Oklahoma Space Grant Consortium
Lead Institution: The University of Oklahoma
Director: Dr. Victoria Snowden
Telephone Number: 405.325.6559
Consortium URL: http://okspacegrant.ou.edu/
Grant Number: NNX11AB54H

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 Oklahoma Space Grant Consortium is a Designated Consortium funded at a level of $575, 000 for fiscal year 2013.

PROGRAM GOALS

Consortium Goals and SMART Objectives from your 2010 base proposal and budget (or as amended in subsequent submissions)

OKLAHOMA GOALS FOR NASA OUTCOME 1

WORKFORCE DEVELOPMENT GOAL: *To enhance state economic and workforce development in aeronautics and space, while providing applied learning experiences for students and faculty.*

SMART Objectives to achieve Goal:

- Develop linkages between Oklahoma aerospace industry, researchers, and students that foster the creation of market driven technology products.
- Award competitive grants/fellowships to faculty and diverse student populations to facilitate hands-on learning related to state economic and workforce development.
- Provide University Career Services personnel support to increase their knowledge of employment opportunities within aerospace-related industry and at NASA Centers.

FELLOWSHIP GOAL: *To use the NASA mission, facilities, human resources, and programs to provide information, experiences, and research opportunities for students at all levels to support the enhancement of knowledge and skills in the areas of science, technology, engineering, and mathematics.*

SMART Objectives to meet Fellowship Goal:

- Educate students at all levels by encouraging and supporting interdisciplinary and multi-disciplinary research experiences and education programs.
- Provide support to the science and technology workforce pipeline by including greater participation of individuals who are underrepresented in science, mathematics, engineering and technology, in NASA student programs.
- Increase the number of NASA student support opportunities through partnerships and industry collaboration and cooperation.

HIGHER EDUCATION GOAL: *To support Higher Education research capability and opportunities that attract and prepare increasing numbers of students and faculty for NASA-related* **careers.**

SMART Objectives to meet Higher Education Goal:

- Use NASA mission-based programs to demonstrate the integrated education applications of science, technology, engineering, and mathematics for use in student learning activities.
- Provide access to and promote utilization of NASA-related materials and information resources.
- Increase the number and diversity of students and faculty from underrepresented and underserved communities in NASA-related STEM fields.

RESEARCH INFRASTRUCTURE GOAL: *To establish OSGC as a valuable State resource and catalyst for aeronautics and space-related research, education, and state economic and workforce development.*

SMART Objectives to meet Research Infrastructure Goal:

- Create and foster opportunities for faculty and student research at all OSGC affiliates in areas related to NASA's strategic interests.
- Develop and foster interdisciplinary programs to assure the development and transfer of publications in aeronautics and space-related research and education.
- Leverage Consortium and State strengths to meet academic needs and the agenda for economic development.

OKLAHOMA GOALS FOR NASA OUTCOME 2

PRECOLLEGE GOAL: *Increase the number of teachers and students, especially those in underserved and underrepresented communities, who are involved in NASA-related education opportunities.*

Objectives to meet Precollege Goal:

- Develop opportunities for elementary and secondary education teachers to learn effective use of NASA-content, STEM based, materials and programs in the classrooms.

- Introduce students to Space Exploration to encourage an interest in STEM disciplines.

OKLAHOMA GOAL FOR NASA OUTCOME 3

INFORMAL EDUCATION GOAL: Improve public understanding and appreciation of science and technology, including NASA aerospace technology, research and exploration missions.

SMART Objective to meet External Relations Goal:

- Provide instructional materials and technologies derived from NASA research and scientific activities that meet the needs and requests from within the community.

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

Provide concise, meaningful highlights or anecdotes (no more than three) that are directly related to work completed in 2013, highlighting student and/or project accomplishments. Specify alignment to an Outcome.

PROGRAM ACCOMPLISHMENTS

Refer directly to the consortium goals and SMART objectives in your 2010 base proposal when describing your accomplishments.

Outcome 1: *Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals:* (Discussion of achievements and progress related to your Fellowship/Scholarship, Higher Education and Research Infrastructure programs). *(Employ and Educate)*

Highlight 1: Jared Christen, a computer science major at the lead institution, **The University of Oklahoma**, was competitively selected to participate in the OSGC sponsored Workforce Development visit to Jet Propulsion Lab (JPL) in March 2013. He was selected by JPL from among 17 applicants to intern for the Summer of 2013. OSGC provided funding for the internship which enabled Jared to work in the Simulation and Support Equipment group. Jared graduated in May of 2014 and was hired by JPL to return Summer 2014. This NASA Fellowship recipient continues work updating ground test software for the Mars Science Laboratory mission, and the Soil Moisture Active Passive mission.

Highlight 2: Southeastern Oklahoma State University has the highest number of Native American students registered on the rolls of any Oklahoma University. The NASA fellowship recipients have consistently graduated and either joined the workforce in STEM disciplines, or continued their education in graduate and professional programs. One recent graduate, Joshua Stephen Hightower (Native American Computer Science/Aviation double major), for whom we funded a summer 2012 internship at NASA Langley Air Force Base, graduated and was hired as a software design engineer by a consulting firm and is now working on a project for Microsoft in the US. Others

have gone on to join the US Air Force, medical school, pharmacy school, chemical research labs, and other areas in demand in the US.

Highlight 3: Two **Southwestern Oklahoma State University** students went to NASA Langley Research Center as LARRS summer interns. Jennifer Stout, a female Computer Science student is working with the Media Solutions Branch to set up a system for capturing and storing a variety of imagery, including graphic, photographic and video image files so that they may be accessible not only at Langley, but throughout the Agency. She is also doing some graphic design work. Nick Rymer, a male Engineering Technology major, is returning as a LARRS intern to continue his work with Arduino micro-controllers, way point programming and GUI for microkopter first-responder Unmanned Arial Vehicles with his mentor, Dr. James E. Hubbard, Jr

Outcome 2: *Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty:* (Discussion of achievements primarily focused on your Higher Education programs not discussed in Outcome 1 and your Precollege programs). *(Educate and Engage)*

Highlight 1: **Speedfest**, an exciting, high-speed aircraft competition intended to foster enthusiasm for aviation and unmanned aircraft design was conducted for the fourth straight year. Created in 2011, Speedfest receives support from the Oklahoma NASA Space Grant Consortium, Spirit Aerosystems, ZAI Inc., UML, and the Oklahoma State University School of Mechanical and Aerospace Engineering. The event featured two racing classes: Alpha (Advanced) Class which is open to collegiate teams, and India (Invitational) class, which is open to high school teams. A total of 12 teams competed in Speedfest IV, including well over 150 students and teachers. The event also featured demonstrational flights including: aerobatics of helicopters and airplanes, giant scale airplane aerobatics, a vertical takeoff demonstration of the Speedfest II Alpha class winner, and flyovers. The official gate count was over 585 people.

Highlight 2: The **First Tech Challenge Robotic Design Contest** experienced *34% growth this year to involve 63 teams*. The Engineering Technology and Computer Science students from Southwestern Oklahoma State are indispensable for this project. They perform hardware and software inspection, field inspection, refereeing and scoring. They are responsible for all field and computer scoring network setup. Six of these students were selected to attend the super-regional event in San Antonio, Texas. Jeremy Weimer was recognized on the US First national web page as one of the best volunteers in the nation.

Highlight 3: For the *nineteenth consecutive year*, **Mission to Planet Earth (MTPE)** was conducted by the lead office, **The University of Oklahoma. Participants** included two pre-service STEM teachers competitively selected from each of the eight academic affiliates. Participant enrollment included one female African American, and one female Native American. The ten day, summer in-residence institute, utilized NASA content, facilities, and resources to teach these students how to utilize the excitement of aviation and space to Educate and Inspire their future students. The Department of Education

Oklahoma Common Core provides the foundation for the institute curriculum. Throughout the ten days, teachers learn concepts in science, technology, engineering and mathematics related to NASA content, resources and facilities, they are taught the engineering design process, and are provided a new iPad for their future teaching experiences. These pre-service teachers signed an agreement that to keep the iPad for their future classroom usage they must: 1) attend, actively participate in, and complete all MTPE program components, 2) attend and actively participate in the iPad Training Seminar, (September 19-21, 2014), 3) attend, and actively participate in, the VIP Johnson Space Educator Tour as a follow-up to MTPE (Spring 2015), and, 4) provide on-going longitudinal tracking information following their graduation. Throughout the institute participants learned numerous NASA iPad applications and how to integrate them across all disciplines. A course highlight features a one day mini ground school where students learn the basic science principles of flight. With an instructor, the following day each teacher individually takes control of University owned aircraft. Each teacher has the experience of an instructor-led takeoff and landing at different airports within a one hundred mile radius.

Outcome 3: *Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission:* (Achievements and progress of Informal Education programs). *(Engage and Inspire)*

Highlight 1: NASA OSGC affiliate **STARBASE Oklahoma**, an informal science education group, provided multi-day NASA STEM inquiry-based educational opportunities to 220 in-service teachers and 3717 pre-college at-risk students, including those teachers and students in underserved and underrepresented communities such as schools with a large percentage of free and reduced lunch, schools serving rural communities, and schools serving Native American communities. Topics include physics, chemistry, nanotechnology, navigation and mapping, computer-assisted design (CAD), 3-D printing, engineering design process, measurement, geometry, and data analysis.

STARBASE continued to provide linkages to NASA aerospace technology, research and exploration missions by providing information, training and instructional materials to Oklahoma communities statewide via the Flying the Skies: Aerospace Principles for Today's Classroom one-day workshop. *Nineteen* STEM teachers statewide participated, and an estimated 1055 students will be impacted. Activities included weather-related research activities conducted with a weather station. STARBASE has built partnerships with Stafford Aerospace Museum through Union Public Schools Community Night, Oklahoma Mentoring Day at the state Capitol and the Tulsa Engineering Alliance Camp Curiosity sessions.

Highlight 2: A new partnership was created between the OSGC and OEF, the Oklahoma Engineering Foundation. OEF's mission is to organize local engineers, educators, and industry and community partners committed to furthering STEM education in Oklahoma in order to produce engineering professionals and employ them in Oklahoma. We partnered with OEF for two competitive events, *Math Counts*, a middle school math

competition, and *Future City*, for high school engineering students. Two teachers of Future City winning participants were competitively selected to attend a VIP Educator Tour at Johnson Space Center in March. Also, four students and two teachers among the winners of the Math Counts competition were selected to take a mini-ground school at **The University of Oklahoma**. The students and teachers had the opportunity to fly with a flight instructor in a University owned plane, each taking the controls of the plane while in the air to utilize the flight concepts learned in the ground school.

Highlight 3: The Oklahoma Space Grant lead office at **The University of Oklahoma** initiated the "*Stafford Scholars*" program, in which a competitively selected student intern was sponsored to work at OSGC affiliate, **Stafford Air and Space Museum**. Through this program, with matching funds provided by the museum, the intern had the opportunity to learn and share details of specific NASA missions with the public. The intern shared the need for STEM in the past, present, and future to further NASA's mission.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Student Data and Longitudinal Tracking:** Number of program student participants employed by NASA, aerospace contractors, universities, and other educational institutions; Number of undergraduate students who move on to advanced education in NASA-related disciplines; Number of underrepresented and underserved students participating.

  Total awards= 145; Fellowship/Scholarship= 120, Higher Education/Research Infrastructure= 25; 68 of the total awards (47%) are underrepresented minority F/S funding; 26 students have accepted STEM positions, while 3 have graduated and are pursuing advanced STEM degrees.

  Since 2010:

  Percentage of students whom have taken their next step and have been successfully tracked though their next step vs last year of SG support.

  - 92% for 2010
  - 100% for 2011
  - 100% for 2012
  - n/a for 2013 – all participants sill enrolled
  - 57% for 2006-2013

  60% of students significantly supported went onto next steps in STEM disciplines

- **Minority-Serving Institution Collaborations:** Summarize interactions. Reference the names of projects with MSI collaborations.

The Oklahoma Space Grant Consortium embraces diversity in our Consortium membership: five of our eight university members are minority serving institutions:

Langston University (Oklahoma's only HBCU), **Cameron University**, **East Central University**, **Southwestern Oklahoma State University**, and **Southeastern Oklahoma State University**. Southeastern has the highest number of Native Americans students registered of any other public institution within the state. The Cheyenne Arapaho College, although not yet accredited, is hosted on the Southwestern Oklahoma State University (SWOSU) campus.

Three major annual OSGC programs involve every one of the eight academic affiliates with each of the institutions competitively selecting two student participants: The **Summer Geospatial Institute** offered by the **Center for Spatial Analysis**, **Mission to Planet Earth Summer Teacher Institute**, conducted by **The University of Oklahoma**, and **NASA Center Site Visits**, also led by **The University of Oklahoma**. Thus, there is on-going, strong interaction with the minority serving institutions within OSGC.

- **NASA Education Priorities:** *Accomplishments related to the "Current Areas of Emphasis" stated in the 2010 Space Grant solicitation. Report on areas that apply to work proposed in your proposal and budget.*

  - Authentic, hands-on student experiences in science and engineering disciplines – the incorporation of active participation by students in hands-on learning or practice with experiences rooted in NASA-related, STEM-focused questions and issues; the incorporation of real-life problem-solving and needs as the context for activities.

SWOSU and **Cameron University** both had teams that competed in the *NASA Human Exploration Rover Challenge* (Formerly Moonbuggy) at NASA Marshall Space Flight Center. Students built vehicles that were powered by one male and one female student, and traversed a series of obstacles in a course.

The **Southern Nazarene University** *Summer Research Experience* provided four first- and second-year students with hands-on research experience for six weeks in 2014. In one project, two students studied ways to synthesize nanoparticles and their ability to prevent the growth of bacteria. This is a multidisciplinary project that was mentored by two chemistry professors and one biology professor.

Seventeen pre-college biology students at Guthrie High School (coordinated by **Langston University**) gained hands-on experiences in the life sciences through classroom based instructions and lectures, reading assignments, and practical applications in a laboratory environment. Each learning/instructional application incorporated problem-solving skills that enhanced critical thinking skills for daily living. STEM focused issues and questions strengthened each learner's ability to apply the knowledge and skill gained into their planned career development.

Speedfest is a unique aerospace design competition with collegiate and high school level competitive classes. Rules for each class were given before the start of the fall semester, and the competition was held at the end of April. Students at the collegiate level designed, built, and flew airplanes to a rigorous set of specifications to meet mission goals. Students at the high school level raced airplanes built from kits. Included with the kits was information for teachers to help them teach the fundamentals of aeronautics, and to excite the students about aviation topics. At the collegiate level, Speedfest is considered the most challenging aerospace design/build competition in the world. Teams are only allowed to compete if they meet a minimum level of competency evaluated by the judges. At the high school level, teams must prove that they are committed to the project, and also must involve a mentor familiar with safety procedures for model aircraft. The effort was a collaboration between: the Oklahoma NASA Space Grant Consortium, The State of Oklahoma, Zivko Aeronautics Inc., University Multispectral Labs, and **Oklahoma State University**.

Frontier Electronic Systems (FES) is an OSGC Industrial Affiliate and has been offering internship opportunities to OSGC students for now over a decade. It is the most successful internship program offered by OSGC in terms of not only providing real-world experiences for students, but also in terms of placement. To date over 1/3 of the OSGC/FES internships have resulted in permanent hiring of the student.

- Diversity of institutions, faculty, and student participants (gender, underrepresented, underserved).

OSGC is a diverse organization geographically, demographically in terms of students and faculty, and academically spanning community colleges, regional universities, research universities, science museums, and K-12 STEM education organizations. All eight academic affiliates are required to make competitive awards, at a minimum, to closely reflect their campus demographics for underrepresented minorities and gender. This also includes selection of participants for the three consortium-wide programs addressed above within the section: Minority-Serving Institution Collaborations**.**

- Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise. Capabilities for teachers to provide authentic, hands-on middle school student experiences in science and engineering disciplines (see above).

As a result of the three Professional Development Workshops for Teachers implemented by **STARBASE** (open to grades 5-12), 100% of the 40 teachers said 1) their knowledge of NASA related STEM increased and 2) that the information and materials from this workshop would be useful in their classrooms.

The **2014 Professional Development Workshop** at **Langston University** targeted fifteen (15) in-service and pre-service teachers from the metropolitan Oklahoma and

Logan County areas. Each participant developed skills and techniques to teach the STEM sciences to student learners and make the subject matter exciting and fun. At the close of the program year, seventy-five (75) in-service and pre-service teachers have participated in the Professional Development Workshop since inception and over fifty-six (56) will incorporate STEM related learning activities into their weekly plans of instructions

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

Thirty eight, eighth through twelfth graders participated in **Summer 2014 Intensive Math and Science Academy** on the **Langston University** campus. This is an increase of fifteen (15) percent over last summer. The cohort was inclusive of students with an interest in biology, chemistry and mathematics. Over the past five years, the program has had a significant impact on STEM programming at Langston University. Twenty program participants continued their education in the STEM sciences at Langston University; seven became OSGC scholarship recipients; two graduated in 2013; and four graduated in the spring 2014. The Intensive Math and Science Academy has contributed to the retention, graduation and placement rates of STEM students.

The **Center for Spatial Analysis** collaborated with Oklahoma City Community College to offer the **Mapping and More** course through the **College for Kids** program. The course includes fun, hands-on activities to introduce geospatial information science to middle school students who learn to answer qualitative and quantitative questions using geospatial technologies.

Robotic kits were provided to 24 students for the **2014 Summer Science Academy** held on the campus of **Cameron University**. The students built and programmed the robots, and increased their interest in STEM careers.

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

We currently have projects with **Redlands Community College** and **Tulsa Community College** to enhance our recruitment efforts in the STEM sciences. Additionally, we have active informal outreach efforts with **Oklahoma City Community College** and **Rose State College** to assist Associate degree graduates.

- Aeronautics research – research in traditional aeronautics disciplines; research in areas that are appropriate to NASA's unique capabilities; directly address the fundamental research needs of the Next Generation Air Transportation System (NextGen).

Students at **Oklahoma State University** worked with engineers at Cessna Aircraft Inc (now Textron Aviation) to build a 1/8 scale flying demonstrator of a Cessna Citation Jet. This was the first project of its kind, and OSGC leveraged fund to allow additional students to participate in the research to gain experience. Also developed was a unique in-flight data acquisition system which was mounted on the airplane. It allowed pilot input as well as all aircraft degrees of freedom and aerodynamic quantities to be recorded. The data will be useful in developing system identification techniques on small scale lower cost aircraft that can be used to accelerated development of the full scale jets.

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

The School of Agriculture and Applied Sciences and the Office of Assessment and Career Services developed a partnership with the U.S. Geological Survey to brand the agency with **Langston University** students to increase the number of Natural Resource Management majors. Two students participated in internship experiences.

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

This is another area of emphasis of the OSGC. Some OSGC funding was made available to faculty identified research and technology projects related to NASA interest areas. Preference was given to projects that involve Oklahoma industries, particularly small manufacturers who do not have easy access to engineering support. Funding was competitively awarded to students and faculty to work with these companies. This provided the students with a relevant hands-on experience in NASA-related technical areas. Additionally, "seed funding" supported faculty who involved students in projects leading to larger proposals directly to NASA, and / or to support cooperative efforts between NASA Space Grant and NASA EPSCoR. This seed funding had a significant impact in the last year in that it has resulted in part, for 4 different successful research proposals and 2 publications

IMPROVEMENTS MADE IN THE PAST YEAR

Succinctly *describe improvements and/or adjustments made last year that demonstrate significant change(s) within the consortium. The improvements and/or adjustments that brought about change may have been in management, resource allocation, project design, project evaluation, etc.*

A two-page graphical brochure was created for OSGC. The emphasis of the brochure, and the title, is *IMPACT*. It was determined that it is important for the consortia to be able to briefly describe itself, and the impact it has had upon the state and the nation. The Space Grant program has so many components that it is difficult sometimes when explaining the program to others for them to understand the impact the program has. The

brochure not only helps those who are unfamiliar with Space Grant understand the impact, but it also helps the people in OSGC focus when explaining programs to others.

Two significant changes were made in the past year to the **Geospatial Summer Institute**. It has historically been a two-week residential program. Recent trends in summer education and economic conditions impacted student ability to attend a two week program on site. The summer institute was revised to a mixed model with online courses and a one-day symposium with a keynote speaker and student presentations. Course discussions took place on Facebook. Dr. May Yuan also held interactive help sessions with individual students via web meetings throughout the institute. Students gave positive responses on the flexibility but also asked for more interaction time, which we will have in the next summer institute. The other key change was the incorporation of the research infrastructure topics in the graduate seminar for the first year graduate students. The motivation was to introduce the research element to incoming graduate students and encourage them to incorporate space-time analytics in their thesis research. Two graduate students did class projects on related topics and indicated that their thesis research would include space-time analytics of climate data.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

List the institutions that comprise the consortium; include the name, type of institution, key characteristics, and role.

OSGC represents a state-wide partnership of universities, State Government, City Government, industry, an aerospace education organization, and an air and space museum. These members work together to enhance opportunities for Oklahomans to understand and participate in NASA's Mission by supporting programs in science, technology, engineering, mathematics, and other aeronautics and space-related disciplines throughout the State. Each member plays an active role in the development and implementation of Space Grant programs based on that affiliate's mission, human, and financial resources.

A representative from each of the affiliates comprises the Advisory Committee which meets twice a year at the lead institution. In addition, conference calls are conducted several times a year for input to program direction to meeting the changing needs of NASA, the State, economic environments, and funding opportunities to leverage funding.

University Affiliates

The University of Oklahoma – lead institution
Oklahoma State University
Cameron University
Langston University – a Historically Black College and University
East Central University
Southeastern Oklahoma State University
Southern Nazarene University

Southwestern Oklahoma State University

Academic Affiliates

Applications Engineering Programs

Center for Spatial Analysis

Industrial Affiliates

Frontier Electronic Systems Corporation

Science Applications International Corporation

Informal Science Education Affiliates

Tom Stafford Air & Space Museum

STARBASE Oklahoma

City Government Affiliate

Norman Economic Development Coalition