

Texas Space Grant Consortium (TSGC)
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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 Texas Space Grant Consortium is a Designated consortium funded at a level of **\$785,000** for fiscal year 2009. The Texas Space Grant Consortium has effectively administered and operated programs since 1989. The TSGC member currently includes 46 academic, government, industrial and non-profit affiliates listed above.

PROGRAM GOALS

Our goals and programs serve multiple constituencies with emphases on customer focus, NASA-related content, the STEM (Science, Technology, Engineering and Math) pipeline, increased diversity, effective evaluation of programs, the development of partnerships, and program sustainability. We place special emphasis on involving program participants from Texas' large minority communities. Texas Space Grant goals are summarized below.

NASA Outcome 1 TSGC Goal A: Focus on Minority and Underserved Participation Enhancement: TSGC has a primary focus on increasing the number of females and minorities in its programs and increase quantity and quality of female and underrepresented minorities in our programs to levels commensurate with the number of female and minority enrollees in Texas colleges and universities.

NASA Outcome 1 TSGC Goal B: Fellowship and Scholarships and Longitudinal Tracking: Continue to provide undergraduate training through the mechanism of fellowship and scholarship awards, Emphasize awards with effective student research and mentoring components, Recognize high achieving students who have strong interests in space related careers/fields, Encourage high achieving students to pursue graduate studies in space related fields, Encourage high achieving women and members of underrepresented ethnic groups to pursue - space related careers, Maintain a balance of awards across academic member institutions. Award at least \$200,000 in Fellowships and Scholarships in 2009, and continue successful longitudinal tracking of program participants through the National Space Grant Foundation tracking system.

NASA Outcome 1 TSGC Goal C: Workforce Development: Continue TSGC's flagship Higher Education project is the Design Challenge Program which pairs undergraduate student design teams from TSGC member institutions with real-world projects provided by the NASA community.

NASA Outcome 1 TSGC Goal D: Higher Education: Provide opportunities for undergraduate students to participate in space based research and exploration. Support NASA related research activities through student projects, Facilitate mentor relationships between students, faculty and the NASA community, Develop interdisciplinary space related courses and curricula, Develop space related introductory courses for undergraduate students not majoring in scientific or technological disciplines.

NASA Outcome 1 TSGC Goal E: Research Infrastructure: Build research infrastructure through a New Investigators Program. (TSGC NIP), - to assist new faculty members or researchers - to begin research aligned with NASA's strategic plan.

NASA Outcome 2 TSGC Goal F: K-12: Empower Texas educators, students, and the general public to understand and appreciate the benefits of space exploration and space based research. -Inspire and motivate students at all levels to pursue careers in science, technology, engineering and mathematics (STEM), Enhance K-12 educator knowledge in space related fields, Increase K-12 student knowledge in STEM education, Increase underrepresented and underserved participation, Enhance career exploration by using space science professionals, NASA employees, and NASA-sponsored scientists, technical and engineering experts as role and career models.

NASA Outcome 3 TSGC Goal G: General public and public awareness: Continue to support informal education in the state by partnering and collaborating with various state organizations to enhance STEM learning and career exploration.

NASA Outcome 3 TSGC Goal : – Internal management: Continue to focus on management efficiency and effectiveness, update strategic plan and goals to ensure clear alignment with NASA strategic goals.

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

NASA Outcome 1 TSGC Goal B: Fellowship and Scholarships and Longitudinal Tracking. We ask our Fellowship and Scholarship students (1) how participation in this program impacted their education and life, and (2) what role have you played in the aerospace industry since graduation? Here are a few highlights from 2009 recipients:

“The NASA/TSGC Fellowship has helped me be able to focus more time on my research in the lab. I am close to finishing up my PhD in biochemistry. My project is related to one of the missions of NASA, long-term spaceflight. My research focuses on understanding our lab's model of suspended animation.” (Isadora Daniels, 2009 TSGC Graduate Fellowship Program-UH Downtown)

“It gave me the opportunity to seek for STEM related activities and positions. Such as an Internship with Texas Instruments” (Ivon Ayala, 2009 TSGC Scholarship Program-UT El Paso)

“The scholarship that I was given by the TSGC has been very useful in helping to pay for my education. I have been working on a National Science Foundation project to create a virtual 3D physics lab for middle school students, and this project's progress can be tracked at <http://www.m2-t2.com> and <http://www.gamedev.net/community/forums/mod/journal/journal.asp?jn=557559> Last summer I taught middle school students directly using the XNA platform from Microsoft. I focused on creating a simple breakout game and during the process of creating that game, concepts such as vectors and forces were explained to the students. This summer I am planning to use the platform I am creating called 'Newton's Enigma' to explain robotics concepts by leveraging SMART board technology. The students will be challenged to use knowledge of physics to design and build a robotic capable of completing a course at the end of the camp.” (Donald May, 2008 TSGC Scholarship Program-TAMU Commerce, 2009 TSGC Scholarship Program-TAMU Commerce)

“I participated in both a USRP internship and a NASA Academy research assistantship. I am also an active NASA Student Ambassador. I am currently pursuing my PhD in Physics at Texas A&M University.” (Elizabeth Sooby, 2009 TSGC Scholarship Program-Texas A&M University)

PROGRAM ACCOMPLISHMENTS

Outcome 1: (Employ and Educate)

TSGC Goal A – Minority and Underserved Participation enhancement. We work closely with our Minority Serving Institutions Activities Council (MSIAC) made up of institutional representatives from MSIs and minority faculty members from non-MSI institutions). Texas Space Grant, through its MSIAC,

continues to explore the establishment of a national MSI organization within the National Space grant community. Last year, our MSIAC representatives reported that many good minority students fail to complete scholarship applications because they are unaware of how their STEM majors might relate to space activities. Based on a recommendation from the MSIAC, TSGC developed a STEM focused Scholarship in addition to our space-focused Columbia Crew Memorial Scholarship. The applicant pool for the new scholarship was significantly larger with a significant increase in applications from and awards to minority students. Details on this scholarship are referenced in goal B below. We competitively selected applications, not limiting the number of awardees at a given institution, remaining cautious to keep a fair balance of applications and participation among all of our institutions.

We have established a Minority Student organization database, and use it for publicizing programs and events. This provides a basis for better advertising of programs to minority students. We also met with the Texas Higher Education Coordinating Board (THECB) to identify additional ways to leverage programs, better identify state needs, identify additional organizations that might be potential partners, and to better advertise our programs. The Board provided us with information on several studies and funded activities focused on increasing minority STEM involvement.

TSGC Goal B - Fellowship and Scholarships and Longitudinal Tracking:

TSGC Graduate Fellowship Program: TSGC annually awards 20 to 25 graduate fellowships at the \$ 5000 level as supplements to local funding. We awarded no more than three fellowships to students at any one TSGC institutions in a given year. A three person committee (two members from MSIs) ranks the applicants and selects the recipients each year. In 2009 we received 128 applications in the system. We selected and awarded 25 Fellowships. There were 12 females, 13 males, 6 minorities, 1 Asian and 18 Caucasian.

TSGC STEM Scholarship: 339 applications were started online, with 99 complete and reviewed. We awarded 25 Stem Scholarships at \$1500 each. Out of the 25 awarded, 13 were females, 12 males, 10 students were minorities, 11 were Caucasian, 3 were Asian, and 1 unknown.

Columbia Crew Memorial Scholarship program: 169 applications were started online with 70 complete and reviewed. We awarded 30 scholarships at \$1000 each. The awardees consisted of 10 females, 20 males, 13 minorities, 1 Asian, 14 Caucasians, 2 unknown.

We also provided 6 NASA Academy stipends and smaller design scholarship stipends to outstanding students in our design challenge program and supported students attending the summer academies at the various NASA centers. In total, we awarded \$ 216,650 in fellowships and scholarships in 2009-2010 to 100 directly funded students. Our Fellowship and Scholarship target levels for 2009-2010 were: 39% minority, 40% female. We met our female target numbers with 43/100 students being female (43%) and 29/100 students were minorities (29%) which is short our 39% goal.

TSGC Goal C- Workforce Development: TSGC's flagship Higher Education project is the Design Challenge Program. The TSGC Design Challenge involves student teams working for academic credit on problems of interest to NASA and its industry partners. Design project topics, mentors, and instruction on proposal writing and conference presentation are provided to participating student teams. At the end of each term, students present their work to interested members of the NASA JSC community at a Design Challenge Showcase where a team of NASA judges award top prizes for poster, model and oral presentation. During 2009-2010, 21 teams (116 students) participated; the program was integrated into the engineering curriculum at 7 Texas institutions of and spawned a freshmen introductory design course at Texas A&M.

“One of the best experiences of my education! This program allows students to experience tackling a real world problem before they get out of school. The experience is worth more than you could ever imagine, and has increased my interest in the aerospace industry.”

TSGC Goal D - Higher Education Programs: TSGC supports two to three small higher education improvement projects each year and provides supplemental funding for student teams flying experiments on NASA's microgravity aircraft. In 2009, to make our activities in this area more competitive, the maximum funding amount for these programs was increased from 15K to 20K.

In 2009, two new higher education projects were supported at \$20K each and were matched with \$20K from their home institutions (Texas A&M: "AggieSat Lab, and Houston Community College Northwest: "Undergraduate Science Research Program –USRP").

"The program I participated in was the Reduced Gravity Student Flight Opportunity program at Ellington field. It completely changed my life forever by exposing me to complex maneuvers in aircraft, as well as allowing me to meet flight surgeons and the pilots who flew the C-9. This led to my acceptance in the navy pilot program and officer candidate school." (Jonah Cherry - Lamar University)

WIALD - In its efforts to involve more females in STEM disciplines, TSGC provided \$6K toward the building of a sounding rocket payload by a group of 11 female students at UT Austin. They founded a new organization, WIALD (Women in Aerospace Leadership and Development), to encourage female students to develop and enhance leadership skills in STEM disciplines. This group proposed to design and build a payload to capture real-time video aboard a hybrid ballistic rocket built by students from Fredericksburg High School. The payload was completed but launch delays kept the project on the ground until after the end of the reporting year, but the rocket was launched from White Sands in August. TSGC provided \$6K toward the building of the payload.

Goal E - Research / New Investigator Program: TSGC provides research start-up funding of \$ 15K, matched by the recipient's home institution, to two to five new faculty each year. These funds are awarded competitively to young investigators starting space-related research programs. In 2009 we awarded 2 new Research grants in the amount of \$15k. (U of Texas- Arlington - "The Development of a Systems Engineering Simulator", Texas Southern University - *An Integrated Program of Research Focused on Development of Artificially Mediated Refreshable Electrochemical Biosensors, Professional Career Development, Mentoring, and Public Outreach*"). We also collaborated with the Ohio Space Grant Consortium to jointly fund "Self-Powered NanoFiber Surface Acoustic Wave Sensors for Aerospace Structure Health Monitoring" with Dr. Jiang Zhe at The University of Akron and Dr. Yin J. Lin at the University of Texas at Tyler, Departments of Mechanical Engineering. TSGC supported Dr. Lin with a \$5,000 grant award. As a result of the OSGC grant, Dr. Zhe received two National Science Foundation grants: 1) A High Throughput Microfluidic Sensor for Real Time Health Monitoring of Rotating Machinery - \$270,000, 9/1/2010 – 8/31/2013; 2) MRI: Acquisition of an AFM/Raman Integrated System for Bio/Nano Functional Materials and Devices Research and Education - \$252,166, 9/1/2009 – 8/31/2011. Dr. Zhe also showed the electrospun nanofibers and introduced the applications in health monitoring for aerospace structures to more than 30 middle school girls in Summer 2009 via University of Akron's Women in Engineering program.

Outcome 2 (Educate and Engage)

Goal F - K-12 Education Program: TSGC's K-12 program focuses on teacher education to use the leverage of excited teachers to help fill the STEM pipeline. Since 1990, TSGC has conducted a weeklong teacher workshop, *LiftOff*, at NASA JSC. These workshops emphasize STEM learning experiences by incorporating a space science theme supported by NASA missions. Teacher participants are provided with information, materials, and experiences through hands-on activities and field trips in 2009, *LiftOff 2009: Celestial Travelers!* Enabled teachers to learn about NASA missions and research related to astronomy, the solar system, the sun, and its interactions with Earth. The teacher features (sharing of ideas among educator participants) and opportunities to interact with scientists and researchers dedicated to space missions are highlights for the educators attending.

"LiftOff 2009 was wonderful! The materials, speakers, and teacher features were all valuable resources! The tours are chances to visit areas that are once in a lifetime places. Thank you!!! The materials and

ideas fit perfectly into my curriculum. I will hold a workshop so share my info with my colleagues (and send pictures when we do it).” 2009 Teacher Participant

Ignite Systems Go Program: High school students in this program design and build hybrid rockets that are launched at White Sands. The program was founded by teacher Brett Williams at Fredricksburg High School, to promote engineering studies through research, to develop work force skills, and encourage high school students to enter academic and career paths in STEM fields. In 2009, we supported a team of Houston minority high school girls in the amount of \$2,000 to travel to Fredricksburg for the launch of their rocket.

STEM Educational Initiatives - As a result of TSGC’s activities in STEM education, TSGC is often contacted to conduct STEM activities for teachers, students and the general public. We are asked to conduct more space science teacher training than we have staff available. We usually employ a train-the-trainer model in which each participant is expected to train about 15 additional teachers and each teacher is expected to reach about 50 students. The events and the number of teachers we trained are: Austin Science and Nature Center: (25 teachers trained), (expect to reach 400 teachers and 20,000 students), Westlake Elementary, 400 participants, Brushy Creek Elementary (25 trained), 200 participants, Deer Park Elementary, 500 Participants, student programs, 75 trained, 395 participants, Space Vision (16 trained), UT Pan American Science Workshops (18 trained), SEEC (90 Trained), Region IV (50 trained), National Science Teacher Conference, (100 trained), Space Day, 500 visitors to TSGC booth, Conference for the Advancement of Science Teachers (CAST) 150 teacher participants who attended workshops.

“Wow! This is the most awesome program I’ve ever attended. I think being an engineer would be really cool. I want to work for NASA.” Student participant

Outcome 3 (Engage and Inspire)

Goal G - Public Awareness: Our goal in this area is to make the public aware of program opportunities, awards, and successes, We continue to collect “Success Stories” to highlight the ongoing activities and accomplishments of students and teachers that have participated in our programs. TSGC also maintains an extensive website. (www.tsgc.utexas.edu) as well as developed a TSGC fan Facebook page which has over 450 fans to date <http://www.facebook.com/pages/NASA-Texas-Space-Grant/286095539201?v=wall>.

International Symposium: In 2009, we supported the First International Symposium on Nanotechnology, Energy and Space held Clearlake Texas in the amount of \$5,000. One of our member institutions, University of Houston, was a sponsor of this event and sought TSGC support. Nearly 100 participants were treated to 38 presentations ranging from Carbon Nanotube wires for energy transmission, to beaming solar energy from space to earth. Significant graduate and undergraduate student participation was realized with students both presenting their research efforts and asking questions of other presenters.

Informal Education: TSGC has partnered with the Texas Agri-Life Extension Service (leaders for the 4-H and Youth Program), Americorp, Bob Bullock State History Museum, Lyndon B. Johnson Presidential Library, and the Austin Science and Nature Center. By collaborating with these agencies we have trained informal educators, distributed materials to the general public, and conducted standards-based educational activities for students, parents, and the general public. CD’s, DVD’s, and educational materials have been distributed to enhance STEM learning and career exploration. We have collaborated with the Bob Bullock State History Museum on the new exhibit “Alpha, Tango, Charlie” and the Austin Science and Nature Center’s Exhibit, “A View from Space.” The 4-H CAPITAL Project, leaders of an after-school science and literacy program for elementary and middle school youth in underserved areas with underrepresented youth, continue to come to TSGC for training of their staff and resource materials. TSGC trained staff and conducted student programs for teachers and youth at the Texas School for the Blind and Visually Impaired. Students with visual impairments, mainstreamed in classrooms across the state, participated in a summer camp conducted by TSGC staff.

Goal H - Management and Infrastructure: TSGC’s goal in this area is to manage program activities efficiently and at low cost. We review our strategic plan annually, seek external support, require matching

from recipient institutions on many of our programs, and augment activities initiated by other groups whenever possible. We use our institutional representatives to review proposals and select scholarship and fellowship recipients. We recruit NASA and contractor mentors for our design challenge teams. We are working to identify all cost elements of our program and to present them as matching wherever possible.

PROGRAM CONTRIBUTIONS TO PART MEASURES

Student data and Longitudinal Tracking

Student Data and Longitudinal Tracking: Total awards = 142; Fellowship/Scholarship = 58, Higher Education/Research Infrastructure = 84; 45 of the total award represent underrepresented minority F/S funding. During the FY09 program year 21 graduated and are pursuing advanced STEM degrees, 2 students have accepted STEM positions with Aerospace Contractors, 34 have accepted STEM positions in industry, 3 are employed at NASA, 0 accepted STEM positions in academia and 3 are working in a other STEM academia, and 1 in non-STEM field. 21 students are pursuing advanced STEM degrees.

Overall, the percentage of students whom have taken their next step and have been successfully tracked through their next step vs. last year of space grant support: 89% in 2006, 100% in 2007, 100% in 2008, 100% for 2009. Overall from 2006-2009 95% have been successfully tracked.

Course Development: Two new courses targeted at the STEM skills needed by NASA were developed in 2009. A course entitled “Space Exploration” has been developed at the U of Texas at Austin as one of a new Signature Course offerings. Students in the course develop writing skills by researching and writing about space exploration activities. Another course developed at Tx A&M University entitled “Foundations of Engineering, which is a lower division course.

Matching Funds: TSGC requires matching from recipient institutions on many of our programs, as well as affiliate inkind match. We augment activities initiated by other groups whenever possible.

Minority Serving Institution Collaborations: The MSI collaborations were highlighted on page 3 of this report under Goal A.

IMPROVEMENTS MADE IN THE PAST YEAR

STEM Scholarship Program - We improved our minority student participation and awareness and saw a rise in number of applications with our newly developed TSGC STEM Scholarship.

Design Challenge Program - In our TSGC Design Challenge program, we had closer involvement with Johnson Space Center including support for the Design Challenge Showcase event from the Education Office, Displays Office, and Division Representatives serving as Judges. We expanded the program to include previous Design Challenge participants to speak about the benefits of participating in the program. Two previous Design Challenge students participated last year - (a NASA Student Ambassador who delivered the Welcome Address and a JSC employee served as a Judge).

Minority Participation - We established a Minority Student organization database, and use it for publicizing programs and events. The TSGC Education and Outreach staff has supported proposal efforts by affiliates and institutions that serve underrepresented, underserved populations. As a result, new grants have been received and partnerships established that will enable teachers and students in the Rio Grande Valley to benefit from STEM education programs and minority student educational opportunities. New evaluation methodologies and tools have been developed to provide a complete program assessment for these education programs.

LiftOff 2009: TSGC has expanded and enhanced partnerships with various agencies including the Texas Cooperative Extension Service, Texas Education Agency Regional Service Centers, Statewide Science and Math Regional Collaborative, Governor’s Task Force on STEM Education, Central Texas T-STEM

Academy, Lunar and Planetary Institute, and NASA's AESP program. Our partnerships with these organizations allowed for expansion and integration of space science activities into professional development and informal education activities in space science.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Four Year University Affiliates - 34

Angelo State University, Baylor University, Lamar University, Prairie View A&M University, Rice University, Southern Methodist University, Sul Ross State University, Tarleton State University, Texas A&M University, Texas A&M University Commerce, Texas A&M University Corpus Christi, Texas A&M International University, Texas A&M University Kingsville, Texas Christian University, Texas Southern University, Texas State University – San Marcos, Texas Tech University, Trinity University, University of Dallas, University of Houston, University of Houston Downtown, University of Houston, Clear Lake, University of North Texas, University of Texas Pan American, University of Texas at Arlington, University of Texas at Austin, University of Texas at Dallas, University of Texas El Paso, UT Health Science Center Houston, UT Health Science Center San Antonio, UT Medical Branch Galveston, University of Texas San Antonio, UT Southwestern Medical Center, University of Texas at Tyler

Community College Affiliates - 3

San Jacinto College, Houston Community College, Austin Community College

Industry / State / Non-profit Affiliates - 9

Austin Planetarium, Bob Bullock State History Museum, Don Harrington Discovery Center, Lockheed Martin, Office of the Governor, Southwest Research Institute, TX Higher Education Coordinating Board, United Space Alliance, University Space Research Association

Partnerships

Johnson Space Center remains strong with Division support (throughout the Engineering Directorate and ISS), JSC/USRA Career Exploration Program continues to partner with the Design Challenge by sending a select number of high school students to attend the Design Challenge Showcase for the purpose of gaining inspiration and incentive to continue a STEM-related educational path. TSGC Partners have assisted in identifying program content and needs for teachers, students, and the general public. The committee that helps to plan the LiftOff Summer Institute (made up of LPI, NASA JSC, TSGC, Houston Museum of Natural Science, etc.) assists in identifying speakers, tours, and activities, for the LiftOff Summer Institute. The Texas Education Agency and the Texas Regional Collaboratives for Science and Mathematics assist in identifying areas where teachers and students need resources and training. The Bob Bullock History Museum and Austin Science and Nature Center partnered with TSGC to identify exhibits, topics, and training needed for staff for upcoming space science exhibits and educational programs. The Texas Agri-Life Extension Service partners with TSGC to train their staff for after school space science curriculum and hands-on activities as well as developing activities for the summer space camp and 4-H and youth programs. The Central Texas K-12 STEM Initiative partners with TSGC to promote STEM activities and events for teachers and students in Texas.