

Puerto Rico Space Grant Consortium
Lead Institution: University of Puerto Rico
Director: Gerardo Morell
Telephone Number: 787-282-7047
Consortium URL: www.prsqc.upr.edu
Grant Number: NNX10AM80H

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 Puerto Rico Space Grant Consortium is a Designated Grant Consortium funded at a level of \$575,000 for fiscal year 2012.

PROGRAM GOALS

Goals

- A. Increase the number of students pursuing undergraduate and graduate studies in STEM areas
 - Provide fellowships and scholarships to STEM students participating in projects pertinent to NASA
 - Strengthen existing graduate programs by sponsoring research travel and internships at NASA centers for students and faculty
 - Provide research experiences to STEM undergraduates at four-year colleges
- B. Enhance PR's research capability and infrastructure in areas relevant to NASA
 - Provide seed grants in areas relevant to NASA as evidenced by collaborations with NASA centers
 - Promote college-level hands-on hardware projects: such as robotics, balloon sat and rock sat projects
- C. Infuse pre-college education with exciting STEM activities to increase students' interest in STEM careers
 - Provide a range of professional development workshops for in-service and pre-service teachers

- Promote the incorporation of NASA-related science topics and content in the pre-college classrooms through teacher workshops that make use of NASA content and NASA educational materials
- D. Disseminate exciting information about NASA to the general community to build support for the enhancement of STEM education and research
- Involve mass media in the dissemination of news about NASA accomplishments and NASA spinoffs that enhance our quality of life
 - Support the training of pre-service teachers as general public educators through internships at science museums and similar facilities

PROGRAM BENEFIT TO OUTCOME 1

Students that participated in PRSGC's Fellowship Program, NASA Internships and hands-on hardware projects were hired by NASA, other federal agencies or the Aerospace Industry, as follows:

- Enid Contés (PRSGC Fellow and NASA Ames Intern) was hired by NASA Ames.
- Abigail Rodríguez (PRSGC Fellow and NASA Glenn Intern) was hired by NASA Glenn.
- José Molina (PR CubeSat and NASA Marshall Intern) was hired by NASA Marshall.
- David Ramos (NASA Goddard Intern) was hired by the Department of Commerce.
- Juan Colón (PR CubeSat) was hired by the Naval Research Lab.
- Emmanuel Avilés (PR CubeSat) was hired by the Naval Surface Warfare Center.
- Néstor Vargas (PR CubeSat) was hired by Honeywell Aerospace.
- Leysha González (PR CubeSat) was hired by Honeywell Aerospace.

PROGRAM BENEFIT TO OUTCOME 2

The NASA Aerospace Educational Laboratory (AEL) located at the University of Puerto Rico, Arecibo Campus, engaged 450 participants in real world challenges pertaining to Aeronautics and Space Exploration during the 2012-2103 academic year. The AEL is a state-of-the-art, electronically enhanced, computerized classroom that puts cutting-edge technology at the fingertips of middle and high school students and teachers. It houses real aerospace hardware and software including an Advanced Flight Simulator, a research wind tunnel, a short-wave radio receiver, and hand-held global positioning systems, or GPS, for aviation. In ten unique workstations, participants explore technology through hands-on, minds-on activities that model real-world challenges in aerospace. All of the participants were Hispanic US citizens, 73% from public schools and 27% from private schools from all geographical areas of the Jurisdiction. After completing the AEL experience, 67% of the participating students indicated interest in pursuing STEM careers, a significant increment from the initial 45%.

PROGRAM BENEFIT TO OUTCOME 3

Astronaut Gregory (Box) Johnson (STS-123 and STS-134) visited Puerto Rico for four days in October 2012 to give presentations at different places around the Island. He was the main speaker at public activities organized at the Mayagüez Campus and Humacao Campus of the University of Puerto Rico, reaching a total of 1800 participants in four days of activities. Through this visit, Astronaut Johnson reached the general public across the Jurisdiction and conveyed the message that education is essential in order to succeed in life, and that NASA welcomes students from all socio-economic levels and races to join its excellent workforce. This high-impact informal education activity was done in partnership with NASA Glenn Research Center.

PROGRAM ACCOMPLISHMENTS

- **Outcome 1:** *Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals. (Employ and Educate)*
 - a. Fellowships/Scholarships Program: PRSGC provided full support (stipend and tuition) to 24 college students during the 2012-2013 academic year: 10 PhD students, 5 MS students, and 9 BS. The demographics of the student fellows is 100% Hispanic US citizens, 54% male and 46% female. The recipient students participated in NASA-related projects developed by researchers in the Jurisdiction in collaboration with NASA centers. The participating projects include topics in: Astrophysics, Astrochemistry, Electrochemistry, Bioremediation, Nanotechnology, Photovoltaic Cells, Fuel Cells, Catalysts, Biosensors, and Atmospheric Aerosols. The collaborating research centers include: Marshall Space Flight Center, Kennedy Space Center, Glenn Research Center, Langley Research Center, Goddard Space Flight Center, Johnson Space Center, Ames Research Center, Institute for Functional Nanomaterials, Center for Advanced Nanoscale Materials, and Jet Propulsion Lab.
 - b. Research Internships Program: PRSGC supported a total of 24 students doing research internships during the academic semesters and summer session. The award covered travel costs and full stipend during the internship period. The host research centers include: Glenn Research Center, Kennedy Space Center, Langley Research Center, Goddard Space Flight Center, Johnson Space Center, Ames Research center, Wallops Flight Facility, Argonne National Lab, and the Jet Propulsion Lab.

- c. Research Infrastructure Development Projects: PRSGC supported 6 seed projects relevant to NASA in collaboration with NASA centers. A total of 8 faculty members and 22 college students participated in these projects. The seed projects involved the participation of 3 affiliate member institutions: University of Puerto Rico at Mayagüez, University of Puerto Rico at Río Piedras, University of Puerto Rico at Bayamón. The following institutions collaborated in the seed projects: NASA Ames Research Center, NASA Langley Research Center, NASA Marshall Space Flight Center, Harvard-Smithsonian Astrophysical Observatory, and NASA Glenn Research Center, Center for Advanced Nanoscale Materials, and the Institute for Functional Nanomaterials.

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

- a. Hardware Projects for Undergraduate Students: PRSGC supported 5 hands-on hardware projects that involved 95 students and 7 faculty members. They were developed by 4 different affiliate institutions: University of Puerto Rico at Río Piedras, University of Puerto Rico at Humacao, Interamerican University of Puerto Rico, University of Puerto Rico at Bayamón. The participating affiliate institutions received expertise and support from: NASA Goddard Space Flight Center, NASA Marshall Space Flight Center, NASA Wallops Flight Facility, National Undergraduate Research Observatory, and the University of California at Berkeley. The Higher Education projects included: Solar MiniCart Competition, Aero Design Competition, A satellite engineering course using the CubeSat platform, two meteorology instrumentation courses using the RockSat platform, The Great Moonbuggy Race. By participating in these projects, the students gained technical knowledge relevant to NASA and became better prepared to lead a successful career in STEM.
- b. Pre-service Teacher Experience: PRSGC supported 5 pre-service STEM teachers to obtain an innovative teaching experience at STARBASE Puerto Rico. STARBASE is a premier educational program, sponsored by the Office of the Assistant Secretary of Defense for Reserve Affairs. At STARBASE, pre-college students participate in challenging "hands-on, mind-on" activities in Science, Technology, Engineering, and Math (STEM). The program's curriculum provides 25 hours of stimulating experiences divided in five weekly visits. STARBASE Puerto Rico training site to provide premier teaching experiences to pre-service teachers in order to prepare them to educate the highly skilled American workforce that can meet the advanced technological requirements of the Nation.

- c. Experimental Astronomy Research Experience for Undergraduate Students: PRSGC supported 10 students to do mentored undergraduate research at the National Undergraduate Research Observatory (NURO). NURO is a consortium of primarily undergraduate education institutions from around the country, both public and private, that have joined together to provide training and research experiences for their students. Together they share 120 nights per year on Lowell Observatory's 31-inch telescope, with instrumentation and observer support provided by Northern Arizona University through its Department of Physics and Astronomy. Astronomers and students at the member schools collaborate on key research projects through NURO.

- d. PRSGC NASA Summer STEM Academy: In July 2012, PRSGC implemented the 2012 PRSGC NASA Summer STEM Academy for middle school students. A total of 215 applications were received; 15 female and 15 male students from all over the Jurisdiction were selected to attend this two-week residential camp at UPR-Rio Piedras. The staff consisted of 3 STEM teachers, 10 college faculty members, 5 STEM professionals and 10 upper-level and graduate college students. The campers participated in hands-on laboratory research projects in actual university labs, took English and Mathematics reviews for College Entrance Examination preparedness, received academic and professional role modeling, and participated in NASA awareness activities that empowered them with the necessary tools to achieve their full potential and inspired them to pursue STEM careers.

- e. Pre-College Projects: A range of training activities were implemented in order to provide new NASA content and NASA educational materials to in-service teachers, pre-service teachers, and informal educators. A total of 1640 educators attended these training activities and 78% of them reported bringing some of the new science content learned into their teaching. College faculty and students helped to organize the pre-college activities, exerted leadership in their implementation, and also became participants who benefited from the activity. The training activities were carried out by 11 affiliate institutions: UPR-Mayaguez, UPR-Río Piedras, UPR-Humacao, UPR-Arecibo, UPR-Carolina, Ana G. Méndez System, Interamerican University, PR NASA Explorer School, PR Department of Education, Univision-PR, StarBase-PR. The activities also involved the participation of non-affiliate organizations: NASA Goddard Space Flight Center, NASA Kennedy Space Center, NOAA, PR Department of Education, PR Seismic Web, PR Emergency Management Office.

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

Informal Education Projects: A range of educational projects targeted at the general public were implemented in order to bring NASA science and technology into the realm of the commonly heard of and spoken about topics in Puerto Rico with the purpose of: (a) planting the idea of pursuing STEM careers in children and youngsters and (b) increasing the overall societal esteem for STEM career paths, so that adults provide positive feedback to young people who express interest in STEM careers. The Informal Education Projects included astronomy observations for the community, NASA astronaut visits, conferences open to the general public, and demonstration/information booths in malls. The public-at-large NASA enrichment activities were carried out throughout the 2012-2013 academic year attracting a total of around 16,500 pre-college student attendees. Seven affiliate institutions participated in organizing the activities: PR Astronomy Society, Univision-PR, UPR-Arecibo, UPR-Mayagüez, UPR-Bayamón, UPR-Humacao, UPR-Río Piedras. The activities also involved the participation of NASA centers and non-affiliate organizations: NASA Glenn Research Center, NASA Kennedy Space Center, NASA Marshall Space Flight Center, Institute for Functional Nanomaterials, and the National Oceanic and Atmospheric Administration.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Student Data and Longitudinal Tracking:**
 - a) Total number of awards = 198
 - Fellowship/Scholarship = 24
 - Higher Education = 78
 - Research Infrastructure = 96
 - b) 100% of awardees kept good academic progress in the 2011-2012 academic year.
 - c) 19 awardees that graduated (10%) accepted job positions in STEM.
 - d) 179 awardees (90%) are successfully progressing towards their next academic year or to study an advanced degree in STEM.

- **Diversity:** 100% of the awardees (198) are Hispanic US citizens. Their gender distribution is as follows: 44% female, 56% male.

- **Minority-Serving Institutions:** 10
These minority-serving affiliate institutions are strategically located, covering all geographical regions and socio-economic levels across the Jurisdiction. All of the PRSGC projects and activities involve Minority-serving institutions and US Hispanic citizens.

- **Course Development: 2**
Renewable Energy Course
MATLAB Fundamentals Course
- **Funding leverage:**
The ratio of funds leveraged by NASA funding support is 1:1 (\$575,000 from NASA and \$575,000 from UPR).
- **NASA Education Priorities:**
 - Sixteen long duration (greater than or equal to 2 days in length) professional development workshops for teachers were provided. Of the 380 participants, 85% reported using NASA resources in their classroom instruction.
 - Thirty-five short duration (less than 2 days in length) professional development workshops for teachers were provided. Of the 1250 participants, 76% reported using NASA resources in their classroom instruction.
 - Five long-duration student-centered projects were supported that attracted a total of around 1460 middle and high school students. A total of 1066 of these students expressed interest in pursuing STEM careers (73%).
 - A total of twenty-three public-at-large NASA instructional and enrichment activities were carried out that attracted a total of around 16,500 pre-college students among the attendees.

IMPROVEMENTS MADE IN THE PAST YEAR

PRSGC successfully implemented a continuous student tracking system that makes efficient use of social media and digital networking to find out the fate of the students who have received significant support. Moreover, PRSGC has reorganized its management structure by appointing an Assistant Director (Ms. Mayra Martinez) and a new Project Administrator (Ms. Luz Gonzalez). These management enhancements enable PRSGC to submit the project reports more efficiently and timely. The Consortium has also refined its strategies by devoting significant efforts and investments to three high-impact student hardware projects (i.e., CubeSat, RockSat, and MoonBuggy) and having the affiliates align their efforts accordingly towards these hardware projects.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

- UPR-Central Administration: lead institution and Jurisdiction-level management
- UPR-Mayagüez: undergraduate research, graduate research, in-service teacher training, pre-service teacher training, pre-college education, outreach projects
- Mayagüez Planetarium: pre-college education, outreach projects
- UPR-Río Piedras: hardware projects, undergraduate research, graduate research, UPR-Humacao: hardware projects, undergraduate research, in-service teacher training, pre-service teacher training, pre-college education, outreach projects
- UPR-Cayey: in-service teacher training, pre-college education, outreach projects
- UPR-Arecibo: in-service teacher training, pre-service teacher training, pre-college education, outreach projects
- UPR-Bayamón: hardware projects, undergraduate research, pre-college education, outreach projects
- UPR-Carolina: undergraduate research, in-service teacher training, pre-service teacher training, pre-college education, outreach projects
- Ana G. Méndez University System: in-service teacher training, pre-college education, outreach projects
- Interamerican University of PR: hardware projects, undergraduate research
- PR NASA Explorer School: hardware projects, in-service teacher training, pre-college education, outreach projects
- Arecibo Observatory Visitors' Center: undergraduate research, graduate research
- PR Department of Education: in-service teacher training, pre-college education
- Univision-PR: undergraduate research, in-service teacher training, pre-service teacher training, pre-college education, outreach projects
- EcoExploratorium: pre-college education, outreach projects, informal education
- StarBase-PR: in-service teacher training, pre-service teacher training, pre-college education

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.