

Nevada NASA Space Grant Consortium
Nevada System of Higher Education
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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 Nevada NASA Space Grant Consortium is a Capability Enhancement Consortium funded at a level of \$430,000 for fiscal year 2011.

PROGRAM GOALS

The overall goal of the Nevada NASA Space Grant Consortium is to create and expand opportunities for Nevada students and faculty to be active and valued participants in our Nation's NASA aeronautics and space programs. NVSGC meets its general goal by implementing programs within Nevada that target the following objectives:

- Objective #1: Recruit:* We will a) recruit, train and reward scholars and fellows within all of our academic institutions, b) strive to ensure that they are representative of our state's population, and c) engage faculty and students at all NSHE institutions such that they acknowledge and promote successes of scholars and fellows in ways that enhance employment in STEM careers.
- Objective #2: Support and Guide:* NVSGC will develop new avenues for NASA research projects in Nevada that will ultimately result in new publications or research proposals to NASA.
- Objective #3: Develop Curricula:* Establish new courses and infuse NASA-related content within the NSHE institution's curricula.
- Objective #4: Engage:* Engage students in internships and academy positions at Industrial Affiliates and NASA centers.
- Objective #5: Compete:* Conduct curricular and extracurricular programs where multiple students are involved in hands-on science or engineering activities with an emphasis on the development of teams that compete in science and engineering competitions rooted in NASA-relevant and real world problems.
- Objective #6: Promote STEM materials:* Promote and increase the awareness and availability of NASA content-based STEM materials among teachers so that they can effectively integrate these in their future teaching endeavors.
- Objective #7: Promote STEM literacy:* Promote STEM literacy and increase awareness and perceived importance of NASA's missions through NVSGC activities.

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

Anecdotes illustrating contributions to Outcome 1 – Higher Education – Employ and Educate:

Francell Rodriguez, University of Nevada, Las Vegas NVSGC scholar, and his team won first place in the Harriet & Fred Cox Civil and Environmental Engineering Design competition at the University of Nevada, Las Vegas. Francell is studying Civil and Environmental Engineering and hopes to have a positive impact on the environment, growth and development of renewable energy.

Leah Preston, NVSGC scholar, is a senior at the University of Nevada, Las Vegas studying Civil and Environmental Engineering. She recently passed the Fundamentals of Engineering Exam and is now certified as an Engineer in Training. She has accepted a position as a Civil Engineer for British Petroleum in Houston, Texas, after graduation.

Caleb Alborno, NVSGC scholar and senior in computer science at the University of Nevada, Las Vegas, participated in a 24-hour competition called the Extreme Engineering Challenge in Anaheim, CA in October 2011. He and his team won first place and shared the \$4,000.00 prize money awarded by the Society of Hispanic Professionals and Engineers.

Anecdote illustrating contribution to Outcome 2 (Elementary and Secondary Education – Educate and Engage) and Outcome 3 (Informal Education – Engage and Inspire):

Dan Ruby, associate director of the Fleishmann Planetarium (NVSGC education affiliate) and graduate student in the University of Nevada, Reno, College of Education, is among 26 educators from across the country to be selected for research flights aboard SOFIA, NASA's Stratospheric Observatory for Infrared Astronomy. As a participant in the Airborne Astronomy Ambassadors program, along with his teammate, Matt Oates, Dilworth STEM Academy, Sparks, Nevada, he will partner with professional astronomers using SOFIA for scientific observations in 2012 and 2013. For the application process, these educators described how they plan to take what they learn from SOFIA back to their classrooms and communities to help promote increased literacy in science, technology, engineering and math.

PROGRAM ACCOMPLISHMENTS

Outcome 1:

Fellowships and Scholarship Programs (Objective #1 -1a. We will recruit, train and reward scholars and fellows within all of our academic institutions. 1b. We will strive to ensure that they are representative of our state's population. 1c. We will engage faculty and students at all NSHE institutions such that they acknowledge and promote successes of scholars and fellows in ways that enhance employment in STEM careers): Six (6) Fellowships, for a total of \$92,499, were awarded to graduate students in Mechanical Engineering, Astronomy, Astrophysics, Geoscience, and Hydrogeology graduate programs at both the University of Nevada Reno (UNR) and the University of Nevada Las Vegas (UNLV). Fifteen (15) Scholarships, for a total of \$70,000, were awarded to students in Computer Science, Biology, Mechanical Engineering, Computational Physics, Civil Engineering, Aviation Technology, Electrical Engineering and Environmental

Engineering at UNR, UNLV and the College of Southern Nevada (CSN). The ratio of awardees to applicants was 6:34 for Fellowships and 15:21 for Scholarships in these statewide competitions. The number of awards going to students from underrepresented groups was 29%, which is more than the program's target of 26% and the number of awards going to women was 24%, which is less than the program's target of 53% women.

Research Infrastructure Programs (Objective #2 - NVSGC will develop new avenues for NASA research projects in Nevada. The objective is to facilitate grant workshops, create new NASA contacts, and implement small seed research programs that will ultimately result in new publications or research proposals to NASA.

NVSGC is sponsoring a program at the University of Nevada, Las Vegas to build research infrastructure in space science through investment in control design architecture efficiency in the area of electronic beam steering for future use in Wireless Power Transmission. The objective of this technology is to design a control system on a chip for a two-dimensional liquid crystal beam steering system towards WPT applications in space. Due to its inherent relevance to NASA research interests, the project is expected to inspire many STEM students in higher education in Nevada to get involved in WPT and, upon graduation, seek careers in NASA organizations.

Curricula Development (Objective #3 - Establish new courses and infuse NASA-related content within the NSHE institution's curricula. Specific targets include interdisciplinary classes utilizing or implementing mission directorate content as well as senior design courses and senior research projects): Through our statewide solicitation and review process, we awarded a curriculum development award to Sierra Nevada College to support the development of an Earth Sciences curricula at the college and to complement the existing curricular offerings in Environmental Science and Ecology. An overall framework for a six-course offering in Earth Sciences at the college is being developed. The funding from the NVSGC award is being used to complete the specific detailed curriculum for the first two courses offered within that six-course framework: *Introduction to Geology (ESCI 101) and Hydrology and Water Resources (ESCI 301)*. By aligning the Earth Sciences curricula with NASA's Earth System Sciences programs, these new courses, when implemented, assist NASA in advancing its Science Mission Directive and contributes to our SMART objective 5.

Higher Education Programs (Objectives #4 - Engage students in internships and academy positions at Industrial Affiliates and NASA centers, and #5 - Conduct curricular and extracurricular programs where multiple students are involved in hands-on science or engineering activities with an emphasis on the development of teams that compete in science and engineering competitions rooted in NASA-relevant and real world problems): NVSGC allocated resources to support three NASA internships during the summer of 2011. Gabe Herz was sponsored as an NVSGC summer intern at the Jet Propulsion Laboratory (JPL). During the internship, Gabe had the opportunity to be part of the ATHLETE mechanical team. ATHLETE (All-Terrain Hex-Limbed Extra-Terrestrial Explorer) is a vehicle concept developed at JPL with six limbs - each having six degrees of freedom of motion. He finished the construction of a counter rotating auger anchor that

ATHLETE could use to secure itself to the surface of an asteroid. Related to this project, Gabe developed a test bed that will allow the ATHLETE team to test the effectiveness of the auger anchor and demonstrate the robot's anchoring capabilities. Another focus of his work was to develop a system to allow ATHLETE to test a variety of tools in a general test bed.

Seth Gainey, Ph.D. candidate at the University of Nevada, Las Vegas, and an NVSGC-sponsored intern at JPL during the summer of 2011 is presenting a poster at the 43rd Lunar and Planetary Science Conference in March 2012 based on the data generated during his internship at JPL. His data is also part of a proposal submitted by Dr. Elisabeth Hausrath to the NASA Mars Fundamental Research Program, which is currently pending. His interest is to complete a postdoc at JPL or a NASA center after he graduates.

NVSGC continues to support several training programs to enhance extracurricular and curricular experiences through hands-on training and event-based activities that promote teamwork and enhance the types of training extremely relevant to NASA and the STEM workforce. Specifically, NVSGC has continued its nationally-known and respected balloon-Sat program collaboratively run by Drs. E. Wang and J. LaCombe at UNR along with faculty from NSC (S. Thanki) and TMCC (D. Loranz). This program has evolved over the past 10 years and now engages students and faculty from across the state, specifically through the implementation of activities at Nevada State College, in conjunction with the NASA Spaceward bound camp (run by C. McKay in the Mohave Desert), and with the Davidson Academy of Nevada in Reno (a free public school for profoundly gifted middle and high school students from across the nation).

NVSGC has continued its tradition to develop local systems' controls and engineering competitions through its *Lighter Than Air Vehicle* competition at Truckee Meadows Community College where students compete by building a remote controlled balloon vehicle capable of meeting design criteria, as well as compete in a timed obstacle course. This competition has resulted in the participation of 3-8 teams of community college students and has engaged both the administration and the TMCC Foundation in the program. NVSGC continues to build on these programs for the expansion of the BallonSat and Visualization programs (contributing to outcome 1) as well as the development of a hands-on engineering course for high school and middle school teachers (which contributes to Education outcome 2 and SMART objectives 5, 6 and 7).

Outcome 2:

Pre-college Programs (Objective #6 -Promote and increase the awareness and availability of NASA content-based STEM materials among pre-service teachers so that they can effectively integrate these in their future teaching endeavors):

NVSGC solicited proposals and conducted reviews for both Pre-College and Informal Education programs and have funded one Pre-College proposal and two Informal Education proposals. The proposal funded for Pre-College intends to act as a bridge between existing sources of NASA projects and lesson plans for teachers to contribute to the integration of these NASA data and products in STEM disciplines in Nevada classrooms. The project targets 20 to 25 STEM teachers from the Washoe County School district, grades 6-12, to participate in a one-day workshop resulting in the creation of an

individualized project for each teacher's use in a specific STEM course. The intention is to impact 2500-4250 students as a mechanism to achieve NASA's strategic goal of "engaging the public in NASA's mission."

Outcome 3:

Informal Education Programs (Objective #7 -Promote STEM literacy and increase awareness and perceived importance of NASA's missions through NVSGC activities):

Two informal education projects were funded through the statewide solicitation and evaluation process. In an effort to expand the success of the near space weather balloon projects currently in Nevada, the University of Nevada, Las Vegas is embarking on a program for undergraduates and high school students to build and launch research payloads on high altitude weather balloons. Bringing together the support of the Las Vegas Radio Amateur Club, the Las Vegas Repeater Association and the UNLV Department of Physics and Astronomy, this project gives students an opportunity to learn in an informal environment outside of the classroom. Bringing together 20 high school students and 20 undergraduate students builds a support structure to allow students to participate in sophisticated projects involving near space research, telemetry, electronics and engineering. As more and more launches are made, the plan is to make high altitude balloon launches a part of the long term plan of the department by forming a sustainable group of department, student and community members who can continue to learn from each other.

The second award went to the College of Southern Nevada to provide an opportunity for informal science education to take place on various levels within the context of the collection and culture of extremophile organisms that thrive in physically or geochemically extreme conditions from locations in southern Nevada. Students from CSN microbiology classes will complete field and laboratory work to collect and culture extremophiles, from which they will draw analogies to planets in our solar system, or exoplanets outside of our solar system, where organisms with these characteristics could survive. The 20 students will then present their findings in the form of informal science education presentations for the general public at the CSN Planetarium. In addition, Dr. Naaktgeboren, the PI on this project, will use these materials to enhance the current work in her microbiology lecture classes to further engage students in this field.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- **Student Data and Longitudinal Tracking:** significant awards = **22**; Fellowship/Scholarship = **21**, Higher Education/Research Infrastructure = **1**.
- **Diversity:** Six F&S awards went to underrepresented minority students (29%). The consortium has come close to meeting its diversity goals both in terms of diversity of students and diversity of institutions. All eight of NSHE institutions have received resources for participating in the consortium. Three of the eight institutions' students received scholarship or fellowship awards in FY11, which is one less than the number in FY10. Diversity among participants is being met through our consortium network that includes Hispanic engineering clubs, as well as the Society of Black engineers on institutional campuses. We have reached 24% women and 29% underrepresented

students, below our target of 50% women and above our target of 26% under-represented for the overall program.

- **Minority-Serving Institutions:** The University of Nevada, Las Vegas and College of Southern Nevada have large populations of minorities, yet do not qualify as a MSI, because the minority students as a whole do not constitute at least 50 percent of the total undergraduate enrollment. This is being revalued in 2012 as student enrollment continues to increase for both campuses.
- **NASA Education Priorities:** In FY10-11, NVSGC ran several programs that included hands-on student activities with experiences rooted in NASA-related issues. A number of active hands-on activities are evident in the expansion of the NevadaSat balloon program conducted in several areas across the state. However, there is currently a hands-on applied course at the University of Nevada, Las Vegas where students must develop a sophisticated robotic mechanism to solve a unique problem requiring the use of sensors, computer-aided design, mechanism design and control programming. Through this new hands-on multidisciplinary engineering program at UNLV, which also includes a STEM educator workshop component, engineering students participate in more open-ended hands-on engineering design courses. Currently established courses offer higher education students experience with robotics, which are then used in STEM robotics competitions. The goal of this project is to create a project-oriented class where engineering students must design and build a robot or robotic manipulator to solve a complex design problem. A secondary goal is to coordinate this class so it ends with a workshop for STEM educators involved with robotics programs, giving the educators an opportunity to learn beginning and advanced robotics design and programming concepts they can then take into their classrooms.

NVSGC currently includes all community colleges in Nevada and we continue to strengthen programs at these colleges. All Nevada System of Higher Education (NSHE) institutions have representation through the participation of campus Associate Directors in developing the ongoing goals for the consortium. NVSGC FY11 resources have been released for competition and awarded to programs emphasizing Environmetrics and the development of sensor networks, atmospheric sciences and ballooning programs. These activities complement earlier work throughout the consortium that targeted remote sensing of soil moisture, as well as the alteration of desert surfaces and clay minerals relevant to understanding climate effects on soil properties.

IMPROVEMENTS MADE IN THE PAST YEAR

Continual communications with NSHE institutions and evaluation of best practices for awards has been ongoing throughout the past year. As part of this effort, NVSGC has reevaluated the means in which we solicit, review and award proposals. As a result of this internal review, we have implemented changes in regards to best practices congruent with other state-wide programs. Specifically, NVSGC has updated and revised solicitations such that they directly solicit activities that clearly align with the program's objectives, and they clarify the review criteria by which the programs will be evaluated.

Communications on NVSGC efforts, the national STEM education agendas, local activities, best practices, and day-to-day operations among the Director (located in Reno),

the Associate Director (located in Las Vegas) and the state Director of the System Sponsored Programs & EPSCoR Office (located in Las Vegas) has resulted in improvements regarding overall state-wide operations. Further developments in the state government and higher education agendas has highlighted the state's commitment to strategic initiatives in areas of STEM Education (by the Chancellor and the Board of Regents) as well as strategic initiatives from the Governor's office regarding Economic Development that includes targeted investment in the state's Aerospace Industries and the workforce needed to grow that industry.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

NVSGC has eight member higher education learning institutions across the state, including: the University of Nevada, Las Vegas (UNLV); the University of Nevada, Reno (UNR); the Desert Research Institute (DRI); the College of Southern Nevada (CSN); Great Basin College (GBC); Truckee Meadows Community College (TMCC); Western Nevada College (WNC), and Nevada State College (NSC). Campus Associate Directors, in conjunction with the program coordinator, program assistant and two NSHE research administrators comprise an internal advisory committee that aids in setting yearly operational goals and aims. The Director of the Nevada NASA Space Grant/EPSCoR Program reports to the Vice Chancellor and the Nevada System of Higher Education's (NSHE) Research Affairs Council. Thus, the consortium operations are run as a system-wide program with those with higher education interests represented.

The Consortium also includes industry and education partners. Digital Solid State Propulsion (Reno, NV), which won the 2012 Entrepreneur Technology Company of the Year award for developing a new class of propellant technology called Electric Solid Propellants, Equipment Links, Inc. (Las Vegas, NV), Sierra Particle Technologies (Reno, NV) and Summit Products (Minden, NV) were active industry partners in 2011. The Challenger Learning Center of Northern Nevada, the Fleischmann Planetarium & Science Center, the Jack C. Davis Observatory at WNC and K-12 Washoe County School District's Science Program Coordinator form the present consortium education partners. The industrial and educational partners' roles in the consortium lie mainly in implementing internship opportunities, as well as informal education and precollege programs. They also are invited and participate in planning and operations and aid in communicating and facilitating NASA program opportunities.