The National Space Grant Office requires two annual reports, the Annual Performance Data Report (APD – this document) and the Office of Education Performance Measurement System (OEPM) report. The former is primarily narrative and the latter data intensive. Because the reporting timeline cycles are different, data in the two reports may not necessarily agree at the time of report submission. OEPM data are used for official reporting.

Texas Space Grant Consortium (TSGC)
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Grant Number NNX10A196H

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 Designated Program was funded at a level of $575,000 for fiscal year 2014.

PROGRAM GOALS

The TSGC strategic goals align with NASA's Educational Outcomes. 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. NASA's Educational Outcomes and how TSGC's goals support them are summarized below.

NASA Outcome 1 Contribute to the development of the STEM workforce (Employ and Educate)

TSGC Goal A: ***Increase and Enhance Minority / Underserved Participation in our programs:*** TSGC has a primary focus on increasing the number of minorities and females in its programs. In our *Design Challenge* workforce program, 110 students participated and 61.8% were minority, and 23.6% were females. In 2014, we had 61 directly funded students in our Fellowship/Scholarship category, (23 females and 38 males) 38 % were female. Out of our 61 directly funded students 26 were underrepresented minorities, (42.6%).

TSGC Goal B: ***Fellowship, Scholarships and Longitudinal Tracking***: We have successfully tracked 100% of our students for 2013 and 100% for 2014 participants are still enrolled. We have determined that in the last five years, 86% of students significantly supported, went onto next steps in STEM disciplines.

TSGC Goal C: ***Workforce Development and Higher Education:*** Our ongoing *Design Challenge* matches design problems suggested by NASA JSC engineering personnel with capstone engineering design classes at our affiliates. During Spring 2014/Fall 2014 and Spring 2015, the program involved 29 design teams and about 50 space professionals (JSC mentors, topic providers, judges) participated in the program. Details are given later in this report

TSGC Goal D: ***Research Infrastructure:*** (TSGC New Investigator Program). We competitively award research initiation grants to assist new faculty members / researchers at our affiliates in i research aligned with NASA's strategic plan. We awarded one $10K grant in 2014.

NASA Outcome 2 Attract and retain students and teachers in STEM disciplines (Educate and Engage)

TSGC Goal E: ***Precollege and K-12:*** Our flagship program, *LiftOff,* continues to provide exemplary STEM professional development for K-12 educators. 50 teachers attended LiftOff 2014. Subsequently, they used NASA based materials with almost 6,000 students and trained an additional 2,000 educators. TSGC trained 18 teachers to conduct *Family Science Nights* in the Rio Grande Valley (RGV), where they conducted programs featuring NASA based hands-on STEM activities for 587 attendees. Parents attending were given the opportunity to enroll their children in the 2014 NASA RGV Science Association *Summer of Innovation* Program.

NASA Outcome 3 Build strategic partnerships and linkages between STEM formal and informal education providers (Engage and Inspire)

TSGC Goal F: ***General public, informal education and public awareness:*** We conduct training for 4-H and Youth Americorp staff, Boys and Girls Club informal educators, and camp leaders at the Texas School for the Blind and Visually Impaired. We host exhibits and hands-on activities at Museums.

TSGC Goal G: ***Internal management:*** We continue to focus on management efficiency and effectiveness in all of our activities. We have only one face-to-face affiliate meeting and one face-to-face board meeting each year to reduce travel costs. We have increased our usage of email, teleconferencing, and web-conferencing. We conducted one face-to-face Affiliate and Board of Directors Meeting in 2014.

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

NASA Outcome 1 Contribute to the development of the STEM workforce (Employ and Educate)

As stated earlier, we directly funded 61 students in our Fellowship/Scholarship category (38% female, 42.6% underrepresented minorities). To demonstrate the impact of the Fellowship and Scholarship programs, we provide a quote from a 2014 awardee below.

The grant provided through the Texas Space Grant Consortium was very important to helping me stay focused as I completed my undergraduate degree. If it wasn't for such wonderful support such as this, I would not have been able to achieve my goals. (Elisabeth Maxwell, 2013-2014 TSGC Columbia Crew Memorial Scholarship-Lamar University)

NASA Outcome 2
Attract and retain students and teachers in STEM disciplines (Educate and Engage)

LiftOff, TSGC's flagship K-12 program, focuses on teacher education. Motivated teachers return to classrooms to excite students in STEM careers, helping to fill the STEM pipeline. Since 1990, TSGC has conducted an annual weeklong summer teacher workshop, *LiftOff*, at NASA JSC. Below is a quote from a *LiftOff* educator who attended in summer 2014.

LiftOff was a tremendous experience! The speakers were all top-notch and so generous of their time and resources. I loved hearing about the exciting lessons other teachers have found successful. The sessions were packed with amazing and inspirational information. I can't wait to go back to my district and share with other teachers and coordinators. I plan to integrate activities into my curriculum as well as share with my project team. The term STEM has been around for several years but no one has ever really explained it. I feel that I now have a better understanding of what it is and how to implement it. LiftOff is an excellent program that is informative and inspiring! Best training for teachers! Thank you!~ Melissa Pagonis, San Antonio, TX

NASA Outcome 3 - Build strategic partnerships and linkages between STEM formal and informal education providers (Engage and Inspire)

TSGC's partnership with the Rio Grande Valley Science Association (RGVSA) informal educator training to *Boys and Girls Club staff* expanded this effort to include sites in the San Antonio, TX area. The *LiftOff* program gives priority to teachers who reach underrepresented and underserved audiences. In follow-up evaluations, 40% of those attending report their students are 80% minority and over 90% on free or reduced lunch. These educators used *LiftOff* materials with over 2,400 students in their respective schools.

<u>PROGRAM ACCOMPLISHMENTS TO OUTCOME 1, 2, 3</u>
Outcome 1 - NASA Outcome 1
Contribute to the development of the STEM workforce (Employ and Educate)

TSGC Goal B - ***Fellowship and Scholarships and Longitudinal Tracking:*** TSGC annually awards Fellowship and Scholarships. In 2014, we received 119 complete online applications (plus over 40 partially completed applications) and awarded 29 Scholarships (12 females, 17 males) (11 minorities, 2 Asian, 16 Caucasian), 21 Fellowships (4 females, 17 males) (7

minorities, 14 Caucasian). We also awarded 10 *Design Challenge* Academic Scholarships (6 males, 4 females, (8 Minorities, 1 Asians, 1 Caucasian) and we sponsored 1 NASA Academy student (1 male, Caucasian).

Fellowships/Scholarships (F/S) and Longitudinal Tracking Texas Space Grant has implemented a comprehensive longitudinal tracking program for all significantly supported students funded by its programs. This integrated system is designed to stay in touch with and regularly survey program participants as they progress though their education and career. It is based upon a balanced blend of automation and direct human interaction to maintain contact with program participants. The system utilizes automated, customizable surveys requests to gather up-to-date information on the participant's history of NASA program involvement, education, employment and antidotal responses regarding the impact of their participation on their education and careers. When participants are not responsive to the surveys the system utilizes automated and manual searches on popular social media sites such as Facebook, LinkedIn, and Google+; university websites; and on-line employer databases. We were able to determine that 45 students took next step in FY14 (SG participation supported from FY06-FY14 funds), 12 are pursuing advanced degrees in STEM disciplines, 5 accepted STEM positions at NASA contractors, 18 accepted STEM positions in industry, 2 accepted positions at NASA, 2 accepted STEM positions in K-12 academia, and 6 accepted STEM positions in academia.

TSGC Goal C - *Workforce Development and Higher Education:* Our *Design Challenge* matches undergraduate student design teams from TSGC affiliates with NASA mentors and real-world space-related design projects. In addition to the student designs, the program has resulted in the development of interdisciplinary space-related courses at participating affiliates. During 2014/Spring 2015, 29 teams at 7 TSGC affiliates participated in the *Design Challenge*. 110 students participated in the program (24 females, 86 males) (68 minorities, 30 Caucasian, 6 Asian, 6 Pacific Islander) (61.8% minority participation). Affiliates that participated in the 2014 program were: Lamar University *Team LU Engineers,* San Jacinto College; *Team RPM, Team Energizer Gators and Team Titans,* University of North Texas, *Team illuminUNTis, Team Hines, Team WiFiers, Team Ad Astra, Team Rocket*; University of Brownsville, *Team High Voltage, Team Flamen Martialis, Team Absolute Zero, Team NETA, Team Vort-X, Team S.I.C.O.F.T, Team Space Net*; Texas State San Marcos, *Team Tx State Mars Drillers*; UT San Antonio, *Team ELIXIR, Team Mars Invaders*; UT Austin, *Team UT Avionics, Team Longhorn Space Wash.*

TSGC Goal C - *Higher Education Proposal Opportunities*: We competitively award new higher education projects to faculty and staff members at our affiliates at a $15K level matched with $15K from their home institutions. In 2014, one new higher Education program was awarded: University of Texas El Paso, (MSI) "*Engineering Economics Course Development through Aerospace Project Based Learning"* PI: Dr. Ahsan Choudhuri (1 male, Asian)

TSGC Goal D - *Research / New Investigator Program*: TSGC provides research start-up funding of $10K, matched by the recipient's home institution, to new faculty each year. These funds are awarded competitively to young investigators starting space-related research programs. In 2014, one new research grant was awarded: University of Houston (MSI), *"Flexible and Stretchable Lithium Ion Batteries for Space suits"* PI: Dr. Haleh Ardebill (1 male, other)

NASA Outcome 2
Attract and Retain students and teachers in STEM disciplines (Educate and Engage)

TSGC Goal E - *K-12 Education Program*: TSGC's K-12 program focuses on teacher education to leverage the excitement of teachers to help fill the STEM pipeline. Since 1990, TSGC has conducted an annual weeklong summer teacher workshop, *LiftOff*, at NASA JSC**.** The theme for *LiftOff 2014* was "*Let's Engineer It*". 50 teachers attended the weeklong workshop. Of the total, 39 were female and 11 male, (20 were minorities: 14 Hispanic, 4 African American, 2 Asian and 30 Caucasian) (40% minority, 78% female). In addition to the *LiftOff* summer program at JSC, our *LiftOff Alumni Teachers* organization conducts space-related professional development training which reaches approximately 2,500 teachers annually.

TSGC Goal E - *K-12 Education Grants*: TSGC provides K-12 Education grants matched by The recipient's home institution, to affiliate faculty each year. These funds are awarded competitively. In 2014, we awarded one new $15,000 K-12 project at University of Texas at Brownsville (MSI), "Einstein's Symphony: *A Gravitational Wave Voyage Through Space and Time",* PI: Ms. Joey Keys (1 female, Caucasian)

TSGC Goal E - *Teacher professional development short term activities:* During 2014-2015, we conducted workshops at The National Science Teacher Association (NSTA) meeting, NASA Wavelength for the Science Mission Directorate, Conference for the Advancement of Science Teachers (CAST), the Space Exploration Educator Conference, Rio Grande Valley Science Association, Giddens Elementary School, and Texas Regional Collaborative for Science and Math. TSGC Outreach staff conducted professional development to 465 educators who implemented programs with over 5,000 youth.

Student outreach STEM initiatives*:*
TSGC partnered with the NASA/ESA GRACE mission to continue a high school summer internship program. 53 students were selected from the 177 applicants and participated in the summer internship program, analyzing NASA satellite data while being mentored by scientists. 25% student participants have been female. 65% student participants have been minority. 96% of participants have gone to college majoring in STEM fields. 14 teachers have served as coordinators for the summer program and have increased their knowledge in earth and space science through this participation.

NASA Outcome 3
Build strategic partnerships and linkages between STEM formal and informal education providers (Engage and Inspire)

TSGC Goal F – *Informal Education* We maintain an extensive website (www.tsgc.utexas.edu) and a TSGC fan Facebook page (http://www.facebook.com/pages/NASA-Texas-Space Grant/286095539201?v=wall) with over 1,050 fans to date. TSGC continues to host the "*Ask-A-Scientist*" link on the TSGC website and newsletter "*Voyage to Spread Space Excitement*" reaching over 1,900 individuals. TSGC has taken the lead in connecting informal education organizations, such as the *Boys and Girls Clubs, Boy Scouts,* and 4-H with NASA STEM curriculum, leveraging activities developed in our support of the *Summer of Innovation Program*.

TSGC participated in numerous elementary, middle and high school programs, both short and long-term in 2014. In total, these activities reached 16,870 students, teachers, and parents. With TSGC collaborations, these activities reached more than 15,560 individuals.

Outcome 3 – TSGC Goal G - ***Management and Infrastructure*****:** We continue to seek ways to manage our program activities more efficiently. We review our strategic plan annually, seek external support, require matching from affiliates on most of our programs, and augment activities initiated by other groups whenever possible. We leverage programs wherever possible.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

Student data and Longitudinal Tracking:

We funded 61 students in our Fellowship/Scholarship category. (38% female, 42.6% underrepresented minorities). Over the last 5 years, 86% of our funded students moved on to STEM disciplines.

Minority Serving Institution Collaborations*:* The Education and Outreach staff of TSGC supported programs and proposals by affiliates, institutions, and partners that serve underrepresented and underserved populations. Minority Serving Institution involvement in our programs and proposals is one of our main focuses. Our Fellowship / Scholarship Selection Committee is comprised of three members with two of the members from MSIs (UT El Paso, Texas A&M Kingsville, Texas Tech). We continue to advertise our programs with as many of the student chapters of minority and women student organizations at our affiliates as we can obtain contact information for. They include 18 chapters of the National Society of Black Engineers (NSBE), 18 chapters of the Society of Hispanic Professional Engineers (SHPE), 2 chapters of Pi Sigma Pi, the Minority Academic Engineering Society, and 17 chapters of the Society of Women Engineers (SWE).

Our collaboration with the Rio Grande Valley Science Association (RGVSA) has provided NASA resources to young Hispanic girls and "Girls in Science" camp co-sponsored by TSGC and RGVSA and has expanded programs for the underserved. We continue programs with the Texas School for the Blind and Visually Impaired offered NASA materials to students, staff, and teachers who serve this disabled and often underrepresented audience.

NASA Education Priorities

In this section, we state a NASA Education Priority in italics, followed by a brief description of how we focus on that priority in our programs.

Authentic, hands-on student experiences in science and engineering disciplines

- TSGC provides support for the NASA GRACE High School Internship Program at the UT Center for Space Research.
- Texas Space Grant sponsors the *Design Challenge* Program with NASA JSC
- TSGC provides student support NASA Internships and NASA Academies.

Diversity of institutions, faculty, and student participants.

- TSGC continues to engage diverse audiences through student programs, teacher professional development, and with institutions who serve diverse populations.
- We partner with The National Society of Black Engineers and NASA's Hispanic Engineering Group
- Out of 42 TSGC academic affiliates, 21 are Minority Serving Institutions.

Engage middle school teachers in hands-on curriculum enhancement capabilities

- TSGC conducts a weeklong summer teacher workshop, *LiftOff*, at NASA JSC.
- TSGC provides $15K K-12 Education grants as funding allows
- NASA JSC merged the Middle School Aerospace Scholars program with the *LiftOff* Summer Institute for 2014.
- We sponsor, conduct, and leverage multiple teacher professional development short term activities as described earlier in this report,

Summer opportunities for secondary students on college campuses -- *with the objective of increased enrollment in STEM disciplines or interest in STEM careers.*

- We participate annually in the Texas Science and Engineering Festival
- We operate the Summer Internship Program at the University of Texas Center for Space Research
- We conduct the short and long term student programs highlighted earlier in this report.

Community Colleges – *develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges.*

- 6 of our 42 academic affiliates are community colleges.
- Continue with Minority Serving activities Council.
- TSGC Community Colleges, led by San Jacinto College, collaborated to successfully propose the C2Stem Transitions Program

Environmental Science and Global Climate Change *– research and activities to better understand Earth's environments.*

- We annually participate in the Earth Science Week career fair.
- We operate the Summer Internship Program at the University of Texas Center for Space Research

Enhance the capacity of institutions to support innovative research infrastructure activities -- *to enable early career faculty to focus their research toward NASA priorities.*

- Through our competitive New Investigator Program, we provide research start-up funding of $10K as funding permits.

IMPROVEMENTS MADE IN THE PAST YEAR

1) **Community College Collaboration:** Led by San Jacinto College, TSGC Community Colleges collaborated to successfully propose the C2Stem Transitions Program, which has the goals of providing STEM Scholarships, Aerospace Scholarships, Student Success Initiatives, Internship and Course Development. 2) **New Affiliates**: Lone Star Community College system (the largest Community College system in Texas) and TX A&M University, Texarkana 3) **Minority and Female Participation**: Goals (41% minority, 40% female). Actual (42.6%

minority, 38% female. In our Design Challenge, 61.8% of the students that participated were minorities. 4) **K-12 Education**: Provided instructors and logistics for the NASA RGVSA SoI program. Sponsored Girls in Science and Underwater Robotics (camps for girls in grades 4-9). Sponsored Science Days and Family Science Nights for underserved audiences that reached over 9,000 students through direct contact. 5) **Public Outreach**: Sponsored the Austin Planetarium's *Portable Planetarium Outreach Program* for UT Explore, 700 attended.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

TSGC is structured to provide strong management input and oversight by representatives of its 56 affiliate institutions. Most affiliate representatives play a vital role in defining Consortium operations, goals, and funding distribution and are provided with many avenues for participation in consortium management and programs. They Advertise and encourage students to apply for our scholarships, fellowships, and NASA internships, and STEM Space Grant and NASA programs, Review scholarship / fellowship applications, review proposals, assist in tracking program participants, and help to recruit and keep students involved in STEM activities. Below we list all TSGC affiliate members (**MSI**s are indicated by boldface type).

Four Year University Affiliates (36) **- 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 A&M Texarkana,** 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 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, **University of Texas Rio Grande Valley, University of St. Thomas.** Community College Affiliates – (6) **- San Jacinto College, Houston Community College, Austin Community College, El Paso Community College,** McLennan Community College, Lone Star College System. Industry / State Agency / Non-profit Affiliates – (14) Austin Planetarium, Bob Bullock State History Museum, Don Harrington Discovery Center, Lockheed Martin, Office of the Governor, Southwest Research Institute, Texas Higher Education Coordinating Board, United Space Alliance, University Space Research Association, Girlstart, Texas Medical Center, Rio Grande Valley Science Association, National Society of Black Engineers, Scobee Education Center, Seal of Valor.

PARTNERSHIPS AND COLLABORATIONS

Key partnerships were sustained and new partners added in 2013-2014. Collaborations with area school districts, Student Spaceflight Experiment Program, NASA JSC Middle school Aerospace Scholars Program, the Boys and Girls Clubs in Texas, Central Texas STEM Resource Center, and the Texas School for the Blind and Visually Impaired provide quality STEM education programs utilizing NASA resources. TSGC and NASA JSC personnel, NASA Mentors, Students from Affiliate institutions, UT Austin and JPL.