

Washington NASA Space Grant Consortium
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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 interests 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 Washington Space Grant Consortium is a Designated Program funded at a level of \$785,000 for fiscal year 2009.

PROGRAM GOALS

The overall objective of Washington NASA Space Grant Consortium is to provide high quality programs that align with the NASA Office of Education Outcomes and serve the needs of our state. WSGC seeks to enhance higher education opportunities for students seeking to pursue careers in the fields of science, technology, engineering and math (STEM); to enrich and improve STEM education at Washington's diverse pre-college, college, university and community learning centers; and to provide public outreach for NASA missions, and thereby strengthen the future workforce for NASA and our nation. To that end, our goals are as follows:

- To attract and retain high-achieving students, especially those underrepresented in the sciences, technology, engineering and mathematics, to space-related degree programs and career tracks supporting NASA's missions.
- To support the integration of research and education in NASA-related fields at the undergraduate and graduate levels.
- To support faculty interested in deepening ties to NASA research and the development of research infrastructure at consortium member institutions
- To increase collaborative efforts of university scientists and students with industry leaders in aerospace-related programs.
- To enhance the teaching of science, technology, engineering and mathematics and to attract students to these fields of study through engaging informal and formal education programs based on NASA's missions on Earth and in space.
- To share the excitement and knowledge gained from NASA's missions with the general public.

- To strengthen collaborative efforts within the consortium as well as with industry, community, and governmental organizations to support NASA and WSGC goals and activities.

We provide here a brief report on our progress toward last year's specific goals and metrics. A full report with specifics on participant data and expenditures may be found in our annual CMIS report.

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

OUTCOME #1: EMPLOY AND EDUCATE In FY2009, Northwest Indian College established the NWIC Space Center, creating an official home for the college's new rocket team. Since then, the WSGC-supported team has been spreading rocket fever around the state, with outreach presentations and bottle rocket launches at Head Start programs and reservation high schools. In April, the NWIC rocket team's construction and design work paid off when they placed second in the First Nations Tribal College Rocket Competition in Wisconsin. Equally important, all five members of the WSGC-supported team earned Tripoli Rocketry Association Level 1 Certification. A new physics course inspired by the team's experiences is now being offered. This summer the team returned from the NASA High Powered Rocketry workshop in Utah eager to compete in the 2010-2011 University Student Launch Initiative (USLI).

OUTCOME #2: EDUCATE AND ENGAGE For the past six years, WSGC has collaborated with veteran science teacher Kareen Borders, team lead for the NASA Explorer School program at Key Peninsula Middle School, supporting her continued professional development and her efforts to provide professional development for others. In that time, she has become Spitzer Space Telescope teacher, a Widefield Infrared Survey Explorer (WISE) Telescope ambassador, and developed and led workshops for the American Institute of Aeronautics and Astronautics. Her aerospace students have won student science investigations nationwide, including several NASA engineering challenges. In FY2009, she was honored to receive the Presidential Award for Excellence in Mathematics and Science Teaching.

OUTCOME #3: ENGAGE AND INSPIRE In FY2009, WSGC successfully collaborated with the University of Washington's Applied Physics Laboratory on an E/PO proposal to NASA's Science Mission Directorate for three years of support for Polar Science Weekend (PSW) at the Pacific Science Center. An annual four-day event, PSW provides the public with an opportunity to learn about careers in scientific research and gain understanding of the complex environment in the Arctic and Antarctic. PSW 2010 consisted of 35 hands-on activities, exhibits, and live science demonstrations; over 100 scientists, graduate students, and volunteer participants; and 6500 visitors, including over 800 students on school field trips.

PROGRAM ACCOMPLISHMENTS

Outcome 1 Objectives: Higher Education contributions to the Development of STEM Workforce – Educate and Employ

SMART Goal #1: *To attract and retain high-achieving students, especially those underrepresented in the sciences, technology, engineering and math, to space-related degree programs and career tracks supporting NASA's missions (Education Outcome 1)*

Modified Metric for 2008-2010: Improve WSGC's coverage of the state so that all major population centers within Washington State will have a Space Grant affiliate from which information on NASA programs can be distributed through local networking and from which local students may become involved in NASA STEM opportunities.

Progress to date: Met. WSU Vancouver joined as a partner, filling a gap in coverage in southwestern Washington. We funded one student researcher there in summer 2009, with the goal of eventually bringing the school's funding into alignment with that of our other members and partners. Additional funding for 2009-2010 allowed us to exceed our target of increasing student participation in research/internship programs by 2%.

Metric: To achieve 95% retention in STEM disciplines of all scholarship awardees (by 2009 – recognizing that students may be forced to leave school due to personal circumstances).

Progress to date: Met. Of the students receiving significant support from WSGC, 99.0% of the students contacted have been successfully tracked through their next step or are still in school. Of the 506 students who were successfully tracked, 98.8% have remained in STEM fields or are still in school.

Metric: To award WSGC scholarships to minority students at or above the percentage of enrollment of underrepresented minority students in higher education in the state of Washington.

Progress to date: Met. The percentage of underrepresented minority students enrolled in higher education in Washington state is 13%, according to the National Center of Education Statistics Digest. Based on 2009 awards reported to date, WSGC has superseded the NCESD percentage by awarding scholarships to underrepresented minority students at 18.6% of our total scholarships and fellowships, an increase of 6% over the previous year.

Metric for Diversity – Minority-Serving Institutions: Foster affiliate partnerships and develop ways for minority serving institutions to tap into the state's research colleges while developing more opportunities for their students to participate in hands-on research.

Progress to date: Met. See below for Program Contributions to PART Measures: Minority-Serving Institutions.

Metric for Diversity – Gender Equity: Foster gender parity within the STEM workforce through an equitable distribution of WSGC scholarships.

Progress to date: Met. Of the 2009 WSGC scholarships, 48% went to women — 2% short of parity but up 3% from 2008. Female scholarship recipients were most heavily represented within the fields of science and mathematics.

Metric: Establish regular communication with WSGC scholarship and fellowship alumni from all consortium institutions. Our alumni serve as role models for incoming students and can assist in opening up new opportunities for students within the program.

Progress to date: Met. WSGC continued its partnership with the National Space Grant Foundation to locate and track alumni from all of our higher education institutions. In 2009, we increased the percentage of all alumni being tracked through the system by an average of 10%. Our long-term objective is still to track a minimum of two-thirds of our alumni. To encourage staying in touch, we maintain a listserv (NASAlumni) specifically for distributing alumni news

and career opportunities, publish a regular alumni update column in our newsletter and are reaching out through our new Facebook page.

SMART Goal #2: *To support the integration of research and education in NASA-related fields at the undergraduate and graduate levels (NASA Education Outcome 1)*

Metric: 1) Provide infrastructure assistance for the continued offerings of two five-credit UW classes, Space and Space Travel (ESS 102) and Access to Space (ESS 205), which are offered annually and are at capacity; 2) Continue to offer Rocks and Stars (ESS 495) to provide UW students with information about NASA-supported research programs on campus and to encourage students to participate in such programs; 3) Work with Aerojet, UW ESS and the UW Department of Aeronautics and Astronautics in development of a rockets and instrumentation class.

Progress to date: Met. In FY2009, ESS 102 was offered in Fall and Winter Quarters: ESS 205 was offered in Spring Quarter. Enrollments were 368 and 49 respectively. WSGC piloted a live stream of the ESS 495 lectures to interested students and faculty at member schools. The pilot course, Rockets and Instrumentation, was offered Fall and Winter Quarters. It exceeded its enrollment target, with 32 undergraduates and eight graduate students, and the UW curriculum committee formalized the course as ESS 472/575

Metric for Workforce Development: Ensure research programs are available at more than 50% of our higher education institutions and expand student participation at a level proportionate to increases in the WSGC budget.

Progress to date: Met. In 2009, new student research programs were created at WSU Vancouver and Seattle Central Community College; programs were also offered at seven other member schools (Central Washington University, Northwest Indian College, University of Washington, University of Puget Sound, Washington State University, Whitman College and Whitworth University). Thus, research opportunities available at nine of our 12 higher education members and partners. Partnerships with the Mary Gates Endowment and the Washington Research Foundation added 20 year-round research opportunities for UW undergraduates.

Metric for Diversity and Gender Equity: 1) Award WSGC internships to underrepresented minority students at or above the percentage of enrollment of underrepresented minority students in higher education in the state of Washington (currently 13%). 2) Foster gender parity within the STEM workforce through an equitable distribution of WSGC internships. 3) Maintain the percentage of underrepresented minority students and women in WSGC-sponsored higher education courses at or above the percentage of underrepresented minorities and women enrolled in the College of Engineering at the institution where the courses are offered.

Progress to date: Partially met. 1) The total percentage of WSGC internships (including student research awards) awarded to underrepresented minority students was 16%. 2) In FY2009, 46% of WSGC internships (including student research awards) were awarded to women, less than parity but stronger than in previous reporting cycles. 3) The percentage of women and underrepresented minorities and women enrolled in WSGC-sponsored higher education courses, which have a strong engineering component, was 29% and 6.3% respectively. This compares to the UW College of Engineering's enrollment for 2009 of 19.5% women and 6.3% underrepresented minorities (of schools with WSGC-supported courses, only UW has an engineering department). While WSGC course enrollments by women and underrepresented

minorities for the comparison year are low, they clearly exceed or match that of the UW College of Engineering, from where we would anticipate drawing the bulk of our course participants.

SMART Goal #3: *To support faculty interested in deepening ties to NASA research and the development of research infrastructure at consortium member institutions (NASA Education Outcome 1)*

Metric: To distribute NASA announcements of opportunity to relevant faculty at all consortium member institutions.

Progress to date: Met. NASA research announcements and opportunities for special funding are forwarded regularly to WSGC representatives at our higher education affiliates so they can distribute the information at their institutions. Links are also posted on the WSGC website and Facebook page. NASA opportunities for formal and informal educators are forwarded to the relevant constituencies in a timely manner.

Metric for Workforce Development: Continue WSGC's graduate fellowship program at UW with a minimum of four fellowships per year and maintain support for several graduate students within fellowship programs at WSU.

Progress to date: Met. In FY2009, WSGC awarded four graduate fellowships at the UW and 12 at WSU. Awards were made to students in the disciplines of astronomy, Earth and space sciences, and engineering.

SMART Goal #4: *To increase collaborative efforts of university scientists and students with industry leaders in aerospace-related programs (NASA Education Outcome 1).*

Metric for Workforce Development: To establish a summer industry internship program with local companies involved in STEM research and development for students from WSGC member institutions.

Progress to date: Met. Despite the slow economy, we were able to place five students from two member schools in summer internships at Aerojet, Tethers Unlimited and Woodruff Scientific, Inc.

Metric: Have strong industry representation at WSGC meetings and events, and participation in projects including jointly submitted proposals, papers and products.

Progress to date: Met. Industry partners, as well as Senate and Congressional staff members, attended the WSGC annual reception and poster session. An Aerojet representative also presented the awards to students who participated in summer internships in private industry and at NASA centers. WSGC leadership has met annually with the partners and continued collaboration with Eagle Harbor Technologies on their two successful NASA Phase I SBIR proposals for the development of a micro-thruster for formation flying of multiple spacecraft and for space debris mitigation.

Outcome 2 Objectives: Elementary and Secondary Schools attracting and retain students in STEM Disciplines – Engage and Educate.

SMART Goal #5: *To enhance the teaching of science, mathematics, and technology and to attract students to these fields of study through engaging informal and formal education programs based on NASA's missions on Earth and in space (NASA Education Outcome 2).*

Metric: Provide technical or professional development to at least one traditionally underserved population in Washington.

Progress to date: From August 2009 to March 2010, North Central Educational Service District (NCESD) conducted 22 professional development workshops in underserved rural communities with high Hispanic and Native American populations, reaching 220 in-service teachers, with more than half of the workshops aimed at middle school teachers. Additional workshops for teachers in underserved areas were offered through WSTA and PSC's Space Odyssey van. PSC staff also traveled to national and regional science conferences to promote their *Astro Adventures* curriculum.

Metric: Provide research experiences for seven pre-service teachers in STEM fields.

Progress to date: Met. Future K-12 teachers in the Science, Mathematics, and Technology Education (SMATE) Program at Western Washington University complete both a major in their STEM disciplines and either the elementary or secondary education program. The eight participants created a poster describing their research and participated in a seminar to discuss how their research experiences will improve their inquiry-based educational methods and how it will relate to their future teaching.

Metric: Work with informal organizations such as museums to provide at least one relevant science activity each year at a major event or exhibit.

Progress to date: Met. In 2009, we increased our collaboration with the Museum of Flight on the state's successful Washington Aerospace Scholars (WAS) program, supporting 18 teachers and 392 students. Created to serve high school juniors statewide, the NASA-based program emphasizes science, technology, engineering and math, and encourages students to consider careers in those fields. Tracking shows that the program working; when surveyed, half of the responding alumni for the first two years (167) were STEM majors attending a WSGC member school.

Outcome 3 Objectives: Informal Education – Build Strategic Partnerships and Linkages.

SMART Goal #6: *To share the excitement and knowledge gained from NASA's missions with the general public (NASA Education Outcome 3).*

Metric: To offer a twice-annual newsletter for WSGC subscribers that highlights NASA and consortium activities for a general audience (each year, 2005-09).

Progress to date: Partially met. One newsletter was printed during FY 2009 and distributed to approximately 5,000 subscribers. We revised our communications strategy with a stronger emphasis on electronic outlets such as Facebook, Flickr and a redesigned website, due to launch in 2010. We continue to relay NASA-related opportunities to our members and targeted groups (students, alumni, the general public, etc.) via e-mail lists and our regular e-letter for educators.

Metric: To provide materials for museum and public events that showcase NASA missions at least once during the year. To help our museum affiliates to publicize their NASA-related programs via our newsletter, educator e-letter and mailing lists to students.

Progress to date: Met. Materials were provided for the Museum of Flight's Educator Open Houses, Astronomy Night and Space Camp; PSC's Earth Revealed and Polar Science Weekend; Expanding Horizons and IGNITE (events that encourage girls to pursue STEM careers); Seattle

CityClub science lectures and public events to be conducted in Eastern Washington by the state's International Year of Astronomy Student Ambassador. WSGC also collaborated with the WSU Extension Office in underserved Ferry County on a Dark Skies-focused astronomy exhibit at the annual Conservation Fair. The booth, staffed by the local astronomy club, drew 582 visitors, all rural residents. A fifth of the visitors identified as Native American.

SMART Goal #7: *To strengthen collaborative efforts within the consortium as well as with industry, community, and governmental organizations to support NASA and WSGC goals and activities (NASA Education Outcomes 1, 2 and 3).*

Metric: Work more closely with consortium members to assure coherence in the program, to share expertise and resources, and to bring together students and faculty from all institutions to present their research (every year, 2005-9).

Progress to date: Met. The annual WSGC Reception and Poster Session drew participation and/or attendance by students and faculty from more than half of WSGC's higher education affiliates, with a display of 75 posters by WSGC student researchers, graduate fellows and interns. The 2009 event was combined with special talk and award presentation by Apollo 13 astronaut Fred W. Haise. Representatives from our museum members, industry partners, and local Senate and Congressional offices attended. Using Facebook and e-mail, we continue to inform our higher education affiliates of NASA opportunities for their students and faculty. As part of the website redesign, a new intranet for members only is planned to encourage additional conversation among the statewide membership.

Metric: Increase Space Grant activities at consortium member institutions through closer collaboration on projects, student opportunities and events (every year, 2005-9).

Progress to date: Met. In 2009, members collaborated in selecting candidates for internships, advertising student opportunities and events, developing curriculum and other consortium projects. Members also collaborated to pursue additional funding opportunities such as the NASA Summer of Innovation proposal. WSGC leadership serve on the oversight board for Pacific Science Center's grant from NASA's Competitive Program for Science Museums and Planetariums and on the oversight board for Seattle Central Community College's NSF-STEP grant aimed at increasing community college students' competency and skills for successful transfer to the state's four-year institutions.

Metric: Obtain additional (i.e., non-NASA Space Grant) funds to strengthen our consortium activities (every year, 2005-9).

Progress to date: Met. In 2009, our three new partners, WSU Vancouver, Washington Science Teachers Association and Woodruff Scientific, Inc., all provided dollar-for-dollar matching funds for their Space Grant programs. At the lead institution, we increased the number of our student research awards by forming new funding partnerships with the Mary Gates Endowment for Students and the Washington Research Foundation. Also at the lead institution, we continue to receive funding for undergraduate scholarships from the Louise and Irving R. Donnergaard Endowment, the Sigurd Olsen Endowment, the Lt. Col. Michael P. Anderson Memorial Diversity Scholarship and the Mary Gates Endowment for Students. Our gift fund, Friends of Washington NASA Space Grant, received donations of \$1,500 in 2009 from an industry partner, alumni and other friends. In summer of 2009, WSGC awarded two internships at NASA Centers with funding from NASA ESMD.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- **Longitudinal Tracking:** Current data for 2009 show that WSGC made 236 total awards. Of those, 231 were significant awards: 134 significant awards in the Fellowship/Scholarship category and 97 in the Higher Education/Research Infrastructure category. Of these students, 31 are from underrepresented groups. Of the total, 227 are still enrolled in their current degree programs. In addition, 212 students who received funding in FY2006 through FY2008 are still enrolled in STEM degree programs. Of the currently known “next steps” made in 2009, 13 students graduated and are pursuing advanced STEM degrees, 5 students accepted positions with NASA contractors, 8 students accepted STEM positions in industry, 3 students accepted STEM positions in K-12 academia, and one student accepted a STEM position in academia.
- **Course Development:** In 2009, WSGC supported the creation of one new course to target STEM skills needed in the NASA workforce and revision of two others. At the SCCC, an interdisciplinary two-credit course called “UGR 214 - INTRODUCTION TO SCIENTIFIC RESEARCH” was introduced to prepare STEM students to successfully complete their own independent research project. Topics include the application of the scientific method, ethics, research methods, proposal writing, and presentation techniques. At CWU, additional equipment was purchased to support new hands-on curriculum in “PHYS 183: General Physics III” and “PHYS 113: Introductory Physics”, both four-credit classes on topics in physics including electromagnetic fields and optics. WSGC-funded equipment from these classes is also made available to CESME (CWU’s Center for Excellence in Science and Math Education) so CWU pre-service teachers (and other courses) may utilize it
- **Matching Funds:** The ratio of funds leveraged by NASA funds, including only non-federal sources, is 0.84, higher than the required amount of 0.75. The ratio of funds leveraged by NASA funds, including both non-federal and other federal sources, is 0.90.
- **Minority-Serving Institutions:** WSGC’s tribal college affiliate, Northwest Indian College, received \$30,000 NASA funding and provided matching funds of \$20,000 for scholarships and research projects, including support of their new Space Center and rocketry program. WSGC’s majority-minority academic affiliate, Seattle Central Community College, received \$22,000 NASA funding and provided matching funds of \$23,200 for scholarships and research awards. These institutions have reported that 27 scholarships and 18 research awards were made with 2009 funds. WSGC continues to concentrate on developing ways for its minority-serving institutions to tap into the state’s research colleges while accomplishing our SMART goals of providing opportunities for hands-on research and fostering affiliate partnerships. A WSGC associate director serves on the oversight board for Seattle Central Community College’s NSF-STEP grant aimed at increasing community college students’ competency and skills for successful transfer to the state’s four-year institutions. WSGC continues to provide scholarships to students enrolled in NWIC’s bachelor of science degree program in Native Environmental Science and has forged additional ties with the college this year through support of the school’s rocket team. The team is now pursuing an ESMD/SG Senior Design Team grant support for their 2010-2011 University Student Launch Initiative (USLI) bid.

IMPROVEMENTS MADE IN THE PAST YEAR

Over the last few years, WSGC has made efforts to expand participation in Space Grant across Washington state, and across all levels of higher education. In FY2009, this expansion led to a re-organization of the consortium's structure to ensure efficient and meaningful support of students while maintaining accurate and timely reporting. The goals of the re-organization were to improve access to undergraduate research opportunities in the STEM disciplines statewide, support additional professional development for educators and allow the development of relationships with additional community colleges.

For this reason, the WSGC affiliates are now broken into two groups: members and partners. Members have sustained programs, work with a significant number of students or teachers, and/or participate on the executive committee. Because of the size of their programs, members have individual subcontracts and provide detailed reporting statements each year. Partners participate in the support of a small number of students or teachers. Because the size or scope of their program is limited, their funding is provided directly by the lead institution (no subcontract). Awards are based on a competitive process dependent on available funding. Partners do not participate in the executive committee. Partners will typically be drawn from private industry, the community college system, or educational nonprofits. The lead institution provides tracking of students participating in partner programs. All educational affiliates (and their students) receive NASA mailings and are invited to participate in WSGC events. Partners who show a strong level of participation and commitment to NASA goals and objectives may be invited to become WSGC members.

Washington Science Teachers Association (WSTA), which is dedicated to advocating and promoting quality secondary education in Washington, and Washington State University Vancouver (WSU Vancouver), a non-residential research university serving southwestern Washington, were added as new partners in 2009. Conversations are underway with two community colleges and we expect to bring them in as partners within a year.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

WSGC is comprised of 14 member institutions and six industry and educational partners, which are described below:

Higher Education

- *University of Washington*, the lead institution, is a major research university and receives over \$1 billion annually in research grants and contracts.
- *Central Washington University*, a four-year public university serving Central Washington, with a main campus in Ellensburg and six off-site centers.
- *Heritage University*, a Hispanic-serving institution (HSI) located within the Yakama Nation reservation in central Washington.
- *Northwest Indian College (NWIC)*, a tribal college in northern Washington,
- *Seattle Central Community College (SCCC)*, an urban majority-minority institution.
- *Seattle University*, the largest independent university in the Pacific Northwest.
- *University of Puget Sound*, a four-year liberal arts college located in Tacoma.
- *Washington State University (WSU)*, also a major research university and the state's land grant university.
- *Western Washington University*, home to the Science, Mathematics, and Technology Education (SMATE) program for pre-service teachers and education research.

- *Whitman College*, a private liberal arts school located in central Washington.
- *Whitworth University*, a private liberal arts school located in eastern Washington.

K-12

- *North Central Educational Service District (NCESD)*, the largest ESD in the state, serving a mostly rural, Hispanic, and economically disadvantaged population.

Informal Education

- *Museum of Flight (MoF)*, a provider of informal education and training for pre-college students and in-service teachers.
- *Pacific Science Center (PSC)*, a provider of informal education and training for pre-college students and in-service teachers.

WSGC industry partners within the field of aeronautics and astronautics are Aerojet and Tethers Unlimited, Inc; partner Woodruff Scientific, Inc. is focused on new energy technologies. Educational partners are North Seattle Community College (NSCC), a two-year college serving north Seattle and the neighboring suburbs; Washington State University Vancouver, a non-residential research university serving southwestern Washington; and Washington Science Teachers Association, a nonprofit professional group dedicated to advocating and promoting quality secondary education in Washington.