Nevada Space Grant Consortium
Lead Institution: Nevada System of Higher Education,
Sponsored Programs & EPSCoR Office
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Telephone Number: 702-862-5412
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A. 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 Space Grant Consortium is a Capability Enhancement Consortium funded at a level of $570,000 (Federal funding for the original plus augmentation awards) for fiscal year 2016.

B. PROGRAM GOALS

The primary goals, and the objectives that will be implemented to meet those goals, for the Nevada Space Grant Consortium (NVSGC) are listed below. To ensure that NVSGC was providing significant NIFS awards, the number and size of fellowship and scholarship awards were modified to ensure that all awards would qualify as significant awards under NASA's new guidelines.

1) Continue to provide and expand STEM research and training opportunities for students through the NASA internship, fellowship and scholarship (NIFS) program.

   1a) We will enhance our outreach efforts to recruit more students, representative of Nevada's diversity, to enter STEM programs and apply for NIFS. The target metrics for this objective include:

   - Internships: two significant awards ($6,500 each) each year administered through NASA's One Stop Shopping Initiative (OSSI).
   - Fellowships: four awards during year one at $13,000 and at least two significant awards ($18,000 for a full academic year) for years two and three.

- Scholarships: nine awards during year one ($4,000 each) and fifteen awards during years two and three.
- Diversity goals for the above NIFS programs will be attained if 36% of awardees are female and 25% are from disabled or underrepresented minority groups.

1b) Nevada System of Higher Education (NSHE) faculty will be mentored and encouraged to aid in outreach and retention efforts.

- NVSGC targeted two workshop/training efforts for the first year with a total of 40 faculty participating. Diversity goals for this effort included 36% female and 25% underrepresented minority groups.

1c) We will develop partnerships with organizations across the state engaged in recruitment and retention of students in STEM academic programs, e.g., Nevada GEAR UP and Upward Bound.

- The target metric for this objective was to provide outreach to at least four student organizations that would result in ten new students applying for NVSGC awards.

2) Expand past/current successful college and pre-college curricular and informal education projects. Partner with other education-based organizations to provide enhanced STEM training to the broadest possible student population in Nevada.

2a) Promote curricular and extracurricular programs to provide college and pre-college students with hands-on science or engineering activities including the development of teams to compete in science and engineering challenges relevant to NASA.

- There are multiple target metrics for this objective including: two higher education and 3 pre-college and/or informal education awards; 10 higher education faculty and 12 pre-college teachers engaged in the awards; 10 college students and 50 pre-college students directly or indirectly engaged (of which 36% would be female, 25% underrepresented minority groups); and twelve participating pre-college schools with a 50-50% participation between northern and southern Nevada, with at least four of the schools being Title I schools.

2b) Promote and increase the awareness and availability of NASA content-based materials among professors and teachers to enhance STEM teaching endeavors.

- The target metrics for this objective are two training workshops with a total of 40 faculty present.

2c) Partner with other student/teacher training entities to increase NVSGC effectiveness, e.g., the DRI's K-12 STEM Education program has a network with over 200 Nevada schools.

- The target over the three year period is to develop a partnership with at least four higher education and pre-college education based organizations and

that at least eight new higher education students and twenty new pre-college students would directly or indirectly be impacted by NVSGC programs.

3) Enhance research infrastructure to provide education and training of students for entry into STEM careers.

3a) NVSGC will support the development of new innovative NASA-related research experience and expertise.

- Two seed grants in new research areas will be funded in years 2 and 3.

3b) We will increase NASA and business collaborations in research endeavors and workshops to improve course content and increase internships so that graduating students are better prepared for NASA-related careers.

- The target metrics for this objective are to: develop three collaborations with NASA scientists, submit two new proposals for NASA-related research and to develop two new business collaborators.

C. PROGRAM/PROJECT BENEFITS TO PROGRAM AREAS

NVSGC is highlighting several significant efforts that were achieved during the second year of this grant, at least one outcome for each of NVSGC's overall goals.

Goal 1: Continue to provide and expand STEM research and training opportunities for students through the NASA internship, fellowship and scholarship (NIFS) program.

NVSGC has created a new website to provide information about NVSGC's solicitations: https://nasa.epscorspo.nevada.edu/funding-opportunities/. This year, NVSGC is highlighting two students, Joy Immak a 2016 fellowship recipient and a Ph.D. student at the University of Nevada Las Vegas and Sierra Adibi, a 2016 internship recipient and a former undergraduate student at the University of Nevada Reno. Joy states:

"*Working with my advisor, Dr. Helen Wing, has provided a great opportunity to study the regulation of virulence genes in a highly infectious bacterial pathogen, Shigella flexneri, which causes the disease shigellosis. This disease is associated with acute abdominal pain, fever, malaise, bloody diarrhea, severe dehydration, and death. When I finish my Ph.D., I plan to pursue a post-doctoral position at a research facility where I hope to study changes in gene expression within a host and pathogen during infection. Afterwards, I plan to apply for a tenured-track faculty position at a research university where I can share my knowledge and explore new research to motivate students. The Nevada Space Grant fellowship that I received this year is enabling me to focus on the regulation of ten Shigella virulence genes by H-NS, a global silencer that is a histone-like nucleoid structuring protein, and VirB, which functions to counter H-NS-mediated repression. The goal is to better understand the regulation of these ten virulence genes to aid in the production of an effective vaccine against S. flexneri. Thus far, I have characterized the DNA regions required for H-NS-mediated silencing and VirB-mediated anti-silencing at the promoter of one Shigella virulence gene, ospD1. Without this fellowship I would not have been able to fully commit to my research. The dedicated time has already resulted in a manuscript in preparation on the ospD1 promoter. Overall, I am more committed than ever to science and I enthusiastically intend to continue this pursuit.*"

Sierra Adibi had the following comments about her internship experience at NASA Ames Research Center during summer 2016:
"In my senior year at the University of Nevada Reno, I was offered a summer internship in the Aeromechanics Branch at NASA Ames Research Center. I spent the summer working on a variety of projects, varying from performing Computational Fluid Dynamics analysis of experimental aircraft, to editing a 100+ page technical data report, and even to assisting in the wind tunnel testing of the Mars Scout Helicopter.

During my time at Ames, I learned about cutting edge technology that researchers and industry experts use to develop rotorcraft, and some of the major challenges that they face. I have been able to use this knowledge to develop my own relevant, interesting research questions to study in my graduate career. My NASA internship directly helped me to develop the skills I needed to write proposals for nationally-competitive fellowships by exposing me to real world research problems in aeronautics. These fellowships have the potential to fund my graduate education up through the completion of my doctorate, which will have enormous effect on both my education and career. I couldn't have completed, or even been qualified for, my NASA internship without the support of the Nevada Space Grant Consortium, which helped fund my undergraduate research projects."

Goal 2: Expand past/current successful college and pre-college curricular and informal education projects. Partner with other education-based organizations to provide enhanced STEM training to the broadest possible student population in Nevada.
NVSGC helped support three amazing pre-college education programs that ended this year, namely the DRI K-12 STEM Education Program (http://greenpower.dri.edu/), the Rover Challenge (1st and 3rd place in the national competitions) and Dr. David James' (UNLV) continuing efforts to make STEM education, particularly physics and engineering, accessible and fun for K-6 and middle school students. The participation of a Nevada team in the Human Exploration Rover Challenge continues to provide exception hands-on training to Nevada college and pre-college students. The team, led by Dr. Daniel Ruby (UNR) has won many awards in the past six years of competition, including: first overall, best design, best systems safety engineering; and others. Podium finishes have been achieved in the past four contests. Dr. Ruby states: "*Almost 90% of the student participants continue to STEM careers in college, mostly to in-state engineering programs. The program is successful in engaging women into STEM, with 40% participants being female, and it attracts diverse participants that reflect the demographics of the region. The project serves both college- and career-track students: industry partners have provided internships that resulted in post-graduation employment from diesel mechanics to race truck fabrication to next-generation welding and machining. The project has a measurable impact on student attitudes toward math, and provides training for teachers in hands-on integrated STEM instruction. In 2016, the student technical writing lead, Danielle Kiserow, was accepted to an astrophysics program at Embry Riddle with scholarships, citing Rover as the reason for her interest in a science career."*

The two new pre-college and informal education projects this year both involve a collaboration with the DRI K-12 STEM Education Program and therefore NVSGC is highlighting the DRI program for this goal. The mission of this program is to support Nevada (and some California and Arizona) K-12 educators with STEM tools and knowledge through the development of Green Boxes (similar to Foss Kits), teacher training programs and workshops. Currently this program

has developed over 100 Green Boxes on 31 topics and provides eight or more statewide teacher training programs annually for teachers from over half of Nevada's schools. Five of the Green Boxes have been and are being developed as a result of collaboration with NSHE faculty on either a Pre-College or Informal Education sub-award. The DRI K-12 STEM Education Manager, Amelia Gulling states: "*The Nevada Space Grant program has been a great resource for us to create and share NASA-themed educational material to both students and teachers across Nevada*." The Education and Professional Development Administrator for this program, Craig Rosen, states: "*Thanks to the Nevada Space Grant program, DRI has formed exciting new partnerships and has been able to bring unique and important science/STEM content to educators and students throughout Nevada."*

Goal 3: Enhance research infrastructure to provide education and training of students for entry into STEM careers.

The focus for this goal during the past two years has been to provide more outreach and training to NSHE faculty and students interested in education and research aligned with the NASA Strategic Plan 2014. NVSGC funding has enabled Dr. Elisabeth "Libby" Hausrath at UNLV to excel at enhancing STEM education and outreach, in her own words:

"*As a new faculty member at UNLV, the first funding I received was from Nevada Space Grant, to collect and analyze phosphate-rich rocks from Craters of the Moon, Idaho, which had previously been shown to be a Mars analog environment. This funding allowed me initial support for my first PhD student at UNLV, Chris Adcock. It also acted as a seed grant to the multi-year award on phosphate mobility on Mars I received from NASA, which supported Chris through his PhD and resulted in multiple papers, including one in Nature Geoscience that attracted considerable popular press.*

My second seed grant from Nevada Space Grant, to work on clay minerals, supported my second Ph.D. student, Seth Gainey, and helped establish a collaboration with a Mars scientist at JPL. This work also acted as a seed grant to a multi-year award from NASA, and Seth, who has now graduated, is now working as a postdoctoral researcher for the scientist he worked with as a student at JPL.

Education and public outreach Space Grant funding has allowed my postdocs and me to develop modules to present in the Clark County Schools, as well as incorporate astrobiological topics into UNLV coursework. This has allowed us to provide hands-on science experiences to elementary school children in Clark County, to help them gain enthusiasm for and appreciate science. In short, Nevada Space Grant funding has really benefitted my research group and me, by allowing us to collect preliminary data, supporting my students, and allowing my students to spend time at JPL. I think it worked in the way that seed grant programs work best!"

D. PROGRAM ACCOMPLISHMENTS

- NASA Internships, Fellowships, and Scholarships: The NIFS target metrics for this year included two internships, two fellowships, and eight scholarships per year. NVSGC met all but one of these target metrics and all NIFS awards were funded at the NASA defined level to be considered significant awards. The two NVSGC internships were funded to one female and one male from two different NSHE institutions. The two fellowships were awarded to one male

and one female graduate students. Only six scholarships were funded this year, which is the same number of applications submitted. Three of the six scholarships were awarded to female students of which one was from under-represented groups (Hispanic). Two of the three male recipients were also from under-represented groups (a veteran and a Pacific Islander). NVSGC therefore exceeded both the metric of 36% female NIFS recipients (actual was 50% female) and the metric of 25% under-represented minority, veterans or disabled recipients (actual was 30%). Both internships were located at NASA Ames Research Center and both focused on the topic of rotorcraft aeromechanics working under Dr. William Warmbrodt. The titles for the two fellowships were Preventing Monopolies in UTM (the NASA effort to address Unmanned aircraft system Traffic Management) and Regulation of Essential Virulence Genes with *Shigella* Species. Scholarship topics ranged from animal physiology, methods for detecting plant water stress, mutation modeling, photovoltaics and snow algae.

- Higher Education projects: The target metric for NVSGC higher education awards was two projects that collectively with one pre-college and one informal education award would engage 10 faculty and 10 college students directly. NVSGC exceeded these metrics by funding four higher education curriculum development projects this year. Because these projects have just started there are limited results to report and no data yet on the total number of faculty and students who are being directly impacted by the projects. Half of the projects funded are being led by female faculty and none from under-represented groups. The higher education curriculum development project titles are: Computational Skills for Big Data: Analysis, Statistics and Visualization; A Multi-Week Learning Module on Remote Sensing for Intro to Environmental Science and Geology Classes; Undergraduate and Graduate Robotics Curriculum for UNR; and Harnessing the Power of Astrobiology. One of the projects is a collaborative effort among female faculty in engineering, science, mathematics and journalism, one of whom is African-American and two of whom are immigrants to the U.S. Across the other three new higher education projects there are a total of seven additional faculty who will be direct participant, of which four are female and one of the female faculty is Hispanic. Dr. Penny Boston with NASA Ames Research Center will be collaborating on the remote sensing project. The project leads do not have an estimate at this time on the number of college students who will be directly or indirectly impacted by these projects.

- Research Infrastructure projects: Four research infrastructure projects were funded this year, which is double the target metric, but due to the late Fall 2016 semester start of these projects, little progress has been made to date. Two of the recipients were female and none were from under-represented groups. Two to the projects will actively engage a significant number of students and the other two projects will include one or more graduate students. The titles of the research infrastructure projects are: Identification of Air Pollution in Meteoric Waters and Distribution Across the Las Vegas Valley; Nvantage: STEM Success via UAS Curriculum and Discovery for Nevada Teachers and Learners; NASA Collaboration to Acquire Satellite Remote Sensing Data for Air Quality Modeling in the Western U.S.; and Developing and Communicating Rain Shadow Science in Nevada. Two of these projects include NASA science collaborations. The NASA collaboration project for air quality monitoring will include a visit to NASA Goddard Space Flight Center to acquire information about the Visible-Infrared Imaging Radiometer Suite (VIIRS) data from Dr. Nai-Yung "Christina" Hsu and Dr. Andrew Sayer. The Rain Shadow project will include a collaboration with Dr. Ali Behrangi from the Jet Propulsion Laboratory and Chris Smallcomb with the National Weather Service.

- Pre-college projects: The NVSGC target metric for pre-college projects was a total of two pre-college and informal education projects that would collectively engage 12 teachers and 50 pre-college students. NVSGC funded one pre-college project this year entitled: Spaceward Bound Death Valley 2017. Ten teachers from the Clark County School District will participate in five days of field work in Death Valley. To date, nine of the ten teachers have already been recruited and six of these are female teachers. The teachers will video record their experience and use both the video and knowledge gained to enhance their class curriculum that will directly impact approximately 250 students total. In addition, the teachers will participate in a Desert Research Institute (DRI) existing (and funded through several sources) K-12 STEM Teacher Training program that will further disseminate the knowledge gained to approximately additional 100 teachers who will in turn use the information in their classrooms and thereby increase the number of students impacted exponentially. The video will also be released for public viewing on the DRI website and affiliated YouTube channel. Given the diversity of Clark County Schools it is anticipated that the under-represented students impacted by the project will be at least 44% Hispanic, 12% Black, 1.5% Pacific Islander, 0.5% Native American and 6% from two or more races. Approximately 48% of all students should be female. NASA collaborators on this project include Dr. Chris McKay (NASA Ames) and Dr. Luther Beegle (JPL) as well as a Caltech collaborator, Dr. Jay Nadeau.

- Informal Education projects: The NVSGC target metric for informal education projects was a total of two pre-college and informal education projects. NVSGC awarded one informal education project this year entitled: Astrobiology Alive!: Reinforcing Traditional STEM Concepts in Las Vegas Schools Through the Wild World of Astrobiology. This effort is being led by a female faculty member, a female post-doctoral scholar and two female graduate students. Two of the three schools already identified for participation in this project are Title 1 schools with one of the schools serving an 82% minority student population. Because this project started late Fall 2016 semester, results of the project will not be known until Fall 2017.

E. PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE GOALS

Include summary data for the bulleted list below:

- **Diversity**: (Note: due to the fact that sub-awards were recently made, NVSGC does not have diversity numbers for API ED-15-2 through API ED-15-5 and therefore we are providing total estimated numbers of people who will be impacted by these NVSGC programs. We plan to update these numbers with actual diversity numbers for the OEPM reporting.)
- **Minority Serving Institution Collaborations**: Nevada is currently a state with no ethnic majority and this is reflected in the designations higher education institutions have achieved over the past decade. All NSHE institutions are NGSGC collaborators. In 2012, the University of Nevada Las Vegas achieved designation as a Minority Serving Institution (MSI) and in 2015 achieved designations as an Asian-American and Native American, Pacific Islander-Serving Institution (AANAPISI) and as a Hispanic Serving Institution (HSI). The College of Southern Nevada is a MSI and HSI. Nevada State College and Truckee Meadows Community College recently became HSI and two other NSHE institutions are emerging HSI; namely, the University of Nevada Reno and Western Nevada College.

- **Office of Education Annual Performance Indicators**: Provide numerical values for consortium contributions to API's.

- API 2.4.1: ED-16-1 ____7____ (Number of NIFS to racially or ethnically underrepresented students, women, and persons with disabilities)
- API 2.4.2: ED-16-2 __120__ (Number of educators)
- API 2.4.4: ED-16-4 ___18____ (Number of informal education events)
- API 2.4.5: ED-16-5 _2900___ (Number of K-12 students)

F. IMPROVEMENTS MADE IN THE PAST YEAR

This is the second year of new NVSGC leadership and therefore efforts are continuing to improve NVSGC solicitation schedules and review processes and enhance outreach efforts to faculty and student groups. A new Research Coordinator was hired and his skill sets are providing a significant contribution to program organization, outreach and timely documentation and reporting. This individual, Gibran Chavez-Gudino, has created and maintains very active social media sites (Facebook and Twitter) about Nevada Space Grant and NASA missions.

NIFS awards are now all funded at the NASA-defined significant level, which reduces the total number of NVSGC awards but helps ensure that there is adequate time and funding for students to successfully complete projects. Both faculty and students have stated that significant funding levels are more important to them than the total number of awards available. Despite the fact that scholarship and fellowship solicitations were announced at a significantly earlier date, faculty and students stated that the award notices still were not arriving early enough for them to make decisions about teaching and graduate research assistantships versus accepting a NVSGC scholarship or fellowship. Therefore, the solicitation process for the coming year has already been initiated and award notices will be delivered by the end of the Spring semester. Our attempt last year to align NVSGC solicitations with both NASA EPSCoR and NSF EPSCoR undergraduate research opportunities was not as successful as we had hoped and we have therefore abandoned this effort to align multiple programs.

NVSGC and Nevada NASA EPSCoR completed the re-design of the Nevada NASA Programs website making it easier for faculty and students to find funding opportunities and relevant information. This new website includes an online application process that verifies information is complete before an application can be submitted and the system also stores the submission in an organized manner for easy retrieval and archiving of files.

NVSGC, in collaboration with Nevada NASA EPSCoR, continues to sponsor a statewide meeting that has been quite successful in communicating program results, providing a forum for networking and an opportunity for faculty and students to explore proposal ideas. The meeting location alternates between northern and southern Nevada and all NIFS recipients are invited to present a poster.

G. CURRENT AND PROJECTED CHALLENGES

The most significant challenge for NVSGC continues to be the attainment of the diversity targets that were established in the NVSGC proposal. NVSGC has made significant improvements in meeting revised target metrics and currently meet the gender target metrics on almost every solicitation. The diversity of STEM enrollment within NSHE has always been lower than state and/or local diversity numbers and therefore the challenge for NVSGC is to not only improve the diversity of STEM applications to NIFS, but to enhance overall diversity for NSHE STEM

enrollment. NVSGC is continuing to improve outreach to NSHE and community programs who have recognized the need to reach Nevada students at a much younger age (K-6) to motivate and encourage students from under-represented minority groups to consider STEM classes and careers. The school districts in Nevada are becoming increasingly diverse and when students reach college age, NVSGC's goal is to help ensure that the demographics of students enrolling in STEM more closely resembles the overall demographics of the high schools from which they graduated.

NVSGC hired a new Research Administrator, Gibran Chavez-Gudino, at the beginning of April to replace both the Program Coordinator and Program Administrator. With little to no overlap between personnel, Gibran has faced a steep learning curve. With the assistance of the NSHE Sponsored Programs and EPSCoR Office Director, NVSGC has been able to fulfill its program mission, financial tracking and deliverable deadlines in a timely manner. It is anticipated that Gibran, given his prior experience and skill sets, will rapidly learn all of the budget tracking and other NSHE systems to continue to improve the overall NVSGC operation.

H. PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

NVSGC partners include all institutions within NSHE and planetarium and business affiliates. The roles of NVSGC partners are listed below.

PhD Granting Universities and Research Institute: The University of Nevada Las Vegas, the University of Nevada Reno and the Desert Research Institute all play a significant role in mentoring NIFS awardees and implementing higher education, pre-college and informal education projects.

Outreach Institutions: Pre-college and informal education projects are a highlight of Fleischmann Planetarium (University of Nevada Reno), the College of Southern Nevada Planetarium, the Jack C. Davis Observatory (Western Nevada College), and the Challenger Learning Center of Northern Nevada.

Industry: NVSGC business affiliates provide guidance to education and research programs as well as a few periodic internships. These affiliates include: Arabis Training Resources; Digital Solid State Propulsion; Equipment Links, Inc.; and Sustainable Grounding Systems. Arabis Training Resources is providing free training on composite materials repair for University of Nevada Reno students as space allows. Arcata Associates Inc., although not currently a NVSGC business affiliate, is continuing to play a significant role in providing collaborative opportunities with Teledyne Brown Engineering at Marshall Space Flight Center. Last year they launched an internship program for UNLV students and they are providing information to faculty with projects related to CubeSat and the International Space Station. Arcata Associates, Inc., is currently a member of the NV NASA EPSCoR Technical Advisory Committee.