



THE NATIONAL SPACE GRANT COLLEGE & FELLOWSHIP PROGRAM

FISCAL YEAR 2020 ANNUAL PERFORMANCE REPORT (APR)

FUNDING SOURCE:
OFFICE OF STEM ENGAGEMENT
SPACE GRANT

MANAGING ORGANIZATION:
NASA HEADQUARTERS OFFICE OF STEM ENGAGEMENT

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INSTITUTION:
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COOPERATIVE AGREEMENT/GRANT NUMBER:
80NSSC20M0043

ACTIVITY DESCRIPTION: (100 – 250 words)

The Mission of the Nevada Space Grant Consortium (NVSGC) is to enhance and provide NASA-relevant STEM education and research opportunities to Nevada’s pre-college and college students. A significant part of this mission is provided by competitively awarded undergraduate scholarships, graduate fellowships and NASA internships to college students that enhance all areas of NASA’s Mission Directorate. The other significant part of the NVSGC mission are competitive awards to academic affiliate faculty at any of the institutions within the Nevada System of Higher Education (NSHE), namely: College of Southern Nevada (CSN); Desert Research Institute (DRI); Great Basin College (GBC, which serves several rural communities); Truckee Meadows Community College (TMCC); Nevada State College (NSC); University of Nevada, Las Vegas (UNLV); University of Nevada, Reno (UNR) and Western Nevada College (WNC). All NSHE institutions are degree granting institutions except for DRI, which is a soft money environmental research institution. All of the NSHE institutions have MSI, HSI and/or AANAPISI status or emerging status. Faculty awards are provided annually for: higher education curriculum development and college student hands-on-training; pre-college teacher training and K-12 student hands-on-training; and research infrastructure and work force development that involves college students.

ACTIVITY GOALS: (Bulleted list)

State the Consortium Goals and Objectives from your base proposal and augmentation proposal.

The objectives should express quantitative targets when appropriate.

Goal 1: Build strong foundations for STEM literacy and STEM workforce develop for the future of Nevada and the nation.

Objective 1.1: Enhance hands-on NASA experiences for college and pre-college students.

Objective 1.2: Improve college and pre-college STEM instruction.

Objective 1.3: Enhance research infrastructure for faculty development and student workforce training.

Goal 2: Improve relevancy and collaboration with NASA Mission Directorates and Centers.

Objective 2.1: Ensure all awards are relevant to NASA Mission Directorates by addressing high priority workforce and/or research needs.

Objective 2.2: Increase collaborations with NASA Center Scientists and Engineers.

Goal 3: Increase Diversity, Equity, and Inclusion in STEM education and research.

Objective 3.1: Increase participation of under-represented and under-served groups in NVSGC programs through presentations to student groups and identification of and mitigation for barriers.

Objective 3.2: Communicate student research success stories to demonstrate not only the knowledge gained but also to demonstrate the diversity of NVSGC students conducting NASA-relevant research.

**ACTIVITY CONTRIBUTIONS TO PERFORMANCE GOALS (PG)
AND SUCCESS CRITERIA**

List appropriate FY 2020 PGs and Success Criteria and write a brief description of the project activity’s contribution to each.

PG 3.3.3: Provide opportunities for students to engage with NASA’s aeronautics, space, and science people, content, and facilities in support of a diverse future NASA and aerospace industry workforce.

PG 3.3.3 Success Criteria: Meet or exceed the national average in two of the four categories of student diversity for NASA STEM enrollees in internships, fellowships, or other student engagement opportunities. Diversity Categories: (1) students across all institutional categories and levels (as defined by the U.S. Department of Education), (2) racially or ethnically underrepresented students (Hispanics and Latinos, African Americans, American Indians, Alaska Native, Native Hawaiians and Pacific Islanders), (3) women, and (4) persons with disabilities at percentages that meet or exceed national averages for science and engineering enrollees, as determined by the most recent, publicly available data from the U.S. Department of Education’s National Center for Education Statistics.

Response to PG 3.3.3 and/or PG 3.3.3 Success Criteria goes here:

Introduction: The Nevada Space Grant Consortia (NVSGC) solicits applications for all programs across all academic affiliates, which includes the Nevada System of Higher Education’s (NSHE) two graduate-degree granting research universities, one non-profit research institution, a four-year degree granting college and four community colleges. To meet NVSGC goals and objectives, NVSGC broadly advertises and competitively funds student awards including undergraduate research scholarships, undergraduate STEM training scholarships, graduate fellowships and internships at NASA Centers (Goal 1, Objective 1.1; Goal 2, Objectives 2.1 and 2.2; and Goal 3). NVSGC also provides competitively awarded funds faculty to improve: 1) research infrastructure and workforce training (Goal 1, Objective 1.3; Goal 2, Objectives 2.1 and 2.2 and Goal 3); 2) higher education curriculum development and hands-on-training (Goals 1, Objective 1.2; Goal 2, Objectives 2.1 and 2.2 and Goal 3); and 3) pre-college teacher training and student hands-on-training (Goals 1, Objective 1.2; Goal 2, Objectives 2.1 and 2.2 and Goal 3). Although Goal 3, Objective 3.1 is primarily met through direct and indirect outreach efforts and Objective 3.2 is primarily addressed through the Statewide NV NASA Programs Meeting, efforts are made through-out all NVSGC programs to ensure broad and diverse participation. NVSGC Campus Associate Directors are encouraged to provide outreach to under-represented and under-served students and faculty and NVSGC administrative staff (Director and Research Coordinator) typically attend several student events through-out the year to encourage student participation. This past year was an exception due to the inability to hold in-person events.

Nevada is currently a state with no ethnic majority, and most of the NVSGC affiliates have received one or more minority serving institution designations. These include:

- 1) Hispanic Serving Institutions: College of Southern Nevada (CSN); Nevada State College (NSC); Truckee Meadows Community College (TMCC) University of Nevada Las Vegas (UNLV); and Western Nevada College (WNC)
- 2) Minority Serving Institutions: CSN, NSC and UNLV
- 3) Asian American, Native American and Pacific Islander Serving Institution: UNLV
- 4) Emerging Hispanic Serving Institution: University of Nevada Reno (UNR)
- 5) Serving rural Nevada: Great Basin College (GBC)

Although the state is quite diverse, it has been a challenge in the past for NVSGC to meet the diversity targets that have been set. We have found that a lack of STEM experiences at the pre-college (and younger) age, impacts the diversity of STEM students in higher education, particularly at the graduate level. Therefore, a focus for NVSGC has been pre-college education and NVSGC participation in pre-college events, such as the DRI “May the Science be With You” event that is held each Spring (except this past year).

NVSGC Program Implementation: As stated in the mid-year report, NVSGC unexpectedly discovered that a portion of the federal and state special projects matching funds had not been expended on the previous Space Grant award. NVSGC was awarded a no-cost extension (NCE) for that grant. A meeting was held with the NVSGC Campus Associate Directors to discuss a potential second round of solicitations to allow expenditure of both old and new grant funds for this academic year. However, the Campus Associate Directors requested that the remaining new grant funds for year one be used to increase the number of awards during year two. Their impression was students and faculty were impacted by COVID adjustments that would limit response to solicitations in a timely manner. Therefore, all 2020 scholarships, internships, fellowships and faculty awards for higher and pre-college education were funded from the old grant to fully spend-out the matching funds. The new award, which is reported here, funded competitively awarded research infrastructure projects and a STEM workforce training project entitled the Nevada Community of Practice (NV CoP). NV CoP provides hands-on experiences in NASA relevant research for community college students.

NVSGC initiated tasks for the new grant award in a timely manner with student and faculty solicitation announcements occurring in October 2019 with application due dates ranging from February 2020 through April 2020. This was a new solicitation schedule that had been initiated for the first year of the new grant award. The NVSGC Campus Associate Directors (one from each academic affiliate) had thought the new schedule would be acceptable, but it proved to be difficult for students to prepare applications during the semester break and resulted in a reduced number of applications in comparison to previous years. The start of the COVID-19 lockdown likely had a small impact as well on the number of applications. NVSGC leadership modified the schedule for year two and provided more time for students to prepare applications. The solicitation announcements were made in November 2020 and applications have due dates ranging from February 16 through April 2021.

NVSGC Year 1 Results: As stated in the mid-year report, faculty solicitations were announced and awarded for the following programs: Higher Education (curriculum development and hands-on-training), Pre-college Education (teacher training and hands-on-training) and Research Infrastructure. The total number of applications was lower than previous years due to the start of COVID-19 during the application period. Sub-awards made this past year received funds from both the prior and new Space Grant awards. Three Higher Education and two Pre-college Education awards were funded by the prior Space Grant award. Two of the Higher Education and one of the Pre-College Education awards were to female faculty (60%). The NV CoP and Research Infrastructure awards (one NV CoP award and eight Research Infrastructure) were funded by the new Space Grant award. These awards exceeded the number of awards set for the first year, i.e., one NV CoP with at least ten STEM training scholarship awards (31 reported to date) and five research infrastructure awards (base plus augmentation target).

The NV CoP has been a highlight for NVSGC program during the first six months of the new Space Grant award. All of the faculty involved in the NV CoP program (faculty from all four community colleges) are female (100%). Although one of the colleges (GBC) was only able to provide scholarships to two students due to a COVID-caused high faculty workload, the other three colleges maintained the full scholarship load (six per institution per semester). Partial data has been reported by the faculty leads and to date this program has exceeded all NVSGC diversity targets, i.e., 50% female and 40% from under-represented and/or under-served groups. Scholarships and STEM research experiences were awarded to 31 reported students. The average diversity of the reported students is 76% female (21 female, 1 cisgender male and 9 male), 45% from under-represented groups (8 Hispanic, 2 Black, 2 Native American and 3 mixed race), and 53% from under-served groups (11 first generation college students, one disabled and 3 from rural areas; two of these are first generation and rural students).

A second highlight has been the NVSGC Research Infrastructure program. Nine proposals were received and 56% of those applications were from female faculty. (Note: the mid-year report mistakenly reported ten proposal submissions.) After a competitive review process, five proposals were initially selected for funding. After the additional unexpended funds were identified, three additional proposals were fully or partially funded; one principle investigator (PI) requested a reduced amount of funding given her other commitments. Five of the funded proposals (63%) were submitted by female faculty and the remaining three (37%) by male faculty. The funded projects included:

- 1) Updating NASA's Measurements of Aerosols from space using a novel aerosol climatology from surface sun photometry. Dr. Marco Giordano, lead PI; Desert Research Institute (male). Project aligned with the Science Mission Directorate Earth Science Division's fundamental objective to answer the question of how and why are the earth's climate and environment changing.
- 2) Advanced Manufacturing and Characterization of Self-coiled Polymer Muscles with Applications to Wearable Resistive Exo-gloves. Dr. Yifei Jin lead PI; University of Nevada Reno (male). Project aligned with the interests of Dr. Ji Su, a senior scientist from the Advanced Materials & Processing Branch at NASA Langley Research Center.
- 3) Pattern Recognition Algorithm for Monitoring Global Desert Change. Dr. Mingon Kang, lead PI; University of Nevada Las Vegas (male). Project aligned with NASA Terrestrial Ecology Program.
- 4) Informing Models of Life in Ocean World Brines: Lessons from Active Microbial Life in Briny Waters of Lake Vida at -13°C. Dr. Alison Murray, lead PI: Desert Research Institute (female). Project aligned with the Flagship Clipper mission to Europa to study habitability of this moon of Jupiter, and aligned with two of NASA's new Research Coordination Networks, i.e., the Network for Life Detection and the Network for Ocean Worlds.
- 5) Fluid Shear on Biofilm Formation Under Microgravity. Dr. Boo Shan Tseng, lead PI; University of Nevada Las Vegas (female). Project is aligned with the goal of the Human Exploration and Operations Mission Directorate to have humans explore deep space by providing a first step toward understanding how biofouling of water processing systems may be affected by low gravity.
- 6) Multipath TCP Architecture in a Hybrid Satellite Communication Environment; Dr. Ju-Yeon Jo, lead PI; University of Nevada, Las Vegas (female). The project is aligned with the Human Exploration and Operations Mission Directorate research on transformational communications technology for space communication navigation, which is a research priority for NASA Glenn Research Center.
- 7) A Machine Learning Approach for Studying the Correlations Between Ocular Structures and Visual Functions. Dr. Alireza Tavakkoli, lead PI; University of Nevada, Reno (female). This project aligns with the NASA Human Research and Exploration Mission Directorate, specifically with the Human Research Program (HRP)'s mission. The Human Health Countermeasures (HHC) Element of the HRO employs a risk-based approach to research and has identified certain risks that require mitigation prior to any long-term spaceflight mission, such as the scheduled lunar or the Mars missions.
- 8) Determination of the Optical Constants of Natural Mineral Dust Samples. Dr. Wendy Calvin, lead PI; University of Nevada, Reno (female). As part of NASA's fourth Earth Venture Instrument opportunity the Earth Surface Mineral Dust Source Investigation (EMIT) was selected for development and flight on the International Space Station (<https://eospsso.nasa.gov/missions/earth-surface-mineral-dust-source-investigation-evi-4>). EMIT will use imaging spectroscopy to determine the mineral composition of natural sources that produce dust aerosols around the world. The proposed work will contribute fundamental measurements of dust samples to form a library of materials valuable to this investigation.

PG 3.3.4: Enhance the effectiveness of education investments using performance assessment and evaluation-driven processes.

PG 3.3.4 Success Criteria: Discuss how the Consortium has or plans to implement evaluation-driven processes to assess the overall impact of the Consortium and its activities.

Response to PG 3.3.4 and/or PG 3.3.4 Success Criteria goes here:

NVSGC in its base award proposal had planned to sub-contract for an unbiased, objective evaluation of its programs. Due to the COVID-19 shutdowns, this effort has been delayed. However, NVSGC continues to self-evaluate its programs and effectiveness through requested reviewer, faculty and student input. The comments provided are discussed at NVSGC Campus Associate Directors' meetings and any recommended changes are voted upon and implemented if approved by the Associate Directors.

PG 3.3.5: Provide opportunities for students to contribute to NASA's aeronautics, space, and science missions and work in exploration and discovery.

PG 3.3.5 Success Criteria: Number of paper presentations and peer-reviewed research publications (and beginning in FY2021 to include student proposed solutions and products) resulting from STEM engagement investments. (Target number is 1,300)

Response to PG 3.3.5 and/or PG 3.3.5 Success Criteria goes here:

Given that NVSGC sub-awards for the first year of this award were made during the 2020 summer and fall, none of the projects receiving sub-awards have been completed. After project completion this Spring, it will likely take at least an additional year for paper presentations and peer-reviewed research publications to be completed and accepted.

NOTE: For the following categories, complete if applicable to your base award. If not applicable, indicate "Not Applicable".

BASE AWARD ACCOMPLISHMENTS: (250 – 500 words)

The Nevada Space Grant Consortium (NVSGC) achieved several significant accomplishments during the first year of the new Space Grant award despite challenges resulting from COVID-19 impacts and the identification of unexpended funds from the prior Space Grant award. The two significant programs funded by the current Space Grant award included the Nevada Community of Practice (NV CoP) and Research Infrastructure programs. The NV CoP provides hands-on NASA relevant STEM research experiences to NVSGC community college students. This program reported at least 31 students who received scholarships during the Fall 2020 and Spring 2021 semesters, which exceeded the goal of ten scholarship awards. The NVSGC Research Infrastructure program funded eight proposals to advance NASA Mission Directorate priority research topics and build research capacity in Nevada. This number of awards was double the base award target number (four) set for the first year and more than the revised augmentation number of awards (five). All NVSGC award and diversity targets were exceeded for both programs. The demographic targets included awards to at least 50% female and 45% under-represented and/or under-served populations. The NV CoP program funded four female faculty (100% female) to lead the 31 students reported to date. The student demographics were 75% female, 45% under-represented and 53% under-served. The Research Infrastructure program

funded eight proposals. Five (63%) of the proposals were submitted by female lead Principle Investigators.

NCAS AND SPACE GRANT PILOT ACCOMPLISHMENTS (If applicable): (250 – 500 words)

Not Applicable.

BIG Idea FY2020 ACCOMPLISHMENTS (If applicable): (250 – 500 words)

Not Applicable.

FIRST NATIONS LAUNCH (If applicable): (250 – 500 words)

Not Applicable.

ACTIVITY IMPROVEMENTS MADE IN THE PAST YEAR:

(e.g. activity management, cost efficiencies) (100 – 250 words)

No significant base award activity improvements were made for year one of the new Space Grant award. However, a significant change was made for the old award. Given COVID-19 restrictions during Spring 2020, the NV NASA Programs Statewide Meeting was cancelled, but a virtual student poster competition was provided for students completing research in 2020; (<https://nasa.epscorspo.nevada.edu/2020-virtual-poster-competition/>). The virtual poster competition was funded by the old Space Grant award. Ten undergraduate and nine graduate students participated. All degree-granting academic affiliates were represented by undergraduate student posters and both graduate degree-granting institutions were represented with graduate student posters.

ACTIVITY PARTNERS AND ROLE OF AFFILIATES IN ACTIVITY EXECUTION:

Bulleted list or table. Should include a brief description of how affiliates were involved in the project activity.

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

NVSGC Academic Affiliates: All of the NSHE degree-granting Universities, Colleges and a non-degree granting Research Institute are vital members of NVSGC. The affiliates include: University of Nevada, Las Vegas (UNLV); the University of Nevada, Reno (UNR); Desert Research Institute (DRI); Nevada State College (NSC); College of Southern Nevada (CSN); Great Basin College (GBC); Truckee Meadows Community College (TMCC); and Western Nevada College (WNC). UNLV, UNR and DRI play significant roles in mentoring fellowship and scholarship awardees and implementing higher education, precollege, and informal education projects. The number of students applying for and receiving scholarship awards from the colleges is gradually increasing, and undergraduate STEM training scholarships are only awarded to the NVSGC four community colleges through the NV CoP program.

Outreach Institutions: Precollege 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), the Challenger Learning Center of Northern Nevada and particularly the DRI Science Alive center. This center focuses primarily on teacher training events and the development of precollege, hands-on-training kits (Green Boxes, which are similar to Foss kits) that provide STEM content for Nevada's K-12 schools. Science Alive is also working to provide enhanced STEM education to higher education students and adult populations.

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, and Sustainable Grounding Systems. Arabis Training Resources provides 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. Approximately five years ago, they launched an internship program for UNLV students, which has resulted in the successful employment of former UNLV interns. Arcata Associates, Inc., is currently a member of the NV NASA EPSCoR Technical Advisory Committee and has provided significant funding for two Clark County School District Student Spaceflight Experiments Program (SSEP) awards.

CURRENT AND PROJECTED CHALLENGES:

Identify any current or projected challenges in the implementation or execution of activities. Explain how the management team is working to address the challenges identified and/or how National Program Staff can assist.

The next challenge facing NVSGC is the organization and implementation of a virtual NV NASA Programs Statewide Meeting that will be held in mid-late April. NVSGC successfully developed and implemented a virtual student poster competition last year that was well received. The challenge is to expand upon the virtual poster competition to organize a full meeting agenda that will be appropriate for both faculty and students.

REFERENCES (optional – include only if needed):

(APA style reference list)

As noted above, there are no new references for this award to date. It will take at least one year after project completion for faculty and students to develop paper presentations and papers that have completed the peer review process and have been accepted for publication.