. Topics included

constellations, the solar system, celestial motion, moon phases, and characteristics of the Sun and Earth. The presenters also provided to 169 1st and 2nd graders programs on the constellations, the sun, the Underground Railroad and celestial motion.

- Northern Michigan University, Seaborg Center's Educator Resource Center, hosted a Science Learning Team meeting for 22 educators. They learned about the ERC and the services that are available to them and received NASA resource materials.
- The Educator Resource Center (ERC) at Glenn Research Center (GRC) hosted a telecon for 8 participants representing the ERC's within Glenn's six-state region. This telecon provided a means for the regional representatives to remotely get together to verbally interact with one another and to find out what each is doing at their respective ERC's. Topics discussed included changes to the lunar/meteorite sample loan program, the importance of providing updates for inclusion in the Weekly Activity Report (WAR) providing workshops to give educators a better understanding of NASA's educational resources and how to obtain them, the importance of educators completing the online surveys at the conclusion of a workshop or activity, and other NASA-related items of importance.
- The Educator Resource Center (ERC) at Central Michigan continues to plan for their upcoming Space Science Camp Workshop for 4th and 5th grade teachers. The goal is to improve delivery of Michigan Grade Level Content Expectations (GLCE's) to 4th (Earth in Space and Time) and 5th (Earth Systems & Earth in Space and Time) grade students. They will also learn how to deepen student understanding of key space science concepts and recent NASA space exploration activities. The College of Education Criminal Justice and Human Services (CECH) Library of the University of Cincinnati hosted an orientation workshop to five pre-service educators studying secondary mathematics and one mathematics faculty member. The participants learned about NASA resources that are available at the Educator Resource Center (ERC), how to obtain them, and how to access these resources online. In addition they learned about the NASA Central Operations of Resources for Educators (CORE).

The CECH also provided and staffed a NASA Educator Resource Center (ERC) booth at the Sixth Annual Southwest Ohio District Science and Engineering Expo (SEE). There were 390 science fair participants and about 1,500 students, parents, teachers, and community observers at the SEE event, all of whom had an opportunity to visit the NASA website, see NASA resources, and take away resource materials. The keynote speaker for the event was a NASA engineer from the Jet Propulsion Laboratory (JPL), who stopped by the booth and provided insight into some of the lithographs and educational materials on display.

- North Michigan University's Seaborg Center hosted a Mathematics Learning Team Workshop for nine K – 12 educators. Through SKYPE technology, a Glenn Aerospace Education Specialist provided the teachers with content information about the Moon and conducted a hands-on activity relating to measuring the moon. Science Central participated in the Hubble 3D opening, which was attended by 225 educators. The Educator Resource Center (ERC) talked with the educators about the services provided by the ERC, how to obtain resource materials, and how to access them online. Various resource materials were distributed.
- Science Central also hosted an educator workshop in which a Glenn Aerospace Education specialist provided 20 educators with hands-on activities and inquiry-based lessons relating to the moon and meteorites. At the conclusion of the workshop, the participants were certified to participate in the lunar/meteorite sample loan program.

- The Central Michigan Educator Resource Center (ERC) is in the planning stages to offer a week-long professional development workshop this summer entitled NASA Space Camp. Using NASA resources, the workshop goal is to increase teacher's knowledge and to offer them new teaching strategies to teach the Michigan Grade Level Content Expectations for grades 4 – 5 related to space. Central Michigan is part of the regional network of the Educator Resource Center field office at Glenn Research Center in Cleveland, Ohio.
- The Educator Resource Center (ERC) at Glenn Research Center (GRC) hosted an educator workshop at which an Aerospace Education Specialist (AES) provided 15 pre-service educators with hands-on-activities and inquiry-based lessons relating to the Apollo program and robotic moon missions. At the conclusion of the workshop, the participants were certified to participate in the lunar/meteorite sample loan program.
- The Northern Michigan University Seaborg Center planetarium specialist, who is also a NASA Ambassador, provided portable planetarium presentations to 210 fifth grade students and their teachers. Students were exposed to NASA- related educational activities to enhance their interest in the STEM disciplines.
- On June 14 - 15, 2010, the Educator Resource Center (ERC) at Glenn hosted a 2-day conference for its six regional ERC sites. There were 13 participants. The conference provided the regional centers an opportunity to get together and share ideas and information. Participants learned about various NASA education programs; received updates on the Educator Resource Center Network (ERCN); Summer of Innovation (SOI); and participated in a hands-on activity relating to robotics. On both days during the afternoon session, the participants received a tour of Glenn, Plumbrook Station, and the new NASA Glenn Visitor Center at the Great Lakes Science Center. ERC point of contacts who were unable to attend the conference could participate during the morning presentations via telecon. The highlight of the conference was Mr. Michael Foreman, Chief of the External Programs Division, welcoming the participants and speaking about his experiences as an astronaut.

At the conclusion of the conference, the regional point of contacts could utilize what they learned at their own ERC location when interacting with educators in their workshops, programs, and other educational activities. Most of the participants rated the conference a one or two with one being strongly agree. The majority strongly agreed that the tours and presentations were extremely informative; the robotics hands-on activity was very useful at their sites; the conference was well organized and planned; and that they would attend future ERCN conferences.

- On July 6, 2010, the Educator Resource Center (ERC) at Science Central in Indiana hosted two workshops for 35 pre-service educators. The ERC Coordinator gave a presentation about the Educator Resource Center and the services it provides. Participants were given an on-line tour of how to access NASA resources and were shown various educational websites. All participants received various curriculum-based resource materials to use in their future classrooms.
- On August 14, 2010, the ERC at Science Central in Fort Wayne Indiana supported three educator events which featured the following NASA items: the Robotics Activity Kit, NASA folders, NASA Online Workshops, Glider Kit, and Space Book & Hubble. Approximately 123 educators were engaged in NASA activities.
- On August 31, 2010, the Educator Resource Center (ERC) at Science Central in Indiana reached 51 pre-service educators. The ERC Coordinator gave a presentation about the Educator Resource Center and the services it provides. Participants were given an on-line tour of how to

access NASA resources and were shown various educational websites. All participants received various curriculum based resource materials to use in their future classrooms.

- The Educator Resource Center (ERC) at Glenn provided support to a local school event in Pekin, Illinois. The school will be renamed in honor of Astronaut Scott Altman, who will visit on September 10 and attend a dedication ceremony on September 11. The ERC supported this event by providing a variety of resource materials for inclusion in commemorative bags for distribution to the school's 200 students.
- On September 11, 2010, the Regional ERC at the University of Cincinnati supported ScopeOut 2010, an all day/all night open house that celebrated the telescope. The event was sponsored by the Cincinnati Observatory Center. The ERC manned a booth and passed out NASA resource materials to educators in attendance including posters, lithographs, bookmarks, teacher guides and other types of resource materials.
- On September 13, 2010, the Regional ERC provided support at the STEM Innovation Initiative Conference that was sponsored by the Southwest Ohio STEM Education Hub of Ohio Stem Learning Network (OSLN). The regional ERC Coordinator, along with an Aerospace Education Specialist (AES) -who participated via SKYPE - co-taught a one hour breakout session in which 27 pre-K in-service educators were in attendance. The participants were introduced to the Educator Resource Center and wide variety of resources that are available at their fingertips by way of the NASA portal and in print.
- On September 27, the Educator Resource Center (ERC) Coordinator at Glenn provided support at a NASA Glenn Research Center Educator Workshop and Professional Development Rollout Event sponsored by the Microgravity Educational Outreach Team. Participants were introduced to the ERC and the services it provides. They were given an on-line tour of how to access NASA resources and were shown various NASA educational websites. By utilizing the websites, these educators can enhance their lessons as well as engage their students in the STEM disciplines. The workshop also included a tour of the Zero Gravity Research Facility and presentations describing the educational programs available to both teachers and students. All participants received a packet of resource materials to use in their classrooms.

Minority STEM Forum

Administered by: NASA Glenn Research Center and Kennedy Space Center
Project Manager: Darlene Walker, NASA and Stephanie Brown-Houston, NASA
Education Programs Office
Glenn Research Center

Project Description:

The Tom Joyner Morning Show hosted a national "Back to School Event". GRC partnered at two local events that coincided with the national "Back to School Event". They engaged participants in activities and provided them with resources and information to kick off the school year in the right direction.

Project Goals:

Underrepresented youths will gain a better understanding and appreciation of NASA's educational programs and information on how to become involved in NASA's STEM pipeline. This will be done through hands-on, family friendly activities.

Project Benefit To Outcome (1, 2, or 3):

Outcome 2.0: Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty.

Project Accomplishments:

The Allstate® Tom Joyner Family Reunion celebrated the culture of African Americans reaching 10,000 attendees from many different areas of the county. NASA GRC participated with educational activities for parents and students and brought awareness to the community about the Agency as a whole.

NASA Glenn Research Center, in collaboration with the Tom Joyner Morning Show (TJMS), assisted in supplying Media Reach, affiliate of the TJMS, with materials to hand out to students and provide NASA educational information for two sites (Akron and Cincinnati) and book bags for the 6 NASA sites that participated in the Back-to-School event. Educational exhibits were also used for this event. This event exposed approximately 5,000 individuals to the various NASA educational opportunities for students, teachers and educators, in hope that NASA will be able to attract individuals for the programs and make the public aware of science, technology, engineering, and math related subjects.
