

Montana Space Grant Consortium
Montana State University
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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 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 \$575,000 for fiscal year 2012.

PROGRAM GOALS

2012 SMART Objectives by Strategic Goal:

(These SMART Objectives apply to the 2012 MSGC grant year unless otherwise specified)

(1) Develop and connect interdisciplinary aerospace education programs that will build and enhance opportunities for involvement in space-based science, technology, engineering and math in Montana.

1a. By August 1st, award \$1,500 competitive scholarships to deserving undergraduate students; maintain at least a 3.5 mean grade point average (GPA); maintain at least 25% underrepresented awardees; increase the percentage of female awardees from 40% to 45% for the 2010-2014 grant period.

1b. By August 1st, award \$7,500 one-semester competitive fellowships to deserving graduate students with 3.25 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 and female awardees from 3% and 38% to 5% and 40%, respectively for the 2010-2014 grant period.

1c. Continue to strive to award at least one scholarship to each Academic Affiliate, maintaining the number of represented institutions at a minimum of 16 per year for the 2010-2014 grant period.

1d. Award Education Enhancement grants that continue to be impactful, interdisciplinary and have diverse participants; increase the average percentage of female PIs from 19% to 22% in the 2010-2014 award; increase the number of participating affiliate institutions to 8 (from 6 in the 2005-2009 award), including an increase in the number of Tribal College participants from 2 to 3 for the 2010-2014 grant period.

1e. Increase the number of Affiliate Institutions actively participating in the BOREALIS high altitude ballooning program from 3 to 5 in the 2010-2014 award.

1f. Through the efforts of the Space Public Outreach Team (SPOT) graduate managers, continue to educate 8% or more of the Montana K-12 teachers and students (~700 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 a 80% level of teachers who use SPOT-provided NASA materials in their classroom instruction.

1g. 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 ‘Expanding Your Horizons,’ ‘Astronomy Day,’ ‘Science Olympiad,’ and ‘FIRST Lego League Tournaments;’ continue to participate (on a volunteer basis) on Montana museum boards.

(2) Strive to build a Montana aerospace workforce, integrating women, under-represented minorities and persons with disabilities.

2a. Continue to create interdisciplinary, hands-on, and meaningful opportunities for Montana students to participate in 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 and female participants from 8% and 16% to 10% and 20%, respectively for the 2010-2014 grant period.

2b. Continue to offer interdisciplinary, hands-on, and meaningful summer internships for Montana students from campuses other than MSU to participate in MSGC student space hardware projects; maintain at least a 90% level of interns that continue on to STEM employment or STEM advanced education; increase the percentage of underrepresented and female participants from 8% and 16% to 10% and 20%, respectively for the 2010-2014 grant period.

2c. Continue to create interdisciplinary, hands-on, and meaningful opportunities for Montana students to design and build BOREALIS high altitude balloon experiments at the BOREALIS launch centers; maintain at least a 90% level of major awardees that continue on to STEM employment or STEM advanced education; increase the percentage of underrepresented and female participants from 8% and 16% to 10% and 20%, respectively for the 2010-2014 grant period.

2d. Continue to offer interdisciplinary, hands-on, and meaningful summer internships for Montana students to participate in MSGC BOREALIS high altitude ballooning projects;

maintain at least a 90% level of interns that continue on to STEM employment or STEM advanced education; increase the percentage of underrepresented and female participants from 8% and 16% to 10% and 20%, respectively for the 2010-2014 grant period.

2e. Increase the involvement of students from Tribal College Affiliate Institutions in the MSGC Minority Serving Institution Partnership Development Program, BOREALIS, student space hardware, undergraduate research, and internship programs from 30% to 100% involvement of at least one student in at least one program for the 2010-2014 grant period.

(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.

3a. 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.

3b. Continue to hold MSGC Student Research Symposia (MSRS) for all students involved in MSGC programs; maintain at least 120 student and faculty participants from at least 15 Affiliate Institutions, and maintain at least a 95% participant agreement that the Symposium was beneficial.

3c. Continue to offer support for NASA center internships; maintain at least a 90% level of NASA interns that continue on to STEM employment or STEM advanced education; increase the percentage of underrepresented and female participants from 5% and 10% to 7% and 15%, respectively for the 2010-2014 grant period.

3d. Increase support for aerospace industry internships – provide support for at least one industry internship.

3e. [Updated] Continue nearly 100% MSGC director attendance at Space Grant Regional and National Meetings.

(4) Expand and enhance aeronautics and NASA-related research activity in Montana colleges and universities.

4a. Continue to maintain a 100% level of NASA-related interdisciplinary Research Initiation awards; create an evaluation of the number of PIs who propose for follow-on NASA funding and obtain at least 50%; increase the percentage of underrepresented and female PIs from 14% and 14% to 17% and 17%, respectively for the 2010-2014 grant period.

4b. Competitively award stipends to Montana State University students involved in STEM research; maintain at least a 90% level of students who present their work and/or submit a paper; increase the percentage of underrepresented and female participants from 2% and 35% to 5% and 40%, respectively for the 2010-2014 grant period.

4c. Competitively award stipends to University of Montana students involved in STEM research; increase the percentage of students who present their work and/or submit a paper to at least 70%; maintain at least 50% female awardees; increase the percentage of underrepresented awardees to 3% for the 2010-2014 grant period.

4d. Competitively award stipends to Montana Tech students involved in STEM research; increase the percentage of students who present their work and/or submit a paper to at least 70%; increase the percentage of female awardees from 43% to 48%; increase the percentage of underrepresented awardees to 3% for the 2010-2014 grant period.

4e. Continue to make stipends available to students attending institutions other than MSU, UM and Montana Tech who are involved in STEM research; increase the average number of participating Academic Affiliate Institutions from 3 to 10; increase the percentage of students who present their work and/or submit a paper from 50% to 70%; maintain at least 50% female awardees; increase the percentage of underrepresented awardees from 8 to 11% for the 2010-2014 grant period.

4f. [NEW] Competitively award Apprenticeship stipends to Montana undergraduate students involved in *major* NASA research projects; have at least 90% present their work and/or submit a paper; 40% female awardees; 10% underrepresented awardees for the 2010-2014 grant period.

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

Note: Here, we have highlighted the activities not covered in the other sections below.

1) National Student Solar Spectrograph Competition (Outcome 1)

The yearly National Student Solar Spectrograph Competition is MSGC's Education Program for NASA's Interface Region Imaging Spectrograph (IRIS) mission and uses state dollars as a match for our Space Grant award.

MSGC hosted the 2011-2012 National Student Solar Spectrograph Competition (NSSSC) May 16-19, 2012 with nine teams travelling to Bozeman to compete for scholarship prizes and travel awards. The student teams built and demonstrated ground based spectrographs as part of an interdisciplinary team that was then judged in four categories. The categories and winning teams are:

Best Science Observation Award -- Montgomery College in Rockville, Md; **Best Presentation of Results Award** -- San Diego State University; **Best Spectrograph Design Award** -- team "Darkstar" from MSU; **Best Spectrograph Build Award** -- "The Greek Team" from MSU. Five articles appeared in various publications about the NSSSC and are listed on the competition webpage at <http://spacegrant.montana.edu/iris/index.html>. In addition two refereed Proceedings Articles were included in the 2012 SPIE Proceedings: *Proc. SPIE.* 8481, Optics Education and Outreach II 84810Z (October 15, 2012) doi: 10.1117/12.965323; *Proc. SPIE.* 8481, Optics Education and Outreach II 84810Y (October 18, 2012) doi: 10.1117/12.965320

MSGC will host the 2012-2013 NSSSC May 15-18, 2013 in Bozeman, MT. The 2012-2013 NSSSC registration closed with 24 teams representing 10 different states.

Metrics of success for the IRIS National Student Solar Spectrograph Competition (NSSSC)

Professional evaluation data from the first year of the original NSSSC shows that: 1) 96% of participants strongly agreed (82%) or agreed (14%) that *working on an interdisciplinary team was a valuable experience*, 2) 100% of participants strongly agreed (96%) or agreed (4%) that *participating in NSSSC provided opportunities to learn and practice practical skills related to science and engineering*, and very importantly 3) 77% of participants strongly agreed (50%) or agreed (27%) that *participating in NSSSC increased their interest in pursuing a STEM-related career*. This last statistic is particularly compelling because it indicates the Competition had an effect on career choices rather than the students already having decided on a STEM career, as is often the case with participants in other STEM competitions. Jim Boger, faculty advisor at Flathead Valley Community Colleges says, “*The opportunity to work on a real project has been a true motivation for our students who can feel isolated at a small school with no significant research going on.*”

NSSSC participant success stories

Courtney Peck, a member of the 2012 NSSSC Best Science Award team and a now first year physics graduate student at the University of Colorado, Boulder, won a highly prestigious NSF fellowship partly as a result of her NSSSC experience at Montana State University. In addition, Courtney’s career goals changed slightly to optical astrophysics as a result of NSSSC.

Jerry Johnson, a member of the 2012 NSSSC team from Flathead Valley Community College credits his interest in an aerospace career to the NSSSC: “At the beginning of my engineering studies, while attending FVCC, my interest in design and engineering led me to compete in the 2012 National Student Solar Spectrograph Competition. With only a small understanding of optics and the engineering process at the time, this experience introduced me to what being an engineer is all about, and it left me hungry for more.” As a result of his NSSSC experience, Jerry transferred to the mechanical engineering program at Montana State University and won a position working at the highly successful Space Science and Engineering Laboratory (SSEL). SSEL is the only university program in the country to have a CubeSat on *both* NASA ELaNa launches with three additional CubeSats manifested for launch. This summer, Jerry will intern at JPL.

David Riesland, a member of the 2012 NSSSC Best Build Award team and an electrical engineering junior at Montana State University, credits NSSSC with his career path choice: “I was first exposed to Optics when I competed with a team in the National Student Solar Spectrograph Competition. Even though it was a subject that was foreign to me, I immersed myself in the topic and found a world that intrigued and absorbed me.” David had amazing 2013 summer internship offers, including working with optical engineering researchers at JPL and with the Glenn NASA Academy (he chose the Academy position).

2) Tribal College student highlights (Outcome 1)

Two students that both started with MSGC as part of the MSI Partnership Development program (one at SKC and one at Blackfeet Community College) are featured in the following article about their work at JPL as part of the Mars Science Laboratory Science Team.

<http://www.valleyjournal.net/Article/2840/SKC-professor-students-part-of-Mars-Rover-team>

Judy Hudgins and **Noel Stewart** are both members of the Mars Science Laboratory Science Team at JPL working as part of the MAHLI/MARDI/Mastcam camera science team. As a science team member they contribute to deciding what data to collect, help with scientific interpretation of the data and write scientific papers describing the interpretation of the data. On the camera team they assist the science team in designing observations that use the cameras and “command the cameras to make observations.” Judy has been working mainly as a payload downlink lead for the MAHLI, MARDI and Mastcam cameras. Noel also has been working as a payload uplink lead for the MAHLI, MARDI and Mastcam cameras.

Judy Hudgins is currently a student at Salish Kootenai College working towards a degree in Computer Engineering. Judy not only worked on the MSGC Aurora Detector MSI project but also continues working with the Salish Kootenai College (SKC) Cubesat project and will intern at Johnson Space Center this summer.

Noel Stewart is currently a student at Salish Kootenai College working towards a degree in Hydrology. Noel continues working with the Salish Kootenai College (SKC) Cubesat project and was a summer intern at NASA’s Marshall Space Flight Center (MSFC). As the 2011 Hiscock Memorial Award recipient Noel studied ways to use the SKC Cubesat project to enhance the hydrology, science, and education curricula at SKC. She is also a NASA Student Ambassador sharing NASA science and opportunities with fellow students and her community. Noel previously attended Blackfeet Community College (BCC), graduating with two associate degrees in Business Management and Math/Science. She will be the first of four siblings to earn a B.S. degree. Noel was part of the BCC team sponsored by MSGC investigating plant regeneration at the 2006 Red Eagle Fire on the Blackfeet Reservation using a Kingfisher tethered blimp system with infrared and visible light remote sensing cameras.

3) Hiscock Memorial Award (Outcome 1)

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 2012-13 AY Hiscock Memorial Award winner is MSU Physics Teaching Option major Bob Warwood. With the Hiscock Award, Bob is creating a viral Public Service Announcement (PSA) series titled “Keep the Dream Alive,” which will highlight the importance of the STEM fields with emphasis on the importance of space science and exploration. The purpose of his project is an extension of the public outreach performed by MSGC to motivate the public, and especially young people, to consider the STEM fields as viable career choices, or at least give support to the expansion of these fields - both philosophically and monetarily. Most importantly, such a project would serve to inspire in order to combat the current trend of indifference and active anti intellectualism toward sciences.

PROGRAM ACCOMPLISHMENTS

NOTE: THIS LIST REFERENCES OUR SMART OBJECTIVES BY OUTCOME AND REFERENCES RELATED NASA EDUCATION PRIORITIES [IN BRACKETS]. In order to be succinct, NASA Education Priorities are referred to by number: EP1. Hands-on student experiences, EP2. Middle school teachers, EP3. Summer opportunities for secondary students, EP4. Community colleges, EP5. Aeronautics research, EP6. Environmental Science and GCC, EP7. Diversity, EP8. Innovative research infrastructure.

Outcome 1:

1a. Competitive Scholarships [EP7]

- Awarded 27 undergraduate scholarships; mean GPA = 3.25; underrepresented = 26%; female = 44%. All objectives met.

1b. Fellowships [EP7]

- Awarded 7 graduate fellowships; mean GPA = 3.89; all FY 2011 still enrolled (LT for FY 2010: 1 on to STEM employment, 10 still enrolled); underrepresented = 29%; female = 29%. Only objective not met is female, but a five year average meets objective. Current MSGC Fellow, soon to be *doctor* Kathryn Williamson, has accepted a position as the Education Specialist at the National Radio Astronomy Observatory (NRAO).

1c. Statewide Scholarships [EP4] [EP7]

- Increased to 16 Affiliate Institutions receiving awards. The increase can be attributed to visiting institutions with a focus on increasing participation at the institutions where we have not had as much activity, specifically Dawson Community College, Miles Community College, and Little Big Horn College.

1d. Education Enhancement grants [EP4] [EP6] [EP7]

- Awarded 3 grants (details below) to two institutions.

- Female PIs = 0%; underrepresented PIs = 0%. While the female and underrepresented PI numbers are zero this year, our SMART objective is for the entire 2010-2014 period, and we are on our way to meeting it.

- Titles, PIs, and institutions:

- o "Inquiry Learning: Creating an Undergraduate Astronomy Experience Using Laboratory and Research Exercises" Art Alt, University of Great Falls (small college)
- o "Vertically Integrating a Robotics Thread Through the Undergraduate ECE Curriculum at MSU-Bozeman," Brock LaMeres, Montana State University
- o "Development of a Manufacturing of Composite Materials Course at MSU," David Miller, Montana State University

- In 2013 the Celebrating Einstein events initially funded by a FY2011 Education Enhancement grant from MSGC tripled their initial budget with funding from Montana State University and NSF EPSCoR reaching over 5000 participants from the public, local K-12 schools, higher education students, and science community with a wide variety of events including Celebrating Einstein in the Schools, the Speaking of Einstein public lecture series, the Black (W)hole art installation, and the grand finale A Shout Across Time live music, dance, and film events at the

Emerson Center for the Arts and Culture in Bozeman. All of the products are currently being packaged for distribution so other communities can host similar Celebrating Einstein events. [EP1],[EP7]

1e. BOREALIS statewide effort [EP1] [EP4] [EP6] [EP7]

- As a result of the Tribal College tethered ballooning program and our main launch centers, we had BOREALIS activity at Montana State University, University of Montana, Salish Kootenai College (a Tribal College (TC)), Stone Child College (TC), Fort Peck Community College (TC), Blackfeet Community College (TC), and Aaniiih Nakoda College (TC) and Little Big Horn College (TC) in FY 2012. This is *nearly half of all of our Affiliate campuses*, meaning we have well exceeded our SMART Objective metric!

- Students from Salish Kootenai College, Stone Child College, Aaniiih Nakoda College, Montana State University, and University of Montana presented research posters at conferences on their ballooning projects.

- MSGC's BOREALIS program trains Montana students to fly balloons carrying scientific payloads and imaging systems to the edge of space. Launch centers at MSU-Bozeman and UM-Missoula fly student experiments for any MSGC affiliate institution. For the 2012 CatGriz football game the MSU BOREALIS team took a video of the school mascots high above the Montana landscape. Watch the flight video on YouTube at (<http://www.youtube.com/watch?v=FViKxdspqkQ>).

- MSU BOREALIS summer interns provided a tethered blimp to hoist NDVI Imaging Systems above an agricultural test field at the Zero Emissions Research and Technology (ZERT) center at Montana State University. In the experiments at the ZERT site, red and NIR images of the vegetation reflectance were acquired, from which a gas leak location is identified through statistical analysis of the reflectances and the normalized difference vegetation index (NDVI).

- This summer the UM BOREALIS team conducted a camp for middle school students. The camp culminated in a tethered balloon flight in Camas Prairie, MT. The data collected that day has become part of the GIS base layer of that area which is the location of giant ripple marks resulting from the ice age floods of Glacial Lake Missoula. This developing GIS database will be used in the recently created Ice Age Floods National Geologic Trail (<http://www.iafi.org/trail.html>).

1f. Space Public Outreach Team [EP1] [EP2] [EP7]

- This program is making a transition from a long standing collaboration between NASA SDO:AIA E/PO and MSGC. MSGC continues to provide graduate student fellowship support of the SPOT managers and is currently seeking other funding partners for this very successful program. The managers are longitudinally tracked by MSGC and evaluated for their performance. In FY12 MSGC supported 25 SPOT presenters including presenter training in NASA science and engineering topics, public speaking skills, and education and outreach training. FY12 included the addition of a SPOT seminar class at MSU with a total of 28 students participating during the first two semesters of the class.

2a. Student Satellites [EP1] [EP6] [EP7]

- 6 major student awards; underrepresented = 0%; female = 0%. We realize this is one of our toughest areas for recruiting female and minority student participation and are working on ways to boost these levels. From FY 2012 awards, 6 are still enrolled. Three additional MSU Space

Science and Engineering Lab (SSEL) satellites were selected for the NASA CSLI program for launch in the next two years. [Outcome 1] [EP 1]

2b. SSEL internships [EP1] [EP4] [EP6] [EP7]

- As of 4-10-13, no students have been placed for summer 2013. From the FY 2011 (summer 2012) award, both students are still enrolled and pursuing degrees.

2c. BOREALIS launch centers [EP1] [EP6] [EP7]

- Note: In the MSU program, the AY students are volunteers (therefore not counted as 'awards'). In the UM program, however, the AY students are paid, so we count them as awards. Also, several yet to be identified students will be supported on FY12 base funds at UM in summer 2013.

- In the MSU program, total of 36 students participated; 3% underrepresented; 3% female. In the UM program so far, 4 students participated; 0% underrepresented; 50% female. Total, this is 40 students, 3% underrepresented, 8% female. Therefore, we are under our objective for female students. For underrepresented and female students, we continue to find ways to encourage participation.

- MSU FY2012: Of the 36 participants, 32 students are currently enrolled, two students are continuing their STEM education at different institutions, two students graduated midyear with one employed at STEM company and the other looking for STEM employment.

- UM FY 2012: 2 male undergraduates, 2 female undergraduates and 1 male high school student (also 2011 participant). There were 11 middle school participants, 6 females and 5 males. One of the male undergraduates will be pursuing graduate studies in STEM next year. One of the female undergraduates (also a 2011 participant) will be pursuing employment in STEM next year. The other two undergraduates (1 male and 1 female) are still getting their undergraduate degrees. From 2011 one of the female participants is pursuing graduate studies in STEM. The other female participant from 2011 is still an undergraduate student. From the 2010 undergrads 4 are in graduate school in STEM fields and 3 are still finishing undergraduate degrees. The male high school student from 2010 is now at Butte as a petroleum engineering major.

2d. BOREALIS internships [EP1] [EP6] [EP7]

- Awards will be made in summer 2013 to 7 interns (one co-sponsored by the American Indian Research Opportunities MAP program and three co-sponsored on a new MSU Alumni Foundation funded Presidential Emerging Scholars program). 14% underrepresented; 14% female. We are therefore making progress towards the goals set out in our SMART objective.

- All FY 2012 interns (summer 2013) are still enrolled. From FY 2011 awards (summer 2012), 1 student graduated and is looking for employment in STEM, 1 student transferred to another college to study STEM and the remainders are still enrolled.

2e. Minority Serving Institutions [EP1] [EP4] [EP7]

- We continue to support students and faculty on two main Tribal College (TC) projects: the Aurora Detector Project and the Remote Sensing Project. Now that funding for the MSI Partnership Development Program is finished, we support these projects via our primary MSGC

Apprenticeship, ARES, and BOREALIS state-wide programs. Highlights on these two main programs and other TC activities are given below and throughout this report. We are exceeding our SMART Objective metric for engaging our TCs.

- Aurora Detector Project: The last Aurora Detector was provided by MSGC staff to Little Big Horn College. All Tribal Colleges now have aurora detectors. The Montana Aurora Detector Network was announced and can be viewed at (<http://aurora.montana.edu/>). Currently, the MSU and SKC detectors are on-line and working very well. The remainders should be on-line in the near future!

- As a result of the Remote Sensing (tethered blimp) Project activity one refereed Proceedings Article was included in the 2012 SPIE Proceedings and one refereed Research Paper was published in the Journal of Applied Remote Sensing. *Proc. SPIE*. 8481, Optics Education and Outreach II 84810T (October 15, 2012) doi: 10.1117/12.932236; *Journal of Applied Remote Sensing*. 6(1), 063613 (Dec 10 2012); doi: 10.1117/1.JRS.6.063613.

- Tethered blimp training was provided by MSGC staff at Little Big Horn College. All Tribal Colleges now have tethered blimp remote sensing systems.

- Students from Salish Kootenia College worked with the UM BOREALIS students on a tethered blimp project examining remnant ripples on the Salish Kootenai Reservation left from the flooding of Glacial Lake Missoula 12,000 years ago.

- An Education Enhancement Grant was awarded to Robert Kenning at Salish Kootenai College for “Creating a GIS Certificate Program and Expanding the Geospatial Curriculum at the Salish Kootenai College.”

3a. Affiliates’ Meetings [EP4]

- We held our annual Affiliates’ Meeting September 14th, 2012. Of all the 19 institutions, 58% were represented at the meeting. At this meeting, we instituted an improvement (see Improvements section) that resulted in the Reps feeling that the meeting was even more useful than normal. For the third year, our Reps will also have a chance to interact at the Student Research Symposium April 19th, 2013. In this setting, the Reps have a chance to share what is happening at their institutions, rather than the MSGC staff providing most of the dialog.

3b. MSGC Student Research Symposium (MSRS). [EP4] [EP7]

- In 2012 we hosted the third MSRS including 142 participants from 12 Montana campuses, 34 student talks, and 24 student posters. Participant evaluations of the Symposium were overwhelmingly positive. Six Montana companies sponsored student presentation awards. The Museum of the Rockies Best Undergraduate Poster from a Small Institution was won by Judy Hudgins from Salish Kootenai College for the SKC CubeSat project. MSRS 2013 will be held in conjunction with the Montana NASA EPSCoR first annual Montana Aerospace Workshop on 4/19/2013, providing an opportunity for MSGC students to meet and network with Montana Aerospace professionals.

[Outcome 1] [EP 1, 7, 8]

3c. NASA internships [EP1] [EP7]

- As of 4-10-13, awarded 3 NASA Academy internships to take place in summer 2013 at Ames and Glenn; underrepresented = 0%; female = 0%. While our minority and female participation looks low, it is important to remember that at least 5 (including 2 female) Native American interns recruited by MSGC are being paid directly by NASA sources – an even bigger honor than

being supported by MSGC! From FY 2011 (summer 2012), two interns, both female, are pursuing advanced degrees, one is teaching K-12, and 4 are still enrolled.

3d. Industry internships [EP1]

- As of 4-10-13 for FY 2012, we have 2 industry partner internships from 406 Aerospace, 50% female, 0% underrepresented.

3e. National and Regional Meeting Attendance

- We met our goal for staff attendance at regional and national meetings.
- We brought two MSU electrical engineering and Spectrograph Competition students to the 2012 Fall Western Regional Meeting in Idaho. They gave a terrific talk, displayed their spectrograph, and presented a poster, wowing Carl Person and Diane DeTroye.

4a. Research Initiation grants [EP4] [EP5] [EP6] [EP7] [EP8]

- No FY12 awards (all awards were made under MT NASA EPSCoR)

4b. MSU undergraduate research [EP1] [EP5] [EP6] [EP7]

- FY 2012 awards have not yet been made. We anticipate awards will be made to ~12 students. FY 2011 awards were made to 12 students, 100% of the students are presenting their work, 25% female, and 0% underrepresented. We continue to encourage female and minority participation, but it should be noted that the students are chosen by the MSU undergraduate research staff (not the MSGC staff).

4c. UM undergraduate research [EP1] [EP6] [EP7]

- FY 2012 awards have not yet been made. We anticipate awards will be made to ~5 students. FY 2011 awards were made to 5 students, 100% of the students are presenting their work, 60% female, and 0% underrepresented. We continue to encourage minority participation, but it should be noted that the students are chosen by the UM undergraduate research staff (not the MSGC staff).

4d. Montana Tech undergraduate research [EP1] [EP6] [EP7]

- FY 2012 awards have not yet been made. We anticipate awards will be made to ~3 students. FY 2011 awards were made to 2 students, 100% of the students are presenting their work, 0% female, and 0% underrepresented. We continue to encourage female and minority participation, but it should be noted that the students are chosen by the MT Tech undergraduate research staff (not the MSGC staff).

4e. ARES [EP1] [EP6] [EP7]

- In FY 2012, 12 ARES awards were made at 5 institutions including one community college; 25% female; 0% underrepresented. All awarded students complete Responsible Conduct of Research tutorials and present their research at the MSGC Student Research Symposium or another research conference. We continue to actively recruit and encourage female and minority participation.

4f. Undergraduate Research Apprenticeships [EP1] [EP6] [EP7]

- 4 MSGC Apprenticeship awards were made in FY12. 75% are currently scheduled to present their work at the MSRS, 25% female, and 25% underrepresented. All are still enrolled. We continue to actively recruit and encourage female participation.

Outcome 2:

1g. Precollege

MSGC did not spend any base funding on Precollege projects, though we did have volunteer precollege participants. See details below.

- BOREALIS K-12 student opportunity. At UM, one male HS student participated in the weekly academic year program. At MSU two male HS students participated in the program. [EP1] [EP3] [EP7]

- MSU's American Indian Research Opportunities (AIRO) Montana Assistantship Program (MAP). In summer 2012, MSGC hosted a Native American high school MAP research student who worked with our Education Specialist and BOREALIS for 90 hours. [EP1] [EP3] [EP7]

- MSU BOREALIS provided a tethered blimp to hoist payloads built by Monforton School 4th graders to 150 feet for their egg drop project See news coverage from KBZK at (<http://www.kbzk.com/videos/monforton-students-get-hands-on-with-science-during-egg-drop/>). [EP1]

Outcome 3:

1g. Informal Education/Synergistic projects

MSGC did not spend any base funding on Informal projects, though MSGC staff volunteered at several events. Being sponsors and volunteers creates awareness about our Higher Education opportunities among the Precollege teachers and students that is quite valuable. See details below.

- Astronomy Day, April 21st, 2012. MSGC helped arrange the associated visits by Dr. David Levy and Jaime Waydo. MSGC also had interactive booths for our general program, and for our BOREALIS, SPOT, and National Student Solar Spectrograph Competition programs. A total of 850 people attended the event, calling it 'AWESOME!'. For Astronomy Day, April 20th, 2013 MSGC has helped arrange the associated visits by Brian Larson and Jaime Waydo and will again host interactive booths at the event. [EP1],[EP7]

- The Director represents MSGC on the Tribal College and University Program (an NSF STEM higher education program) boards for Chief Dull Knife College and Stone Child College. The Director also represents MSGC on the MSU Women In Science and Engineering (WISE) committee and the Montana Big Sky Space Education Evaluation Committee. [EP1],[EP7]

- MSGC helped with the fund raising for the Museum of the Rockies Taylor Planetarium upgrade to state of the art Digistar-5 planetarium technology. MSGC staff and students volunteered at the Planetarium telethon fundraiser event.

- Volunteer activities include: Science Olympiad: several MSGC staff and students volunteered. FIRST Lego League and FIRST Tech Challenge Tournament: seven MSGC staff and students

volunteered for the Montana regional tournament in February, 2012. Montana Regional Middle School and Montana Regional High School Science Bowls: the MSGC director volunteered for and gave the welcome addresses (talking about MSGC) to hundreds of students at the competitions in February, 2012. [EP1]

- On Tuesday, June 5, 2012 MSGC hosted a Transit of Venus viewing event at the MSU football stadium that attracted 2,000 visitors of all ages. The celebration offered educational booths, activities for children, and a chance for curious stargazers to take a look directly at the sun through solar viewing glasses handed out at the gate or through telescopes with filters set up by the local astronomy club. The transit was also shown live on the big screen of the stadium scoreboard. Even though rain, lightning, and even a little hail threatened the event shortly after MSU President Waded Cruzado gave her opening remarks patient viewers got their chance to see Venus as it passed across the Sun for the last time in over 100 years. [EP1],[EP7]

- In 2013 the Celebrating Einstein events initially funded by an Education Enhancement grant from MSGC tripled their initial budget with funding from Montana State University and NSF EPSCoR reaching over 5000 participants from the public, local K-12 schools, higher education students, and science community with a wide variety of events including Celebrating Einstein in the Schools, the Speaking of Einstein public lecture series, the Black (W)hole art installation, and the grand finale A Shout Across Time live music, dance, and film events at the Emerson Center for the Arts and Culture in Bozeman. All of the products are currently being packaged for distribution so other communities can host similar Celebrating Einstein events. [EP1],[EP7]

PROGRAM CONTRIBUTIONS TO PART MEASURES

Student Data and Longitudinal Tracking:

Clarification note: as instructed, the numbers below are for FY 2012 base data ONLY. Some awards allocated on FY12 base funding, such as undergraduate research stipends and student support associated with the UM BOREALIS program have not yet been made. See 'Program Accomplishments' section above for LT highlights from FY 2011 students.

Total awards so far = 122; Fellowship/Scholarship = 41, Higher Education/Research Infrastructure = 81; 33% of the total awards were made to females and 9% to underrepresented minority students. F/S funding; 32% of the total awards were to females and 20% to underrepresented minorities. HE/RI funding; 33% of the total awards were to females and 4% to underrepresented minorities. Total major awards = 58; all but 3 are still enrolled. Of the 3 students not still enrolled one is pursuing an advanced STEM degree, one is employed in a STEM field, one is seeking STEM employment.

Minority-Serving Institutions:

Activities with our MSIs are highlighted in the Program Accomplishments: Outcome1: 1e and 2e sections.

NASA Education Priorities:

Accomplishments related to NASA Education Priorities are given in the ‘Program Accomplishments’, ‘Program Contributions to PART Measures’, or ‘Improvements’ sections. See references above to numbered Education Priorities: EP1. Hands-on student experiences, EP2. Middle school teachers, EP3. Summer opportunities for secondary students, EP4. Community colleges, EP5. Aeronautics research, EP6. Environmental Science and GCC, EP7. Diversity, EP8. Innovative research infrastructure.

IMPROVEMENTS MADE IN THE PAST YEAR

For MTSGC, FY12 has been a year of digging deep, listening to needs, and finding ways to maximize our impact. The 27% reduction in our core budget between FY11 and FY12 has led us to dig deep and seek new and different avenues to keep our longstanding, successful programs alive. For example, we are seeking to gain donor support and/or find corporate sponsors for our Space Public Outreach Team (SPOT), which visited over 13,000 Montana K-12 students last year, as well as our BOREALIS scientific high altitude ballooning program. At our annual Affiliates’ Meeting, we listened closely to the diverse needs of our 19 Academic Affiliates and are now acting on those needs. MTSGC is also working to find ways to maximize our impact, including working with NASA Center Education partners and our Advisory Board. Via digging deep, listening to needs, and finding ways to maximize our impact, we are refining the purpose of MTSGC as appropriate for the current status of federal funding and Montana’s STEM students.

- MSU Foundation/program institutionalization Two official initiatives with the Montana State University (MSU) Foundation - SPOT and BOREALIS - were approved by the MSU president. It will take time to see any significant results, but the Foundation is strongly behind the effort, which is focused primarily on MTSGC alumni. Three BOREALIS students have already received Foundation Presidential Emerging Scholar awards totalling \$9,000 for summer 2013.

- Affiliate meeting breakout for needs At our 21st annual Affiliates’ Meeting in September, we asked for feedback on the needs of Montana’s higher education institutions. In response that feedback, we have started or are in the process of starting three new programs. These programs are the Blimp Workshops, Faculty Supplies program, and Montana Aerospace Workshops and are focused on our Tribal Colleges, small colleges, and larger institutions and aerospace industry respectively. The Supplies program and Workshop are already being carried out by MT NASA EPSCoR. We are in the staff and funding identification and planning stages for blimp workshops. In addition to fulfilling needs, these programs will help to maximize our impact with a relatively small amount of funding.

- NASA Education Activity Training (NEAT) National Expansion NASA EPOESS Proposal. MTSGC will submit a NASA EPOESS proposal in May in partnership with Goddard Space Flight Center education staff to expand our pilot NEAT program to hubs in 20 diverse locations across the US.

- Advisory Board focus on Alumni. We are working with the MTSGC Advisory Board on capitalizing on our numerous alumni. Many of our alumni are now in positions where they want to give back. A Board subcommittee will work to identify ways our alumni can best contribute.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Academic Affiliates:

Aaniiih Nakoda College, Harlem, MT; Blackfeet Community College, Browning, MT; Carroll College, Helena, MT; Dawson Community College, Glendive, MT; Flathead Valley Community College, Kalispell, MT; Fort Peck Community College, Poplar, MT; Little Big Horn College, Crow Agency, MT; Miles Community College, Miles City, MT; Montana State University, Bozeman, MT; Montana State University-Billings, Billings, MT; Montana State University-Northern, Havre, MT; Montana Tech, Butte, MT; Rocky Mountain College, Billings, MT; Salish Kootenai College, Pablo, MT; Stone Child College, Box Elder, MT; University of Great Falls, Great Falls, MT; University of Montana, Missoula, MT; University of Montana-Western, Dillon, MT

Industrial Affiliates:

Anasphere, Inc., Bozeman, MT

All 19 institutions of higher education in Montana are MSGC Academic Affiliates. Only two members of the Consortium – Montana State University-Bozeman and the University of Montana-Missoula are Research Universities offering the Ph.D. degree in fields of science (MSU and UM) and engineering (MSU only). Montana Tech offers Master's degree studies in engineering. In STEM fields, MSU-Billings, Rocky Mountain College, UM-Western, Salish Kootenai College, MSU-Northern, Carroll College, and the University of Great Falls offer Bachelors degree studies. The remaining nine affiliates, including six of the tribal colleges, are two-year institutions. Enrollments at MSGC affiliates range from about 13,000 students at Montana State University to less than 200 at Aaniiih Nakoda and Stone Child Colleges.

In FY12, ALL of our 19 Academic Affiliate institutions were 'active', meaning they were involved in at least one MSGC program during the year! Below is a list of the institutions and the primary programs they participated in. It is always our goal to garner as broad of Affiliate participation as possible in all programs.

- o Aaniiih Nakoda College: remote sensing/BOREALIS, aurora detector, Affiliates' Meeting
- o Blackfeet Community College: scholarship, aurora detector, remote sensing/BOREALIS
- o Carroll College: scholarship, undergraduate research
- o Dawson Community College: MSGC staff visit
- o Flathead Valley Community College: scholarship, undergraduate research, National Student Solar Spectrograph Competition (NSSSC), MSRS, Affiliates' Meeting
- o Fort Peck Community College: remote sensing/BOREALIS, aurora detector
- o Little Big Horn College: scholarship, remote sensing/BOREALIS, aurora detector, MSGC staff visit
- o Miles Community College: scholarship, NSSSC, MSRS, MSGC staff visit, Affiliates' Meeting

- o Montana State University: scholarship, fellowship, BOREALIS, undergraduate research, education enhancement grants, SPOT, student satellites, NSSSC, NASA internship, MSRS, Affiliates' Meeting
- o Montana State University-Billings: scholarship, undergraduate research, MSRS, MSGC staff visit, Affiliates' Meeting
- o Montana State University-Northern: scholarship
- o Montana Tech: scholarship, undergraduate research, MSRS, Affiliates' Meeting
- o Rocky Mountain College: scholarship, student satellite internship, undergraduate research, MSRS, MSGC staff visit, Affiliates' Meeting
- o Salish Kootenai College: scholarship, undergraduate research, remote sensing/BOREALIS, aurora detector, MSRS, student satellites (mostly NASA TCUP funding), NASA internships, Affiliates' Meeting
- o Stone Child College: scholarship, remote sensing/BOREALIS, aurora detector, MSRS, Affiliates' Meeting
- o University of Great Falls: scholarship, undergraduate research, MSRS, education enhancement grant, Affiliates' Meeting
- o University of Montana: scholarship, fellowship, BOREALIS, undergraduate research, NSSSC, MSRS, MSGC staff visit, Affiliates' Meeting
- o University of Montana-Western: scholarship, NASA internship, MSRS, undergraduate research

The National Space Grant Office requires two annual reports, this Annual Performance Data Report (APD) and the Office of Education Performance Measurement System (OEPM) report. The former is primarily narrative and the latter data intensive. Because the reporting timeline cycles are different, data in the two reports may not necessarily agree at the time of report submission. OEPM data are used for official reporting.