

Arizona Space Grant Consortium
The University of Arizona, Lead Institution
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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 Arizona Consortium is a Designated Consortium funded at a level of \$730,000 for fiscal year 2008.

PROGRAM GOALS

All AZSGC sponsored programs are geared to fulfill NASA education goals by strengthening NASA and the Nation's future workforce, attracting and retaining students in STEM disciplines, and engaging Americans in NASA's mission. Our mission is to expand opportunities for Americans to learn about and participate in NASA's aeronautics and space programs by supporting and enhancing science, and engineering education, research, and delivering high quality public education programs. Our goal is to integrate research with education to help build a diverse, scientifically literate citizenry and a well-prepared science, engineering and technology workforce.

AZSGC Fellowship programs are geared to expand representation among active scientists and engineers, of our nation's diverse population. Programs are designed to be accessible to students from a variety of backgrounds, including those in non-technical disciplines. Programs improve and inform graduate and undergraduate education by providing experiences for a substantial number of students which will contribute in a number of ways, including fostering some students toward professional careers in aerospace science and technology, while also fostering understanding, appreciation and sensitivity to space science and engineering as important national endeavors.

The goal of the AZSGC Research Infrastructure component is to sponsor innovative programs in space science/engineering focused research and design, with associated opportunities to apply classroom knowledge to real-world problems. These programs "encourage cooperative programs among universities, aerospace industry and Federal, state and local governments" as articulated in the National SG Program objectives. Through team research/engineering and design programs, Space Grant students learn to work as team members, to be held to industry standards for deliverables, to complete tasks on schedule, to communicate about technical work to professionals, peers, and the public through oral and written presentations, and to work side-by-side with science and engineering faculty, researchers, NASA, and industry professionals. These challenging programs impact student education, future employability in industry, and contribute to science and technology development.

AZSGC Higher Education program goals are to recruit and support a diverse group of participants, promote initiatives to develop interdisciplinary courses/curriculum and teacher training, sponsor group educational activities for Interns, Fellows and others to complement and enhance student learning, to foster a sense of community by building linkages and promoting networking among students, faculty, researchers, industry professionals and the public, and to provide a diverse group of students opportunities for educational/professional growth and promotion.

AZSGC Precollege programs are geared to attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers and faculty with special focus on training STEM educators—not only to excite and inspire P-12 students—but to excite and inspire while instilling basic competencies to insure that AZ students are prepared and able to study science in college. All AZSGC precollege programs are aligned with AZ and National Standards, leverage funding, are directed to underrepresented and underserved populations, and support NASA Education programs.

Public Programs actively engage members of the public from traditionally underrepresented groups, bridge the gap between Earth systems science research and geospatial technology and societal needs in Arizona; leverage funding to extend the reach of SG beyond direct investment, support science education needs in underserved areas of our state, engage SG students in informal education initiatives and track impacts and evaluate programs success via quantitative and qualitative methods (plus longitudinal tracking of graduate fellow/undergraduate intern participants) to insure continuous process improvement.

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

AZSGC has become a catalyst for synergy between NASA, industry, and Arizona's education/research efforts. Programs extend the arms of NASA—expanding our universities' capacity to conduct research and doing it in a way that educates our next generation of scientists and engineers, by integrating Fellowships students into the research enterprise and then leveraging student research into outreach designed to promote the understanding of space related research to precollege audiences and the public. Select FY08 examples are: (1) During Phoenix Mars Lander Mission science operations at UA, SG Interns Cherie Achilles and Stephanie Barnes were the Instrument Sequence Engineers for the Surface Stereo Imager (SSI) responsible for generating all the commands sent to the instrument on Mars, Patricia Wroblewski and Clayton Chu served as SSI downlink Engineers, Gerard Droege was a key member of the TEGA Instrument team and Chelsea Hodson wrote news releases for Mission public affairs. Such extraordinary educational opportunities contribute directly to NASA Education Outcomes 1, the development of the STEM workforce, and 3, promoting STEM literacy and awareness of NASA's mission. (2) AZSGC sponsored science journalism internships at three major state newspapers (*Arizona Daily Star*, *Tucson Citizen*, *Arizona Daily Sun*) and the UA College of Science Public Information Office contribute directly to the development of the STEM workforce (Outcome 1), while promoting STEM literacy and awareness of NASA's mission to the general public (Outcome 3). Science-writing interns play an increasingly important role in helping newspapers provide informative and important science stories to readers as they deal with harsh economic realities and declining revenues. In FY08 UA SG Intern Megan Levardo wrote a news release about UA research on "How Martian Winds Make Rocks Walk" that was picked up by MSNBC, *New Scientist*, Physorg.com, Eureka! *Science News*, *Space & Earth Science*, *Innovations Report*, *Space Ref*, *Science Forums-Hypography*, *Spaceflight Now*, *Starry Skies Network*, *Astronomy Report*, Physicsworld.com, ABC15.com, PhysicsWeb, and others. (3) AZSGC partners with Orbital Sciences Corp. and BAE Systems, Inc. to sponsor robotics programs that epitomize the NASA pipeline at work and directly contribute to NASA Education Outcomes 1 and 2. SG Mentor Shea Ferring (AZSGC alum and Orbital Sciences steering committee representative) works with SG Undergrad Interns to mentor high school FIRST Robotics Rookie Team 2449 (in 2008 they won the 2008 Xerox Creativity award for design and the Rookie All Star Award). Upon graduation, FIRST students are encouraged to join the (college level) ASU Underwater Robotics team—also led by Mentor Ferring and SG Interns. This concerted effort uses robotics create a pathway from high school to college while training and inspiring America's future engineers.

PROGRAM ACCOMPLISHMENTS

Fellowships Programs: In FY08 AZSGC awarded Fellowships/Scholarships to 169 students—153 undergraduates and 16 graduate students. 39 (23%) of the total awards went to students from underrepresented minorities, and 70 (41%) of awards went to females. All Graduate Fellows designed and

implemented programs (delivered through our precollege, higher education and public programs components) that give many others opportunities to participate in NASA's science, engineering and education (Outcomes 1, 2, 3). Undergraduate Research Interns from UA, ASU, NAU, ERAU, and Pima Community College (PCC) from a variety of backgrounds and technical and non-technical disciplines, are receiving a mentored, professional work experience on university campuses, in local industry and at NASA Centers, focusing on science/engineering, education, journalism and science policy (Outcomes 1 and 2).

Research: In FY08, ASCEND!, a statewide balloon satellite development/launch program, is providing teams of students from UA, ASU, ERAU, PCC, SMCC, and their mentors, two launches/year and opportunities to experience the full design, build, fly, operate, analyze cycle of a space mission. Student teams at ERAU are constructing a CanSat for the national competition, and submitted a successful proposal to the NASA High-Altitude Student Payload (HASP) program. They are working collaboratively with personnel from several ERAU departments and students and mentors from PCC (MSI) to develop the HASP payloads, system and operations. These activities contribute AZSGC Research goals and objectives (see above) and to NASA Education Outcomes 1 and 2.

Higher Education: In November 2008, fifteen members of UASEDS visited and toured Johnson Space Center and attended the SEDS National Conference. Once again, a UA SEDS member was elected Chairman of the national organization. The 2009 National SEDS conference will be co-hosted at UA by AZSGC. An ongoing club R&D project is preparing a rocket for a national competition. The club also contributes to NASA-focused community outreach, using their student-constructed SEDScope as the centerpiece for numerous community educational sky viewings. AZSGC also provides opportunities for students, faculty and members of industry to come together to interact and to learn new things through a series of brown bag lunches with speakers and other events. We also hosted the Seventeenth Annual Statewide Undergraduate Research Internship Program Symposium in April 2008, where over 115 students made oral presentations about their year-long research efforts--covering topics relevant to all NASA Mission Directorates--to audiences of peers, mentors, dignitaries, family, friends and others. Congresswoman Gabrielle Giffords, 8th District Arizona, Member of U.S. House Committee on Science and Technology and Chair of the Subcommittee on Space and Aeronautics was keynote speaker. These and other Higher Education activities contribute directly to AZSGC goals and objectives and to NASA Education Outcomes 1, 2 and 3.

Public Programs: Over the past year our Public Programs, led by the Earth Grant Geospatial Extension Program, engaged 3,901 participants in 212 educational events involving 12,266 contact hours. These audiences were diverse and involved those traditionally underrepresented in science and technology (49.3% women and 34.0% minorities). Students, trained to provide educational outreach as a form of public service reached another 4,000 people through community public service events. We launched a new initiative called DroughtView, which combines research and education to provide new tools involving NASA sensor data in support of community drought preparedness monitoring, mitigation and education. Results of these activities contribute directly to NASA Education Outcomes 1, 2 and 3.

Precollege: The NAU-led Changes in Altitudes statewide precollege balloon satellite development/launch program, supported 67 students; 16 (24%) were Native American, African American or Hispanic. The Phoenix Mars Lander Mission E/PO Funding ended in Sept. of 2008 and additional funding was secured from Science Foundation AZ to allow program teachers trained in 2007, to complete their final 2 launches with their students early in 2009. The SG supported GEMS workshop addressed our goal of providing educational opportunities promoting STEM literacy and awareness. Fifteen Arizona middle school teachers participated (3-20% underrepresented, 14-93% women, in the 3 day workshop held in Nov 2008. AIMER support continues to reach hundreds of teachers, students and community members of the Navajo & Hopi Nations providing opportunities to learn about astronomy. AIMER and some of the Space Grant personnel participate actively with the Prescott Astronomy Club's events particularly during Astronomy Week in May. Activities meet AZSGC Precollege component goals and map directly to NASA Education Outcomes 2 and 3.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- Longitudinal Tracking: In FY 08 AZSGC made considerable progress in meeting statewide longitudinal tracking goals to track *all* program awardees (direct student awards are all made in Fellowships/Scholarships area) across AZSGC since the 1990 grant inception. Results to date are: total awards = 1833 (1654 undergrads, 66 Masters, 113 PhD. 338 (18.4%) underrepresented F/S funding and (19.58% when include 21 awards to students with disabilities). 348 are still enrolled in current degree program; 3 seek STEM employment, 239 are employed with STEM aerospace contractors, 450 work in STEM non aerospace positions, 20 are employed by NASA/JPL, 44 work in K-12 STEM academic jobs, 158 are employed in “other” STEM academic fields, and only 113 work or pursue studies in non STEM areas. Of 1485 students who have completed degrees, and/or have moved on to “next steps” (i.e., are not still enrolled in current degree programs), 172 (11%) are untracked to date. *Most significantly, greater than 91% of tracked students are pursuing careers in STEM fields, demonstrating that AZSGC fellowship/scholarship awards serve as catalysts for students to continue into advanced STEM degree programs and into America’s STEM workforce in keeping with National Space Grant Act goals and NASA Education Outcome 1.*
- Course Development: (1) With Space Grant support, two minority serving community colleges (PCC and SMCC) are incorporating development of payloads for launch from high altitude weather balloons into their class offerings. (2) New FY08 partner, Tohono O’odham (Tribal) College, is using FY 08 Space Grant funds to improve and enhance a team-taught, multidisciplinary STEM 101 course with biology, chemistry and physics components. (3) AZSGC Graduate Fellow Arin Haverland created and leads “The Junior Watershed Steward Program”, a cooperative high school extension education program focusing on the education and training of students and teachers across AZ to serve as volunteers in the protection, restoration, monitoring, and conservation of water and watersheds. (4) Graduate Fellow Chris Pagliarulo, works with the Sunnyside High School Science Program (this school serves many students from underrepresented groups) to design, implement, teach and test NASA based curriculum that supports the Arizona Science Standards for 9th-11th graders. Specifically, 115 students are working toward designing, modeling, testing, and presenting various necessary components to support a long term mission to the moon to search for ice. (5) PCC utilized AZSGC funds to design and sponsor a summer Math for Science academy/course to help bring promising minority students up to college level math.
- Matching Funds: AZSGC NASA Space Grant funds are highly leveraged with funds from state and other federal sources: NASA SG (\$730,000-51%), Arizona (\$623,516-44%) and Other Federal (\$72,796-5%).
- Minority-Serving Institutions: In FY08 AZSGC sponsors programs/activities with four Minority Serving Institutions: Diné and Tohono O’odham (TOCC) (Tribal) colleges, Hispanic-serving Pima Community College (PCC) and Hispanic and minority-serving South Mountain Community College (SMCC). Programs/activities are (1) Diné: (a) peer educator tutors for STEM students; (b) bringing guest speakers to that remote campus; (c) and mini-bridge programs/workshops at UA and ASU for Diné students interested in transitioning to four-year universities. (2) TOCC: (a) build their STEM 101 curriculum, class activities and content. (3) PCC: (a) sponsor a summer Math for Science academy/course to help bring promising minority students up to college level math; (b) 14 students awarded Undergraduate Research Internships at UA; (c) PCC NW faculty/students team joined AZSGC Statewide ASCEND! (balloon sat) program. (4) SMCC: (a) ASCEND! Program participation. In addition, PCC and SMCC students participate in the AZSGC Statewide Undergraduate Research Internship Program Symposium in April.

IMPROVEMENTS MADE IN THE PAST YEAR

ASU has the largest enrollment of America’s universities. This presents unique challenges for SG advertising and recruiting. In FY08 ASU SG partnered with students from ASU’s Walter Cronkite School of Journalism and Mass Communication who are working to develop new and improved methods/strategies to advertise programs and to recruit participants. In addition, the AZ Art Institute is working with ASU SG to develop a public service announcement geared to promote public interest in NASA SG programs by featuring outstanding internship research projects.

ASU has shown marked growth in diversity numbers for F/S awards from 13.6% in FY07 to 22% in FY08. NAU increased the number F/S supported undergraduate interns from 11 in FY07 to 15 in FY08, while increasing the percentage of female awardees from 2 to 6 and students from underrepresented groups from 9% in FY07 to 13% in FY08.

ASU made significant strides in leveraging NASA SG funds by obtaining split-funding support for 22 of 45 (49%) undergraduate F/S awardees. 38 (60%) of 64 Undergraduate Research Interns at UA are being split- or fully-funded by research mentors, allowing us to provide mentored academic-year-long internships to many more deserving students than could be supported with NASA Space Grant funds alone. ASU Graduate Fellowship outreach program quality was enhanced by making it the focus of fellowship awards and including SMART goals in the award/selection process.

NAU has worked to grow relationships with local businesses and in 2008 secured a science writing Undergraduate Research Internship at the city newspaper (the *Arizona Daily Sun*). We hope to grow our relationship with the *Daily Sun* leads into a new affiliate member of AZSGC in FY09. The NAU SG science writing Intern, Michael Thiel, was also selected to receive an IYA Student Ambassador Program Scholarship.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Members:

University of Arizona (Lead): State University
Arizona State University State University
Northern Arizona University State University
Embry-Riddle Aeronautical University

Affiliate Partners:

Higher Education Program Partner: Pima CC (*Hispanic*)
Higher Education Program Partner: Dine College (*Tribal*)
Higher Education Program Partner: Nat'l Undergrad Research Observatory
Industry Affiliate: AZ Near Space Research
Industry Affiliate: EmbeddedPlus Engineering
Industry Affiliate: General Dynamics
Industry Affiliate: Northrop Grumman
Industry Affiliate: Orbital Sciences Corp
Industry Affiliate: Paragon Space Development Corp
Industry Affiliate: PM & AM Research
Industry Affiliate: Raytheon Corp
Industry Affiliate: Rincon Research
Industry Affiliate: SunCat Solar
Outreach Affiliate: AZ Aerospace Found-(NPO)
Outreach Affiliate: AZ Daily Star
Outreach Affiliate: Indigenous Ed Institute (*NPO*)
Outreach Affiliate: International Dark-Sky (*NPO*)
Outreach Affiliate: Tuba City Boarding School
Research Partner: Jet Propulsion Laboratory
Research Partner: National Optical Astronomy Observatories (*Federal*)
Research Partner: Planetary Science Inst (*NPO*)
Research Partner: USGS, Flagstaff (*Federal*)
Research Partner: USDA SWRC (*Federal*)