

**Delaware Space Grant Consortium Lead Institution: University of Delaware**

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**A. 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 Delaware Space Grant Consortium is a Program Grant Consortium funded at a level of \$581,400 for fiscal year 2019.

**B. PROGRAM GOALS:**

DESGC goals are grouped in six principal categories.

**1) FELLOWSHIP/TUITION AWARD PROGRAM**

*Goal:* To administer a program that offers educational and research opportunities to college students in Delaware, undergraduate and graduate, including underrepresented minorities, who are pursuing degrees in areas that are related to STEM.

*Objective:* Ensure the fair distribution, in easily accessible form, of information about tuition awards and fellowships to DESGC affiliate universities and colleges. Facilitate the process by means of a DESGC website and online applications. Achieve diversity in DESGC student awards.

*Metric:* By 2018, the current DESGC website and Facebook page will be as user-friendly as possible to Delaware students.

*Metric:* We seek to have at least one undergraduate academic year tuition award awarded on each campus of the consortium, especially on those campuses that are MSI (DSU, DTCC, Wesley).

*Metric:* By 2018, the current DESGC application process will rely entirely on the NSGF online application process.

*Metric:* We seek to have at least one Graduate Fellowship each year be awarded to students at each of the two research universities in the consortium.

*Metric:* We seek to improve participation by panel members to six or more in order to ensure that the review is as well-informed, broad-ranging, and as fair as possible.

*Metric:* We seek to have at least one student from each of the affiliate research campuses participate in summer research activities, either on their own campus, or elsewhere.

*Objective:* Offer hands-on research experiences to undergraduate and graduate students (including underrepresented minorities and students with disabilities) at various programs in NASA centers.

*Metric:* DESGC strives to support two Delaware students at NASA centers each summer.

*Objective:* Ensure funding for fellowships and tuition awards to women, underrepresented minorities, and persons with disabilities.

*Metric:* DESGC seeks to have at least one graduate fellowship awarded annually to a student at the HBCU affiliate. DESGC seeks to have at least one underrepresented minority student receive funds for summer research.

## 2) RESEARCH INFRASTRUCTURE DEVELOPMENT (RID)

*Goal:* Re-establish RID funding to promote the improvement of research infrastructure and capabilities of affiliate members with an emphasis on NASA-related interest areas so the awardees can eventually propose to national agencies for larger research grants.

*Objective:* Increase the number of research proposals submitted by DESGC institutions in fields aligned with NASA's mission.

*Metric:* At least one research proposal will be submitted each year from Delaware in response to the NASA EPSCoR research CAN solicitation.

## 3) HIGHER EDUCATION

*Goal:* Use DESGC funding as leverage in academia to enhance the quality of course work in STEM-related fields on college campuses.

*Objective:* Support student attendance at RockOn and RockSat-C programs at NASA's Wallops Flight Facility through the DESGC affiliate DTCC Dover campus, Delaware State University, and also through the student engineering club on the UD Newark campus.

*Metric:* At least three students/instructors should attend the RockOn program at NASA WFF each summer.

*Objective:* Offer hands-on research opportunities to undergraduates on campuses of the DESGC. An important element in preparing a student who may in future be interested to seek employment in a NASA-related position is to expose the student to the excitement of cutting-edge research in a STEM-related area. Summer programs, either on the local campus, or on another campus belonging to the DESGC, provide essential opportunities.

*Metric:* DESGC seeks to have at least one student from each of the affiliate research campuses participate in summer research activities, either on their own campus or elsewhere.

*Objective:* Exploit the high-quality research environment of a NASA center to offer hands-on research experiences in an off-campus setting to students at undergraduate and graduate levels.

*Metric:* At least one student from Delaware should participate in a NASA center program each summer.

*Objective:* Make available opportunities for students (undergraduate and graduate) to have hands-on research experiences at research centers in the state of Delaware.

*Metric:* At least one student should participate in a Delaware Research center (e.g. Center for Composite Materials, Center for Remote Sensing, DE Biotechnology Institute, Bartol Research Institute) each summer.

#### 4) K-12 (PRE-COLLEGE) EDUCATION

*Goal:* To increase student awareness and access to education and career opportunities in aerospace, earth science, and supporting STEM disciplines.

*Objective:* Use DESGC and NASA resources to contribute to professional development of K-12 teachers.

*Metric:* Increase by 10% the number of Delaware teachers who attend development programs offered by Dr. Stephanie Wright, founder and CEO of Delaware Aerospace Education Foundation (DASEF).

#### 5) GENERAL PUBLIC

*Goal:* Support outreach activities that convey to the public, using the many successful programs that NASA operates, a sense of wonder about the universe in which we live.

*Objective:* Build on the strengths of existing outreach programs.

*Metric:* During FY2015-2019, DESGC will strive to achieve each year an increase in the annual funding to Dr. Wright's activities.

### **C. PROGRAM/PROJECT BENEFITS TO PROGRAM AREAS:**

- 1) Female middle school student who attended Delaware Aerospace Academy (DAA) during summer 2019: *"I went to Destination Mars last week and loved it! I enjoyed making things manually as well as participating in physical activities like the 'Mars Olympics'. My favorite parts of the camp were training like an astronaut and building a rocket that I got to launch at the end of the week. I was so proud to see it soar really high in the sky. Thanks for sponsoring this amazing camp – a week I will never forget!"*

Aligns to Space Grant Program Area: Informal Education Projects

- 2) Delaware Space Grant sponsored Showvik Haque, an undergraduate student studying mechanical engineering at the University of Delaware, in a summer internship at Ames Research Center in Moffett Field CA. Mr. Haque participated in the CFD Validation of NFAC 80x120 Upwind Blockage Experiments. He summarized his experience: *"Working as an intern in the Rotorcraft Aeromechanics branch of Ames Research Center has been an outstanding privilege and pleasure. The people I have met and experiences I have had are unforgettable and have shaped the trajectory for my future career in science and engineering."*

Aligns to Space Grant Program Area: NASA Internships and Fellowships (NIF)

- 3) Dr. Alexander Wise is a recent 2019 Ph.D. graduate from the University of Delaware (UD) in Physics. He received a Bachelor of Arts degree in Physics in 2012 from State University of New York (SUNY) at Geneseo. His Ph.D. research, which was partially funded and supported by the Delaware Space Grant Consortium through graduate fellowships, included a study of the physics behind the semi-major axis distribution of high-mass exoplanets including theory and numerical simulation, and a project devoted to improving our ability to detect earth-mass planets in 1 AU orbits around sun-like stars, filling in the space in the mass-semi-major axis distribution where Earth would go. Dr. Wise summarized the benefit of his graduate fellowship support: *"The Delaware Space Grant gave me more time for research than if I was a TA,*

*which allowed me to publish three papers before graduating that became the basis for my application to Penn State as a Postdoc.”*

Aligns to Space Grant Program Area: NASA Internships and Fellowships (NIF)

#### **D. PROGRAM ACCOMPLISHMENTS:**

- **NASA Internships and Fellowships (NIF):**  
A goal in FY19 was to offer educational and research opportunities to college students in Delaware, undergraduate and graduate, including underrepresented minorities, who are pursuing degrees in areas that are related to STEM.  
*Metric:* Award at least one undergraduate academic year tuition award on each affiliate campus.  
*Outcome:* In FY19, undergraduate awards were issued to 15 students on three affiliate campuses: Delaware State University, University of Delaware, and Wesley College.  
*Metric:* Award at least one graduate fellowship at each of Delaware’s two research universities.  
*Outcome:* In FY19, six graduate fellowships were issued to two affiliate campuses: Delaware State University and University of Delaware.  
*Metric:* Award at least one graduate fellowship annually to a student at Delaware’s HBCU.  
*Outcome:* A graduate fellowship was issued to an underrepresented minority student at Delaware’s HBCU, Delaware State University (DSU).
- **Higher Education projects:**  
A goal in FY19 was to enhance access to quality instruction and research experiences offered in STEM related fields by supporting student attendance at RockOn and RockSat-C programs at NASA’s Wallops Flight Facility and offering hands-on summer research experiences to Delaware students.  
*Metric:* At least three students/instructors should attend the RockOn program at NASA’s WFF each summer.  
*Outcome:* In FY19, two students (one female) from Delaware Technical Community College participated in the RockOn Workshop accompanied by Dr. Bennett Maruca, a UD Assistant Professor in Physics. In addition, DESGC sponsored a team of four University of Delaware students in the RockSat-C Program.  
*Metric:* at least one student from each affiliate campus should participate in summer research activities, either on their own campus, or elsewhere.  
*Outcome:* Nine students (six female, two underrepresented) received DESGC summer internships at four affiliate campuses: University of Delaware, Villanova University, Wesley College, and Wilmington University. In addition, DESGC sponsored three students (one female, one underrepresented) in internships at NASA Centers (ARC and GSFC).
- **Research Infrastructure projects:**  
RID funding was reestablished in the FY16 DESG augmentation budget and continued during the FY19 award period.  
*Metric:* As budgeted in FY19, sponsor \$20,000 in RID awards.

*Outcome:* In FY19, four University of Delaware researchers received RID award funding: Dr. John Clem for his support of the *Neutron Monitor Network*, Dr. Tracy DeLiberty for her work to create a dual enrollment geography course for local high school students, Dr. Bennett Maruca for his work on the *Curie Mission*, and Dr. Xiao Hai Yan for his research on global warming and climate change.

- **Precollege projects:**

In FY19, a goal was to enhance K-12 teachers' abilities to make students aware of education and career opportunities in STEM areas by using DESGC and NASA resources to contribute to Professional Development of K-12 teachers.

*Metric:* increase by 10% the number of Delaware teachers who attend development programs offered by Dr. Stephanie Wright, founder and CEO of DASEF (Delaware Aerospace Education Foundation).

*Outcome:* The number of Delaware teachers who attended Dr. Wright's development programs increased 56% over FY18. This year's programs were entitled "Wallops Flight Facility Focus Day", "Goddard Space Flight Center Focus Day", and "Educator Eyes on the Skies". Plans are being made to take development programs to the teachers in their schools, which is expected to greatly increase participation. In addition, Dr. Wright attended the National Science Teaching Association (NSTA) conference in St. Louis MO.

- **Informal Education projects:**

A goal in FY19 was to support outreach activities that convey a sense of wonder about the universe in which we live by helping to strengthen existing outreach programs offered by Dr. Stephanie Wright.

*Metric:* strive to increase by at least 5% each year the DESGC funding for Dr. Wright's public outreach activities.

*Outcome:* FY19 funding allowed DESGC to maintain Dr. Wright's FY16 - FY18 funding levels, which included a 13% increase from FY15, for public outreach activities. Also during FY19, Dr. Wright received an additional \$5,000 in support of a public event to celebrate the 50<sup>th</sup> anniversary of the Apollo 11 Moon landing.

## **E. MILESTONES**

DESGC's proposed milestones for FY19 have been met as outlined in our 5<sup>th</sup> year funding extension proposal. Graduate Fellowship, Undergraduate Tuition, Summer Internship, and Research Infrastructure awards were awarded during Quarter 3. Student participants were selected for the RockSat-C team and the UD Mechanical Engineering Senior Design project during Quarter 1, and student participants were selected for the RockOn Workshop during Quarter 2.

**F. PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE GOALS:**

- **Diversity:**  
DESGC’s academic affiliates include an HBCU (Delaware State University), an MSI (Wesley College), and all four campuses of Delaware Technical Community College. Our Associate Directors and Academic Consortium Members include four females and three underrepresented minorities. In FY19, over 39% of DESGC’s Internships, Fellowships, and Tuition Awards have been awarded to underrepresented/underserved students, and over 51% were awarded to females.
  
- **Minority Serving Institution Collaborations:**  
DESGC’s academic affiliates include one HBCU (Delaware State University) and one MSI (Wesley College). Associate Directors from each of these institutions, Dr. Hacene Boukari (DSU) participated as a reviewer for the FY19 Graduate Fellowship applications, and Dr. Malcolm D’Souza (Wesley College) participated as a reviewer for the FY19 Undergraduate Tuition Award applications.
  
- **Office of Education Annual Performance Indicators:**
  - API 3.3.3: STEM-19-1       33
  
  - API 3.3.5: STEM-19-5       46

**G. IMPROVEMENTS MADE IN THE PAST YEAR:**

- 1) Professor Bennett Maruca, a space hardware experimentalist in the Department of Physics and Astronomy at the University of Delaware, was appointed Associate Director with an emphasis on coordinating DESGC supported student experimental activities across the consortium last year. Since then, he has expanded participation in the RockSat-C program in complete coordination with other faculty who have been participating on a piece-meal basis. We are now in the first year of this expanded activity.
  
- 2) Last year’s plan to appoint Dr. Milton Muldrow of Wilmington University as Associate Director has been accomplished. The motivation for this was the opening of a new campus in North Wilmington at which increased STEM instruction and activities were anticipated. Following Dr. Muldrow’s appointment, DESGC provided RID funding for 3 student internships to help him develop this new STEM activity. With Dr. Muldrow’s appointment, there are three African-American Associate Directors on the Board of DESGC.
  
- 3) The DESGC website was updated and redesigned during FY19. The overhaul provides clarity of content and a greater focus on student imagery. The site also enables mobile-friendly access to web pages.

## **H. CURRENT AND PROJECTED CHALLENGES:**

- 1) We have in past years worked towards securing participation by the campuses of Delaware Technical Community College (DTCC) in DESGC activities by meeting with several faculty from DTCC campuses. Getting such participation continues to be a challenge.
- 2) Although there has been significantly increased participation by underrepresented groups in application for space grant activities, we continue to feel that there is room for additional improvement and we accept this as a challenge going forward.

## **I. PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION:**

- 1) 4-year Academic Institutions:

(a) The lead institution of DESGC is the University of Delaware (UD). UD is classified by the Carnegie Foundation for the Advancement of Teaching as a doctoral university with highest research activity, a designation accorded to just 2.5% of the more than 4,600 degree-granting institutions in the USA. Currently, UD has 19,047 undergraduate students and 4,130 graduate students enrolled, and offers bachelor degrees in all STEM subject areas. Many of the DESGC graduate fellows are UD students from a variety of colleges: Arts & Sciences (Departments of Chemistry and Physics & Astronomy), Engineering (Departments of Chemical, Computer, Electrical, Materials Science, and Mechanical), and Earth, Ocean & Environment (Oceanography). UD undergraduates from a variety of colleges have benefitted from DESGC-funded tuition awards and summer research opportunities. Researchers in various colleges (Engineering, Earth, Ocean & Environment, Arts & Sciences, Agriculture & Natural Resources) and the Delaware Biotechnology Institute (DBI) have benefitted since 2005 from DESGC Research Infrastructure (RID) Funds.

(b) Delaware State University (DSU), an HBCU, has 4,208 undergraduate students, 378 graduate students, and offers bachelor degrees in at least one STEM area. The undergraduate student body is 76% underrepresented minorities. In FY19, four DSU undergraduate students were awarded DESGC tuition awards, and one graduate student was awarded a DESGC graduate fellowship.

(c) Wilmington University (WilmU) (9,042 undergraduate students, 5,744 graduate students) offers a range of bachelor degrees that includes one or more of the STEM disciplines. In FY19, two (one underrepresented minority) undergraduate students participated in summer research sponsored by DESGC. WilmU's undergraduate student body is 65% female and 34% underrepresented minorities. In FY19, two WilmU students participated in summer research sponsored by DESGC.

(d) Wesley College, an MSI with over 1,229 undergrads, offers a range of bachelor degrees in the STEM disciplines. 48% of the undergraduate student body are underrepresented minorities, and 55% are female. In FY19, two Wesley students were awarded DESGC tuition

awards, and two participated in summer research sponsored by DESGC.

(e) Swarthmore College, with 1,641 undergrads, offers bachelor degrees in several STEM areas. The student body is 20% underrepresented minorities and 51% female.

(f) Villanova University is a DESGC affiliate in southeastern Pennsylvania with 6,516 undergraduate students and 3,161 graduate students. The student body is 53% female. In FY19, DESGC supported one female student in summer research.

## 2) 2-year Academic Institutions

Delaware Technical Community College (DTCC) has a total of 13,895 students on four campuses distributed widely across the State. The average student body includes 38% underrepresented minorities and 64% female. In FY19, two DTCC students participated in the RockOn Workshop at Wallops Flight Facility.

## 3) Non-Profit Affiliates

DASEF (Delaware AeroSpace Education Foundation) is an enterprise founded in 1989 by Dr. Stephanie Wright (at one time, Delaware's Teacher in Space) to create an exceptional learning environment that inspires children and their families with an appreciation of the Earth and its place in the universe. DASEF has contributed to the academic development of over 601,600 students, educators, and the general public through the delivery of context-based activities consistent with current aerospace research and development. Many youth, through DASEF experiences, have been inspired to pursue the sciences, technology, engineering, and mathematics.

## 4) Industrial Affiliates

ILC Dover LP (makers of space suits for NASA) and Northrop Grumman (formerly Orbital ATK, Inc.) supply active members to DESGC's Advisory Board. Air Liquide Advanced Technologies U.S. LLC in Newark DE is our newest industrial affiliate. Activities of these board members include reviewing applications for DESGC Graduate Fellowships and providing a detailed statistical analysis of the results to ensure a lack of bias among reviewers. Another Advisory Board member, Dr. Aaron Owens, is retired and continues to represent the DuPont Company.