

The Pennsylvania 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 Pennsylvania Space Grant Consortium (PSGC) is a Designated Grant Consortium funded at a level of **\$785,000** for fiscal year 2009.

PROGRAM GOALS

PSGC Goals: (1) Develop and promote opportunities for students to participate in research and discovery, including student flight projects; include programs with a focus on enhancing 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) Support the development of interdisciplinary courses, curricula, and workshops, including introductory courses designed for undergraduate students not majoring in scientific or technological disciplines. (4) Model diversity in space grant leadership, programs, and activities; implement programs targeted at increasing the retention rate of students from underrepresented groups in science and engineering. (5) 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. (6) Cultivate a statewide network of partners from universities, industry, museums, science centers, state and local agencies to pursue aerospace research, education, and economic development goals. (7) Develop earth, air, and space programs to enhance public scientific literacy and to complement community needs.

FY2009 Targets: Specifically, we aimed to have 55 PSGC fellowships and scholarships for graduate students and undergraduates. We intended to award 14 state-wide scholarships for NASA Centers, and to have 50 research scholarships to support women and minorities in hands-on laboratory experiences. We aimed to award 4 Lehigh-Goddard student research internships. We expected to support 10 students to participate in the ACURA research project, and 10 for the National Radio Astronomy Observatory project

at Abington. We expected to support 4-5 West Chester University astronomy majors and 4-5 undergraduates at Franklin and Marshall and/or Gettysburg College performing undergraduate research in the National Undergraduate Research Observatory Program. We aimed to have 30 students participate in the Student Space Programs Laboratory (SSPL), 5 students in OSIRIS, 5 students participate in CanSat, and 5 students in the USLI program. We aimed to have 25 student participants in two NASA-supported courses offered (FDVF/Sailplane and Geospatial Training for Pre-service Teachers). We aimed to have two HBCU participants in our Lincoln University Environmental Sciences Research. For all of our programs, we aim to have over 13.6% of the awards go to underrepresented minorities and have an application to award ratio of 3 to 1. We aimed to implement a research infrastructure seed grant program by awarding 7 grants. We aimed to have educators from minority school districts attend the BEST Robotics teacher training. We intended to have 75 teachers attend our science workshops at Penn State. Our aim was to have 40 teachers be part of GLOBE workshops around the state. We intended to have 12 Saturday Science Program events in the year with 15 students participating each time. We expected to have 50 participants in Temple's Engineering Explorers Post and 25 students involved in Temple's Introduction to Electrical & Computer Engineering. Finally, we aimed to have 50 university exhibitors and 2,000 public attendees at Penn State's Exploration Day.

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

Outcome 1 Highlights

Examples of workforce development: Two of our 2009 students have since been involved with SpaceX. **Ross Finman** (CMU) has finished a summer internship working on the software for the Dragon cargo capsule and is now starting a Ph.D. at MIT. Another 2009 PSGC student is currently in negotiations for employment at SpaceX. **Tony Tao** (PSU), who had a JPL internship through the PSGC, has spent this last summer at AeroVironment and is starting a graduate degree in Aeronautical Engineering at MIT. **Jonathan Gross** (PSU), who was supported for a NASA internship, is starting a Ph.D. at Georgia Tech in Aerospace Engineering. **Jeffrey Diebold** (Lehigh) is now starting a Ph.D. in Aerospace Engineering at the University of Illinois. **Emily Gehrels** (CMU) has reported to us that her experience as a 2009 summer intern at NASA Goddard helped her land a prestigious internship at the National Institute of Standards and Technology (NIST). Current undergraduates **Matthew Kuhn** (CMU), **Donovan Bolger** (Temple), **Mallory Snowden** (Lehigh), and **Ben Beers** (PSU) are all working on significant NASA projects. Kuhn, who was sent by PSGC to NASA Goddard in 2009, is now at MSFC working as an intern on small thrusters. Over the past year, Bolger has been testing space-flight hardware for the Express Logistics Carrier project at NASA Goddard. Snowden was invited back for a second summer with the Advanced Materials and Processing Branch at Langley Research Center. Finally, Beers was specifically invited back for a second summer at MSFC to work in the Combustion Laboratory.

Participating in the Marshall Space Grant Research internship gave me an in-depth experience into the field I someday hope to be a part of ...The program provided me with the opportunity to become better acquainted with the Aerospace field in general while giving me the chance to network with both NASA employees and fellow interns and co-ops. The overall experience was one of a lifetime and I couldn't have asked for a better

summer. ... It directly impacted my choice of career paths by allowing me to determine what my interests are and how to direct my education toward earning the most appropriate degree. –B. Beers, 2009 Space Grant-NASA/Marshall Internship

Outcome 2 Highlights

I had no background in the topic, but now I have knowledge of the space program, exploration, and future. ...Now I am able to get my students excited that, in 20 years, they could be on the moon. - Anonymous STEM Educator, Lunar Exploration Workshop

My participation in the Space Grant consortium started when I was in second grade through the Saturday Science program at Susquehanna University. This program was the best thing to ever happen to me as it was a catalyst for future scientific endeavors... Because of this program, more specifically, there was never a question of what I wanted to study or do later in life. I knew since elementary school that I wanted to pursue science and/or engineering further and eventually work for NASA. – G. Wilt, 2009 Stein Scholar

PROGRAM ACCOMPLISHMENTS

In relationship to our overall goals, we are proud to report that we funded 10 student flight projects and competitions with 160 higher education participants, awarded 190 fellowships, scholarships and internships to students in the STEM fields, and developed 3 new courses, including 2 teacher professional development workshops (2-credit graduate level courses at Penn State). Additionally, the PSGC supported 47 underrepresented undergrad and graduate students in FY2009, and 334 underrepresented students from around the commonwealth participated in long-term student-based STEM PSGC projects aimed at inspiring and engaging youth. Finally, more than 65% of the 492 in-service educators who participated in PSGC programs were from schools with >50% minority populations.

In terms of our specific targets for our **Fellowship and Scholarship** programs, we met our target of awarding 55 PSGC Fellowships and Scholarships with 14.5% being awarded to underrepresented minorities. We exceeded our target with 19 students funded for internships at NASA Centers from around the state and another 4 Lehigh students for the Lehigh-Goddard program. However, only 8.7% of the funded students were underrepresented minorities. We exceeded our targets with 112 WISER/MURE/FURP Scholarships (with over 93% awarded to either women or underrepresented minorities). In terms of our specific targets for our **Higher Education** programs, we exceeded our target with 15 students in the ACURA program (with 20% from underrepresented minority populations). We approached our target with 8 students in the National Radio Astronomy Observatory project. An astonishing 38% of these students were underrepresented minorities far exceeding our target of 13.6%. We missed our targets for our West Chester program with only 2 STEM majors involved in undergraduate research. At Franklin and Marshall and at Gettysburg College, our NURO program exceeded its targets with 14 majors involved with undergraduate research and 5 heading to graduate school. Our student space hardware programs at PSU (SSPL, OSIRIS, CanSat, and USLI) greatly exceeded their targets with a total of 118 student participants. However, only 8.5% of these students were women significantly missing our target of 20%. These results underscore the challenges of promoting hands-on-engineering experiences to

women students when programs grow quickly in size, and suggest that our office needs to reevaluate how this is done. Our Sailplane project exceeded both of its targets with 42 participants with 21.4% women. Our Geospatial Training at CUP approached its target with 4 student participants with 25% of the students reporting being from an underrepresented population. Our Lincoln University Environmental Sciences project met its target of 2 student participants, both of which were underrepresented minorities. Finally, our high education mini-grant program exceeded its target with 5 funded projects.

In terms of our specific targets for our **Research Infrastructure** programs, our seed grant program exceeded its target with 13 junior faculty supported and met its target of 7 papers published. The program also met its target of funding two postdoctoral bridge grants awarded to recent Ph.D. students, but this has not yet resulted in papers published. In terms of our specific targets for our **Precollege** programs, we exceeded our 2009 targets for BEST Robotics Teacher Training, Science Workshops at PSU, and GLOBE workshops with a total of 422 teachers trained with over 50% of the teachers serving classrooms with >50% minority populations and 80% of the teachers reporting using the course content after a year. Saturday science program met its targets with 12 meetings, 88 K-12 student participants (with 24% underrepresented minorities), 20 parents involved, and 32 pre-service teacher participants. The Engineering Explorer's post and the Introduction to Electrical Engineering Course missed its target with only a collective total of 26 participants, 14 of whom were underrepresented minorities. Our Precollege seed grant program exceeded its targets with 68 participants and 50.5% of the participants serving classrooms with >50% minority populations. Finally, Exploration Day approached its targets with 45 university exhibitors, ~2000 attendees, and 99% of the attendee feedback reporting a positive experience.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- **Longitudinal Tracking:** Total awards = 494; Fellowship/Scholarship = 190, Higher Education/Research Infrastructure = 304; 29 of the total awards represent underrepresented minority F/S funding. During the FY09 program year, 3 students graduated and are pursuing advanced STEM degrees, 1 accepted a STEM position at a NASA contractor, 1 accepted a STEM position in industry, and 2 accepted STEM positions in industry. The remaining students have not yet received the degree that they were pursuing while they received their Space Grant award.
- **Course Development:** Three courses were developed this year by the PSGC. IST 110 at Penn State – Abington, and two graduate-level workshops for in-service educators at Penn State – University Park; ASTRO 897B and ASTRO 897C. We continued our support of the Penn State Sailplane class and the Geospatial Training for Preservice Teachers class at California University of Pennsylvania.
- **Matching Funds:** \$585,000 of matching funds for the past year.
- **Minority-Serving Institutions:** Cheyney University of Pennsylvania is the oldest of the Historically Black Colleges and Universities in America. This year the PSGC supported a summer STEM internship at Cheyney. Lincoln University, another HBCU, is nationally recognized for producing African Americans with undergraduate degrees in the physical sciences, computer sciences, biological and life sciences.

PSGC funding focuses on student research regarding laboratory applications in environmental science and scholarships for underrepresented students.

IMPROVEMENTS MADE IN THE PAST YEAR

To align with the PSGC 2008 improvement plan we have established an internal advisory board (AMAB) and have begun the process of collecting and evaluating proposals for new affiliates. We successfully implemented a state-wide research infrastructure seed grant program and supported projects at six different universities and supported two post-doctoral STEM researchers. We significantly increased the number of higher education students supported by evaluating and redesigning existing programming. We decreased the use of NASA funds to support precollege programming, while maintaining the number of projects completed through the support of our most effective projects.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECTS

Higher Education Institutions (4-year): Pennsylvania State University, Lead Institution; California University of Pennsylvania, Affiliate; Carnegie Mellon University, Affiliate; Cheyney University, HBCU Affiliate; Clarion University, Affiliate; Franklin & Marshall College, Affiliate; Gannon University, HE Seed Grant Recipient; Georgia Institute of Technology, Mars Desert Research Project; Gettysburg College, Affiliate; Lehigh University, Affiliate; Lincoln University, HBCU Affiliate; The Pennsylvania State University-Abington campus, Affiliate; The Pennsylvania State University-Wilkes-Barre campus, RI Seed Grant Recipient; Susquehanna University, Affiliate; Temple University, Affiliate; The University of Massachusetts – Amherst, Higher Education workshop; The University of Pennsylvania, RI Seed Grant Recipient; The University of Pittsburgh (including their NASA Ed. Resource Center), Affiliate; The University of Texas – Austin, Higher Education presentation; West Chester University, Affiliate

Government Institutions (Federal, State, Local): Aerospace Education Services Project, Teacher Prof. Development Workshops; Kennedy Space Center, ESMD Internships; NASA Astrobiology Institute, Teacher Prof. Development Workshops; NASA Goddard Space Flight Center, Teacher Prof. Development Workshops; NASA Swift Mission, Teacher Prof. Development Workshops

Industry: Boeing Corporation, Mentor/Tutor Funding; Honeybee Robotics, Internships

Other Non-Profit Organizations: Academic Space Alliance (Bald Eagle, Bellefonte, PennsValley School Districts), STEM Education and Educator Network; Centre Region YMCA, STEM Education and Educator Network; Challenger Learning Center, Paramis, New Jersey, STEM Education and Educator Network; 4-H in Centre County, STEM Education and Educator Network; Girl Scouts of Eastern Pennsylvania, STEM Education and Educator Network; Hatsboro-Horsham School District, STEM Education and Educator Network; National Alliance of State Science and Math Coalitions, STEM Education and Educator Network; National Society of Black Engineers, STEM Workforce Development; Pennsylvania STEM Initiative, STEM Education and Educator Network; Philadelphia School District, STEM Education and Educator Network; Wissahocken School District, STEM Education and Educator Network

Other Organizations: National Federation for the Blind, STEM Opportunities for persons with disabilities; Public Broadcasting in Central Pennsylvania, STEM Education and Public Outreach; Space Explorers Program, STEM Education