



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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WASHINGTON SPACE GRANT CONSORTIUM LEAD
INSTITUTION:
UNIVERSITY OF WASHINGTON

WASHINGTON SPACE GRANT DIRECTOR:
KRISTI MORGANSEN HILL

ACTIVITY DESCRIPTION: (100 – 250 words)

Washington NASA Space Grant Consortium (WSGC) serves a state with a tremendous gap between the percentage of jobs being created in the science, technology, engineering, and math(STEM) fields and the percentage of its population qualified to fill those positions. Washington —a hub for new developments in software, aviation, aerospace, and medical research — was ranked in 2013 as “the most innovative state in the country.” In the Kauffman Foundation New Economy Index of Leaders of Innovation, Washington stands second only to Michigan in the percentage of our workforce that are engineers; yet, it is also the largest per-capita importer of college-degreed professionals. Washington’s population is growing at about 1.6% annually with a population of 7.3 million (2016), with 69.3% white, 12.5% Hispanic, 8.1% Asian and 2% Native Americans.

Despite some improvement in educational accomplishments, the percentage of underrepresented minority students earning bachelor’s degrees is still low. In 1982, only 6% of American Indian students completed college degrees, compared to 7% of Latinx students, 12% of African Americans, and 23% of white students. Twenty-three years later, 15% of American Indian students who enter college earned a bachelor’s degree within 6 years. This compares to 24% of Latinx students, 31% of African Americans, 49% of white students, and 51% for Asians. Underrepresented minorities (URMs) face several barriers, including lack of financial support, racism, inadequate precollege preparation and cultural bias from higher education institutions. By the same token, research shows that there are distinct factors that contribute to success. These include high academic aspirations, good study habits, quality interactions with faculty and staff, preservation of American Indian cultural traditions, and support from family.

WSGC addresses these issues by incorporating a geographically diverse set of higher education institutions that are in close proximity to key populations in Washington and within these institutions creating smaller communities that provide academic and financial support. In addition, these students are given the opportunity to be immersed in hands-on experiences centered on NASA STEM. Because of the latter, students increase their aspirations and improve their study habits because they have a clearer understanding of the potential applications of the basic material taught in classes.

To this end WSGC includes 7 four-year universities or colleges — four public: University of Washington (UW), Central Washington University (CWU), Washington State University (WSU), and Western Washington Univ (WWU); three private: Heritage University (HU), University of Puget Sound (UPS), and Whitworth University (WU); and six community colleges: Seattle Central College (SCC), North Seattle College (NSC), Everett Community College (EvCC), Bellevue College (BC), Peninsula College (PC), and Pierce College Fort Steilacoom (PCFS). The consortium members also include Pacific Science Center (PSC) as an affiliate and the Museum of Flight as a collaborating institution. This consortium includes one Hispanic serving institution (HSI: HU), and three Asian American and Native American Pacific Islander Serving Institutions (AANAPISI: BC and SCC). Our leadership reflects the diversity that we seek among our students, with an Executive Committee comprised of five women and six persons of color, including two African Americans, a Native American, and two Asians.

All the following projects align with (1) Federal Strategy for STEM education, (2) NASA’s Strategy, and (3) OSTEM Performance and Evaluation Strategy by enabling contributions to NASA’s research efforts, building a diverse and skilled STEM workforce, and by collaboratively using immersive transdisciplinary opportunities centered in NASA STEM.

ACTIVITY GOALS: (Bulleated list)

State the Consortium Goals and Objectives from your base proposal and augmentation proposal. The objectives should express quantitative targets when appropriate.

SG8.A. SMART Goal: To have internships and fellowships at four WSGC institutions (SCC, UW, WWU, and WU) that are competitively awarded.

A. SMART Objective: Provide immersive experiences for undergraduate and graduate students in topic areas of focus for NASA, through the placement of students at NASA, the private sector, and university research laboratories.

A. SMART Metric: Award WSGC NIF direct student awards to underrepresented minority students at or above 20% and to women undergraduates at or above 50%, consistent with The National Center for Education Statistics report.

A. SMART Target Number: Provide 40 university internships, 4 private sector internships, 4 NASA internships, and 23 graduate fellowships.

A. SMART Deadline: Applications will open in March and be offered by end of May each year. Results from internships and fellowships will be presented at a consortium wide poster session/reception at the start of each academic year (Sept./Oct.).

SG8.B. SMART Goal: To have studentships at nine WSGC institutions: (BC, CWU, PC, SCC, WWU, WU, UW, UPS, and PSC) that are competitively awarded.

B. SMART Objective: Provide initial workforce development that would aid students in gaining more immersive experiences for undergraduates in topic areas of focus for NASA.

B. SMART Metric: Award WSGC student awards to underrepresented minority students at or above 20% and to women undergraduates at or above 50%, consistent with The National Center for Education Statistics report.

B. SMART Target Number: Provide 59 studentships.

B. SMART Deadline: Applications will be open Winter each year, with selections made in spring for support of students in the following academic year.

SG8.C. SMART Goal: To set up supersonic rocket research programs at five WSGC institutions: (BC, PCFS, NSC, SCC, and UW) to provide studies in performance associated with different materials and airfoils.

C. SMART Objective: Provide initial workforce development that would aid students in gaining more immersive experiences, particularly undergraduates, in the focus area of supersonic flight performance within ARMD.

C. SMART Metric: Take data from at least 5 supersonic systems each year, with different flight characteristics in terms of peak altitude reached, peak speed, and size of payload.

C. SMART Target Number: Have 60 students participate in launches.

C. SMART Deadline: Provide workshops for students across WSGC in Fall with launches performed in Spring/Summer in the following year; each year we anticipate incorporating increasingly advanced rocket design and diagnostics.

SG8.D. SMART Goal: To set up high altitude balloon programs at four WSGC institutions: (EvCC, CWU, HU, and UW) to provide studies in dust altitude profiles at several locations in Washington over a long period of time to investigate potential influences from climate change.

D. SMART Objective: Provide initial workforce development that would aid students in gaining more immersive experiences for secondary school students and undergraduates in the focus area of climate change in SMD.

D. SMART Metric: Take data from at least four launches per year in Washington, with 20% URM and 50% women participation.

D. SMART Target Number: Have 60 secondary school students participating in launches, and 30 undergraduates.

D. SMART Deadline: Develop initial prototype for dust collection in Year 1 and distribute to affiliates in subsequent years with launches primarily in Spring and Summer.

SG8.E. SMART Goal: To sustain a CubeSat Technology Development Program at the lead institution with the goal of developing a preliminary design for a 3U to 6U CubeSat able to study a near-Earth asteroid starting from an SLS launch.

E. SMART Objective: Provide initial workforce development that would aid students in gaining immersive experiences for undergraduates in space technology and space sciences.

E. SMART Metric: Develop a preliminary design for space launch system and develop and test subsystems as needed.

E. SMART Target Number: 40 undergraduates per year.

E. SMART Deadline: Preliminary design would be developed at the end of Year 1, with subsystems developed in subsequent years. Additional preliminary designs would be developed as opportunities for space flight become available.

SG8.F. SMART Goal: To support educators and teams across Washington who wish to participate in student challenges that are being run as part of sponsored programs within SMD with an emphasis for educators in the Yakima Valley, an underserved community with an above average population of underrepresented minorities which is served by ESD105.

F. SMART Objective: To provide professional development for K-12 educators with the STEM components associated with student challenges.

F. SMART Metric: Provide at least 4 professional development workshops in rural Washington.

F. SMART Target Number: Support 20 educators as well as support 8 teams with a total of 40 students participating in challenge events.

F. SMART Deadline: Host professional development workshops in Fall and Winter to support educators.

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:

WSGC's application period for NIFs opens in March with awards being offered by the end of May.

To date, WSGC has awarded 70 Multidisciplinary Studentships, awarding students as follows:

- Women (& nonbinary) students — 60%
- Underrepresented minority students — 18.6%

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:

WSGC conducts project evaluations at the end of the academic year. Our project evaluation plan is as follows:

WSGC will participate in all components required by NASA for its external evaluations. In addition, to ensure the quality of the program, WSGC will continue its assessment plan to not only monitor the success of the program in terms of retention of students in STEM during their higher education efforts and in their next steps beyond higher education, but will continue formative and summative evaluations of the students as they enter and move through activities supported by WSGC.

Studentship Formative Evaluation: The questions guiding the formative evaluation will be: (1) What are participants' perceptions of their higher education institution (e.g., class performance, networking, financial and education support, research skills)? (2) To what extent are NASA resources enabling progress in carrying out the students' intended educational and research interest? (3) Does assignment of a science matter expert with experience in NASA STEM aid the student in attaining their goals? (4) How well does the project's collaboration (such as the creation of a smaller community within the larger university community) take advantage of the unique expertise of the WSGC?

Internship Formative Evaluation: (1) What is the quality of the experience between the different types of internships offered (private, NASA, or higher ed experiences), (2) Does the

quality of experience change with progression through the years at the higher education program? (3) What types of barriers does the student encounter and/or overcome in having access to research opportunities? (4) Does the experience increase the student's capacity to more effectively compete in their next steps towards working in STEM/aerospace workforce and/or class performance?

Team Formative Evaluation: (1) How is classroom knowledge translated into real life experiences through the team activity? (2) Conversely, does team experience translate into increased performance in class efforts? (3) Does the team experience open new avenues of STEM inquiry?

(4) Is the experience interdisciplinary versus disciplinary, and does that impact the student interests and outcomes?

All students will participate in the summative evaluation.

Summative Evaluation. The summative component of the evaluation will focus on the project's impacts on student outcomes. The questions guiding the summative evaluation will be: (1) To what extent are the project-based efforts influencing student outcomes? (2) Does the program provide a seamless pipeline through higher education for all students, including women and underrepresented minorities? (3) Does the program increase the students' interest to persist in their STEM degrees? (4) Is the program able to increase the students' aspirations in STEM careers?

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 3.3.3 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:

To date, the lead institution has received notice of two student co-authored papers submitted for publication. We are awaiting full citation information.

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

BASE AWARD ACCOMPLISHMENTS: (250 – 500 words)

A. NASA Internships and Fellowships (NIF) — WSGC's application period for NIFs opens in March with awards being offered by the end of May.

B. Multi-Disciplinary SMD, HEOM, STMD Studentships — To date, WSGC has awarded 70 Multidisciplinary Studentships, awarding students as follows:

- Women (& nonbinary) students — 60%
- Underrepresented minority students — 18.6%

C. Activities Relevant to Aeronautics Research Mission Directorate Research & Armstrong Flight Research Center: Supersonic Rocket Research Program (SRRP) — WSGC continues its support of the vibrant rocketry programs at affiliates Bellevue College, Pierce College – Fort Steilacoom, North Seattle College, Seattle Central College, and the UW, with approximately 60 students in total engaged across all participating institutions. All launches are currently on hold because of the COVID-19 pandemic, but we aim to start those again in summer 2021.

D. Activities Relevant to Science Mission Directorate Research: High Altitude Balloon Research Program (HABRP) — Most high altitude balloon activities, most notably all launches, have been delayed during the COVID-19 pandemic. Development of the initial prototype for dust collection is planned for spring quarter 2021 at the UW.

E. Activities Relevant to Space Technology Mission Direction and Glenn Research Center and Marshall Space Flight Center: CubeSat Technology Development Program — The CubeSat program at the UW continues with robust student engagement. Participants average at around 35 students, with approximately 32 undergraduates of whom women/nonbinary students comprise about 33%. Current projects include a BlueOrigin micro-gravity electroplating experiment as well as a project to make BlueOrigin missions more accessible to underserved populations.

F. Professional Development Associated with Science Mission Directorate Student Challenges — The ROADS Challenge -related Professional Development programs that had been planned for winter quarter 2021 were put on hold in light of the death of WSGC Director Robert Winglee.

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

Not Applicable

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

WSGC affiliate Washington State University has had a team selected for the Big Idea Challenge:

Leidenfrost Dusting as a Novel Tool for Lunar Dust Mitigation

Leidenfrost dusting uses the novel evaporation of cryogenic liquid droplets to lift and transport lunar dust from spacesuit materials. A cryogenic spray bar utilizing present fluids and no auxiliary power will remove and collect dust at the lowest point and pressurize within an airlock.

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

WSGC is providing support to the University of Washington’s chapter of AISES (American Indian Science and Engineering Society) as they prepare for First Nations Launch. Support includes equipment as well as time-spent by rocketry expert Mike Harrell, staff member in the UW’s Department of Earth and Space Sciences.

ACTIVITY IMPROVEMENTS MADE IN THE PAST YEAR:

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

Nothing to report at this time.

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.

Bellevue College	SG8.B, SG8.C	Multi-Disciplinary Studentships, Supersonic Student Research Program	Participant Support
Central Washington University	SG8.B, SG8.C	Multi-Disciplinary Studentships, Supersonic Student Research Program	Participant Support
Central Washington University	SG8.D	High Altitude Balloon Research Program	Launches
Everett CC	Aug1.2	Bridge Program at Everett Community College	Bridge Program
Everett Community College	SG8.D	High Altitude Balloon Research Program	Launches
Heritage University	SG8.D	High Altitude Balloon Research Program	Launches
Pacific Science Center	SG8.F	Professional Development Associated with SMD Student Challenges	Participant Support
Peninsula College	SG8.B	Multi-Disciplinary Studentships	Studentships
Seattle Central College	SG8.A	NASA Internships and Fellowships	Research/Internships
Seattle Central College	SG8.B	Multi-Disciplinary Studentships	Studentships
University of Puget Sound	SG8.B	Multi-Disciplinary Studentships	Studentships

University of Washington	Aug1.1, SG8.A	Workforce Development (NASA Internships and Fellowships)	Graduate Research Fellowships
University of Washington	Aug1.1, SG8.A	Workforce Development (NASA Internships and Fellowships)	Summer Undergraduate Research Program
University of Washington	Aug1.3, SG8.C	Northwest Indian College Supersonic Rocket/Robotics Program	Launches
University of Washington	Aug1.3, SG8.C	Northwest Indian College Supersonic Rocket/Robotics Program	Supply Support
University of Washington	Aug1.4, SG8.D	High Altitude Ballooning Projects for Lunar Eclipses in 2023/24.	2023 Annular Eclipse
University of Washington	Aug1.4, SG8.D	High Altitude Ballooning Projects for Lunar Eclipses in 2023/24.	2024 Total Eclipse
University of Washington	SG8.A	NASA Internships and Fellowships	Graduate Research Fellowships
University of Washington	SG8.A	NASA Internships and Fellowships	NASA Internships
University of Washington	SG8.A	NASA Internships and Fellowships	Private Industry Internships
University of Washington	SG8.A	NASA Internships and Fellowships	Summer Undergraduate Research Program
University of Washington	SG8.A, SG8.E	NASA Internships and Fellowships, CubeSat Technology Development Program	Internships
University of Washington	SG8.B	Multi-Disciplinary Studentships	UW First Year Scholars
University of Washington	SG8.B	Multi-Disciplinary Studentships	UW Transfer Scholars
University of Washington	SG8.C	Supersonic Student Research Program	Launches
University of Washington	SG8.C	Supersonic Student Research Program	Supply Support
University of Washington	SG8.C	Supersonic Student Research Program	Workshops

University of Washington	SG8.D	High Altitude Balloon Research Program	Launches
University of Washington	SG8.D	High Altitude Balloon Research Program	Prototype Development
University of Washington	SG8.D	High Altitude Balloon Research Program	Workshops
University of Washington	SG8.E	CubeSat Technology Development Program	HuskySat
University of Washington	SG8.E	CubeSat Technology Development Program	Launches
University of Washington	SG8.E	CubeSat Technology Development Program	Prototype Development
University of Washington	SG8.F	Professional Development Associated with SMD Student Challenges	Competitive Educator Support
University of Washington	SG8.F	Professional Development Associated with SMD Student Challenges	Supply Support
University of Washington	SG8.F	Professional Development Associated with SMD Student Challenges	Workshops
Washington State University	SG8.A	NASA Internships and Fellowships	Graduate Research Fellowships
Western Washington University	SG8.A	NASA Internships and Fellowships	Research/Internships
Western Washington University	SG8.B	Multi-Disciplinary Studentships	Studentships
Whitworth University	SG8.A	NASA Internships and Fellowships	Research/Internships
Whitworth University	SG8.B	Multi-Disciplinary Studentships	Studentships
Whitworth University	SG8.B	Multi-Disciplinary Studentships	Studentships

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.

WSGC's greatest challenge was the sudden and unexpected death of Director Robert Winglee at Christmas 2020. Thanks to the extraordinary efforts of Mary Denmon, associate director, and the incredible support and guidance of Erica Alston, deputy project manager at HQ, a new director was found in Kristi Morgansen Hill, professor and chair of the Aeronautics and Astronautics Department at the University of Washington. Dr. Morgansen was approved as director by a full consortium vote on March 27, 2021.

REFERENCES (optional – include only if needed):
(APA style reference list)