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 Pennsylvania Space Grant Consortium (PSGC) is a Designated Consortium funded at a level of $575,000 for fiscal year 2015.

B. PROGRAM GOALS

PSGC Goals: (1) Develop and promote opportunities for undergraduate and graduate students to participate in research and discovery, including space-related student engineering projects; include programs that enhance the participation of students from underrepresented groups. (2) Provide graduate and undergraduate training in NASA-related fields through the mechanism of fellowship and scholarship awards; increase the number of awards to students from underrepresented groups. (3) Implement programs targeted at increasing the retention rate of students from underrepresented groups in science and engineering. (4) Provide information and programs to increase access to the excitement, knowledge, and technology from America’s Earth, air, and space programs; establish PSGC as a viable state resource and catalyst for aerospace research, education, and economic development. (5) Cultivate a statewide network
of partners from universities, industry, and science centers to pursue aerospace research, education, and economic development goals.

C. PROGRAM/PROJECT BENEFITS TO PROGRAM AREAS

• **NASA Internships, Fellowships, and Scholarships (NIFS):** Over the course of a semester, our fellowship and scholarship awardees are required to participate in mentoring or education outreach activities for a minimum of 10 hours. Many students choose to donate their time at Discovery Space of Central Pennsylvania, a children’s science museum located in downtown State College. Altogether, our students donated an estimated 110 hours of community outreach in FY 2015.

Daniel Rueda graduated from Pennsylvania State University in 2014 having had two NASA summer internships. His first internship was at NASA Goddard Space Flight Center, and his second was at NASA Ames Research Center as a Rotorcraft Aeromechanics Intern. **He is now a software engineer at Lockheed Martin Space Systems Company.**

• **Higher Education:** Due to the popularity of our Women in Science and Engineering Research (WISER)/Minority Undergraduate Research Experience (MURE)/Freshman Undergraduate Research Program (FURP) scholarship program, we were able to invite an additional 21 new research labs to host students for first-year research experience. The number of participating students increased from 78 in our previous cohort to 94 in this fiscal year.

Dean Ripley is a recent graduate of Drexel University, with a B.S. degree in Mechanical Engineering. In 2014, he received funding from the PSGC while working on an Origami Solar Array for CubeSats at Drexel. The goal of this project was to develop a small scale, modular array capable of launching with and operating on a CubeSat of standard dimensions. **Dean joined the In-Space Propulsion team at SpaceX in the summer of 2015.**

• **Precollege:** For the sixth consecutive year, Commonwealth Connections Academy was awarded first place in the Pennsylvania Real World Design Competition and was invited to participate in the national Real World Design Competition. Students who have participated in prior challenges have gone into various STEM fields.

Michele Crowl received funding from the PSGC in 2012 while working to earn her Ph.D. in Science Education at Penn State, where she also received her B.S. in Astronomy and Astrophysics. Her research focused on outreach to interest children in various science fields. She got involved with Discovery Space of Central Pennsylvania, and initially worked there as a volunteer while conducting her PSGC-funded research. **Michele is now the Director of Education at Discovery Space, and dedicated to informal science education.**
D. PROGRAM ACCOMPLISHMENTS

- NASA Internships, Fellowships, and Scholarships (NIFS): In FY2015 we awarded 11 (81% female, 18% minority) statewide fellowships and scholarships. In terms of our specific targets for our statewide fellowship and scholarship programs, we did not meet our goal of 40 awards because new sub-awards were not issued to programs that had carry over funds from grant number NNX10AK74H. Once the new sub-awards were issued later in the fiscal year, additional time was needed to implement them. However, we exceeded our metrics for supporting underrepresented minorities.

An estimated additional 48 NIFS were awarded on grant number NNX10AK74H using carried over funds from previous years that resulted from a delay to some programs during the initial ramp-up phase of that project.

We had a total of 21 new researchers participate who hosted a total of 29 students in our WISER/MURE/FURP undergraduate research scholarship program. Of the scholarships awarded, 90% were granted to females and 21% were granted to underrepresented minority groups.

An additional 67 WISER/MURE/FURP students were supported on grant number NNX10AK74H.

In FY 2015, we did not support students during summer 2015 for NASA Center internships because this required commitment in early March 2015 before our funds arrived at the University.

Eleven NASA center internships were supported throughout the country on grant number NNX10AK74H. We made a strong effort to offer internship funding to students from underrepresented groups with the percentage at 63% women awardees and 10% underrepresented minorities.

- Higher Education projects: The PSGC supported the higher education student programs Penn State Flight Vehicle Design and Fabrication course, Drexel University Space Systems Laboratory, Temple University Student Space Exploration and Embedded Systems Laboratory, Messiah College Compact Particle Detectors, Franklin and Marshall Undergraduate Research, Gannon University Undergraduate Research, Lehigh Hopper Spacecraft, Gettysburg NURO, and Carnegie Mellon University Building an Atmosphere Interdisciplinary Design course. We met our metric of state-wide higher education programs funded by supporting Messiah College and the Carnegie Mellon School of Architecture. Messiah College provided 5 undergraduate students (20% female) the opportunity to participate in hands-on research and heighten their interest in STEM areas.

We exceeded our metric of two consortium mini-grants by awarding five mini-grants to the following institutions in support of their higher education student engagement: Drexel University, Carnegie Mellon University, Gannon University, Lehigh University, Gettysburg University, and Franklin & Marshall College.
An additional 13 higher education projects operated on an extension of their sub-award on grant number NNX10AK74H.

- **Research Infrastructure projects:** In FY 2015 we did not support any research infrastructure projects. We believe this lack of funding is due to our promotion strategy. Our goal for the next fiscal year is to develop a marketing plan to attract more Research Infrastructure projects.

  However, we supported Amanda Martino from Saint Francis University, who worked on “Microbial community analysis of deeply buried sediments of the Costa Rica margin” on grant number NNX10AK74H.

- **Precollege projects:** Precollege programming supported a total of 436 students and 80 educators. We met our specific target of funding two new precollege programs by supporting the Commonwealth Connections Academy (CCA) and Marine Advanced Technology Education (MATE) program. CCA is a public cyber charter Title I school located in Harrisburg, PA. The CCA high school team (6 students, 1 educator) was invited to the national Real World Design Challenge, a competitive aviation challenge. The challenge this year was to design an unmanned aerial system that determine the moisture of crops during three phases of the growing season. We contributed to their funding to attend the challenge in Washington, DC on April 24, 2016.

  We continued our Penn State Science Workshops for Educators program by supporting a total of 36 in-service educators. These educators participated in five workshops offered throughout FY 2015, with an emphasis on inquiry-based activities and discussions designed to deepen understanding of STEM topics which are aligned to the PA elementary and middle school science, technology, engineering, environmental and ecology standards.

  An additional six precollege programs for in-service educators and K-12 students were supported on grant number NNX10AK74H.

- **Informal Education projects:** In FY 2015, informal education examples include Penn State students volunteering at the Discovery Space children’s science museum. In the future, we plan to continue our collaboration with the Carnegie Science Center, the Franklin Institute, and the Whitaker Center.

  Additional informal education programs were supported on grant number NNX10AK74H.

E. **PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE GOALS**

- **Diversity:**
  Fellowships and Scholarships were provided to 9 students from underrepresented minority groups out of 47 participants (19%); and 36 female students out of 47 participants (77%).
All programming combined (FS, HE, & RI) involved 13 students from underrepresented minority groups out of 135 participants (10%); and 45 female students out of 135 participants (33%).

Additionally, a high number of our participants come from underserved rural populations throughout Pennsylvania.

Also, underrepresented minority groups were supported on grant number NNX10AK74H.

- **Minority-Serving Institution Collaborations:**
  We have Minority-Serving Institution (MSI) collaborations with Lincoln University and Cheyney University. Both of these schools offer PSGC scholarships so that deserving can gain valuable, authentic research experience at their home institution. Lincoln University and Cheyney University both did not award scholarships in FY 2015 because they were operating on an extension of their sub-award on grant number NNX10AK74H.

  *In FY2015 Lincoln University awarded four scholarships and Cheyney University awarded one scholarship on grant number NNX10AK74H.*

  We plan to continue our partnership with the Penn State Department of Biochemistry and Molecular Biology and several other MSIs (University of Puerto Rico, University of Maryland-Baltimore) to offer quality, authentic summer research experiences.

  *In FY2015 we awarded seven (71% female) summer internships to these minority serving institutions on grant number NNX10AK74H.*

- **Office of Education Annual Performance Indicators:**
  - **API ED-15-1** 136
    - *In addition, an estimated 88 NIFS were awarded to underrepresented minorities on grant number NNX10AK74H.*
  - **API ED-15-2** 121
    - *An additional 121 educators were supported on grant number NNX10AK74H.*
  - **API ED-15-4** 197
    - *An additional 2 events were supported on grant number NNX10AK74H.*
  - **API ED-15-5** 436
    - *An Additional 197 students were supported on grant number NNX10AK74H.*

F. **IMPROVEMENTS MADE IN THE PAST YEAR**

In our office, Linda Bell retired after 36 years at Penn State, nine of which were spent at Space Grant. Jaclyn Stimely was hired in December 2015 to replace Linda’s position as the Grants/Operations Manager. We have restructured our office by adding a new Program Coordinator, Jessica Beebe, and a new Penn State Program Manager, Erin DiMaggio. Erin
oversees our Penn State WISER/MURE/FURP undergraduate research program, and is the point of contact for all faculty and students involved.

G. CURRENT AND PROJECTED CHALLENGES

Historically the number of state-wide scholarship applications received each year was record breaking. However, in recent years, the number of applications has declined. We believe the decline in applications could be due to our promotion strategy. Currently we announce our scholarship opportunities on our website, but we are not sure that students visit our page. We are very successful in promoting our WISER/MURE/FURP scholarships at Penn State through various communication channels. In the upcoming year we would like to work on a strategy to better engage students across the state to increase our application pool.

H. PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

- **The Pennsylvania State University**: Lead institution; 4-year University. Manages undergraduate and graduate student scholarships and fellowships, undergraduate research programs, K-12 educator professional development workshops, public outreach events, and hosts three unique space systems laboratories and flight courses; mini grant recipient.

- **California University of Pennsylvania**: Affiliate; 4-year university. Manages atmospheric sciences/remote sensing research group.

- **Carnegie Mellon University**: Affiliate; 4-year university. Manages “Go Research!” summer undergraduate research program; involved in Lunar Lion X-Prize team internship.

- **Cheyney University (MSI)**: Affiliate; 4-year university. Manages undergraduate scholarship program.

- **Drexel University**: Affiliate; 4-year university. Operates Drexel Space Systems Laboratory.

- **Franklin & Marshall College**: Affiliate; 4-year university. Manages the NURO undergraduate research in astronomy program.

- **Gannon University**: Affiliate; 4-year university. Operates Gannon University High-altitude Balloon Program.

- **Gettysburg College**: Affiliate; 4-year university. Manages the NURO undergraduate research in astronomy program.

- **Lehigh University**: Affiliate; 4-year university. Manages undergraduate and graduate student and NASA explorers schools project; mini grant recipient for the hopper spacecraft simulator project.

- **Lincoln University of Pennsylvania (MSI)**: Affiliate; 4-year university. Administers undergraduate student scholarship.

- **Montgomery County Community College**: Affiliate; community college. Involved in projects and activities in collaboration with the Temple University Space Systems Laboratory.

- **NASTAR Center**: Affiliate; industry. Manages STEM education programs for students and teachers.
Penn State University – Abington: Affiliate; 4-year university. Manages undergraduate research program, ACURA; facilitates radio astronomy investigations program at the National Radio Observatory.

Susquehanna University: Affiliate; 4-year university. Operates Saturday Science program for pre-service educators and K-12 students.

Temple University: Affiliate; 4-year university. Manages the Student Space Exploration and Embedded Systems Laboratory, summer program in electrical engineering for high school students, and undergraduate scholarship program.

University of Pittsburgh: Affiliate; 4-year university. Manages NASA Space Grant fellowship program for undergraduate students; Education Resource Center elementary and middle school GLOBE program.

West Chester University: Affiliate; 4-year university. Manages the undergraduate research program to increase numbers in STEM majors.

Academic STEM Alliance (Bald Eagle, Bellefonte, Penns Valley Area School Districts): Program partner; K-12 school district. Involved in Centre County pre-college and informal education programs.

The Aerospace Corporation, Ball Aerospace, Boeing, and Lockheed Martin: Industry partners. Involved in Penn State student projects.

Carnegie Mellon University, School of Architecture: Mini grant recipient; 2 STEM design courses focused on the research, ideation, design, and physical mockup of an inflatable Mars habitat.

Carnegie Science Center: Program partner; museum. Involved in new educator workshops starting next FY.

Center for Science and the Schools: STEM education network member. Involved in educator professional development workshops at Penn State University.

The Franklin Institute: Program partner; museum. Involved in activities related to the Drexel Space Systems Laboratory.

Messiah College: Mini grant recipient; provide research and educational opportunities to undergraduate students in STEM education.


National Radio Astronomy Observatory: Program partner; government facility. Hosts undergraduate research in astronomy for Penn State Abington teams.

Selinsgrove Area Intermediate School: Program partner; K-12 school. Involved in Susquehanna University Saturday Science program.

Selinsgrove Area School District: Program partner; K-12 school district. Involved in Susquehanna University Saturday Science program.

Penn State Public Broadcasting: STEM public outreach partner. Involved in marketing and outreach for informal education events and programs.