District of Columbia Space Grant Consortium
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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 2012.

PROGRAM GOALS

We proposed the following goals for FY 12-13:

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 21 scholarships to undergraduate and graduate students in STEM disciplines (including 12 to female students, 8 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 12 of these students become employed in a STEM field; and to have 8 of these 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 scholarships to undergraduate and graduate students; to arrange internships for 6 students; to provide robotics and ballooning activities for 40 undergraduate deaf students in one revised and one new STEM course; 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 2013

International Space University; and to meet our target diversity participation level of 57.6% women and 38.6% 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 1 faculty member (and 3 scholarship students) in on-campus mechanical and aerospace engineering research projects; to support 3 faculty members and 1 graduate student (and 1 scholarship student) in on-campus mechanical engineering research projects; to provide VLF research opportunities and training to 4 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 energy-efficient communications protocol 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 57.6% women and 38.6% 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 8 students) in a robotics and engineering Botball precollege course and tournament; to provide curriculum and programming support for 27 teachers (with 1,088 students) in the Student SpaceFlight Experiments Program (SSEP) Mission 3 to the International Space Station (ISS); to send 8 teachers (with 8 students) from a school for the deaf and schools with high student minority populations for hands-on training at NASA Space Camp; to train 50 teachers (and 1,500 students) to utilize an internet-based Space Explorers program that utilizes NASA data, research, and themes; to provide long-duration training to 36 teachers; to provide short-duration training to 50 teachers; and to have 46 out of the 86 teachers utilize the long-duration and short-duration 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 hold 7 Family Science Nights at the Smithsonian Air & Space Museum and to reach 2,450 members of DC's diverse population.

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

The following anecdotes highlight just a few of the projects we supported so far in FY 12-13:

Outcome 1

We supported Derssie Mebratu, an African-American doctoral engineering student at Howard University, with 2 scholarships to intern at NASA GSFC during Summer and

Fall 2012. His NASA mentor was so impressed with his research that he continued to fund him on the project through Spring and Summer 2013. Mr. Mebratu hopes to be offered a full-time position at NASA GSFC upon completion of his Ph.D. Mr. Mebratu submitted an article on his NASA research that was published in the Spring/Summer 2013 issue of the INSPIRE Journal and can also be found on the INSPIRE website. NASA also asked Mr. Mebratu to serve as a NASA Student Ambassador, and his NASA Student Ambassador profile can be seen on NASA's website. As a NASA Student Ambassador, Mr. Mebratu generates awareness at Howard University of the vast STEM opportunities available at NASA for underrepresented minorities. He also serves as a mentor to STEM students, including an undergraduate DCSGC scholarship recipient.

In Summer 2012 we supported a research project for American University (AU) biology faculty member Katie DeCicco-Skinner and AU student researcher Tracy Tabib, to work as a team to study the effects of ionizing radiation on inflammatory proteins in the brain. Their research findings led to a collaboration with a team from Johns Hopkins. Through the collaboration, Dr. DeCicco-Skinner is named as a collaborator on two grants. One grant is still under review, but the other grant was just funded for $1.8 million from the National Space and Biomedical Research Institute. Dr. DeCicco-Skinner now has several new students to continue the research. Ms. Tabib just graduated with a B.S. in biology, and her experience with this NASA-funded research project made her very competitive when applying for Ph.D. programs. She was offered positions at 8 of the 9 top-ranked Ph.D. programs in the country. Ms. Tabib ultimately chose a Ph.D. program at Duke and will start the program, seeking her advanced STEM degree, in Fall 2013.

Outcome 2

We supported 7 K-12 teachers to train at Space Camp, and we are highlighting 3 of them. Mark Tao, a science teacher from Model Secondary School for the Deaf who attended Space Camp in 2013, was interviewed by the local ABC News television station which also posted the interview on its website. Florentia Spires, an African-American math teacher at Howard University Middle School of Math and Science and NASA Endeavor Fellow who attended Space Camp in 2012, developed a professional development workshop with curricula she acquired from Space Camp for 20 elementary school educators at 8 DC elementary feeder schools to Howard University Middle School in order to help the educators incorporate NASA STEM into their curriculums. As a result, Ms. Spires was asked to serve as a Washington, D.C. Space Camp Ambassador for the U.S. Space and Rocket Center. She spoke to 70 families about engaging their children in STEM disciplines. Ms. Spires was just selected as a 2013-2014 Albert Einstein Fellow; a prestigious award with only 22 educators selected nationally each year. She was assigned to work full time at the National Science Foundation next year. Jacqueline Fernandez, a Hispanic STEM teacher at Latin American Youth Center Academy Public Charter School who attended Space Camp in 2012, incorporated her Space Camp lessons into her classroom using such resources as NASA 360 to engage students. She is developing a new curriculum for a high school course in space science. Ms. Fernandez was just admitted into the NASA LEARN program at NASA LaRC. In May 2013, 5 of the teachers were invited to the Washington Space Business Roundtable's Luncheon on STEM Education to share their accomplishments with professionals in the space industry.

PROGRAM ACCOMPLISHMENTS

We made the following advancements so far towards our FY 12-13 goals:

Fellowship/Scholarship Programs

18 scholarships were awarded to undergraduate students at Catholic University of America (CUA), Gallaudet University (GU), George Washington University (GWU), Howard University (HU), the Rochester Institute of Technology (at GU for a summer research experience), Tarleton State University (at GU for a summer research experience), and the University of the District of Columbia (UDC). 5 scholarships were awarded to graduate students at CUA and HU. 1 student received 2 scholarships. 11 scholarships (47.8%) were awarded to females, 9 (39.1%) to underrepresented minority students, and 3 (13%) to students with disabilities. All 23 scholarship recipients were matched with NASA mentors and university faculty mentors on various NASA Center internships and on-campus university research projects. 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 the revision of 2 undergraduate physics lab courses at GU to include construction of an underwater remotely operated vehicle (ROV) as a semester-long student project. Our support included new underwater ROV-building and testing labs. 2 teams of deaf students participated in 14 weeks of undergraduate laboratories to build 2 ROVs, which were tested in the campus swimming pool. We supported the creation of a new robotics course at GU – Art, Robotics, and Interactivity – for students to build small interactive robotic systems. 2 faculty members and 35 deaf students participated in the new and revised courses at GU. With the participation of 3 faculty members, we supported the integration of PathEVO STEM academic and career planning software in the Department of Engineering at UDC. We supported a planning committee that is developing 2 INSPIRE Workshops to be held in 2014 on the topic of "Teaching Science with an Enthusiastic Attitude." The workshops include VLF research and training for attendees, and will be hosted at HU and the DC Public Schools. We supported scholarships and internships for 5 students at NASA Goddard Space Flight Center (GSFC), NASA Johnson Space Center (JSC), and NASA Langley Research Center (LaRC).

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 thruster technology for small satellites, which resulted in an invited research paper being presented at a scientific conference, 4 self-submitted papers being presented, 5 articles that have been published or are pending

publication, and 1 patent application. As a direct result of this research an additional 5 proposals were submitted for non-DCSGC funding, which have garnered an additional $15,000 in funding from NASA Ames, and GWU has been selected to host a major international conference in 2013. We supported the publication of a VLF research journal and website, which included scientific articles and content from some DCSGC interns and program participants. We supported a faculty-student team at UDC in a research project on cognitive networking for space communications that resulted in the faculty member co-authoring a book on energy efficiency that was published in 2013. As a direct result of this research a proposal was submitted for an additional $393,330 in non-DCSGC funding. We supported faculty-student teams at CUA in research projects in oscillating systems and alternative energy that allowed 3 students to complete their Master's theses in STEM. We supported 2 female faculty-student research teams at AU following a competition in which faculty members from every science department submitted proposals for meaningful student research activities. As a result of the efforts of the first team, 1 faculty member submitted a manuscript which is currently in revision and presented a paper at a conference. As a direct result of this research an additional 2 proposals were submitted for non-DCSGC funding, which have garnered an additional $1.8 million in funding from the National Space and Biomedical Research Institute, allowing new students to continue the research. Another proposal is currently under review. The second team carried out research and also developed a science-based welcome week program for incoming freshman, presented an invited paper, presented a self-submitted paper, and submitted an additional 3 proposals for non-DCSGC funding. The efforts of the second team led to an expanded continuation of the project with 3 new female students and support from the university. We supported 2 minority faculty-student research teams following a competition in which minority faculty members from all but 1 DC university (including a former DCSGC student who is now a DC faculty member) submitted proposals for meaningful student research activities. The first team is conducting research on adaptive cooperation and communication paradigms in multi-robot systems. The second team is conducting research on strain dependence of impedance and morphology in carbon nanotube yarns towards their development into integrated strain and damage sensors. This project just began so there are no results yet.

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 47 DCPS K-12 teachers at Anne Beers Elementary School, Brookland Educational Campus, Brookland Educational Campus-Bunker Hill, Capitol Hill Montessori, Garfield Elementary, Houston Elementary School, Hyde-Addison Elementary, Maya Angelou Public Charter School, and River Terrace Elementary School. We supported 2 K-12 teachers and 1 faculty member in mentoring a team of 4 deaf students from the Model Secondary School for the Deaf (MSSD) in the April 2013 Greater DC Regional Botball Tournament. The team placed 5th in the double elimination tournament out of 23 teams, and won the K.I.S.S. Award, a Judge's Choice Award for excellence in a variety of categories. We supported 1 K-12 teacher and 14 deaf students in 2 robotics courses given at MSSD in Fall 2012. We supported 7 K-12 educators and 10 of their students (including 6 deaf students) at Space Camp in Huntsville, AL (a program that partners with NASA Marshall Space Flight

Center (MSFC)) to offer 45 hours of intensive classroom, laboratory, and training time. The program focuses on space science and exploration with astronaut-style training and simulations. It also provides lessons for teachers to take back to their classrooms that are directly related to STEM activities. The teachers we supported came from schools with high minority student populations and a school for deaf students. We supported 27 teachers at Stuart Hobson Middle School in mentoring 1,100 6^{th}-8^{th} grade students for the SSEP Mission 3 to the ISS. 1 project and 2 patches will be competitively selected for the launch to the ISS in Fall 2013. We supported a professional development STEM education workshop for 11 K-12 teachers and 2 informal educators in June 2013. It was hosted by the DCPS at Stuart Hobson Middle School and included topics such as programs in earth and space science, classroom experiences, critical thinking, conceptual understanding, interdisciplinary exploration, scientific inquiry, Next Generation Science Standards, the Student Spaceflight Experiments Program, and more. With the exception of the 11 teachers at the STEM education workshop, all 84 of the teachers we supported have incorporated NASA resources into their classrooms. The teachers who attended the workshop indicated that they would do so as well, but it is too early to get a full assessment.

Informal Education Programs

We supported a Family Science Night series at the Smithsonian National Air & Space Museum. Attendees explore the museum's galleries after hours, experience an IMAX film, and hear a presentation by a dynamic space scientist. So far, 5 evening events have been held, reaching 1,632 students, parents, and teachers. Jay Carney, the White House Press Secretary, attended one of the events with his son and later wrote to one of the presenters: "My son Hugo and I have been talking about your presentation ever since we left that night, and I've been raving about it to every adult I encounter, including my staff!" We supported Discover the Sciences at AU in October 2012 that reached approximately 130 students, faculty, administrators, and parents. The event was designed to engage prospective students and their parents about STEM opportunities at AU, and a student was invited to present on her DCSGC-sponsored research. We supported Science Research Day at AU in January 2013 that reached approximately 120 students, faculty, administrators, and staff. The event was designed to bring awareness to students of the vast array of STEM research opportunities at AU. We were invited to attend and reach out to students about our opportunities. We supported an upgrade to the content storyboards for the Voyage Scale Model Solar System on the National Mall. These educational storyboards will be seen by the millions of people who visit the National Mall each year, and the DCSGC logo will be featured prominently – one of only 3 logos to be featured – next to the Smithsonian logo and the National Center for Earth and Space Science Education logo on the entry panel next to the Smithsonian National Air & Space Museum. They will be installed on the National Mall in June 2013.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE 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 166 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 186 students we are tracking, 84 (45.2%) of the students were underrepresented minority students and 27 (14.5%) of the students had disabilities. 90 (48.4%) of the students were female. 69 (37.1%) of the students are still enrolled in their current degree program, 33 (17.7%) have graduated and are pursuing advanced STEM degrees, 22 (11.8%) have graduated and are seeking STEM employment, 4 (2.2%) are employed in STEM as aerospace contractors, 41 (22%) are employed in STEM in non-aerospace positions, 3 (1.6%) are employed by NASA, 1 (0.6%) is employed in a STEM K-12 field, 7 (3.8%) are employed in a STEM higher education academic field, and 6 (3.2%) are employed in a non-STEM field.

- **Minority-Serving Institution Collaborations:** We supported scholarships and programs at 2 HBCUs (HU and UDC) and 1 university for the deaf (GU). We supported scholarship programs such as GU Scholarship Program, HU Scholarship Program, UDC Scholarship Program, and NASA Summer Internship Program for students at GU, HU, and UDC. We supported the research program Lightweight Protocols for Cognitive Networking Program at UDC. We supported higher education programs such as Undergraduate Robotics Activities and New Course Development at GU and PathEVO at UDC. We supported research programs such as Remote Sensing Imagery Analysis at GU and Minority Faculty Research Competition at CUA and UDC. We supported precollege programs such as Botball, Space Camp for Educators, Space Explorers, and SSEP in the DCPS, which are predominantly African-American. We have begun a collaborative research project partnership (that will be reported on next year) between AU and HU for the purpose of teaching astronomy to undergraduates with up-to-date facilities and holding public observing sessions to promote STEM education to the DC area.

- **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.
  - **Diversity:** The institutions, faculty, and students involved in our scholarship, research, higher education, precollege, and informal education programs were diverse. Our affiliates include 2 HBCUs and 1 OMI. 39.1% of our scholarship recipients were underrepresented minorities.
  - **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 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.
- **Aeronautics research:** Our scholarships, higher education programs, and research programs included NASA 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. Student researchers at CUA worked on alternative energy research.
- **Enhanced capacity:** Our research 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 have seen an increase in applications and proposals as our profile increases at the lead and affiliate universities and as we increase advertising of our opportunities through venues such as FaceBook; we circulated our Strategic Plan for input from all affiliate members; we created new consortium-wide program reporting forms; as a result of contacts and partnerships made through other DCSGC activities, we collaborated with a high level team to submit two strong augmentation proposals to NASA for FY 12-13; we created a team of interdisciplinary review committee members made up of representatives from other Space Grant consortia who assist us when we have competitions; we made adjustments that saved money as we hosted the National NASA Space Grant Directors' Meeting for the 13th year in a row; we successfully launched a new minority research program; and we are near completion 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:

- 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

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.