

Nevada Space Grant Consortia
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. Nevada Space Grant Consortium is a Capability Enhancement Consortium funded at a level of \$590,000 for fiscal year 2009.

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. This general goal is aligned with the National Space Grant Fellowship and Scholarship program's objectives and was implemented locally within Nevada by targeting the following six programmatic objectives:

- 1. Implement a broad-based approach to ensure the NVSGC Fellowship and Scholarship program recognizes and rewards students for their achievements, interest and potential in the development of their careers in STEM fields and that the recognition and rewards are available to eligible students among different disciplines at all Nevada Institutions of Higher Learning.*
- 2. Conduct workforce development (WFD) programs where multiple students from campuses are involved in hands-on team building activities or host local, state, national and/or international science and engineering competitions.*
- 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.*

4. Engage students in internships and academy positions at Industrial Affiliates and NASA centers. In addition, formalize roles and expectations with our industrial affiliate program to include enhanced student interactions with industry.

5. 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.

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.

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

All but one of NVSGC's 2009 objectives (objectives #1 to #5) resulted in activities that directly contributed to NASA's Office of Education Outcome #1, with a small allotment of resources allocated to an additional activity contributing to Outcome 2 (through objective 6). Specific accomplishments and benefits to outcomes are discussed below.

PROGRAM ACCOMPLISHMENTS

Fellowships and Scholarship Programs

Five Fellowships, for a total of \$77,500, were awarded for graduate students in Mechanical Engineering, Geology, Mechanical Engineering, Computer Science, and Astronomy graduate programs at both UNR and UNLV, and \$77,500 was awarded for 12 Scholarships for students in Atmospheric Science, Math, Computer Science, Geological Engineering, Computer Engineering, Mechanical Engineering, Physics/Astronomy, Aerospace Engineering, Civil Engineering, Entertainment Engineering, Electrical Engineering, Chemical Engineering, Mechanical Engineering degree programs at UNLV, UNR and WNC. The ratio of awardees to applicants was 5:12 for Fellowships and 13:22 in Scholarships in these competitions. The number of the awards going to students from underrepresented groups was 26%- and exceeded our state's target. The fellowship and scholarship program continues to be run through a state-wide competitive process and has been promoted more on campuses throughout the state such that the program is truly multi-disciplinary. Efforts continue to engage all the campuses to the degree that all campuses are getting students to apply and gain these awards.

Higher Education Programs

Hands on Extracurricular Activities:

NVSGC initiated a number of new programs across the state that promoted hands on team building efforts in engineering. The programs encompassed a lighter than air vehicle competition at the Truckee Meadows Community College, a training program in imaging and robotics at the University of Nevada Reno, an automation controls bootcamp at the University of Nevada Las Vegas and a Baja-buggy Challenge team at Western Nevada College. In addition, NVSGC sponsored faculty and student participation in the national RockOn workshop at the Wallops flight facility. All of these programs

compliment the ongoing Nevada Sat program that has been run out of the University of Nevada Reno- but engages multiple campuses across the state. Thus, our hands-on (formally known as our workforce development program) met the objective of engaging multiple students across multiple campuses.

Highlights from these programs include the success of the LTA competition at the Community college, the success of promotional materials compiled and presented by Nevada's Rock on student participant (namely Gabe Herz) and the engagement of the Ames Research Center personnel in UNR's formal curricula and informal campus-wide presentations. Brief descriptions of these highlights are provided.

TMCC's Lighter Than Air competition

The Lighter Than Air Vehicle (LTA) Competition was a huge success for the faculty and students who participated in the Truckee Meadows Community College Space Grant sponsored program. The developed course, and the competition later in the spring, gave students a hands-on learning experience for concepts involving engineering, math, physics and design. Daniel Loran, the TMCC physics professor who developed the course incorporated the LTA competition as part of the curriculum. "When they [students] were actually flying and building their LTAs, you could see it in the student's eyes – all the wheels clicking – oh, I get it, we have to do this, or we have to do that." Five teams comprised the completion, with three to six members on each team. Each member of the first place team received a scholarship worth 12 credits per semester for the following year from the TMCC Foundation. The next competition is scheduled for spring 2011- and the TMCC foundation has pledged scholarship funds to support the competition beyond the first year.

RockOn

Two UNR faculty members and one undergraduate student (Gabe Herz) attended the 2009 RockOn workshop. The team successfully built and launched a payload on a sub-orbital sounding rocket. The faculty and student created a pair of videos that summarized the workshop experiences. Both videos were shown during the dinner on the last day of the workshop. One of the videos has been shown at multiple Space Grant meetings (regional and national). The undergraduate student gave a presentation at the 2009 Western Region Space Grant meeting. Based on the video that was developed, the student was invited to document both the 2010 RockOn workshop and the 2010 Lunar Regolith Excavator Competition. The faculty now have outlined a proposal and plan to submit a proposal at the next opportunity to participate in future RockOn workshops.

Workforce Training in Imaging and Robotics

Students learned about NASA research through guest lectures by researchers at NASA Ames. An invited talk was given by NASA's researcher Terry Fongm who concentrated on computer vision and robotics applications with emphasis on future NASA missions to the Moon. Kristin Rozier from NASA Ames talked about how NASA is using Formal Methods such as Boolean Satisfiability and Software Verification techniques in its operations. UNR classes (CS482/682) had already covered topics on boolean satisfiability and after the talk the students completed a programming assignment related

to this material. Participants were asked to implement a system to automatically count the number of galaxies in images taken by NASA's Hubble telescope (see <http://www.cse.unr.edu/~bebis/CS302/>, Prog 3 & 4) and these students also investigated the tools from AI that NASA employs.

Curricula Development

Five new courses were newly developed in FY2009 on topics ranging from the geology of Moon and Mars (UNLV), mapping fluvial features of Nevada (UNLV), climate change (WNC), astronomy (WNC), and planning algorithms in computer sciences (UNR). Three additional courses were revised with NASA content in computer sciences and geological sciences. Two senior design courses regarding robotics operations (UNLV) and nanotube material science (UNR) were implemented. Thus, NVSGC met its objective of infusing mission directorate content into several of Nevada's institutions of higher education and promoting hands-on activities in the classroom.

Industrial Partnering and Internships:

NVSGC supported six interns with Nevada private aerospace-related industries. Interns worked on projects related to aerosols characterizations, developing headlamps for EVA suits, designing solar powered airplanes, developing small-scale thrusters and teaching math skills to summer space camp students.

NASA Center Internships:

NVSGC did not directly support interns at NASA centers during FY09. Several students did participate in programs and visited centers and NASA scientists, but formal internships directly supported by NVSGC internship funds were not provided – rather these activities were supported through other programs reported on elsewhere.

Research Infrastructure Programs

Phosphate is an important nutrient on Earth, and therefore may be important in characterizing the habitability of Mars. Thus, NVSGC supported a program led by Elisabeth Hausrath, UNLV, regarding the Phosphate Mobility in a Mars Analog Environments. The program led to the collection of samples from the Craters of the Moon, Idaho, in summer 2009. UNLV undergraduate student Jason Cornell analyzed the samples for evidence of mineral dissolution and formation of secondary phosphates (Cornell and Hausrath, submitted, LPSC 2010). In addition, Chris Adcock, who began as a student in January 2010, is preparing phosphate dissolution experiments and kinetic modeling of phosphate behavior on Mars (Adcock and Hausrath, submitted, LPSC 2010). Both of these lines of research are continuing and included presentations at LPSC in 2010.

Lynn Fenstermaker (of DRI) led an activity for the determining soil moisture in desert ecosystems. The primary objectives of the activity was to 1) to build scientific expertise in the appropriate use and analysis of microwave data (passive and active) for the assessment and monitoring of soil moisture; 2) to develop collaborations with NASA researchers who focus on climate change and soil moisture remote sensing; and 3) prepare competitive proposals for submission to three NASA ROSES programs, i.e., Precipitation Sciences, Terrestrial Hydrology and Terrestrial Ecology. Achievement of these objectives are helping us realize our fundamental goal to successfully utilize

multiple satellite data sources for the assessment of soil moisture spatial and temporal heterogeneity across the Nevada Mojave and Great Basin landscapes, and to utilize the resulting information to model summer monsoons and quantify carbon and water flux for these systems over varying spatial scales and time periods and under predicted global change scenarios.

Pre-college and Informal Education Programs

In 2009, NVSGC supported three programs aimed at bolstering pre-college programs. The Space Science for Schools in collaboration with Sierra Nevada College Teacher Education department created a Science Methods course that emphasizes "Connecting NASA missions to the Classroom." The hands-on course makes available NASA's vast resources to connect K-12 students. It is designed to teach technique and technology to bolster student engagement. It creates a dynamic and student involved space science classroom. The labs that are aligned with the State's education standards demonstrate how these techniques can be used to enhance Science, Math, Education and Technology (STEM) lessons, while emphasizing the key focal areas for the national aeronautics and space missions. The link to NASA missions reinforces the long-term value of learning, applying, and discovering science. Two other pre-college programs were partially funded; however the bulk of the work is being performed in the FY2010 year.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- Longitudinal Tracking:

Total significant awards = **31**; Fellowship/Scholarship = **17**, Higher Education/Research Infrastructure = **14**; **8** of the total awards represent underrepresented groups; **1** student has accepted a STEM position in an aerospace industry, **1** student has accepted a STEM position in a non-aerospace science-based industry, while **19** have graduated and are pursuing advanced STEM degrees.

- Course Development:

Course Development: NVSGC continues their efforts in 2009 to infuse NASA-STEM content into the campus and departmental curricula across the state. NVSGC initiated five new courses across four institutions of higher education (including community colleges) effecting departments in Science, Engineering, Math, Physics, Geosciences, and Computer Science, and supported revision to three courses. These projects have ranged from the infusion of content and substantial modifications of existing courses (e.g. increasing undergraduate student projects in robotics courses at UNLV, infusing research projects into an Astronomy course at TMCC) to the creation of new courses (e.g. Artificial Intelligence Programming at UNR, Geophysics and degree programs.

- Matching Funds:

NVSGC has maintained its ability to provide matching funds mostly through a combination of state funding, institutions providing in-kind matching funds, and private partners contributing in-kind support (**with 35% of the FY09 matching funds being provided by the state, 63% provided from NSHE institutions, and the remaining 2% provided by Industry.**

- **Minority-Serving Institutions:**

Nevada has no minority serving institutions- yet continually seeks opportunities for partnering. Formal partnerships in FY09 were not realized and will become a renewed emphasis in FY10. Moreover- there have been efforts at one affiliate campus (CSN) to become designated as a minority serving institution and NVSGC is seeking new avenues for having this campus be even more engaged in the student extracurricular and scholarship programs.

IMPROVEMENTS MADE IN THE PAST YEAR

NVSGC made considerable gains in its engagement of multiple campuses in programs during 2009. Moreover- increased communications through monthly teleconferences, quarterly newsletters and various meetings has substantially improved the knowledge, participation and satisfaction among NVSGC affiliates. In addition, NVSGC added the Challenger Learning Center of Northern California as an informal education partner.

Based on input suggestions from Space Grant headquarters in August 2009- NVSGC budget reports now track programs and projects throughout the budget year according to our programmatic categories- and has resulted in more up-to-date and accurate reporting for annual CMIS/OEPM reports.

Longitudinal tracking efforts have improved through working with the Space Grant Foundation to determine their best practices. The NVSGC then has taken what the foundation has utilized and the NVSGC has been conducting longitudinal tracking through our own efforts.

Overall, NVSGC has made significant improvements in areas of operations and engagement of the affiliate campuses and knowledge, participation, and satisfaction throughout the consortia has greatly improved. Efforts in the future will seek to build upon these gains by growing the consortium through strategic partnerships with industry and other STEM education providers, and through the renewal of its strategic operations plan.

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).

The consortium utilizes Campus Associate Directors in a management and advisory capacity, as well as in a communication and reporting capacity. The 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 that consists of the Research Vice Presidents from UNR, UNLV and DRI. In addition, the Director also meets with the NSHE EPSCoR Advisory Council (formed in 2007). Thus, the consortium operations are effectively run as a system-wide program with those with higher education interests represented.

Respectfully submitted,

Christian H. Fritsen