

Montana Space Grant Consortium
Lead Institution: Montana State University
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Consortium URL: <http://spacegrant.montana.edu>
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LOB: NASA Internships, Fellowships, and Scholarships; Stem Engagement;
Institutional Engagement; Educator Professional Development

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 Montana Space Grant Consortium is a Designated Consortium funded at a level of \$760,000 for fiscal year 2017.

B. PROGRAM GOALS

Strategic Goals:

- (1) Develop and connect interdisciplinary aerospace education programs that will build and enhance opportunities for involvement in space-based science, technology, engineering and math (STEM) in Montana.
- (2) Strive to build a Montana aerospace workforce, integrating women, underrepresented minorities and persons with disabilities.
- (3) Network Montana colleges, universities, aerospace industries, and government with national aerospace programs in government and industry, especially NASA centers and other Space Grant Consortia.
- (4) Expand and enhance aeronautics and NASA-related research activity in Montana colleges and universities.

SMART Objectives:

MTSGC's Scholarship SMART Objectives are to:

- Each academic year award \$1,000 - \$2,000 competitive scholarships to deserving undergraduate students; maintain at least a 3.5 mean GPA; maintain at least 25%

underrepresented awardees; increase the percentage of female awardees from 47% to 50% for the 2015-8 grant period.

- Continue to strive to award at least one scholarship to each active Academic Affiliate, increasing the number of represented institutions from 50% to 70% per year for the 2015-8 grant period.

MTSGC's Fellowship SMART Objective is to:

- Each academic year award \$9,000 one-semester competitive fellowships to deserving graduate students with 3.5 GPAs or higher; maintain at least a 90% level of major awardees that continue on to STEM employment or STEM advanced education; increase the percentage of underrepresented awardees from 8% to 10% and female awardees from 40% to 45% for the 2015-8 grant period.

MTSGC's Internship SMART Objectives are to:

- Continue to offer interdisciplinary, hands-on, meaningful summer internships for Montana students to participate in MTSGC BOREALIS high altitude ballooning, space hardware, and NASA center projects; maintain at least a 90% level of interns that continue on to STEM employment or STEM advanced education; increase the percentage of underrepresented awardees from 5% to 8% and female awardees from 10% to 20% for the 2015-8 grant period.

- Maintain at least one Tribal College participant per year, either as a NASA-supported or MTSGC-supported intern.

- Increase support for aerospace industry internships – provide support for at least two industry internships per year.

MTSGC's BOREALIS SMART Objective is to:

- Continue to create interdisciplinary, hands-on, meaningful opportunities for Montana students to design, build, fly and analyze data from BOREALIS high altitude balloon experiments; maintain participation of at least five Affiliate Institutions with at least one being a Tribal College; increase the percentage of underrepresented participants from 5% to 8% and female participants from 10% to 20% for the 2015-8 grant period.

MTSGC's ARES SMART Objective is to:

- Competitively award stipends to undergraduate students involved in STEM research; maintain at least 1/3 participating active Academic Affiliate Institutions; maintain 100% of students presenting their work; maintain at least 50% female awardees; increase the percentage of underrepresented awardees from 5% to 10% for the 2015-8 grant period.

MTSGC's Apprenticeship SMART Objectives are to:

- Competitively award Apprenticeship stipends to Montana undergraduate students involved in *major* NASA research projects; maintain 100% present their work and/or submit a paper; increase the percentage of underrepresented awardees from 10% to 12% and female awardees from 15% to 20% for the 2015-8 grant period.

- Continue to create interdisciplinary, hands-on, and meaningful opportunities for Montana students to participate in *academic year space hardware projects*; maintain at least a 90% level of major awardees that continue on to STEM employment or STEM advanced education; increase the percentage of underrepresented awardees from 5% to 8% and female awardees from 10% to 20% for the 2015-8 grant period.

MTSGC's SPOT SMART Objectives are to:

- For the undergraduate presenters, maintain at least a 90% level of major awardees that continue on to STEM employment or STEM advanced education; increase the percentage of underrepresented participants from 5% to 8% and maintain at least 40% female participants for the 2015-8 grant period.
- Through the efforts of the SPOT graduate managers and undergraduate presenters, continue to educate 9% or more of the Montana K-12 teachers and students (~600 and 12,000 respectively) each year about NASA-related opportunities and careers available to Montana students as those students look forward to higher education; maintain at least an 80% level of teachers who use SPOT-provided NASA materials in their classroom instruction.

MTSGC's Student Research Symposium SMART Objective is to:

- Continue to hold Student Research Symposiums for all students involved in MTS GC programs; maintain at least 150 student and faculty participants from at least 50% of active institutions, and maintain at least a 95% participant agreement that the Symposium was beneficial.

MTSGC's Education Enhancement Grant SMART Objective is to:

- Award Education Enhancement grants that continue to be impactful, interdisciplinary and have diverse participants; increase the average percentage of female PIs from 20% to 25% in the 2015-8 award period; maintain at least five participating affiliate institutions, including at least one Tribal College for the 2015-8 grant period.

MTSGC's Precollege and Informal SMART Objectives are to:

- Support the Science Horizons program, bringing science educators from predominantly Native American communities to Montana State University for one week of in-depth learning and planning; strive for at least 25% female and underrepresented awards
- Seek, wherever possible, to foster programs that reach across the artificial boundaries of "precollege," "general public," or "higher education;" continue to participate at least three times per year, on a volunteer basis, in outreach programs such as 'Astronomy and Aerospace Day;' continue to participate, on a volunteer basis, on Montana STEM advisory boards.

MTSGC's Consortium Management SMART Objectives are to:

- Continue to hold meaningful yearly Affiliates' Meetings, maintaining at least 75% Affiliate Representative attendance; create an evaluation of the Affiliates' Meeting and obtain at least 90% satisfaction with the meeting.
- Continue 100% attendance of at least one MTS GC staff member at Space Grant Regional and National Meetings.
- Continue MTS GC staff visits to at least four Affiliate Campuses each year.

C. PROGRAM/PROJECT BENEFITS TO PROGRAM AREAS

1) Eclipse Ballooning Project [Higher Education]

MTSGC BOREALIS students and staff along with teams from Louisiana State University, University of Minnesota, Iowa State University and University of Colorado Boulder developed the Common Payload for the NASA Space Grant 2017 Eclipse Ballooning Project. Several test flights were conducted throughout the year by participating teams using the Common Payloads built at workshops held in 2016. The Common Payloads were tested, refined and optimized to stream near real time video of the eclipse to a common website. Still images were captured during flights and accurate balloon locations were reported in real time to the FAA on a common website. Fifty- five teams launched at precise times on August 21, 2017 under the watchful eye of mentors and provided stunning video and still image pictures of the eclipse for the public to view. Hands on student engagement was the underlying goal of this project and there were opportunities for anyone with an interest and motivation. Many public outreach events were held around the country for the public to interact with the teams. MTSGC BOREALIS interns have interacted with students and mentors from all fifty-five teams either on the support forums, at workshops, one-on-one troubleshooting or presenting at conferences like the 2017 Fall National Space Grant Directors Meeting in Grand Forks, ND or the 2017 Academic High Altitude Stratospheric Ballooning Association Conference in Minneapolis, MN.

In conjunction with the large balloons, MTSGC students developed the national eclipse radiosonde balloon launch standard operating procedure. MTSGC had students participate along with 15 additional teams in launching radiosonde atmospheric science payloads during the eclipse. The dataset collected has lead to four student presentations to date, two at national conferences and two at Montana events. Three scientific publications from MTSGC's radiosonde data collection efforts are currently being written.

2) Hiscock Memorial Award [Higher Education]

The \$1,500 William (Bill) A. Hiscock Memorial award is given annually to the applicant who best embodies Bill's passion for aerospace-related education. The 2017-18 AY Hiscock Memorial Award winner is student Ayla Grandpre, a student at Rocky Mountain College. This award will be used for Ayla to expand SMArt Girls (Science Math & Art Girls), an outreach program at Rocky Mountain College to get middle-school-age girls introduced and excited about STEM and STEAM fields by doing interactive projects every other week.

3) Educational Enhancement Grant [Higher Education]

MTSGC funded a pilot project with “Wings Over Water”, a program that uses a wide variety of technologies to study ospreys, including drones, aircraft, and satellite transmitters. Ospreys (*Pandion haliaetus*) are an ideal species around which to build an exciting STEM curriculum for middle school students: they are unique fishing raptors; they migrate thousands of miles; they are important indicators of the health of aquatic ecosystems; and most schools in Montana are within a few miles of an osprey nest. The pilot project involved working with five gifted middle school teachers (two from tribal schools, two from rural schools, and one from an urban school) to help develop and teach this curriculum in their schools. This project has lead to award nominations and follow on funding requests to two different agencies.

D. PROGRAM ACCOMPLISHMENTS

- NASA Internships, Fellowships, and Scholarships (NIFS):

- Scholarships

Awarded 30 scholarships.

Maintain at least 3.5 mean GPA: 3.62

Maintain at least 25% underrepresented awardees: 14%. We continue to work affiliates from underrepresented minority institutions to identify and encourage students to apply.

Increase female awards from 47% to 50%: 50%

Increase the number of represented institutions from 50% to 70% per year: 40%

- Fellowships

Awarded 6 one-semester fellowships.

Maintain at least 3.5 GPA mean GPA: 3.77

Maintain at least 90% of major awardees in STEM employment or pipeline: all still enrolled.

Increase underrepresented awards from 8% to 10%: 0%; We continue to actively recruit and encourage minority participation.

Increase female awardees from 40% to 45%: 34%

- Internships with BOREALIS, space hardware, NASA, and industry

FY2017 award decisions will be made in mid-March, 2018. We awarded 10 FY2016 internships last summer. The information below was unreported (in the APD) FY2016 for summer 2016.

The 10 FY2016 internships were reported in the FY2016 OEPM data as they had been determined by then.

Maintain at least a 90% level of major awardees that go to STEM employment or advanced education: All still enrolled.

Increase underrepresented awards from 5% to 8%: 10% in FY2016, TBD FY2017

Increase female awardees from 10% to 20%: 50% in FY2016; TBD FY2017

Maintain at least one Tribal College student award: 0 in FY2016; however, a female community college student at Miles Community College was supported; TBD FY2017

Provide at least two industry internships per year: provided 1 in FY2016

- Higher Education projects:

- BOREALIS high altitude ballooning projects

A total of 21 students participated that are not counted in other report categories. Many other students participated in BOREALIS projects but are reported under paid ARES, Apprenticeship, or Internship categories.

Increase underrepresented participants from 5% to 8%: 9.5%

Increase female participants from 10% to 20%: 24%

Maintain at least five participating affiliate institutions, including at least one Tribal College: 5 institutions: Montana State University, University of Montana, Miles Community College, Missoula College, Flathead Valley Community College and Chief Dull Knife College (a TC).

Stronger collaborations within Montana were formed for the nationwide network of total solar eclipse high altitude balloon flights. Additional awards from FY 2017 will be made in summer 2018.

- **ARES** undergraduate STEM research

ARES awards were made to 25 students from 5 institutions.

Maintain at least eight participating Academic Affiliates: 4 Affiliates+lead institution

Maintain 100% of students presenting work: 100%

Maintain at least 50% female awardees: 40%

Increase underrepresented awards from 5% to 10%: 8%

- **Apprenticeships** - major NASA undergraduate research projects

Apprenticeship awards were made to 16 students from 4 institutions. We plan to offer summer apprenticeships to reach the underrepresented group at small institutions.

Maintain at least 90% level of awardees that go to STEM employment or advanced education: all still enrolled

Maintain 100% of students presenting work: 100%

Increase female awardees from 15% to 20%: 38%

Increase underrepresented awards from 10% to 12%: 12.5%

- **Space Hardware** Apprenticeships

Space hardware apprenticeship awards were made to 3 students. Leadership in space hardware has recently shifted and we anticipate more awards in summer 2018.

Maintain at least a 90% level of major awardees that go to STEM employment or advanced education: 3 still enrolled

Increase underrepresented awards from 5% to 8%: 0%

Increase female awardees from 10% to 20%: 33%

Space Hardware apprenticeships remain one of our toughest areas for recruiting minority student participation and we continue to recruit and encourage participation from minority students.

- **SPOT undergraduate presenters**

Awards were made to 8 SPOT presenters with recruitment ongoing.

Maintain at least a 90% level of major awardees that go to STEM employment or advanced education: All 8 still enrolled, 1 applying to graduate school

Increase underrepresented participants from 5% to 10%: 0%, working with tribal colleges to get student presenters at their institutions.

Maintain at least 40% female participants: 63%

MTSGC continues to provide graduate student fellowship support of the SPOT manager and is actively searching for funding partners for this very successful program.

- **Student Research Symposium**

The Symposium consisted of 24 student talks, 25 student posters, and two keynote talks.

Maintain at least 150 student and faculty participants from at least 16 institutions: 120 participated from 12 institutions.

Maintain at least a 95% participant agreement that the Symposium was beneficial: 98%

Participant evaluations of the Symposium were overwhelmingly positive. One Montana company sponsored the event and awards.

- **Education Enhancement grants**

Awarded one grant in FY17 (details below) to one institution, the University of Montana. We received three proposals from two different institutions.

Increase female PIs from 20% to 25% over the entire grant period: 100% female PI this year; 67% female over the first three years of the grant.

Maintain at least five participating affiliate institutions over the entire grant period, including at least one Tribal College: first three years of participation from 4 campuses: Flathead Valley Community College, Salish Kootenai College (a TC; 2 awards), UM (3 awards), UM Western
FY17 Titles, PIs, and institutions: “Student Support for Success in Science,” Jenny McNulty, University of Montana.

-Research Infrastructure projects:

We did not originally propose to fund any research infrastructure projects in FY17. However, in the mix of proposals submitted to our faculty Education Enhancement grant and Montana NASA EPSCoR Research Initiation grant opportunities, we recognized that MTSGC funds would be better spent on the UM Western research grant than a second education grant. We will submit a budget modification request to cover this change.

Awarded one Research Initiation grant in FY17 to one institution: “Precipitation Isotope Ratios and Tree-ring based Snowpack Relationships to inform Paleoclimate Reconstructions from Lake Sediment Cores”, Spruce W Schoenemann, the University of Montana Western.

- Precollege projects:

MTSGC assisted 7 Montana K-5 teachers from rural schools with travel to attend the Montana Learning Center STEAM training program, provided registration, travel, lodging and meals for 3 Montana high school teachers to attend the annual RockOn! workshop in Wallops, VA, and continued to support our successful Space Public Outreach Team (SPOT) program. Volunteered for several other precollege activities. See details below.

- SPOT K-12 outreach

In the last year, SPOT reached 3,700 Montana K-12 students; dates set for thousands more.

Present to 9% or more Montana K-12 educators and students: 5%

Maintain at least an 80% level of teachers who use SPOT-provided NASA materials in their classroom instruction: 82%

Strive for at least 25% female and underrepresented awards for K-12 teacher travel: 100%

- Other precollege activities

UM BOREALIS worked with Aaniiih Nakoda College for a community STEM event providing a radiosonde launch. Additionally the team provided a radiosonde launch for a girls STEM camp with the Montana Learning Center

MTSGC staff participated as volunteers at the regional Science Olympiad, state science fair, Regional Science Bowls, FIRST Lego Robotics, and FIRST Tech Challenge.

- Informal Education projects:

- Informal Education/Synergistic projects

MTSGC did not spend any base funding on Informal projects, though MTSGC staff volunteered at several events.

Continue to participate at least three times per year, on a volunteer basis, in outreach programs: completed six events.

Continue to host annual Astronomy and Aerospace Day: will take place April 15th, 2018.

Sponsoring and volunteering at events across the state increases knowledge about our Higher Education opportunities among the Precollege teachers and students that is quite valuable.

- Astronomy and Aerospace Day, April 9th, 2017. MTSGC helped arrange the visit by Google[x] Systems Engineer Jaime Waydo (a native of Montana and favored lecturer), provided interactive booths highlighting MSU and affiliate programs as well as Dr. Des Jardins' presentation on the upcoming total solar eclipse,. Over 1500 people attended the event - a community favorite.

- Other volunteer activities include: Montana Science Olympiad: several MTSGC staff and students volunteered. FIRST Tech Challenge & Lego League: MTSGC staff and students volunteered for the Montana regional tournament. Science Bowl (middle school and high school): MTSGC staff and students volunteered for the Montana regional tournament. Girls in Science: MTSGC staff and students volunteered in Billings. Science fairs: MTSGC staff and students volunteered at the Missoula and Billings fairs.

E. PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE GOALS

Include summary data for the bulleted list below:

- **Diversity:**

All of our SMART objectives include diversity of institution and diversity of students metrics. In general, we are meeting or exceeding our diversity goals. For example, one of the traditionally toughest areas for us to recruit women and underrepresented minority students is in the higher-paid internships and apprenticeships. As a result of continued focus, effort, and research on expanding diversity, our numbers in these areas continue to climb. This year we exceeded our metrics for women and minorities in internships and apprenticeships.

- **Minority Serving Institution Collaborations:**

We continue to offer support to all Tribal Colleges via our primary MTSGC Education Enhancement grant, Apprenticeship, ARES, and BOREALIS statewide programs. Highlights are given below and throughout this report. We continue to work towards the goals set out in our SMART objective.

- Students from Chief Dull Knife College, Fort Peck Community College, and Little Bighorn Community College won funding to participate in WISGC's First Nations High-Powered Rocket Launch competition.

-Tribal College students remain involved in MTSGC's ballooning efforts through the eclipse ballooning project (reported on separately).

- **Office of Education Annual Performance Indicators:**

- API 2.4.1: ED-17-1 ____47____

Higher Ed diversity - direct student awards in higher ed to diverse populations across programs (women and minorities)

- API 2.4.2: ED-17-2 _____3_____

Educators that participated in NASA professional development

- API 2.4.4: ED-17-4 _____3_____

We have partnerships with Museum of the Rockies in Bozeman, MT to co-sponsor our annual Astronomy & Aerospace Day, SpectrUM in Missoula, MT to collaborate with our educational enhancement grant “Wings Over Water”, and Exploration Works in Helena, MT to co-sponsor our Affiliates Meeting on FY17.

- API 2.4.5: ED-17-5 _____3700_____

SPOT K-12 students seen in the last year = 3700, with a three-fold increase this fall over last fall.

F. IMPROVEMENTS MADE IN THE PAST YEAR

Last August MTSGC saw the successful unfolding of the Eclipse Ballooning Project, which we led. Several partnerships that were started during the Eclipse Project will continue to be meaningful for MTSGC efforts. These partnerships include but are not limited to: 1) NASA entities such as the Science Mission Directorate and Balloon Program Office, 2) ballooning companies such as World View, Raven, and Google Loon, and 3) academic groups such as other ballooning programs and other Space Grant Consortia.

G. CURRENT AND PROJECTED CHALLENGES

National budget uncertainty makes it difficult to plan for the future. We are always evaluating our programs to ensure we spend funds in the most effective ways. Uncertainty, however, limits the practicality of effort being spent on creative new ideas.

H. PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

In FY17, 18 of our 23 Academic Affiliate institutions were ‘active’, meaning they were involved in at least one MTSGC program during the year. Below is a list of the institutions and the primary programs they participated in.

- Aaniiih Nakoda College: Affiliates’ Meeting, MSRS, MTSGC staff visit (SPOT)
- Blackfeet Community College: MSRS, scholarship
- Carroll College: undergraduate research, MSRS, scholarship, Affiliates’ Meeting, MTSGC staff visit
- Chief Dull Knife College: Affiliates’ Meeting, MSRS, BOREALIS
- Great Falls College - MSU: undergraduate research, MSRS, Affiliates’ Meeting
- Flathead Valley Community College: MSRS, BOREALIS, scholarship
- Helena College - UM: MSRS, Affiliates’ Meeting
- Little Big Horn College: MSRS
- Miles Community College: MSRS, BOREALIS
- Missoula College: undergraduate research, Affiliates’ Meeting

- o Montana State University: scholarship, fellowship, BOREALIS, undergraduate research, SPOT, student satellites, MSRS, Affiliates' Meeting
- o Montana State University-Billings: undergraduate research, MSRS, Affiliates' Meeting
- o Montana Tech: scholarship, MSRS, NASA intern travel support
- o Rocky Mountain College: scholarship, undergraduate research, MSRS, Affiliates' Meeting, NASA KSC intern travel support,
- o Salish Kootenai College: MSRS, Affiliates' Meeting
- o University of Providence: scholarship, MSRS
- o University of Montana: scholarship, fellowship, BOREALIS, undergraduate research, SPOT, MSRS, Educational Enhancement Grant
- o UM-Western: undergraduate research, NASA Goddard internship, scholarship, MTSGC staff visit