

The National Space Grant Office requires two annual reports, the Annual Performance Data Report (APD – this document) 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.

District of Columbia Space Grant Consortium
Lead Institution: American University
Director: Richard Berendzen
Telephone Number: 202-885-2755
Consortium URL: www.dcspacegrant.org
Grant Number: NNX10AT91H

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 2014.

PROGRAM GOALS

We proposed the following goals for FY 14-15:

Fellowship/Scholarship Programs

Our goal was to competitively provide NASA Internships, Fellowships, and Scholarships (NIFS) to meet the needs of NASA and DC, with an emphasis on women, minorities, and persons with disabilities. Our objectives were to competitively provide twenty scholarships to undergraduate and graduate students in STEM disciplines (including ten to female students and seven to underrepresented minority students); to provide meaningful research opportunities for DC's diverse student population; 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 the students pursue advanced STEM degrees and/or STEM careers, and to meet our diversity targets.

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 one faculty member (and three scholarship students) in on-campus mechanical and aerospace engineering research projects; to support three faculty members and one graduate student (and one scholarship student) in on-campus mechanical engineering research projects; to support one 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 Goddard Space Flight Center (GSFC)'s Laboratory for Terrestrial Physics with a NASA mentor and his team of scientists; to support four faculty members and four higher education students in the production of a research journal and website; to support one faculty member (and two scholarship students) in on-campus robotics research activities; and to meet our diversity targets.

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 six students; to support robotics and ballooning activities for thirty undergraduate deaf students in two revised STEM courses; to support VLF training and a STEM career workshop at an HBCU for twenty-six underrepresented students and five faculty members; to support two faculty members (and two scholarship students) in on-campus research activities; and to meet our diversity targets.

Precollege Programs

Our goal was to inspire precollege students to pursue STEM disciplines and careers by supporting precollege teacher training activities. Our objectives were to support one teacher (and five students) in a robotics and engineering Botball precollege course and tournament; to support eight teachers (and eight students) from a school for the deaf and schools with high minority populations in hands-on training at Space Camp; and to support curriculum and programming support for twenty-five teachers (and one thousand students) in the Student Spaceflight Experiments Program (SSEP) Mission 7 to the International Space Station.

Informal Education Programs

Our goal was to inform and inspire DC citizens about NASA themes and STEM content. Our objectives were to support six Family Science Nights at the Smithsonian National Air and Space Museum and reach 1,800 citizens, and to support a science research day outreach event at a university and reach 100 STEM faculty members and students.

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

The following anecdotes highlight just a few of the projects we supported so far in FY 14-15:

Outcome 1

One of the faculty research projects we funded at American University in Summer 2014 garnered the attention of the Catalyst, the student science magazine on campus. Tara Shreve, a student reporter for the Catalyst and a mathematics major, not only wrote an

article about the project, she joined the project as a student researcher and received a Space Grant scholarship. A few months later, Tara won a prestigious 2015 Barry Goldwater Scholarship based on the work she did on this project. Her experience on this project has led her to pursue a Ph.D. in Geophysics, with the goal of conducting research in remote sensing techniques and teaching at the university level.

Outcome 1

We supported an underrepresented faculty member and his team of nine underrepresented students from Howard University, an HBCU, in the RockSat-C Program. The team designed and built a sounding rocket payload that was launched on a rocket from NASA's Wallops Flight Facility in June 2014. The project collected atmospheric samples near the highest point of the flight to test for the presence of microorganisms. Data from the samples was used to develop a bio-signature that can help look for life on Earth-like, extra-solar planets. This was the first payload ever launched into space that was entirely designed and built at Howard University – and only the second payload from an HBCU. The activity was so successful that twenty underrepresented students signed up for a follow-on project, and the faculty member is working to make it a permanent activity.

Outcome 2

Our INSPIRE Space Camp for Educators Program has a profound impact on the teachers who participate. Three of them are STEM Enrichment Teacher Britni Whitti from Rose L. Hardy Middle School, Science Teacher and STEM Coordinator Jacqueline Fernandez-Romero from the Latin American Youth Center Career Academy, and STEM Coordinator Daisy Rayela from Thomas Johnson Middle School. As a result of this program, Ms. Whitti incorporated Kerbal Space Program, an online STEM-based teaching tool, into her curriculum. KSP is an online computer simulation where students build and design rockets, conduct launches, and collect data. Her students participated in the Team America Rocketry Challenge this year against 700 high school teams across the country. They built rockets after using RocSim to plan and simulate their launches, then went for their qualifying launches. As the ONLY middle school team and one of only two teams from Washington DC, her students placed 104th and missed the cutoff for Nationals by only .75 points (less than 1 foot in altitude). Her students celebrated World Space Week by designing Mars Habitats in a design competition and Skyped with Astronaut Leroy Chiao. As a result of this program, Ms. Fernandez-Romero built a teaching unit plan on space sciences and incorporated Space Camp materials into her classroom, including an activity where her students built their own version of a Mars Rover. In March 2015, she received the National Science Teachers Association Distinguished Service to Science Award. She was appointed as a USSRC Space Camp Ambassador and was selected by NASA for the 2015 SOFIA Airborne Astronomy Ambassadors Program. She is pursuing a Ph.D. in Curriculum and Instruction with a concentration in STEM Education. As a result of this program, Ms. Rayela uses most of the strategies and activities she learned at Space Camp. She is teaching flight and space and uses a lot of NASA resources. She is teaching other science teachers how to integrate STEM into their classrooms, and made a presentation about her experience in this program at STEM Family Night. Her classroom became more interactive, and she gives students design challenges using engineering. She developed and brought 7 new STEM activities to her school: STEM Career Day, Engineer in the

Classroom, Earth Day Activity, STEM in the Garden, SSEP Mission 8, Seaperch Challenge, and STEM Festival.

PROGRAM ACCOMPLISHMENTS

We made the following advancements so far towards our FY 14-15 goals:

Fellowship/Scholarship Programs

Eighteen scholarships have been awarded so far. Twelve scholarships were awarded to undergraduate students and six scholarships were awarded to graduate students. The scholarship recipients attend American University, Catholic University, Gallaudet University, George Washington University, Howard University, and the University of the District of Columbia. Nine scholarships (50%) were awarded to females, eight (44%) to underrepresented students, and three (17%) to students with disabilities. All 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 graduate 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.

Research Infrastructure Programs

We supported thirteen students and ten faculty members in STEM research activities at NASA Centers and universities. We supported two faculty members and four students in on-campus mechanical and aerospace engineering research projects at George Washington University. We supported three faculty members and three students in on-campus mechanical engineering research projects at Catholic University. We supported one faculty member from Gallaudet University to research and develop software for use in undergraduate STEM courses, analysis of NASA data, and support of NASA-sponsored websites, and conduct hands-on research at NASA GSFCs Laboratory for Terrestrial Physics. We supported four faculty members and six students in the production of a research journal and website on VLF. We exceeded our student diversity target of 35% underrepresented by supporting 44% underrepresented, and nearly met our target of 52% female by supporting 50% female.

Higher Education Programs

We recruited sixty-six students this year through research scholarships and higher education activities. We provided twelve scholarships to undergraduate students and six scholarships to graduate students. We arranged research internships at NASA GSFC for ten students, and supported higher education activities and research projects on university campuses for fifty-five students. We supported robotics and ballooning activities for thirty-three undergraduate deaf students at Gallaudet University. We supported the revision of three undergraduate STEM courses at Gallaudet University. We supported one faculty member and eight students in a research project at American University. We supported one faculty member and one student in a joint American University-NASA GSFC research project. We supported one underrepresented faculty member and nine underrepresented students at Howard University on the RockSat-C Program, where they designed, built, and launched a payload from NASAs Wallops Flight Facility in June 2014. We supported two

students to travel to the Mid Atlantic Regional NASA Space Grant Directors Meeting in Williamsburg, VA in September 2014 to present their research and posters. We exceeded our student diversity target of 35% underrepresented by supporting 44% underrepresented, and nearly met our target of 52% female by supporting 50% female.

Precollege Programs

We supported three precollege STEM teacher training activities. We supported one teacher and seven deaf high school students in a robotics and engineering Botball precollege course and tournament. The teacher incorporated a robotics course into the high school curriculum to recruit more students. We supported one teacher and seven deaf high school students in hands-on training at NASA Space Camp for the Deaf. We supported two teachers in the Space Camp for Educators Program. All of the teachers we supported incorporated the STEM content into their classrooms.

Informal Education Programs

We supported two informal education activities to inform and inspire DC citizens about NASA themes and STEM content. We supported four Family Science Nights at the Smithsonian National Air and Space Museum and reached 1,282 DC-area citizens. We supported a science research day outreach activity at American University and reached 148 STEM faculty members and students.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Diversity:** The institutions, faculty, and students involved in our scholarship, research, higher education, precollege, and informal education programs are diverse. Our affiliates include two HBCUs (Howard University and the University of the District of Columbia) and one OMI (Gallaudet University), the DC Public Schools are predominantly African-American, and the Model Secondary School for the Deaf is attended by deaf students. The faculty and Project Managers who received direct funding included two females and two underrepresented minorities, and additional female and minority faculty members participated in our activities. The affiliate representatives from STEM non-profit INSPIRE and HBCU University of the District of Columbia are female, and we supported two female teachers in hands-on teacher training. The DCSGC Assistant Director is an underrepresented female. 44% of our student scholarship recipients were underrepresented minorities, 50% were female, and 17% were persons with disabilities.
- **Minority-Serving Institution Collaborations:** We collaborated with five MSIs. We supported scholarships and programs at two HBCUs (Howard University and the University of the District of Columbia) and one university for the deaf (Gallaudet University), we supported precollege activities in the DC Public Schools which are predominantly African-American, and we supported precollege activities at Model Secondary School for the Deaf which is attended by deaf students. We supported student research scholarships at all three university MSIs (five from Howard

University, one from the University of the District of Columbia, and two from Gallaudet University). We supported NASA Center internships for five students from Howard University and one from the University of the District of Columbia. We supported higher education programs such as Gallaudet University Robotics Activities Program which supported robotics activities and revised courses for deaf students at Gallaudet University, INSPIRE Workshop Program which will support a STEM workshop at Howard University, Student Research Presentations Program which supported an underrepresented student from Howard University to travel to a conference to present his research and poster, and Howard University RockSat-C Program which supported an underrepresented faculty member and his team of nine underrepresented students to develop a science payload that was launched into suborbital space. We supported research programs such as Gallaudet University Faculty Research Program in remote sensing imagery analysis and University of the District of Columbia Robotic Systems Program at the University of the District of Columbia. We supported precollege programs such as Space Camp for Educators and the Student Spaceflight Experiments Program in the DC Public Schools, and Botball and Deaf Space Camp at Model Secondary School for the Deaf.

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, higher education, and research programs incorporated hands-on student experiences in NASA Center internships, on-campus STEM research programs, engineering activities, robotics activities, payload development and rocket launches, and research presentations at the university level. Our precollege programs in Botball, Space Camp, and SSEP, though focused on teacher training, incorporated hands-on student participation at the precollege level as an added benefit.
- **Engage middle school teachers:** Our precollege programs in Botball, Space Camp, and SSEP 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 and STEM content. Our informal education programs include Family Science Nights that also involve the participation of middle school teachers.
- **Summer opportunities for secondary students:** We do not support any summer opportunities for secondary students on college campuses.
- **Community Colleges:** There are no community colleges in the District of Columbia.
- **Aeronautics research:** Our scholarships, higher education, and research programs included NASA internships at NASA GSFC and on-campus research activities at Catholic University and George Washington University that incorporated research in areas relevant to aeronautics research. We supported internships at NASA GSFC where students worked on research in areas such as composite materials technology. We supported research activities at Catholic University in alternative energy, working fluids, and thermodynamic performance. We supported research activities at George Washington University in propulsion systems.

- **Environmental science and Global Climate Change:** We supported a hands-on research experience for a Gallaudet University faculty member at NASA GSFC's Laboratory for Terrestrial Physics that included analysis of data on earth's environments. We supported hands-on research for three faculty members and three students at Catholic University in engineering research related to energy, sustainability, environmental impacts, and global climate change. The research projects included alternative energy and working fluids. We supported hands-on research for one faculty member and one student at American University related to measuring small-scale turbulent features in the ocean using a satellite-borne radar to enhance the capability of existing and future satellites to supply relevant and actionable environmental data to scientists. We supported hands-on research for one faculty member and one student in a joint American University-NASA GSFC research project related to developing a low-cost CubeSat instrument for the measurement of carbon dioxide and methane in the Earth's atmosphere.
- **Enhanced capacity:** Our higher education and research programs at American University, Catholic University, George Washington University, Howard University, and the University of the District of Columbia included support of faculty members in research geared towards NASA priorities in the Science Mission Directorate. We supported higher education activities at American University in measuring small-scale turbulent features in the ocean using a satellite-borne radar and developing nonlinear filter algorithms that can be used to measure the fine-scale structure of the ocean surface from radar images collected by satellites. We supported higher education activities at American University in developing a low-cost CubeSat instrument for the measurement of carbon dioxide and methane in the Earth's atmosphere. We supported research activities at Catholic University in engineering research related to energy, sustainability, environmental impacts, and global climate change. We supported research activities at George Washington University in improving micropropulsion systems for CubeSats. We supported higher education activities at Howard University in designing, building, and launching payloads. We supported research activities at the University of the District of Columbia in adaptive cooperation in robotic systems using artificial intelligence.

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 programs and 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. In February 2015 we revised our Strategic Plan with input from all affiliate members. We created new consortium-wide program reporting forms. We negotiated an 8% indirects rate with the lead institution for the new FY15-18 proposal, which allows more funding to go to students and programs. We worked with all of our affiliates to submit the new FY15-18 proposal. Our recent augmentation award has led to new partnerships and the launch of new programs. We supported a new program with an underrepresented faculty member that has led to a new partnership at one of DC's HBCUs.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

In addition to working with various organizations on particular aspects of certain programs, the following fifteen 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: STEM nonprofit – supports higher education and precollege programs
- Catholic University: 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
- National Space Grant Foundation: STEM nonprofit – supports scholarship and higher education programs
- Smithsonian National Air and Space Museum: government – supports higher education, precollege, and informal education programs
- Space Explorers, Inc.: STEM nonprofit – supports precollege programs
- The INSPIRE Project, Inc.: STEM nonprofit – supports scholarship, research, higher education, and precollege programs
- University of the District of Columbia: HBCU/public university – supports scholarship, higher education, and research programs