

South Carolina Space Grant Consortium
College of Charleston
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PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The South Carolina Space Grant Consortium (SCSGC) is a Capability Enhancement Consortium funded at a level of \$430,000 for fiscal year 2012.

PROGRAM GOALS

*All goals and objectives for the individual programs support the South Carolina Space Grant Consortium (hereafter SCSGC) strategic plan, created in April 2008, and submitted with our budget package.

Vision

The vision of the SCSGC is to expand opportunities for all South Carolinians through education, research, and public service in NASA-related science, technology, engineering and math (STEM) disciplines.

Mission

The SCSGC exists to implement the National Space Grant Act of 1988 in South Carolina. Within the larger context of national science and technology initiatives, we promote activity in research, education, and public service related to the NASA mission.

Values

The SCSGC is committed to helping students and faculty excel in NASA STEM-related research and to promoting and expanding STEM education and outreach projects across the state of South Carolina. We specifically seek to include underrepresented groups in all of the programs and activities supported by the SCSGC.

Consortium Goals

Six goals provide the nexus of our SCSGC mission statement. Each of our research, education, and public outreach programs fulfill one or more of the goals listed below.

GOAL 1. To increase access, understanding, development, and utilization of resources in four primary areas: Science, Aeronautics, Human Exploration and Operations, and Space Technology

GOAL 2. To encourage cooperative programs among colleges and universities, state organizations, business and industry, and pre-college interests

GOAL 3. To enhance interdisciplinary research, education and public service activities

GOAL 4. To recruit and train students, educators, and professionals, especially women and underrepresented groups

GOAL 5. To promote a strong science, mathematics, engineering and technology base throughout all levels of South Carolina education

GOAL 6. To facilitate statewide communication of NASA opportunities and programs

To address each of these goals, the SCSGC provides specific, measurable, attainable, realistic, and timely (SMART) objectives with key indicators of success.

I. Consortium Management

GOAL 2: To encourage cooperative programs among colleges and universities, state organizations, business and industry, and pre-college interests.

GOAL 6: To facilitate statewide communication of NASA opportunities and programs.

Objective I.1: (Reporting) The Management Team will provide timely reporting and responses to NASA Headquarters regarding Consortium operations and finances.

Outcome Indicator: All reports will be submitted on time and in accordance with NASA guidelines.

Objective I.2: (National Network) The Management Team will work to strengthen relationships with NASA Centers, the national Space Grant network, and the state's NASA EPSCoR Program.

Outcome Indicators: Each year at least three students will participate in an internship program at a NASA Center and all faculty research projects are required to have a strong relationship with NASA scientists at one of the NASA Centers. The SCSGC Director and/or Program Manager will be present at biannual national Space Grant meetings. The SCSGC Director and Program Manager also serve as the Director and Program Manager for the SC NASA EPSCoR Program.

Objective I.3: (Consortium Network) The Management Team will faithfully represent the diverse interest and resources of the Consortium member institutions and affiliates.

Outcome Indicators: The roles and responsibilities of Consortium Management, member institutions, and all categories of affiliate organizations were established with the inception of the SCSGC and were updated in 2004 and again in 2006 and 2011. Relevant electronic communication is sent to all member institutions, affiliates, and interested parties, as appropriate.

Objective I.4: (State government) The Management Team will ensure that Consortium programs are aligned with state and federal priorities.

Outcome Indicators: Members of the Management Team provide annual reports to representatives of state and federal government on Consortium activities.

Objective I.5: (State industry) The Management Team will foster interaction between the Consortium and state industries involved in aerospace, earth and space science and related technologies.

Outcome indicator: Facilitate at least one student or faculty project with an industry partner in South Carolina.

Objective I.6: (Link to public) The Management Team will seek to maintain and improve the effectiveness of the Consortium as the link between the public and NASA in the state.

Outcome indicator: Consortium website is updated on a weekly basis to reflect new opportunities within and/or related to NASA.

Objective I.7: (Increase resources) The Management Team will pursue opportunities to increase the resources available to the Consortium, to broaden participation within the state, to collaborate with other state Consortia in areas of mutual interest and capability, and to assure long-term sustainability.

Outcome indicator: SCSGC serves as a clearinghouse for information on funding and research opportunities from NASA and other agencies that support STEM-related research and education, especially in areas of aerospace and earth and space science. All targeted announcements of opportunity released from NASA will be disseminated through electronic communication and the SCSGC website each year. The Management Team will coordinate submission of proposals to NASA and other agencies on projects in STEM research and education. Encourage collaborative proposals each year to NASA or other agencies.

Objective I.8: (Diversity) The Management Team will ensure diversity in all Consortium programs and activities by seeking to include women, underrepresented minorities, and persons with disabilities.

Outcome indicator: Diversity will be ensured in all aspects of the Consortium and participation by underrepresented groups will increase. NASA content or other STEM educational opportunities for faculty and students are expanded within the state.

Objective I.9: (Evaluation) The Management Team will continually monitor and seek to improve the quality and effectiveness of the SCSGC program.

Outcome indicator: In consultation with the Campus Directors, the Management Team will continue to determine appropriate data collection and evaluation procedures that are consistent with available resources. The Consortium website was redesigned in 2011 so that evaluation data could be collected through online surveys and compiled for analysis by the Management Team.

II. Fellowship/Scholarship Program

GOAL 4: To recruit and train students, educators, and professionals, especially women and underrepresented groups.

Objective II.1: (Competitiveness) Ensure the fair distribution of funds to member universities and educational affiliates.

Outcome indicator: SCSGC will forward NASA's Annual Call for Fellowship/Scholarship applications to all higher education members and affiliates, and hold a competitive peer-review of submitted proposals for selection of awardees. Awards will reflect the diversity of the Consortium's membership and statewide balance.

Objective II.2: (NASA Center ties) SCSGC will offer hands-on, tangible research experiences to student research fellowship awardees at NASA Centers.

Outcome indicators: SCSGC will maintain or increase the number of SC students involved with NASA Center Internships; however this is based annually on the SCSGC budget from NASA. 100% will make a presentation at the SC Academy of Sciences (SCAS) meeting or at a national meeting. 100% will provide feedback to their Campus Director and make campus presentations.

Objective II.3: (Industry ties) SCSGC will offer hands-on, tangible research experiences to student research fellowship awardees at aerospace and related science and technology industries.

Outcome indicator: At least one student will receive supplemental funding through SCSGC each year.

Objective II.4: (Mentoring and professional development) SCSGC will provide mentoring and professional development experiences to student researchers, which will develop skills that contribute to the future STEM workforce.

Outcome indicator: 100% of awardees graduate from college; 100% make a presentation at the SC Academy of Science or at a National meeting within a year of receiving the award; 80% produce a paper or abstract with their mentors within a year of receiving the award; and 50% continue on to graduate school and pursue a NASA-related discipline.

Objective II.5: (Diversity) SCSGC will ensure funding for fellowships and scholarships to women, underrepresented minorities, and persons with disabilities through intensive marketing techniques (e.g., personal visits, direct faculty contacts, email) to encourage women and minority students to apply for funding.

Outcome indicator: Awards to women and minorities will equal or exceed previous year applicants. At least 15 student awards will be awarded annually within underrepresented groups.

Objective II.6: (Longitudinal tracking) All students who have received significant fellowship or scholarship assistance from SCSGC will be longitudinally tracked through first employment or beginning of advanced degrees.

Outcome indicator: Continue arrangements with National Space Grant Foundation to include SCSGC in the longitudinal tracking system so that students funded can continue to be tracked in subsequent years at least through first-employment.

Objective II.7: (Evaluation) The SCSGC will develop methods to document, measure, and assess the impact of the fellowship and scholarship programs in conjunction with its implementation of an overall evaluation strategy (see Obj. I.9).

Outcome indicator: Adjustments are made to the SCSGC fellowship and scholarship program to strengthen activities that are working and drop or improve activities that are not having the intended impact.

III. Research Infrastructure

GOAL 3: To enhance interdisciplinary research, education and public service activities; to encourage cooperative programs among colleges and universities, state organizations, business and industry, and pre-college interests

Objective III.1: (Research proposals) Increase the number of research proposals submitted by SCSGC institutions in fields aligned with NASA's mission and vision.

Outcome indicator: At least eight research awards are distributed among appropriate SCSGC institutions each year. 100% of the REAP recipients submit proposals to NASA or another federal agency within two years. 50% of the REAP recipients submit new proposals which are funded within two years. 100% of the REAP recipients give presentations and submit papers within a year after the end of the grant. 80% of the presentations and papers include students

Objective III.2: (Research support) Support new and developing research, especially multidisciplinary and collaborative projects, in fields aligned with NASA's mission and vision.

Outcome indicator: 50% submit proposals for a SCSGC REAP Research Grant or similar program. 100% of the REAP recipients develop presentations and papers within two years. 80% of the presentations and papers include students.

Objective III.3: (Collaborations) Build research collaborations both within and outside the state.

Outcome indicator: SCSGC will support at least one planning trip to a NASA Center each year from SCSGC. Submit REAP Research Grant proposal within two years of the travel/planning award.

Objective III.4: (Diversity) Increase the participation of women and underrepresented groups in statewide research programs and facilitate their subsequent entry into STEM careers.

Outcome indicator: SCSGC will sponsor activities that encourage women and students from underrepresented groups to enter STEM careers.

Objective III.5: (Evaluation) The Consortium will develop methods to document, measure, and assess the overall impact of the research infrastructure programs including implementation of an overall evaluation strategy (see Obj. I.9).

Outcome indicator: Adjustments will be made to the research infrastructure program to strengthen activities that are working and drop or improve activities that do not have the intended impact.

IV. Higher Education

GOAL 1: To increase access, understanding, development, and utilization of resources in four areas: science, aeronautics, human exploration and space technology; to enhance interdisciplinary research, education and public service activities.

Objective IV.1: (Curriculum and NASA content) Contribute aerospace and space and earth science materials to the higher education community in South Carolina.

Outcome indicator: SCSGC will distribute announcements of opportunities for education and curriculum enhancement in NASA-related fields to faculty at member institutions.

Objective IV.2: (Student Research) Provide research opportunities where students gain hands-on knowledge of scientific methods and processes, gain understanding of the importance of teamwork and experience the exhilarating feeling of discovery. Spark student interest in continuing NASA-relevant research in graduate school and/or to enter the STEM workforce by working on NASA-related endeavors.

Outcome indicator: 100% of the participants are exposed to current NASA research and 100% make presentations about their research experience at SC Academy of Science or a national meeting within one year of award.

Objective IV.3: (Industry involvement) Establish and maintain linkages between SCSGC, higher education and industry in South Carolina by encouraging educational partnerships between the state's academic institutions and private industry.

Outcome indicator: At least two collaborative proposals will be funded, promoting partnerships between industry and academic affiliates in South Carolina.

Objective IV.4: (Diversity) Increase the participation of women and underrepresented groups in all aspects of SCSGC's higher education program.

Outcome indicator: SCSGC will sponsor activities that encourage women and students from underrepresented groups to enter STEM careers.

Objective IV.5: (Evaluation) The Consortium will develop methods to document, measure, and assess the impact of the higher education programs in conjunction with its implementation of an overall evaluation strategy (see Obj. I.9).

Outcome indicator: Adjustments will be made to the higher education program to strengthen activities that are working and drop or improve activities that do not have the intended impact.

V. K-12 (Precollege) Education/Public Service

Goal 5: To promote a strong science, mathematics and technology base throughout all levels of South Carolina education.

Objective V.1: (NASA dissemination) Contribute aerospace and space and earth science materials to the formal and informal education communities in South Carolina.

Outcome indicator: SCSGC will distribute announcements of opportunities for education and curriculum enhancement in NASA-related fields to formal and informal educators across the state; Maintain and update the SCSGC website to provide opportunities and information to formal and informal education groups as well as the general public.

Objective V.2: (Pre-service Educators) SCSGC will increase the number of quality educators pursuing STEM education degrees.

Outcome indicator: SCSGC pre-Service awardees will be tracked to see how many complete their degree programs and become science and math teachers in SC. At least two awardees will pursue a career teaching STEM fields. SCSGC will also query their use of NASA educational materials in the classrooms.

Objective V.3: (Science and education events) The SCSGC will support activities of scientific discovery across the state and will support NASA's commitment to renewing a spirit of exploration and discovery and will use the excitement of space exploration to promote this policy to the general public.

Outcome indicator: SCSGC staff will develop and host opportunities to promote NASA throughout the state of South Carolina. In 2012, the SCSGC will host several statewide events to celebrate Space Grant's 25th anniversary and will host educator workshops and a few talks promoting use of NASA data and current results from NASA's missions.

Objective V.4: (Diversity) Increase the participation of women and underrepresented groups in all aspects of SCSGC's pre-college/general public program.

Outcome indicator: SCSGC will sponsor activities that encourage women and students from underrepresented groups to enter STEM careers.

Objective V.5: (Evaluation) SCSGC will develop methods to document, measure, and assess the impact of the pre-college/public service programs in conjunction with its implementation of an overall evaluation strategy (see Obj. I.9).

Outcome indicator: Adjustments will be made to the pre-college/public service program to strengthen activities that are working and drop or improve activities that do not have the intended impact.

PROGRAM/PROJECT BENEFIT TO OUTCOMES (1, 2, OR 3)

All Year-20 (2012-13) SCSGC projects are still on-going with the exception of the Palmetto Research Academy and NASA Summer 2012 Internships. Below are several anecdotes related to projects completed and reported in 2012.

Outcome 1: Employ and Educate – SCSGC will contribute to the development of the STEM workforce in disciplines needed to achieve NASA’s strategic goals

One of NASA strategies is **“Inspiring students to be our future scientists, engineers, explorers, and educators through interactions with NASA’s people, missions, research, and facilities”** (2011 NASA strategic Plan). SCSGC implements this strategy, fulfilling NASA’s plan by attracting and retaining faculty-mentored students in STEM disciplines. By including students in SCSGC projects, the program “...provides opportunities to participate in [the NASA] Mission, foster innovation, and contribute to a strong national economy,” (Strategic Goal 6) thereby improving retention of [those] students in STEM disciplines (Outcome 6.1).

The SC Space Grant directly addresses all of the objectives from Outcome 1 through faculty (Objective 1.1, 1.4, and 1.5) and student (Objective 1.2 and 1.3) awards. In 2012, we funded 6 faculty for research support and infrastructure, and 3 faculty for curriculum development. In addition, we funded 7 graduate students, 7 undergraduate students, and 6 NASA internships. The Palmetto Research Academy funded 10 faculty mentors and 20 students, 2 of whom were from technical colleges. The programs help educate students in NASA content and skill sets, for future STEM employment. One graduate stated...

“I have been introduced to a much wider field of study through the use of NASA tools and data,”
(M. Adams, CofC)

and another...

“The Space grant helped me in my education and life in several ways. In relation to my education the space grant allowed me to have the very valuable experience as an undergraduate student to do research. This experience helped me to develop the research skills that have proven to be very valuable as a graduate student. Aside from education, being a space grant recipient has gained me much attention from young aspiring scientists within many of the public schools in my community. It feels great knowing that you have younger kids saying that they would like to do research just like me. By giving talks and being a role model to younger children I believe the space grant program has allowed me to pay it forward by helping to lift others as I climb life’s ‘ladder’”

(A. Anderson, Clemson University).

Also, see representative ‘Ladder of Success’ stories below:

- **Missy Gaddy**, a junior in Applied Mathematics and Computer Science at Wofford College, Spartanburg, South Carolina, was an intern at the Goddard Space Flight Center in Greenbelt, Maryland (Summer 2012) where she restored and analyzed data from an Apollo 17 experiment. In addition, Missy was an intern with Vigilix, LLC in Greenville, South Carolina (Academic Year, 2012). Missy received a second-place award for her NASA research presentation at the Southeast Consortium for Computing Sciences Conference's (CCSC-SE). Besides presenting a poster and giving a talk at the CCSC-SE,

Missy was a member of a four-person team that won their Programming Contest, which had twenty-nine college and university teams competing. The group solved all eight problems an hour before the contest was complete! These results reflect the problem-solving abilities, coding skills, hard work, determination, and teamwork skills of Missy and the other students. She also presented her research at the Nebraska Conference for Undergraduate Women in Mathematics, January 2013. Missy intends to pursue a career in Database Administration.

- **Ryan Boodee**, a graduate student in Physics and Astronomy at The Citadel, Charleston, SC, was accepted into the Palmetto Research Academy in his junior year (Summer 2012). He worked on a project to design and modify a camera for the Atsa (the Navajo word for Eagle) suborbital laboratory, developed on the XCOR Aerospace's Lynx spacecraft. Through this project, he developed the skills and confidence to apply to a NASA internship, the NASA Academy at Ames Research Center. While at Ames, he worked with the Center Director, Dr. Pete Worden, to investigate the potential for using lava tubes as habitats for our astronauts. He graduated and has applied for the Robotics Academy at Marshall Space Flight Center for Summer 2013. We recently received confirmation of his acceptance into this program. Ryan was also asked to serve as the Operations Manager for the NASA Academy at Ames. His opportunities have increased through his space grant relationship. Truly, Ryan is moving up the STEM ladder, and is helping to feed the STEM pipeline!

"It [NASA internship experience] helped continue to fuel my interest in the field of astronomy and physics research. It refocused my career interests on space and made it possible for me to receive a NASA Academy internship" (R. Boodee - on 11/20/12, 2011 High Altitude Ballooning Program, 2011 Palmetto Academy, 2012 NASA Center Internship Award, NASA Ames Research Center - Research Associate)

- **Laura Stevens**, an undergraduate student in Physics and Astronomy at the College of Charleston, Charleston, SC received an undergraduate award to work with her mentor, Dr. Joe Carson (who also received a research facilitation award), analyzing images for extra-solar planets. In Fall 2012, Laura and her classmate identified a new extra-solar planet! She presented her discovery to an international audience at the 2012 Division of Planetary Sciences annual conference. To put her discovery in perspective, of the nearly 850 extra-solar planets – planets orbiting stars other than the Sun –known-to-date, only a minute fraction have been captured in actual astronomical images.

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

In 2012, three pre-service teacher fellowships were awarded. The pre-service teacher applicants developed curriculum components focused on NASA-related themes directly addressing *Outcome 2, Objective 2.3 – Curricular Support Resources.*

- **Brandon Hunter**, a junior Special Education major, with a Geology minor, at the College of Charleston, Charleston, SC, prepared a lesson plan where students use

inquiry-based and hands-on strategies to understand the impacts of climate change in the southeastern United States. Brandon's lesson plan includes NASA-collected images, maps and information on wildfires and droughts. Students develop skills in collecting and analyzing data, gain an understanding of the "what" and "why" of climate change, and see the relationships and connections between drought, wildfires and climate change.

Brandon, an underrepresented minority student himself, is determined to engage and inspire other students from underrepresented communities, including students with disabilities, in STEM to help feed the pipeline.

"Receiving these NASA space grant awards, as a science special education teacher, showed how important getting students with disabilities interested in science and math is to NASA. It's encouraging! These awards have helped me develop rich content driven lessons that I can use in my classroom." (B. Hunter, College of Charleston)

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

SC is partnering with NC, GA and VA through the National Space Grant network, to host a workshop for NASA personnel and formal and informal educators of students with disabilities, who work with and/or are developing projects for people with disabilities. The purpose of the workshop is to provide the educators with exciting new NASA-related resources and experience using them, and to provide recommendations for modifications/adaptations for accessibility and future design to NASA personnel. By raising awareness of NASA products and ensuring their accessibility by all learners, NASA and the space grant network broadens its reach to diverse audiences.

SCSGC PROGRAM ACCOMPLISHMENTS

All of our programs are currently in progress and are scheduled to end on June 25, 2013 with the exception of the NASA 2012 Internships and the Palmetto Research Academy. Our entire research infrastructure and some of our higher education projects have received one-year no-cost extensions to complete their projects.

The SCSGC annual goals and objectives address NASA Education Outcomes 1, 2 and 3:

- **Outcome 1:** *Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals:*
Fellowship and Scholarship (F/S), Research Infrastructure (RI-our program REAP) and Higher Education
 - Percentage of students who have taken the next step and have been successfully tracked though their next step vs. last year of SG support.
 - 67% for 2006
 - 88% for 2007
 - 88% for 2008
 - 93% for 2009
 - 92% for 2010

- 100% for 2011
 - 100% for 2012
 - 87% for 2006-2012
- 98% of students significantly supported by SCSGC continued on in STEM disciplines
 - 34 students took the next step in FY12 (SG participation supported from FY06-FY12 funds)
 - 13 are pursuing advanced degrees in STEM disciplines
 - 1 accepted a STEM position as a NASA contractor
 - 14 accepted STEM positions in industry
 - 5 accepted STEM positions in academia
 - 1 went on to a position in a non-STEM discipline, using skills learned through his SCSGC funded experience

Fellowships and Scholarships – In Year 20 (2012/13), SCSGC funded 7 graduate students, 1 Kathy Sullivan Scholarship (undergraduate) award, 6 undergraduate research awards, and 6 NASA Center internships. We also funded 3 Pre-Service Teacher awards (discussed below under “precollege”).

Research Infrastructure - We funded 10 REAP faculty projects, for a total of \$105,988. All projects are currently underway and we have received interim reports on their progress. These projects involve 25 participants, ranging from collaborators to undergraduate students, including 3 female student participants and 1 African American male student.

Higher Education – We funded 10 faculty Palmetto Research Academy projects at 6 different institutions across the state. 20 students participated from 7 different institutions, including two technical colleges. Projects ranged from earth science, biomedical science, bioengineering, chemistry, materials science, and physics and astronomy. 5 of the students were included in their mentors’ research publications; 1 patent was awarded; and 4 open source physics programs were developed. All of the PRA students and several faculty visited NASA Langley Research Center, hearing from scientists and engineers as well as participating in laboratory tours. The students interacted with NASA interns through the Langley Aerospace Research Student Scholars and the DEVELOP programs. One of the students wrote after attending, *“The program has given me a greater appreciation for NASA and the work they do. It made me realize that a lot of everyday technology is something NASA has been using for some time period”* (J. Bunch, University of SC).

2012 Palmetto Research Academy (PRA) awardees include:

- Dr. Adem Ali, College of Charleston, Application of Satellite Remote Sensing techniques for determining Water Quality Parameters in the optically complex waters of Lake Erie
- Dr. Jeffrey Anker, Clemson University, Optical strain indicators to accurately measure the strain of various objects and materials through nondestructive measures
- Dr. Scott Argraves/Jamie Barth, Medical University of SC, Biomedical Issues Regarding Space Travel

- Dr. Frank Chen, University of SC, Novel Solid Oxide Cell Technology to support NASA's Planetary Exploration Missions
 - Dr. Delphine Dean, Clemson University, Understanding the Effect of Ionizing Radiation on Articular Cartilage Biomechanics
 - Dr. John DesJardins, Clemson University, Effects of Irradiation on Polymer Material Properties for Bearing and Structural Applications in Space
 - Dr. Thompson Mefford, Clemson University, Nanostructured Surfaces and Surface Coatings for Photovoltaic Cells
 - Dr. Jeanette Meyers, Francis Marion University, Computational Astrophysics - Modeling Galaxy Collisions and Cosmological Acceleration
 - Dr. Luke Sollitt, The Citadel, Development of the Atsa Suborbital Observatory
 - Dr. Ya-Ping Sun, Clemson University, Advanced Space Materials
- **Outcome 2:** *Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty:*
We funded 3 pre-service teacher awards for a total of \$9,000 to students pursuing an education undergraduate or graduate degree.

All of the PRA students designed and implemented a Mars Curiosity Rover Landing Party held at Clemson University, meeting Objective 2.4: K-12 Student Involvement. The PRA students designed activities and games for all ages, as well as, organized several planetarium shows and a viewing of the rover landing. Over 50 attendees participated in the event and experienced the wonder and amazement of NASA's 7 minutes of terror, landing another rover on the Red Planet. A student wrote about the event, "*I specifically liked the Outreach Project (many people came up to me to who thought that NASA had been dropped because of budget cuts)- I thought it was unique and effective at informing the public about NASA*" (C. Bourean, Wofford College). Another wrote, "*This project gave me the chance to pass my passion about science and research on to future students*" (E. LeCroy, Clemson University).

SC Space Grant will be holding two educator professional development opportunities in Summer 2013, to raise awareness of NASA's unique capabilities (Objectives 2.1 and 2.3). The opportunities will equip formal educators with the skills and knowledge to attract and retain students in STEM disciplines. The first workshop will focus on the cross-cutting relationships emphasized in the Next Generation Science Standards, specifically engineering and science. This effort will be co-hosted with one of our educational partners, the SC State Museum. Educators will focus on designing and building some type of robotic vehicle or glider. The second workshop will focus on adaptation/modification of NASA mission activities to make them accessible for all learners, especially those with disabilities. This workshop will be co-sponsored with Georgia, North Carolina and Virginia Space Grant Consortia.

The SCSGC contributed funds to support a Young Astronauts 4th and 5th grade student group to travel to Kennedy Space Center (KSC) in March 2013. The group spent two full days at KSC and were able to participate in numerous visitor activities, such as the Space Shuttle Launch Experience, the IMAX Eye on the Universe film, and the Angry Birds Space Encounter. The students were also able to attend the Living in Space Workshop. Of the 25

4th grade students, 9 were females and 7 were students with disabilities. Of the 34 5th graders, 21 were female and 3 were students with disabilities.

- **Outcome 3:** *Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission:*
Our campus directors act as NASA representatives on their campuses and in their communities, providing information, regarding NASA activities to media and the general public.

The SCSGC developed several new partnerships to broaden awareness of NASA STEM-related opportunities for faculty and staff (Objective 3.1). Trident Technical College and the SC State Museum were added as educational partners in 2011. Trident Technical College is one of the largest two-year community colleges in the state, serving over 17,000 traditional and nontraditional curriculum students who have a wide variety of educational goals, from personal enrichment to career development to university transfer. Through this partnership, the students and faculty at this institution are eligible for all SCSGC programs. The SC State Museum, an informal education venue, has four large floors devoted to the disciplines of art, history, natural history and Earth and space science/technology, providing educational environments that entertain, inspire imagination and creativity, and enrich the lives of visitors. In addition, they are currently building a state-of-the-art planetarium. Through this partnership, the SCSGC and SC State Museum are hosting an educator professional development opportunity (Objective 3.2) integrating a statewide engineering design challenge, using the next generation science standards and aeronautics as a focus.

Through the PRA, the faculty and students at the Francis Marion site participated in several outreach efforts: they held a Venus Transit viewing party for 150 people at Southern Hops Family Night. Dr. Myers attended an event held at Science South, which had 130 attendees; they also visited local libraries as part of their summer reading programs. Participants were treated to a PowerPoint presentation highlighting topics such as stars and space exploration. Hands-on models were displayed and participants were encouraged to check out books on astronomy before they left the library. The participants were able to view the Sun through solar eclipse glasses and a Coronado Solar Personal Telescope. Palmetto Academy students participated in 5 of the 8 visits and interacted with the children, teens, and adults.

The SCSGC annual objectives and outcomes of success are:

I. Consortium Management (Goals 2 and 6)

Objective I.1: (Reporting) The Management Team will provide timely reporting and responses to NASA Headquarters regarding Consortium operations and finances.

Outcome Indicator: All reports will be submitted on time and in accordance with NASA guidelines.

Outcome – All reports, proposals and requests were submitted early or by the deadline. **This objective was met.**

Objective I.2: (National Network) The Management Team will work to strengthen relationships with NASA Centers, the national Space Grant network, and the state's NASA EPSCoR Program.

Outcome Indicators: Each year at least three students will participate in an internship program at a NASA Center and all faculty research projects are

required to have a strong relationship with NASA scientists at one of the NASA Centers. The SCSGC Director and/or Program Manager will be present at biannual national Space Grant meetings. The SCSGC Director and Program Manager also serve as the Director and Program Manager for the SC NASA EPSCoR Program.

Outcome –More than three students did participate (6 total) with over 50 applying for NASA internships. The Director and Associate Director attended both the Fall and Spring National SG Meetings. In addition, the SC Space Grant team continues to work with and through the University Affairs Officers at the NASA Centers to ensure our faculty and students are able to develop relationships with scientists and engineers at NASA. **This objective was met.**

Objective I.3: (Consortium Network) The Management Team will faithfully represent the diverse interest and resources of the Consortium member institutions and affiliates.

***Outcome Indicators:** The roles and responsibilities of Consortium Management, member institutions, and all categories of affiliate organizations were established with the inception of the SCSGC and were updated in 2004, 2006, and again in 2012. Relevant electronic communication sent to all member institutions, affiliates, and interested parties, as appropriate.*

Outcome – The SC Space Grant team revised its Bylaws in 2012 to reflect the diverse interests of the member institutions, NASA and the state. Specifically, two educational partners, a technical college and a state museum, were voted into the consortium. **This objective was met.**

Objective I.4: (State government) The Management Team will ensure that Consortium programs are aligned with state and federal priorities.

***Outcome Indicators:** Members of the Management Team provide annual reports to representatives of state and federal government on Consortium activities.*

Outcome – The SC Space Grant team met with federal senators and congressman, incorporated the President’s Co-STEM report, and developed a plan around the state’s needs, especially with the arrival of Boeing, Google, and other industry to the state. **This objective was met.**

Objective I.5: (State industry) The Management Team will foster interaction between the Consortium and state industries involved in aerospace and related technologies.

***Outcome indicator:** Facilitate at least one student or faculty project with an industry partner in South Carolina.*

Outcome – This year the SC Space Grant was invited to present at the Boeing/SC Research Authority Small Business Innovation Research Workshop. Through this workshop, SC Space Grant began developing relationships with small aerospace/aeronautical businesses in the region. Discussions have begun regarding a joint project with the SC Research Authority unmanned drones effort. While this **objective has not been met directly**, the much needed relationship building with SCRA and their partners has “set the ball in motion” for a faculty or student internship with industry.

In addition, following discussion with SC Sea Grant Consortium, who jointly funds the Kathryn Sullivan Scholarship, the scholarship was modified to reflect a need observed by both consortia. The Kathryn Sullivan scholarship will now

become a research-based graduate fellowship. Further, in support of the joint sponsorship, he applicants are required to show relevance to both NOAA and NASA. This fellowship will begin in 2013.

Objective I.6: (Link to public) The Management Team will seek to maintain and improve the effectiveness of the Consortium as the link between the public and NASA in the state.

***Outcome indicator:** Consortium website is updated on a weekly basis to reflect new opportunities within NASA.*

Outcome – The consortium website is currently undergoing redesign to be more user-friendly. It is updated on a weekly basis to reflect new opportunities within NASA. This year, the consortium implemented a student spotlight area, where students who are making strides in STEM are highlighted. In addition, the media relations office at the College of Charleston developed several videos highlighting SC Space Grant and the faculty and students participating in our programs. A list of videos/news articles are below:

SC Space Grant – General Information about the Program:

http://www.youtube.com/watch?feature=player_embedded&v=bVB0NItywBo

Heather Meyer - Intern: <http://www.youtube.com/watch?v=NrCkanymvts>

David Weiss – Intern:

<http://www.youtube.com/user/CollegeofCharleston?feature=watch>

Laura Stevens – Undergraduate Awardee:

<http://www.youtube.com/watch?v=HFLPvF8M7gA>

<http://news.cofc.edu/2012/11/19/undergraduates-professor-discover-new-extrasolar-planet/>

Sylricka Foster – Student Awardee: <http://news.cofc.edu/2012/11/26/geology-student-aspires-to-change-the-world/>

This objective was met.

Objective I.7: (Increase resources) The Management Team will pursue opportunities to increase the resources available to the Consortium, to broaden participation within the state, to collaborate with other state Consortia in areas of mutual interest and capability, and to assure long-term sustainability.

***Outcome indicator:** Serve as a clearinghouse for information on funding opportunities from NASA and other agencies that support STEM-related research and education, especially in areas of aerospace and earth and space science. At least 50 targeted announcements of opportunity will be disseminated through electronic communication and website each year. Coordinate submission of proposals to NASA and other agencies on projects in STEM research and education. Encourage collaborative proposals each year to NASA or other agencies.*

Outcome – The SC Space Grant website updates its education opportunities on a weekly basis providing faculty and educators access to NASA programs, workshops, webinars, etc. In addition, the consortium forwards all opportunities through other consortia as well as NASA programs to its affiliates for dissemination. **This objective was met.**

Objective I.8: (Diversity) The Management Team will ensure diversity in all Consortium programs and activities by seeking to include women, underrepresented minorities, and

persons with disabilities.

Outcome indicator: *Diversity will be modeled in all aspects of the Consortium and participation by underrepresented groups will increase. NASA content or other STEM educational opportunities are expanded at these underrepresented institutions.*

Outcome – We are continually working with our HBCUs/MSIs. In addition, this year, we added a technical college, Trident, as an educational partner and have begun discussions with other technical/community colleges in the state to incorporate their students and faculty into our programs. **This objective was met.**

Objective I.9: (Evaluation) The Management Team will continually monitor and seek to improve the quality and effectiveness of the state program.

Outcome indicator: *In consultation with the Campus Directors, the Management Team will continue to determine appropriate data collection and evaluation procedures that are consistent with available resources.*

Outcome – We review our entire program annually to ensure that we are meeting our overarching goals and objectives and by tracking our awardees adequately. The NSGF provides data from our longitudinal tracking. **This objective was met.**

II. Fellowship/Scholarship Program (Goal 4)

Objective II.1: (Competitiveness) Ensure the fair distribution of funds to member universities and educational affiliates.

Outcome indicator: *Annual Call for Fellowship/Scholarship applications at all higher education members and affiliates, competitive review, and selection of awardees. Awards reflect the diversity of the Consortium's membership and statewide balance.*

Outcome – **This objective was met.** Campus visits, Virtual Skype presentations and emails were sent out numerous times by the main office and by the campus directors at each individual institution to be disseminated on their campuses. In addition, the Research Grant Award applicants and the Palmetto Research Academy Faculty applicants are reviewed both externally and internally to ensure fair distribution of funds.

Objective II.2: (NASA Center ties) Offer hands-on, tangible research experiences to student research fellowship awardees at NASA Centers.

Outcome indicators: *SCSGC will note an increase of SC students involved with NASA Center Internships. 100% will make a presentation at the SC Academy meeting or at a national meeting. 100% will provide feedback to their Campus Director and make campus presentations.*

Outcome – **This objective was met.** In 2012, SC Space Grant funded 6 students to participate in NASA Center internships, including Ames, Goddard, Marshall, and Langley. The students have either presented at a national meeting or will be presenting in April at the SC Academy of Sciences meeting.

Objective II.3: (Industry ties) Offer hands-on, tangible research experiences to student research fellowship awardees at aerospace and related science and technology industries.

Outcome indicator: *At least one student will receive supplemental funding to support research through SCSGC each year.*

Outcome – This objective was not met. We only had students at NASA centers for internships. However, we are working on developing relationships with industry as mentioned above (Objective I.5).

Objective II.4: (Mentoring and professional development) Provide mentoring and professional development experiences to student researchers, which will develop skills that contribute to the future workforce.

***Outcome indicator:** 100% of awardees graduate from college, 100% make a presentation at the SC Academy of Science or at a National meeting within a year of receiving the award, 80% produce a paper or abstract with their mentors within a year of receiving the award, and 50% continue on to graduate school and pursue a NASA-related discipline.*

Outcome – Our projects are all currently in progress. As such, our students have not met the milestone of graduating from college or continuing on to graduate school. Based on past data, however, 98% of our students significantly supported by SC Space Grant from 2006-2012 went onto next steps in STEM disciplines. The presentation and publication rate is also not known at this time. However, all students are required to present, which typically entails an abstract submission with their mentor. We will know if this objective has been met next year upon receiving their final reports. **We anticipate meeting this objective.**

All of our students are required to present at a regional or national meeting as part of their SCSGC award acceptance. One meeting that many students attend is the South Carolina Academy of Sciences. As such, the SCSGC co-sponsored the meeting. Students and faculty will be presenting, either orally or through a poster, and will also have a representative to discuss Space Grant and our activities.

Objective II.5: (Diversity) Ensure funding for fellowships and scholarships to women, underrepresented minorities, and persons with disabilities by utilizing intensive marketing techniques (e.g., personal visits, direct faculty contacts, email) to encourage women and minority students to apply for funding.

***Outcome indicator:** Awards to women and minorities equal or exceed previous year applicants. At least 15 student awards awarded annually within underrepresented groups.*

Outcome – Beginning in 2013, A *Minorities in STEM Research Fellowship* will be implemented. Overall, the SCSGC awarded 23 student awards, 7 of which were awarded to females and 3 of which were awarded to underrepresented minorities. One awardee reported having a disability.

Objective II.6: (Longitudinal tracking) All students who have received significant fellowship or scholarship assistance from SCSGC will be longitudinally tracked through first employment or beginning of an advanced degree.

***Outcome indicator:** Continue arrangements with National Space Grant Foundation to include SCSGC in the longitudinal tracking system so that students funded can continue to be tracked in subsequent years at least through first-employment.*

Outcome – This objective was met by continuing the longitudinal tracking program with the National Space Grant Foundation office. 87% of our student awardees from 2006-2012 have been successfully tracked through their next step,

100% from 2012.

Objective II.7: (Evaluation) The Consortium will develop methods to document, measure, and assess the impact of the fellowship and scholarship programs in conjunction with its implementation of an overall evaluation strategy (see Obj. I.9).

Outcome indicator: Adjustments are made to the fellowship and scholarship program to strengthen activities that are working and drop or improve activities that are not having the intended impact.

Outcome – This objective has been met. We review our programs, policies and applications annually. This year, 2012, the SCSGC updated its Bylaws and future revisions are in process.

III. Research Infrastructure (Goal 3)

Objective III.1: (Research proposals) Increase the number of research proposals submitted by SCSGC institutions in fields aligned with NASA's mission.

Outcome indicator: At least eight research awards are distributed among appropriate SCSGC institutions each year. 100% of the REAP recipients submit proposals to NASA or another federal agency within two years. 50% of the REAP recipients submit new proposals which are funded within two years. 100% of the REAP recipients give presentations and submit papers within a year after the end of the grant. 80% of the presentations and papers include students.

Outcome – In 2012, ten awards were funded from 7 different institutions, the University of SC, College of Charleston, Coastal Carolina University, Clemson University, The Citadel, Claflin University, and the University of the Virgin Islands. Awardees and their projects include:

- Dr. Harry Ploehn, University of SC, Polymer-Grafted Platelet Nanocomposites for Engineered Materials and Structures in Extreme Environments
- Dr. Joseph Carson, College of Charleston, Search for Extrasolar Planets of Nearby Young Stars
- Dr. James Neff, College of Charleston, Using the Kepler Spacecraft to Study Stellar Magnetic Cycles and to Probe Stellar Interiors with Asteroseismology
- Dr. Varavut Limpasuvan, Coastal Carolina University, Changes in the Upper Atmospheric Ozone
- Dr. Andrew Mount, Clemson University, Enabling Public Participation in Astronomy: Installation of the 29" Dixon Lomax Telescope at the Taylor Creek Observatory
- Dr. Charles Groetsch, The Citadel, Mathematics for Cosmic Exploration
- Dr. David Morris, University of the Virgin Islands, Developing a Customized Astronomy Lab Manual at the University of the Virgin Islands
- Dr. Louis Rubbo, Coastal Carolina University, Developing scientific reasoning and promoting STEM careers via a robotics summer camp for middle school children
- Dr. Angela Peters, Claflin University, STEM Activities for Middle School girls
- Dr. Angela Peters, Claflin University, Aerospace Academy II

The ten projects are all currently in progress. We will know if this objective has been met 60 days after completion of their project when we receive their final reports. **It is anticipated that we will meet this objective. At this interim reporting time, these 10 REAP awards have resulted in; the submission of 5 follow-on grant proposals -2 of which were awarded, 13 presentations, 2 papers, 1 publication, and 3 pieces of intellectual property.**

Objective III.2: (Research support) Support new and developing research, especially multidisciplinary and collaborative projects, in fields aligned with NASA's mission.

Outcome indicator: 50% submit proposals for a REAP Research Grant or similar program. 100% of the REAP recipients develop presentations and papers within two years. 80% of the presentations and papers include students.

Outcome – Our projects are all currently in progress. We will know if this objective has been met next year upon receiving their final reports. For numbers, see above Outcome III.1. **As such, it is anticipated that SSGC will fully meet this objective upon completion of the projects.**

Objective III.3: (Collaborations) Build research collaborations both within and outside the state.

Outcome indicator: At least one planning trip to a NASA Center is supported each year from SCSGC. Submission of REAP Research Grant proposal within two years of the award.

Outcome – Through a NASA EPSCoR award, 11 faculty, previously funded with Space Grant and/or NASA EPSCoR, have traveled to NASA centers to meet with NASA scientists regarding future collaborative efforts. Most of these trips have involved a student traveling as well, providing them a unique experience at NASA. The remaining SCSGC REAP travel awardees will travel during the spring 2013. **This objective has been met.**

Objective III.4: (Diversity) Increase the participation of women and underrepresented groups in statewide research programs and facilitate their subsequent entry into STEM careers.

Outcome indicator: SCSGC will sponsor activities that encourage women and students from underrepresented groups to enter STEM careers.

Outcome – SCSGC visited several campuses to promote each program. In addition, we hosted Skype presentations for faculty and students at each campus for those interested in learning more about our programs and opportunities. Special attention was paid to recruiting women and underrepresented minorities for our competitive programs. 36.4% of our students participating in a REAP program were either female or an underrepresented minority – three were female and one was an underrepresented male. Of the 15 non-student researchers, one was an African American female. **This objective has been met.**

Objective III.5: (Evaluation) The Consortium will develop methods to document, measure, and assess the impact of the research infrastructure programs in conjunction with its implementation of an overall evaluation strategy (see Obj. 1.9).

Outcome indicator: Adjustments are made to the research infrastructure program to strengthen activities that are working and drop or improve activities that are not having the intended impact.

Outcome – We require interim and final reports from all REAP PI’s. These reports must be very detailed and include all necessary information to complete our annual reporting to NASA HQ. Final reports are required before final invoice payment will be made. These data are compiled on an annual basis and are distributed to our campus directors for review upon receipt of final reports. In all reports we require information on participants, current project status, a list of conferences, presentations, publications, patents, grant proposals submitted and/or funded, new technology and intellectual property, and improvements to SC’s research and development as a direct result of their SCSGC REAP awards. These data help inform our program components – what we need to modify, what is working well, etc. **This objective has been met.**

IV. Higher Education (Goal 1)

Objective IV.1: (Curriculum and NASA content) Contribute aerospace and space and earth science materials to the higher education community in South Carolina.

***Outcome indicator:** Distribute announcements of opportunities for education and curriculum enhancement in NASA-related fields to faculty at member institutions.*

Outcome – We actively act as conduits of information regarding opportunities for the higher education community. Emails are sent out on a daily basis to distribution lists and to campus directors for additional dissemination. New in 2012 – we post information every workday on our Facebook page. The information posted varies from general NASA news, NASA opportunities, South Carolina-specific NASA news and/or opportunities through our SC Space Grant and SC NASA EPSCoR programs. In addition, our website is updated weekly with information from these resources. Student spotlights change monthly. **This objective has been met.**

Objective IV.2: (Student Research) Provide opportunities where students gain hands-on knowledge of scientific methods and processes, gain understanding of the importance of teamwork, experience the exhilarating feeling of discovery, spark an interest in continuing NASA-relevant research in graduate school, and enter the STEM workforce by working on NASA-related endeavors.

***Outcome indicator:** 100% of the participants are exposed to current NASA research and 100% make presentations about their research experience.*

Outcome – The Palmetto Research Academy involved 10 sites, all of which were linked to NASA-relevant research or used NASA data. In addition, the PRA students and several faculty traveled to the NASA Langley Research Center to learn more about research being conducted throughout NASA. Students met with NASA scientists and engineers and toured several facilities. In addition, all of the PRA students shared their research at a final presentation ceremony. Many students have also presented at various national and regional conferences. **This objective has been met.**

Objective IV.3: (Industry involvement) Establish and maintain linkages between SCSGC and higher education and industry in South Carolina by encouraging educational partnerships between the state’s academic institutions and private industry.

***Outcome indicator:** At least two collaborative proposals will be funded, promoting partnerships between industry and academic affiliates.*

Outcome – This year the SC Space Grant was invited to present at the Boeing/SC Research Authority Small Business Innovation Research Workshop. Through this workshop, SC Space Grant began developing relationships with small aerospace/aeronautical businesses in the state. Discussions were initiated regarding a potential joint project with the SC Research Authority unmanned drones effort. **This objective has not yet been met but is currently underway.**

Objective IV.4: (Diversity) Increase the participation of women and underrepresented groups in all aspects of SCSGC's higher education program.

Outcome indicator: SCSGC will sponsor activities that encourage women and students from underrepresented communities

Outcome – The 2012 PRA involved 5 females (one of which was an African American), 1 Alaskan Native male, and 14 additional white males. 30% of the students were from underrepresented communities in STEM. 2 of the 10 faculty were female and 1 male was African. As such, 30% of the faculty were from underrepresented communities. **This objective has been met.**

Objective IV.5: (Evaluation) The Consortium will develop methods to document, measure, and assess the impact of the higher education programs in conjunction with its implementation of an overall evaluation strategy (see Obj. 1.9).

Outcome indicator: Adjustments are made to the higher education program to strengthen activities that are working and drop or improve activities that are not having the intended impact.

Outcome – We require final reports from all participants. These reports must be very detailed and include all necessary information to complete our annual reporting back to NASA HQ. In addition, the Palmetto Research Academy has a specific evaluation to assess successful aspects or weaknesses of the program design. Through both of these mechanisms, SCSGC is able to modify its higher education program to ensure it is meeting all goals. Finally, the Associate Director is in constant communication throughout the summer with faculty and students (via a listserv) to discuss potential issues or successes. **This objective has been met.**

V. K-12 (Precollege) Education/Public Service (Goal 5)

Objective V.1: (NASA dissemination) Contribute aerospace and space and earth science materials to the formal and informal education communities in South Carolina.

Outcome indicator: Distribute announcements of opportunities for education and curriculum enhancement in NASA-related fields to formal and informal educators across the state; Maintain and update the SCSGC website to provide opportunities and information to formal and informal education groups as well as the general public.

Outcome – We distribute information on a daily basis to our contacts throughout the state and through contacts in Education departments on our member campuses. We also advertise through our Educational partners. In addition, we advertise activities, promote programs and distribute NASA news through our SCSGC Facebook page, which is updated 5 days/week and our website, which is updated weekly. **This objective has been met.**

Objective V.2: (Pre-service Educators) To increase the number of quality educators pursuing STEM education degrees.

***Outcome indicator:** Pre-Service awardees will be tracked to see how many complete their degree programs and become science and math teachers in SC. At least two awardees will pursue a career teaching STEM . SCSGC will also inquire about their using NASA educational materials in their classrooms.*

Outcome – Our awardees are still enrolled in classes at their home institution. **Upon their graduation, we will meet this objective.** Through the National Space Grant Foundation, these students will continue to be tracked to ensure they enter a STEM-related teaching field.

In addition, the SCSGC will host two professional development activities for both in-service and pre-service educators. One will be co-sponsored with the SC State Museum and will focus on technology and science/engineering practices as an important concept within the Next Generation Science Standards. The second will be co-sponsored with North Carolina, Georgia and Virginia Space Grant Consortia and will focus on educators working with students with disabilities. SCSGC will lead the workshop but each state, mentioned above, will send approximately 5 educators. NASA activities will be reviewed for accessibility.

Objective V.3: (Science and education events) The SCSGC will support activities of scientific discovery across the state and will support NASA’s commitment to renewing a spirit of exploration and discovery and will use the excitement of space exploration to promote this policy to the general public.

***Outcome indicator:** SCSGC staff will develop and host opportunities to promote NASA throughout the state of South Carolina.*

Outcome – **This objective has been met.** In November 2012, two groups of 7th and 8th grade students attended a Lunar Workshop on the Geology of the Moon. The SCSGC Director and Associate Director made 20-minute presentations to 49 students, which included 27 females and 8 underrepresented minorities.

In addition, the SCSGC main office staff participated in the STEM Education Day, hosted by the College of Charleston Lady Cougars Basketball Team, held at the College of Charleston Basketball Arena on February 4, 2012. Over 1,600 4th-8th grade students from across Charleston, Berkeley and Dorchester Counties participated in the event with many hands-on activities and demonstrations related to STEM. The SCSGC presented NASA activities on Newton’s third law of motion. Students were able to build and take home rocket pinwheels.

One of our REAP awardees, Dr. Andy Mount, hosted 20 students, 5 teachers and 10 parents at the Taylor Creek observatory in Mountain Rest, SC. These students participated in a planet walk, which is a physical scale model of the solar system that extends for 600’ along the main entrance road, observed the night sky through the eyepiece of the Celestron 11” SCT, and listened to audio signals of the night sky. Julie McEnery, NASA Fermi Satellite director from GSFC visited the site on 28 March and delivered a Sigma Xi Distinguished Speaker public lecture that evening at Clemson University. She described newly discovered

Gamma ray energy bubbles that extend from the center of our home galaxy, the Milky Way. She also described anti-matter emissions into space from thunderstorms, a completely unexpected discovery. In addition, The FSX-3 spectrograph, bought with Space Grant funds is now returning data 24/7 at MRAO. It was recently cited by professional astronomer Victor Herro at <http://herrero-radio-astronomy.blogspot.com/search/label/Ionospheric%20Modulations>.

Objective V.4: (Diversity) Increase the participation of women and underrepresented groups in all aspects of SCSGC's pre-college/general public program.

Outcome indicator: SCSGC will sponsor activities that encourage women and students from underrepresented groups to enter STEM careers.

Outcome – We visited each campus (in person or through virtual presentations through Skype) to promote our programs. Special attention was paid to recruiting women and underrepresented minorities to apply for our competitive programs. In addition, Angela Peters received two REAP awards from SCSGC in 2012. Her project involved 30 middle school and 10 high school students. 62.5% of these student participants were female and 80% were underrepresented minorities (African American). **This objective has been met.**

Objective V.5: (Evaluation) The Consortium will develop methods to document, measure, and assess the impact of the pre-college/public service programs in conjunction with its implementation of an overall evaluation strategy (see Obj. 1.9).

Outcome indicator: Adjustments are made to the pre-college/public service program to strengthen activities that are working and drop or improve activities that are not having the intended impact.

Outcome – We are constantly evaluating our programs and making necessary adjustments to better our opportunities. When possible, we have pre- and post-tests to assess effectiveness and content acquisition. This year we developed a needs assessment for middle- and high-school educators across the state. Upon receiving IRB (Institutional Review Board) approval, the survey was sent to educators across the state. We received feedback on what types of professional development are needed – not just desired, from a content and a pedagogical perspective. This aided the SCSGC in the design of two workshops for educators. Pre- and post-tests will be provided at both of these, scheduled in May/June 2013, to assess effectiveness. **This objective has been met.**

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Student Data and Longitudinal Tracking:**

Total awards = 43: 23 Fellowship/Scholarship, 20 Higher Education/Research Infrastructure; 3 of the total awards represent underrepresented minority; 2 in fellowship/scholarship funding (both African American males) and 1 in Higher Education funding (Alaskan Native). During the FY12 program, 13 students are pursuing advanced degrees in STEM disciplines, 1 accepted a STEM position with a NASA contractor, 14 accepted STEM positions in industry, 5 accepted STEM positions in academia, and 1 went on to a position in a non-STEM discipline. The remaining students have not yet graduated.

We awarded 10 research awards to faculty through our Research and Education Awards Program. Within those REAP projects, 11 students are participating in research. Three are female and one male is African American. These students are not tracked since they do not receive significant support.

- **Minority-Serving Institutions:**

This year, the SCSGC began developing relationships with the statewide community/technical college system. Many of these are minority serving institutions. In addition, we have initiated communication with other 4-year minority serving institutions in the state to determine what, if any, NASA-related research they are conducting. This relationship building will aid our consortium in assessing which institutions could be potential partners in the future. In addition, through our NASA EPSCoR Minority Serving Institution Award, we have developed 3 new contacts. Two of these 3 are interested in becoming an educational partner. SCSGC now includes all participants of this program in all announcements regarding all Space Grant opportunities.

- **NASA Education Priorities:**

Authentic hands-on student experiences in science and engineering disciplines:

Four of our programs in 2012 involved hands-on mentored research experiences for students. Our Undergraduate Research Awards, Graduate Fellowships, and the Palmetto Research Academy allow for a student to work directly with a faculty mentor at a member institution on a NASA-related research project. The NASA Internships involve hands-on NASA-scientist mentored research projects. Our REAP program this past year awarded 10 faculty projects which included 11 students. These students worked one-on-one with their faculty on NASA science as well.

Diversity:

Of our 15 member institutions, four are HBCU's. We have 2 educational partners, Trident Technical College and the SC State Museum, serving large underrepresented communities. In addition, we have received a letter requesting educational partnership in SCSGC from Orangeburg-Calhoun Technical College, a minority serving institution; the SCSGC will vote on their membership in the next few months. Of our 15 member institution campus directors, 6 are female, 2 are African American and 2 are Asian. As a Consortium, we strive to have a diverse pool of qualified applicants for all of our programs. We work closely with the minority programs, like the McNair Scholars, SC Alliance for Minority Participation, etc., on each campus to make sure that we reach as many underrepresented students as possible.

Engage middle school teachers in hands-on curriculum enhancement capabilities.

The SCSGC will host two educator professional development opportunities in May/June 2013 for primarily middle school in-service and pre-service educators. One will be co-sponsored with the SC State Museum and will focus on technology and science/engineering practices as an important concept within the Next Generation Science Standards. The second will be co-sponsored with North Carolina, Georgia and Virginia Space Grant Consortia and will focus on educators working with students with disabilities. SCSGC will lead the workshop but each state, mentioned above, will send approximately 5 educators. NASA

activities will be considered for accessibility. Both Professional Development activities will provide NASA hands-on activities as well as sound instructional pedagogy.

Summer opportunities for secondary students on college campuses

The PRA outreach activity was held on the campus of Clemson University. Over 50 participants of all ages, including secondary students, attended the event and were able to experience NASA-related activities as well as celebrate the successful landing of the Mars Curiosity rover. The students were able to interact with the undergraduates, ask questions, experience campus life and more.

With funding from a REAP award, Dr. Angela Peters (Claflin University) brought approximately 30 middle school girls and 10 high school girls, from the GEMSS (Girls Emulating Maturity, Strength and Scholarship) Program to Claflin for a week long Digital Learning Network activity coordinated by Langley Research Center and Oklahoma State University. The overall goal of the program was to forge linkages with K-12 school systems to improve the readiness of underserved youth for college, specifically in STEM, by having the girls experience STEM on a university campus. While at Claflin, they interacted with other students, faculty, and staff, and experienced the daily student routine in an undergraduate environment.

Also with REAP funding, Dr. Louis Rubbo, Coastal Carolina University, hosted a two-week long robotics summer camp for 20 middle school students at Coastal Carolina. The camp was developed around the theme of 'terraforming foreign planets' with the use of autonomous LEGO robots. During the first day of camp, students constructed a basic LEGO Mindstorms robot configuration and programmed it to perform some simple tasks. The remainder of the camp was broken down into two parts, a set of four basic tasks and then a selection of about a dozen more complicated missions. Throughout this adventure, the middle school students were on a university campus and through the program interacted with 3 faculty and several undergraduate students.

Finally, a Charleston County gifted and talented middle/high school, the Palmetto Scholars Academy (PSA) has requested membership into the Consortium. It is anticipated that they will be voted in as our first K-12 educational partner. Students from PSA are currently designing competitive experiments for the Student Spaceflights Experiment Program (SSEP). SCSGC staff are mentoring these students along with former astronauts and scientists and engineers from local industry. As a K-12 education affiliate, the PSA students will be able to participate in activities at local higher education institutions. In addition, the students will be eligible for NASA high school internships.

Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges.

Last year, the SCSGC began developing relationships with the statewide community/technical college system. Trident Technical College, was voted as an educational partner within the SCSGC. The Palmetto Research Academy in 2012 supported two students from technical/community colleges. The applicants conducted NASA-related research at one of the 4-year PRA institutions. We have begun discussions with Denmark Technical College

and Orangeburg-Calhoun Technical College (both MSIs) about SCSGC and our competitive programs available for their students and faculty. We now include these two potential educational partners in all announcements regarding Space Grant opportunities.

Aeronautics Research

At this time, the SCSGC is in discussion with the Boeing-Charleston facility as well as the SC Research Authority (SCRA) to develop joint internships for students and faculty. Our Associate Director made a presentation at a joint Boeing/SCRA SBIR/STTR conference in February 2013. Through this meeting, she was able to develop several relationships with small aeronautical businesses in the region, especially in SC. We anticipate building and fostering collaborations with several industry partners as a result of the SBIR conference presentation.

One of the PRA sites focused on developing a suborbital telescope camera engineering test-bed to fly aboard the XCOR Aerospace's Lynx spacecraft. The team successfully developed a mounting system for their telescope, as well as a design (and prototype) for a payload box for their electronics. The team developed a power system for use in-flight and also developed a control box that allows them to take video and snapshots, and allows both manual and automated advancing of the filter wheel. The PRA team fitted a guide camera to the system as well. Basic function testing was verified at the XCOR facility in Mojave, California.

Environmental Science and Global Climate Change.

Two PRA sites focused on environmental science.

1) Dr. Frank Chen at the University of SC worked with students to develop new solid oxide fuel cell (SOFC) technology. This PRA Site was based at the SOFC Center of Economic Excellence at USC; the team constructed and tested a solid oxide fuel cell for unitized regenerative operations, i.e., to produce electricity under the fuel cell mode and to produce oxygen (and syn-gas (H₂-CO) at the same time) by steam and carbon dioxide co-electrolysis. This technology is one of the most attractive choices for enabling access to renewable energy and supplying power for communications, advanced life support, survey equipment, etc.

2) Dr. Adem Ali at the College of Charleston worked with a student to determine water quality parameters in the optically complex waters of the Western Basin of Lake Erie using remotely sensed data, specifically VIS/NiR hyperspectral data. The team traveled to Lake Erie for half of the PRA to monitor biological activity, harmful algal blooms, which are of great concern for human health and are detrimental to the lake's biodiversity. The team measured phytoplankton abundance, suspended sediment, and dissolved organic carbon to correlate with remotely sensed data. As global climate continues to change, it is expected that the water quality of Lake Erie will continue to degrade. The models developed within this PRA are applicable to similar turbid water bodies, such as large open freshwater bodies and coastal waters.

Enhance the capacity of institutions to support innovative research infrastructure activities to enable early career faculty to focus their research toward NASA priorities.

Our faculty REAP program is designed to help support new and early career faculty and put them on a track toward working on large NASA-related research grants. For example, a new

faculty receives a \$2k travel award, then an \$8k research initiation award and then a \$30k research grant through our programs over the course of three years. This stepping stone, or ladder, approach to becoming immersed in NASA research has proven successful in SC, often leading to much larger NASA EPSCoR grants. For example, four previous Space Grant REAP/PRA awardees received \$750K NASA EPSCoR awards (3 in 2009 and 2010, 1 in 2012). As such, we encourage new faculty to apply for all of our programs to begin climbing their ladder of success. As a ladder of success, Dr. Jim Ritter in USC's Chemical Engineering department proposed, in 2004, to investigate robust process simulators for absorption technology through SCSGC's REAP program. He was funded at \$6K, conducted his research, and in 2008 was awarded \$30K from the much larger research grant program through SCSGC and NASA EPSCoR. Using his findings from these small awards, Dr. Ritter collaborated in 2009 with Vanderbilt and won NASA EPSCoR's \$750K research award. As of 2011, he has submitted two winning proposals to WR Grace and INGENCO that began with this initial Space Grant funding. SCSGC's initial \$36K investment has resulted in more than \$490K in research funds for SC!

IMPROVEMENTS MADE IN THE PAST YEAR

At the end of FY12, Dr. Cassandra Runyon was voted in as Director of SCSGC and Cynthia Hall was named as the Associate Director; Tara Scozzaro serves as the project manager. Since this time, the SCSGC has been rejuvenated. The SCSGC reorganized the executive board and created two subcommittees to evaluate gaps, successes and needs within the consortia. For the first time ever, SCSGC Initiated a significant presence at the premier state student STEM conference, the SC Academy of Sciences. Overall the SCSGC has become more involved in the national space grant network; the Director was selected as a National Space Grant Alliance board member, as well as, the Science Mission Directorate space grant representative Co-lead. The Associate Director is involved in the Space Technology Directorate. Through this involvement, we have been able to communicate more effectively within the national network.

The SC State Museum and Trident Technical College have been approved as educational partners. They will help develop new strategies for the Consortium and participate in educational opportunities of interest. We will add three additional Educational Partners by FY14, Orangeburg-Calhoun Technical College and Denmark Technical College, both MSIs, and the Palmetto Scholars Academy, K-12. We are already working with the technical colleges on NASA EPSCoR MSI projects and are looking forward to their becoming full educational partners. In addition, we have ongoing discussions with Boeing, the SC Research Authority and other potential STEM industry partners. We will continue to build relationships over the next fiscal year.

Since it's inception, the focus for SCSGC has been higher education. However, this year, we are looking more toward middle- and high-school education by implementing two educator professional development opportunities that will help to diversify our portfolio of activities and inspire the next generation of STEM leaders. We are leveraging funding resources by partnering with our neighbor space grant affiliates for these educator professional development opportunities.

Finally, the SCSGC main office has served as a broker for many affiliates and partners within the Consortium. The team has assisted with proposal writing for various NASA programs related to STEM education and research, budget development, and resource sharing.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Member Institutions:

The Campus Director will act as the primary point of contact for the dissemination of NASA resources and Space Grant funding opportunities to the faculty and students at their institution, as well as to educators and the general public in their respective region. In addition, they are responsible for reviewing faculty and student proposals, submitting an annual budget and report to the main office and other administrative duties.

Benedict College, private, liberal arts College, HBCU
Coastal Carolina University, public, liberal arts College
The Citadel, public military College
Claflin University, independent, liberal arts College, HBCU
Clemson University, research-one University
College of Charleston, public, liberal arts College
Francis Marion University, public, liberal arts minority-serving institution (40%)
Furman University, private, liberal arts College
Lander University, public, liberal arts University, minority-serving institution (24%)
Medical University of South Carolina, research-one medical University
Presbyterian College, private, liberal arts College
South Carolina State University, land-grant public College, HBCU
University of South Carolina, research-one University
University of the Virgin Islands, public, liberal arts, HBCU
Wofford College, independent, liberal arts College

Educational Partners:

Educational partners are formal education communities, such as K-12 educators, community and technical colleges, subsets of larger 4-year institutions, etc., as well as informal education communities, such as museums, science centers, planetariums, who are interested in sharing and / or promoting NASA-related STEM to their students, faculty, and staff. Educational partners do not directly receive support funding from the SC Space Grant Consortium; however they are eligible to apply for specific funding opportunities where applicable (e.g., scholarships, fellowships or research awards designated for formal or informal education communities).

South Carolina State Museum, informal education
Trident Technical College, Charleston, SC
Request Made from Orangeburg-Calhoun Technical College, Orangeburg, SC
Request Made from Palmetto Scholars Academy, Charleston, SC

The National Space Grant Office requires two annual reports, this Annual Performance Data Report (APD) and the Office of Education Performance Measurement System (OEPM) report. The former is primarily narrative and the latter data intensive. Because the reporting timeline cycles are different, data in the two reports may not necessarily agree at the time of report submission. OEPM data are used for official reporting.