

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 2016.

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 the development teams including two flights with Raven Industries and one flight on the HASP payload with CSBF. With the underlying goal of student involvement, the Common Payload was replicated and distributed at workshops held on January 15-16, 2016, May 16-20, 2016 and July 16-20, 2016 in Bozeman, MT. 55 Teams (approx. 200 students and staff) from across the country have built, tested and ultimately will fly the system during the total solar eclipse on 8-21-2017 that crosses the US from Oregon to South Carolina.

The primary flight payload is a student designed and constructed low cost platform that can report balloon positions, stream video and take snapshot images all at altitude in real or near real-time. The Iridium satellite modem provides updated latitude, longitude and altitude data allowing the ground station antennas to track the balloon throughout the flight while providing the FAA near real-time tracking information of the balloon. The ground station antennas allow communication both to and from the primary flight payload. Using a 900Mhz radio, students are able to interact with the still image camera settings and take 'on command' images which are then transferred to the ground station. Streaming HD video is accomplished by using a 5.8Ghz modem to transfer video data to the ground station where the feed is then uploaded onto a website for public viewing. Students are able to send a 'flight termination email' via the Iridium satellite modem which then uses on board XBEE radio pairs to command the cut-down system to end the flight.

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 2016-17 AY Hiscock Memorial Award winner is student **Caitlin Carroll**, a student at Helena College (a community college). This award will be used for Caitlin to lead a team of volunteers in STEM mentorship sessions for 20 to 40 middle- and high-school students.

3) Internship [NIFS]

Levin Mullaney was first introduced to MTSGC in Fall 2015. Since that time he has secured an MTSGC Scholarship, MTSGC ARES award, and a 2017 NASA summer internship at Armstrong Flight Research Center. Levin embodies the National Space Grant goals "...to expand opportunities for Americans to understand and participate in NASA's aeronautics and space programs ..." and MTSGC's statewide goal of tiered programs that lead students toward continuing on to STEM employment or STEM advanced education.

D. PROGRAM ACCOMPLISHMENTS

Information is given below for each SMART Objective in terms of the Objective metrics (summarized from the full version in section B). For example, under scholarships, the first metric is to maintain at least a 3.5 GPA and the 2016 result is 3.70.

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

- **Scholarships**

Awarded 26 scholarships.

- i. maintain at least 3.5 mean GPA: 3.70
- ii. maintain at least 25% underrepresented awardees: 3.8%. We are working to emphasize this objective more substantially.
- iii. increase female awards from 47% to 50%: 53.8%
- iv. increase the number of represented institutions from 50% to 70% per year: 52%

- **Fellowships**

Awarded 5 one-semester fellowships.

- i. maintain at least 3.5 GPA mean GPA: 3.75
- ii. maintain at least 90% of major awardees in STEM employment or pipeline: all still enrolled.
- iii. increase underrepresented awards from 8% to 10%: 0%; We continue to actively recruit and encourage minority participation.
- iv. increase female awardees from 40% to 45%: 80%

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

A portion FY2016 awards decisions will be made in mid-March, 2017. To date, we have awarded 7 FY2016 internships for summer 2016 support. The numbers below are both unreported (in the APD) FY2015 (10 interns) for summer 2016 and already funded FY2016 interns (7). The 10 FY2015 internships WERE reported in the FY2015 OEPM data.

- i. maintain at least a 90% level of major awardees that go to STEM employment or advanced education: 1 moved on to graduate school; the remainder are still enrolled.
- ii. increase underrepresented awards from 5% to 8%: 10% in FY2015, TBD FY2016
- iii. increase female awardees from 10% to 20%: 30% in FY2015; TBD FY2016
- iv. maintain at least one Tribal College student award: 0 in FY2015 (1 TC summer student was funded under the Apprenticeship program instead); TBD FY2016
- v. provide at least two industry internships per year: provided 0 in FY2015; anticipate 2-3 for FY2016

- Higher Education projects:

- **BOREALIS** high altitude ballooning projects

A total of 28 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.

- i. increase underrepresented participants from 5% to 8%: 11%
- ii. increase female participants from 10% to 20%: 29%

iii. maintain at least five participating affiliate institutions, including at least one Tribal College: 5 institutions: Montana State University, University of Montana, Montana Tech, Great Falls College - MSU and Chief Dull Knife College (a TC). Stronger collaborations within Montana have been forming for the nationwide network of total solar eclipse high altitude balloon flights. Additional awards from FY 2016 will be made in summer 2017.

- **ARES** undergraduate STEM research

ARES awards were made to 27 students from 9 institutions.

- i. maintain at least eight participating Academic Affiliates: 8 Affiliates+lead institution
- ii. maintain 100% of students presenting work: 100%
- iii. maintain at least 50% female awardees: 44%
- iv. increase underrepresented awards from 5% to 10%: 7%

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

Apprenticeship awards were made to 9 students from 4 institutions.

- i. maintain at least 90% level of awardees that go to STEM employment or advanced education: all still enrolled
- ii. maintain 100% of students presenting work: 100%
- iii. increase female awardees from 15% to 20%: 56%
- iv. increase underrepresented awards from 10% to 12%: 11%

- **Space Hardware** Apprenticeships

Space hardware apprenticeship awards were made to 9 students.

- i. maintain at least a 90% level of major awardees that go to STEM employment or advanced education: 1 on to advanced degree, remaining still enrolled
- ii. increase underrepresented awards from 5% to 8%: 0%
- iii. 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 14 SPOT presenters.

- i. maintain at least a 90% level of major awardees that go to STEM employment or advanced education: 14% advanced education, remaining enrolled
- ii. increase underrepresented participants from 5% to 10%: 7%, working with tribal colleges to get student presenters at their institutions.
- iii. maintain at least 40% female participants: 50%

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

- **Student Research Symposium**

The Symposium consisted of 39 student talks, 22 student posters, and two keynote talks.

- i. maintain at least 150 student and faculty participants from at least 15 institutions: 130 participated from 12 institutions.
- ii. maintain at least a 95% participant agreement that the Symposium was beneficial: 98%

Participant evaluations of the Symposium were overwhelmingly positive. Two Montana companies sponsored the event and awards.

- Education Enhancement grants

Awarded two grants in FY 16 (details below) to two institutions, Salish Kootenai College (a Tribal College) and the University of Montana. We received six proposals from five different institutions including two community colleges and one Tribal College.

i. increase female PIs from 20% to 25% over the entire grant period: 100% female PIs this year; 60% female over the first two years of the grant.

ii. maintain at least five participating affiliate institutions over the entire grant period, including at least one Tribal College: metric met.

FY 16 Titles, PIs, and institutions:

1) "From Space to Species: Wildlife and Fisheries Indigenous STEM Enhancement," Janene Lichtenberg, Salish Kootenai College

2) "Wings Over Water: Using Ospreys to Develop a Multidisciplinary STEM Curriculum for Middle Schools Across Montana," Jenelle Dowling and Erick Greene, University of Montana

• Research Infrastructure projects:

None.

• Precollege projects:

MTSGC spent \$5,000 on the Science Horizons precollege project and volunteered for several other precollege activities. See details below.

- SPOT K-12 reach and Science Horizons

For FY16, SPOT is expected to reach 8,000 Montana K-12 students,

i. present to 9% or more Montana K-12 educators and students: 6%

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

iii. strive for at least 25% female and underrepresented awards for Science Horizons educators: 100%

- Other precollege activities

- MSU BOREALIS students gave ballooning demonstrations to elementary students at both the Belgrade Public Library and Bozeman Library in the fall. Spring 2016 SPOT and BOREALIS tours for Hardin Middle School (75% native american students) were given at MSU.

- UM BOREALIS with Frenchtown Middle School for a community STEM event provided a radiosonde launch. This will be repeated with Aaniiih Nakoda College in April 2017.

- We will invite four teams of middle and high school Montana students who are second place winners at the regional Science Olympiad, state science fair, FIRST Lego Robotics, and FIRST Tech Challenge to our annual Student Research Symposium in April 2017.

• Informal Education projects:

- **Informal Education/Synergistic** projects

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

i. continue to participate at least three times per year, on a volunteer basis, in outreach programs. Completed six events.

ii. continue to host annual Astronomy and Aerospace Day. Will take place April 9th, 2017. 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 17th, 2016. MTSGC helped arrange the associated visits by Google[x] Systems Engineer Jaime Waydo and Earth System Scientist George Seielstad and provided interactive booths for our general programs. Over 1500 people attended the event, calling it ‘the greatest show on earth!’

- Other volunteer activities include: Science Olympiad: several MTSGC staff and students volunteered. FIRST Tech Challenge & Lego League: several 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. Montana State Middle School and High School Science Fair: MTSGC staff and students volunteered.

E. PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE GOALS

• **Diversity:**

All of our objectives include diversity of institution and diversity of students metrics. In general, we are meeting or exceeding our diversity of institutions goals and when taking into account MTSGC efforts with the community college project, meeting or exceeding our diversity of students metrics. Since so much effort with our Native students has shifted to the community college project (and succeeding widely), the underrepresented percentages on the funding reported here are somewhat reduced.

• **Minority Serving Institution Collaborations:**

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

- For a second year in a row, students from Chief Dull Knife College won funding to participate in WISGC's First Nations High-Powered Rocket Launch competition.

- Tribal College students remain involved in MTSGC's community college efforts through our Launching Culturally Relevant Montana Careers in STEM program (reported on separately).

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

- API 2.4.1: ED-16-1 ___43___

- API 2.4.2: ED-16-2 _____4_____
- API 2.4.4: ED-16-4 _____1_____
- API 2.4.5: ED-16-5 _8000_____

F. IMPROVEMENTS MADE IN THE PAST YEAR

We have been thinking and talking a lot about changing the conversation about STEM. We want to make it clear that students interested in design, innovation, and critical thinking are absolutely of interest to NASA. For example, we changed our motto (present on our letterhead, etc.) from “Helping Montana’s students become tomorrow’s aerospace leaders” to “Igniting curiosity, critical thinking, and innovation.” These thoughts affect how we recruit and train our student participants and have made NASA feel more inclusive to them.

Dr. Angela Des Jardins, the MTSGC director, met several times over the course of the year with NASA Deputy Administrator Dr. Dava Newman. They discussed national STEM challenges and potential proactive solutions. While no longer with NASA, Dr. Newman and Dr. Des Jardins plan to continue these discussions.

G. CURRENT AND PROJECTED CHALLENGES

- Continuing successful programs for our community colleges since the funding level dropped from \$250,000 per year to needing to fit within our base budget.
- Involving two (out of the seven) Tribal Colleges where we’ve been unable to replace Affiliate Representatives - Blackfeet Community College and Fort Peck Community College.
- Acquiring more industry partnerships for internships.

H. PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

In FY16 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
- Carroll College: undergraduate research, MSRS
- Chief Dull Knife College: Affiliates’ Meeting, MSRS, BOREALIS, MTSGC staff visit
- Great Falls College - MSU: scholarship, BOREALIS, Affiliates’ Meeting, MSRS
- Flathead Valley Community College: undergraduate research, MSRS, Affiliates’ Meeting
- Helena College - UM: MSRS, Hiscock Award
- Little Big Horn College: MTSGC staff visit
- Miles Community College: MSRS, Affiliates’ Meeting, MTSGC staff visit, BOREALIS
- Missoula College: undergraduate research, Affiliates’ Meeting, MTSGC staff visit

- o Montana State University: scholarship, fellowship, BOREALIS, undergraduate research, SPOT, student satellites, MSRS, Affiliates' Meeting
- o Montana State University-Billings: SPOT, undergraduate research, MSRS, Affiliates' Meeting
- o Montana State University-Northern: scholarship
- o Montana Tech: scholarship, undergraduate research, MSRS, BOREALIS
- o Rocky Mountain College: scholarship, undergraduate research, MSRS, Affiliates' Meeting, student satellite internship, SPOT
- o Salish Kootenai College: MSRS, MTSGC staff visit, education enhancement grant
- o University of Great Falls: scholarship, Affiliates' Meeting, MSRS
- o University of Montana: scholarship, fellowship, BOREALIS, undergraduate research, SPOT, MSRS, Affiliates' Meeting, education enhancement grant
- o UM-Western: scholarship