District of Columbia Space Grant Consortium
Lead Institution: American University
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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 District of Columbia Space Grant Consortium (DCSGC) is a Program Grant Consortium funded at a level of $430,000 for fiscal year 2011.

PROGRAM GOALS

We proposed the following goals for FY 11-12:

Fellowship/Scholarship Programs

Our goal was to competitively provide scholarships and fellowships to meet the needs of NASA and DC, with an emphasis on women, minorities, and persons with disabilities. Our objectives were to competitively provide 23 scholarships to undergraduate and graduate students in STEM disciplines (including 12 to female students, 9 to underrepresented minority students, and 4 to students with disabilities); to provide meaningful research opportunities to students; to increase the NASA/DCSGC presence in affiliate institutions; to facilitate student opportunities to work at NASA Centers; to provide mentoring for student researchers; to have 14 students become employed in a STEM field; and to have 9 students pursue an advanced STEM degree.

Higher Education Programs

Our goal was to attract and retain students pursuing advanced STEM degrees and/or careers. Our objectives were to provide robotics and ballooning activities for 26 undergraduate deaf students in STEM courses; to provide scholarships to undergraduate and graduate students; to arrange internships for 6 students; to provide VLF training and a STEM career workshop at an HBCU for 26 underrepresented students and 5 faculty members; to provide a VLF training workshop for use in the 2012 International Space University; to develop new curriculum modules for use in a DCSGC-developed

introductory astronomy course with input from NASA Goddard Space Flight Center (GSFC) scientists; and to meet our target diversity participation level of 52.7% women and 41.6% minorities.

Research Infrastructure Programs

Our goal was to support students and faculty in STEM research opportunities at NASA Centers and universities. Our objectives were to support 4 faculty members (and 5 scholarship students) in on-campus mechanical and aerospace engineering research projects; to provide VLF research opportunities and training to 3 faculty members, 8 undergraduate students, and 5 graduate students, and produce a VLF research journal and website; to support 1 faculty member to research and develop software for use in undergraduate STEM courses, analysis of NASA data, and support of NASA-sponsored websites, as well as conduct hands-on research at NASA GSFC's Laboratory for Terrestrial Physics with a NASA mentor and his team of scientists; to support 1 faculty member and 1 graduate student (and 3 scholarship students) in an on-campus cognitive networking research project; to support 2 faculty members (and 2 scholarship students) in on-campus STEM research projects; and to meet our target diversity participation level of 52.7% women and 41.6% minorities.

Precollege Programs

Our goal was to inspire K-12 students to pursue STEM disciplines and careers by supporting K-12 teacher training workshops and activities. Our objectives were to support 1 teacher (with 6 students) in a robotics and engineering Botball workshop; to provide curriculum and programming support for 5 teachers (with 440 students) in the Student SpaceFlight Experiments Program (SSEP) Mission 1 to the International Space Station (ISS); to send 8 teachers (with 6 students) from a school for the deaf and schools with high student minority populations for hands-on training at NASA Space Camp; to train teachers to utilize an internet-based Space Explorers program that utilizes NASA data, research, and themes; to provide long-duration training to 14 teachers; to provide short-duration training to 10 teachers; and to have 15 teachers utilize the training in their classrooms.

Informal Education Programs

Our goal was to inform and inspire DC citizens about NASA and DCSGC opportunities. Our objectives were to host 1 activity and to reach 20 members of DC's diverse population.

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

The following anecdotes highlight just a few of the projects we supported so far in FY 11-12:

Outcome 1

Our ongoing support of George Washington University's (GWU) faculty and students in research on micro-propulsion was mentioned in the AIAA Aerospace American annual review published in December 2011. This breakthrough spacecraft propulsion research includes in-house effort to build and characterize a thruster based on the vacuum arc jet

ablation. This research is of vital important both to NASA and the private industry. As a result of this ground-breaking research, GWU has been selected to host the 33rd International Electric Propulsion Conference (IEPC) from October 6th-10th, 2013. This major international conference is organized under the sponsorship of the Electric Rocket Propulsion Society and the partnership of Aerojet. The IEPC is held approximately every 18 months and alternates between locations in the United States and overseas. It is the premier venue for the international community involved in the field of electric propulsion to meet and discuss latest research.

In Summer 2011 we supported a research project for Matthew Hartings and Kathryn Muratore, American University (AU) chemistry faculty, as well as AU student researchers, that resulted in the development of four new advanced chemistry lab courses. The 4 new courses have become the focal point of the AU Chemistry Department's publicity and recruiting efforts, and Department faculty are submitting proposals for additional non-DCSGC grants to support the research that will be done by students in the new courses. 2 research papers and several educational papers are being submitted based on the research work from the first year alone, and a researcher from AU's School of Education has written a National Science Foundation (NSF) proposal in collaboration with the chemistry faculty for $167,000, to further this research work.

Outcome 2

We supported a Hispanic middle school teacher, Anthonette Pena, to carry SSEP Mission 1 to the ISS activities at Stuart-Hobson Middle School (SHMS), which is 85% minority and Title I classification, where more than half of the students receive free or reduced lunch. More than 30 teachers and 1,100 students participated in the activities, and 2 patches and 1 experiment from SHMS were selected to be flown to the ISS in May 2012. As a result of these activities, Anthonette and the student team leader, Kyra Smith, were invited to attend the 2nd Annual White House Science Fair hosted by President Barack Obama in February 2012, to represent the DC Public Schools (DCPS). Anthonette and Kyra also got to meet Guest Speaker Bill Nye the Science Guy. We also supported Anthonette when she was invited to attend the launch of the Dragon spacecraft carrying the patches and experiment, from Kennedy Space Center (KSC), where she was interviewed by NASA Television, and met with NASA Administrator Charles Bolden moments before the launch to discuss her students' experiment. Anthonette was interviewed for articles about this program by The Washington Post, where the article appeared on the front page, and The Washingtonian.

PROGRAM ACCOMPLISHMENTS

We made the following advancements so far towards our FY 11-12 goals:

Fellowship/Scholarship Programs

20 scholarships were awarded to undergraduate students at AU, Catholic University of America (CUA), Gallaudet University (GU), GWU, the University of the District of Columbia (UDC), the University of Arizona (at GU for a summer research experience), and the University of South Florida (at GU for a summer research experience). 8 scholarships were awarded to graduate students at GWU and Howard University (HU).

12 scholarships (42.9%) were awarded to females, 13 (46.4%) to underrepresented minority students, and 4 (14.3%) to students with disabilities. All 28 scholarship recipients were matched with NASA mentors and university faculty mentors on various NASA Center internships and on-campus university research projects. 1 student received 2 scholarships for 2 NASA internships. It is too early to tell what percentage of this year's students will be retained and graduated in STEM disciplines or what percentage will seek or attain STEM employment, but the students have been added to the DCSGC longitudinal tracking database for annual follow-up.

Higher Education Programs

We supported computer upgrades at HU that are used for research and labs, including a NSF-sponsored summer REU program in which the computer upgrades proved invaluable for communicating with deaf students from GU who attended the program. We supported the integration of new NASA relevant lab modules into teaching labs, introducing several new experiments and a great deal of new capability into 2 advanced chemistry courses at HU. We supported the revision of an undergraduate physics lab course at GU to include construction of an underwater remotely operated vehicle (ROV) as a semester-long student project. 3 teams of 7 deaf students participated in 14 weeks of undergraduate laboratories to build 3 ROVs, which were tested in the campus swimming pool. We supported new curriculum modules for an undergraduate astronomy 100 course at Marymount University that is also being offered to Trinity Washington University. We supported implementation of PathEVO STEM career planning software at HU and UDC. We supported 2 INSPIRE Workshops that were held on the topic of "Teaching Science with an Enthusiastic Attitude" at the 2012 Young Women's Conference on Non-Traditional Careers and the 2011 International Space University. The workshops included VLF research and training for attendees. We supported 4 deaf students in summer research projects with 2 deaf scientists at GU and 3 students in internships at NASA Centers. We supported 3 faculty-student research teams at AU following a competition in which faculty members from every science department submitted proposals for meaningful student research activities, and 10 additional faculty members participated in a guest lecture component of the research activities. As a result of this project, four new chemistry courses were developed, the university decided to continue funding one of the activities annually, a proposal was submitted to the NSF, and multiple papers are being submitted for publication.

Research Infrastructure Programs

We supported a GU faculty member with hands-on research experience one day a week at NASA GSFC's Laboratory for Terrestrial Physics (Science Mission Directorate), working with a NASA mentor and his team on remote sensing data processing and updates to the NASA-sponsored website www.oceanmotion.org, the software for which is used in undergraduate STEM courses. We supported a faculty-student team at GWU in an aeronautics research project on micro-propulsion for small satellites, which resulted in an invited research paper being presented at a scientific conference, 4 self-submitted papers being presented, and several articles that have been published and are pending publication. As a direct result of this research an additional 4 proposals were submitted for non-DCSGC funding, which have garnered an additional $225,000 in funding, and

GWU has been selected to host a major international conference in 2013. We supported the production of a VLF research journal and website. In November 2011 we launched the next generation VLF-4 receiver kit with an improved design. The new kit is more user-friendly, and INSPIRE received requests from Tel Aviv University in Israel, Virginia Tech in VA, and the University of Texas in TX for kits to be incorporated into university curriculum for the upcoming year. We supported a faculty-student team at UDC in a research project on cognitive networking for space communications that resulted in 2 articles that have been published and are pending publication. We supported a faculty-student team at CUA in a research project in acoustics and engineering that resulted in 2 articles awaiting publication and 2 papers presented at conferences. The US Army has expressed a great deal of interest in the research because of its importance in detecting IEDs.

Precollege Programs

We supported Space Explorers, Inc.'s hands-on teacher training in an internet-based program that utilizes NASA data, research, and themes to 45 DCPS K-12 teachers at Anne Beers Elementary School, Brookland Educational Campus, Capitol Hill Montessori, Maya Angelou Public Charter School, Orr Elementary School, Powell Elementary School, Raymond Elementary School, and River Terrace Elementary School. We supported 1 K-12 teacher, 1 faculty member, and 1 undergraduate student in mentoring a team of 3 deaf students from the Model Secondary School for the Deaf in the April 2012 Greater DC Regional Botball Tournament. The team placed 4th in the double elimination tournament and 10th in the overall tournament, out of 22 teams. We supported the development of a new astronomy course for the high school level. An outline for the course in earth and space science was developed with the input of NASA scientists, but has not yet been launched. We supported 3 K-12 educators and 13 of their students at Space Camp in Huntsville, AL (in conjunction with NASA Marshall Space Flight Center (MSFC). We supported 30 teachers at Stuart Hobson Middle School in mentoring 1,100 6th-8th grade students for the SSEP Mission 1 to the ISS. 1 project and 2 patches were selected and launched to the ISS on the Dragon in May 2012. All of the teachers we supported have incorporated NASA resources into their classrooms.

Informal Education Programs

Along with the DC Office of the State Superintendent of Education, we co-sponsored the Young Women's Conference on Non-Traditional Careers at GU in March 2012. The conference program was written as a resource guide, providing information on presenters, STEM career opportunities, mentoring opportunities, and networking information. It included interactive exhibits and workshops. Attendees included 481 precollege students, 42 in-service educators, 5 pre-service educators, 1 informal educator, 31 administrators, 17 parents/guardians, 11 higher education faculty, 14 public at large, 4 sign language interpreters, 2 reporters from the AAAS and the DC Government, and 1 representative from the White House Office of Science and Technology Policy. Attendance more than doubled from last year because we held the conference on a school day rather than a weekend. We also supported a Venus Transit Family Night at the Howard B. Owens Science Center and a Venus Transit Webcast and Public Viewing at the HU Observatory

in June 2012 that reached approximately 130 students, parents, teachers, informal educators, administrators, faculty, and members of the general public.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- **Student Data and Longitudinal Tracking:** All of the students we support with direct scholarship funding or who participate in higher education or research infrastructure programs for 160 hours or more are in the DCSGC longitudinal tracking database and are monitored for progress through an annual survey. Since 2006, we have supported 149 students in the fellowship/scholarship category, 17 students in the higher education category, and 3 students in the research infrastructure category (including current year awardees). Of the total 169 students we are tracking, 78 of the students were underrepresented minority students and 24 of the students had disabilities. 80 of the students were female. 74 of the students are still enrolled in their current degree program, 26 have graduated and are pursuing advanced STEM degrees, 19 have graduated and are seeking STEM employment, 4 are employed in STEM as aerospace contractors, 33 are employed in STEM in non-aerospace positions, 2 are employed by NASA, 1 is employed in a STEM K-12 field, 6 are employed in a STEM higher education academic field, and 4 are employed in a non-STEM field.

- **Diversity:** The institutions, faculty, and students involved in our scholarship, research, higher education, precollege, and informal education programs were diverse. Our affiliates include HBCUs and OMIs. 46.2% of the students in our programs were underrepresented minorities.

- **Minority-Serving Institutions:** We supported scholarships and programs at 2 HBCUs (HU and UDC) and 1 university for the deaf (GU). We also supported programs at a minority-serving non-profit (S.M.A.R.T., Inc.), and supported programs in the DCPS which are predominantly African-American. We also supported several underrepresented students from non-DC universities who came to our MSIs for internships, and GWU hosted a student from HU in its DCSGC research program.

- **NASA Education Priorities:**
  We made the following accomplishments so far to support NASA's Current Areas of Emphasis:

  - **Authentic, hands on student experiences:** Our scholarships and higher education programs incorporated internships, robotics, and other hands-on research projects at the university level. Our precollege programs, though focused on teacher training, incorporate hands-on student participation at the precollege level as an added benefit.
  - **Engage middle school teachers:** All of our precollege programs involve engaging middle school teachers in hands-on curriculum enhancement

opportunities for them to incorporate into their classrooms and expose their students to NASA resources. Our informal education programs include conferences and Family Science Nights that involve the participation of middle school teachers.

- **Summer opportunities for secondary students:** Our scholarships, higher education, and research programs included summer internship programs on college campuses.
- **Community Colleges:** There are no community colleges in the District of Columbia. We supported a student at neighboring Prince George's Community College in MD last year, who used our support to finish her Associate's degree at PGCC and transfer to GWU for Fall 2012.
- **Aeronautics research:** Our scholarships, higher education programs, and research programs included internship and on-campus research projects that incorporated aeronautics research.
- **Environmental science:** We supported a hands-on research experience for a faculty member at NASA GSFC's Laboratory for Terrestrial Physics that included analysis of data on earth's environments.
- **Diversity:** The institutions, faculty, and students involved in our scholarship, research, higher education, precollege, and informal education programs were diverse. Our affiliates include HBCUs and OMIs. 46.2% of the students in our programs were underrepresented minorities.
- **Enhanced capacity:** Our research infrastructure programs included support of faculty in research geared towards NASA priorities in the Science Mission Directorate.

IMPROVEMENTS MADE IN THE PAST YEAR

We made several improvements and adjustments over the past year. In addition to generally streamlining the logistics of some of our management and ongoing activities, we moved into new office space at the lead institution; we have seen an increase in applications and attendance as we increase advertising of our opportunities through venues such as FaceBook; we updated our Strategic Plan with input from all affiliate members; we created new consortium-wide program reporting forms; for some of our programs, we now require scholarship recipients to serve as ambassadors at their universities to promote DCSGC programs; for some of our programs, we began incorporating weekly meetings with students to facilitate critical discussions and career counseling; and we are in the process of a total website redesign into a content management system that will make website updates and edits much easier.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

In addition to working with various organizations on particular aspects of certain programs, the following 18 institutions are DCSGC members, affiliates, and partners that regularly participate in activities almost every year:

- American University (Lead Institution): private university – supports scholarship, research, higher education, precollege, and informal education programs, as well as managing the consortium
- Aries Scientific: nonprofit – supports higher education and precollege programs
- Catholic University of America: private university – supports scholarship and research programs
- Gallaudet University: minority institution/federally chartered/quasi-governmental university for the deaf and hard of hearing – supports scholarship, precollege, research, and higher education programs
- Georgetown University: private university – supports scholarship and research programs
- George Washington University: private university – supports scholarship and research programs
- Howard University: HBCU/private university – supports scholarship, higher education, and research programs
- NASA Goddard Space Flight Center: government – supports scholarship and higher education programs
- NASA Headquarters: government – supports scholarship and higher education programs
- National Center for Earth and Space Science Education: science center – supports precollege and informal education programs
- Office of the D.C. State Superintendent of Education: government – supports informal education and precollege programs
- Owen Software: industry – supports higher education programs
- Solar System Ambassadors: government – supports informal education programs
- S.M.A.R.T., Inc.: nonprofit – supports precollege, higher education, and informal education programs
- Space Explorers, Inc.: nonprofit – supports precollege programs
- The INSPIRE Project, Inc.: nonprofit – supports scholarship, research, higher education, and precollege programs
- Trinity Washington University: minority institution/private university for women – supports scholarship programs
- University of the District of Columbia: HBCU/public university – supports scholarship, higher education, and research programs