The National Space Grant Office requires two annual reports, the Annual Performance Data Report (APD – this document) 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.

Alaska Space Grant Consortium
Lead Institution: University of Alaska Fairbanks
Director: Dr. Denise Thorsen
Telephone Number: 907-474-6833
Consortium URL: http://spacegrant.alaska.edu
Grant Number: NNX10A167H

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 Alaska Space Grant Consortium is a Program Grant Consortium funded at a level of $430,000 for fiscal year 2014.

PROGRAM GOALS

Outcome 1: Contribute to the Development of the STEM Workforce (Employ and Educate)

Diversity:

Goal: Encourage participation of female and underrepresented minority students and faculty in Alaska Space Grant Programs.

Objectives:

1. Work to engage our minority population at the Affiliate institutions through American Indian Science and Engineering Society (AISES), Alaska Native Science and Engineering Program (ANSEP) and our Affiliate representatives. Add at least one additional minority fellowship/scholarship application per year until we reach or exceed our stated minority goal.

2. Expand our affiliate organization to include the minority serving rural campuses within the UA system and Ilisagvik College, Barrow, AK. Add one new minority affiliate/year until all Higher Ed campuses in Alaska are represented.
3. Recruit at our rural campuses for summer fellowships to NASA and to our main campus's. Obtain at least one minority student application from a rural campus/year.

Fellowship:/Scholarship Program:

Goal: Provide a program that supports workforce development by pumping the STEM "pipeline" through offering a sequence of competitive scholarship (to engage students early in their career) and fellowship (to provide "authentic" research and engineering experiences) opportunities to Alaskan students from diverse populations in STEM, and related education disciplines at Affiliate member institutions. Fellowship/scholarships will be provided equitably across the state with an emphasis on achieving and maintaining diversity in numbers of applicants and awardees.

Objectives:

1. Recruit at least one applicant per year for an internship or summer program at a NASA center. By 2011 recruit at least one applicant per 4 year affiliate institution per year.
2. Each year, at least one early career scholarship will be awarded at each affiliate institution to a freshman, sophomore or a student transitioning from a rural campus to a 4 year degree program.
3. Every year, at least one fellowship will be awarded at each affiliate institution that has a 4 year STEM degree program or to a rural student performing summer research at an affiliate 4 year degree institution.
4. At least one additional fellowship/scholarship will be awarded per year to an appropriate minority applicant until we reach or exceed our stated minority goal.

Research Infrastructure Program:

Goal: Provide research initiation grants in strategic areas to improve collaboration between Alaska and NASA researchers and to improve the ability of Alaskan researchers to compete for NASA research and development work.

Objectives:

1. At each Affiliate institution identify and support expertise in areas of interest to NASA. By 2012 at least one strategic area of interest will be identified at every Affiliate institution with a 4 year STEM degree program.
2. Build capacity and expertise in the aerospace program at UAF to successfully respond to NSF and NASA solicitations for small satellite missions. By 2012 a small satellite proposal will be submitted.
3. Provide a venue for researchers across the state to meet and develop inter-institutional collaborations. The Alaska Space Grant first annual symposium will be held in May 2010. At least one collaborative research infrastructure project will be awarded by 2012.

Higher Education Program:

Goal: Provide support for interdisciplinary team activities and events that act to synthesis a student's degree program and connect students to NASA higher education programs.

Provide support for curriculum development/modification for the inclusion of NASA relevant topics.

Objectives:

1. By 2012 create an "Alaska Space Grant Grand Challenge" competition with teams at each of our rural affiliate institutions to provide "authentic" research and/or engineering experiences on our minority serving campuses.
2. In 2010, Alaska Space Grant will host their first annual symposium where students may present their research projects. In 2010, 50% of all students receiving fellowship awards or participating in Alaska Space Grant supported higher education activities will present their work either at the Alaska Space Grant Symposium or at some other professional conference. By 2015 over 90% of these students will be presenting their work.
3. Promote NASA higher education programs at our affiliate institutions. At least one student or team will participate in a NASA higher education program every year.
4. Continue to support NASA relevant Higher Education programs at each Affiliate institution that contribute to the overall employment rate in STEM fields. 90% of all students participating in Higher Education programs will continue to graduate school, a career in STEM field, or pre-college teacher training.

Outcome 2: Attract and Retain Students in STEM Disciplines (Educate and Engage)

Precollege Program:

Goal: Provide support for Alaska pre-college STEM education with emphases on NASA content, teacher training, and delivery to underrepresented group.

Objectives:

1. Increase the STEM content knowledge of Alaska's pre-college teachers through teacher professional development. All ASGP sponsored professional development programs will show increased STEM content knowledge.
2. Support rural teacher professional development with summer programs and/or distance delivery programs. At least one professional development project/class targeting rural teachers will be supported each year.
3. Support standards based curriculum development in STEM fields connecting NASA relevant materials to the classroom. All curricula will be standards based and be freely available through the ASGP and/or our affiliate's website.
4. Provide limited support for student involvement activities to inspire interest in STEM fields and careers that specifically target underrepresented students. Each student involvement activity will show increased interest in pursuing STEM education and/or careers.

Outcome 3: Build strategic partnerships and linkages between STEM formal and informal education providers (Engage and Inspire)

Informal Education Program

Goal: Encourage all funded students and projects to seek out opportunities to participate in informal activities to showcase their specific research to the public. (Revised goal from FY13 progress report.)

Objectives:

1. 50% of all funded students and projects will have an informal education component.

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

Math Day: (Outcome 2)

"Math is everywhere," says Donna Hill, a business major at UAF. Hill is standing next to a workstation on wind turbines. The station is surrounded by a bevy of 6th graders; all wide-eyed and enthusiastic. Hill, who developed the business plan for a real-life wind turbine project, lent a hand during Math Day. The students in front of her have been given a math equation; a way to find the power output of a model turbine. The kids around her are advanced and show both interest and aptitude for the math and sciences. As a business major, math is not Hill's forte. But the kids? "They are just right on it," she says. "Some of them are doing the math in their heads, too! They're really impressive kids." What stands out is their fascination with the project. "They're all interested, they're not bored. It's really nice to see this," Hill said.

Math Day offered a wide array of math-related workshops including the role of math in caribou surveys, tracking walruses on ice floes, practical economics, paleontology and weather forecasting. A focus on the future, and the development of a deep passion and knowledge of STEM disciplines, was a major motivating factor behind Math Day. "The importance of Math Day is to show all students how math is important in different areas and in different fields," Wuttig said. "They're seeing where the math fits in a lot of different disciplines," said Darter. Students at Math Day learn how math can be used both theoretically and practically. "So much of what we hear kids say is 'Why do I want to know this? Why do I need to know this? How am I ever going to use this?' This answers those questions," Darter said. "Anything the university can do to get these children thinking about [their university education], even at this level, changes their focus and changes their course," he added.

After last year's Math Day, Darter bore witness to his student's excitement. "They were just buzzing," he said. The students rattled off all the things they could do, and all the places they could go, if they were good at math. Naturally, word of this year's event spread like wildfire. "The kids this year we're talking about [today] days in advance," Darter said. It's no surprise, since the student's at Math Day are among the best and brightest; among the top 8 percent of students in their age group. These are the students who, year after year, sit in a math class and wait for their peers to catch-up, said Darter. "This was their chance, for once, to not have to sit and wait. To fly and to fly with kids who thought just as fast as they did and learned just as quickly as they did," Darter said.

"[Math Day] helps you look at math in a different way," Madelaine Muramoto (6th grader) said. "It's not boring, or something you learn from a textbook, but something you can use in real life." When the bell rang, the students who attended Math Day achieved every teacher's ideal: to have fun and learn at the same time. By this point, word has no doubt spread about next year's event.

PROGRAM ACCOMPLISHMENTS

Outcome 1: Contribute to the Development of the STEM Workforce (Employ and Educate)

Diversity: This section reflects total diversity in the program with respect to student engagement in Fellowships, Scholarships, Higher Education projects, and Research Infrastructure (Graduate Student) projects. In FY14 (i.e. 6/1/2014-5/31/2015) our total student engagement was 31.0% woman (25.0% - FS, 66.7% - RI, 25.0% - HE) and 33.3% minority (37.5% - FS, 16.7% - RI, 25.0% - HE). For FY14 Diversity Objective 1 was met overall and specifically for FS awards and HE engagement. We had no applications from a rural campus FY14 (Diversity Objective 3 not met).

Fellowship/Scholarships: 6 NASA internship applications (3–UAF, 3–UAA: FS: Objective 1 partially met), 3 selected by NASA, 0% female, 33% minority. Awarded: fellowships 12 applications, 11 awards (1-APU, 3-UAA, 7-UAF: FS Objective 4 mostly met), 27.3% female, 27.3% minority; scholarships 28 applicants (9-UAA, 15-UAF, 4-APU: FS Objective 3 partially met) 17 awards, 23.5% female, 47.1% minority. Cumulative rate of fellowship/scholarship awards in underrepresented minorities in FY2014 was 37.5% (FS Objective 5 met) (compared to 36% in FY13; 17.2% in FY12; 24.2% in FY11; 25.0% in FY10; 11.4% in FY09; 7.1% in FY08)

Research Infrastructure: 6th annual Alaska Space Grant/NASA EPSCoR Education and Research Symposium was held in Fairbanks April 2015 (RI Objective 3 partially met). We have yet to see a collaborative proposal. The Research Infrastructure program was restructured in 2013 to award research fellowships to graduate students working on NASA relevant research rather than providing mini-grants to faculty. Graduate Research Grants: 9 applications, 6 awards (2-APU, 4-UAF: RI Objective 1: partially met), 66% female, 16.7% minority. The ASGP sponsored Space Systems Engineering Program submitted a small satellite proposal to the JPL Europa Concept call and were 1 on 10 universities selected (RI Objective 2: MET!).

Higher Education: 6th annual Alaska Space Grant/NASA EPSCoR Education and Research Symposium was held in Fairbanks April 2015. 100% of undergraduate and graduate research fellowship presented in 2014 (HE Objective 2 met). Longitudinal tracking of participating students for FY14 will be compiled this summer after graduation. In FY13, 100% of students taking the "next step" stepped into graduate school, a STEM profession, or pre-college teaching (HE Objective 4: met). Three affiliates (APU, UAA, UAF) conducted hands-on authentic research and/or engineering experiences that include NASA relevant topics either through revised/developed courses or extra-curricular programs (HE Objective 3 mostly met). On new course was developed at APU. UAA participated in NASA's University Student Launch Initiative for the first time. UAF delivered the first CubeSat designed and built by Alaska students. UAF also connected with JSC to collaborate on student projects in a Capstone embedded systems engineering course. One student presented at JSC during the Wearable Technology Symposium.

<u>Outcome 2: Attract and Retain Students in STEM Disciplines (Educate and Engage)</u>

Precollege Program: Due to the turnover in affiliate representatives no pre-college proposal was submitted for the FY14 annual call. Over the course of the following six months we identified a need to support 4 modules for the Alaska Summer Research Academy. The Alaska Summer Research Academy is a two week learning experience for students with an interest in science, technology, engineering, and math. Students participate in project based learning in a college-like environment. The four modules

sponsored by the Alaska Space Grant Program are: Permafrost: Secrets in Ice, Computer Science and Web-Based Programming, BLIMPS 101 (unmanned aerial vehicles), Engineering Extreme Energy. These modules will be conducted during the summer of 2015 and therefore cannot be currently reported on. We continue to coordinate Math Day at UAF campus. This is a collaborative project with the Fairbanks School District to provide 6th grade students the opportunity to explore how math is used in different disciplines. Two education fellowships were awarded. One fellowship recipient created a module "Space and climatic science through the eyes of birds for Teachers" which will be added to an existing online course developed previously through an ASGP pre-college grant (PC Objective 1-3: met). The second fellowship recipient developed collaboration with the Fairbanks North Star Borough School District to train UAF STEM students and connect then with classrooms to present STEM hands-on STEM enrichment activities (PC Objective 4: met).

Outcome 3: Build strategic partnerships and linkages between STEM formal and informal education providers (Engage and Inspire)

Informal Education Program: Both the UAF and UAA HE programs participate in informal education activities. The students in the UAF Space Systems Engineering Program provided hands-on rocket building activities to families attending the 2015 Engineering Open House. The UAA HE students who participated in the University Student Launch Initiative also supported informal education activities through a public viewing of their test launch. (IE Objective 1: met).

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Diversity**: Diversity of student participants was discussed under Program Accomplishments: Outcome 1. In FY14 (i.e. 6/1/2014-5/31/2015) our total student engagement was 31.0% woman (25.0% - FS, 66.7% - RI, 25.0% - HE) and 33.3% minority (37.5% - FS, 16.7% - RI, 25.0% - HE). Our affiliate institutions include the three major academic units in the UA system (UAA – urban 4-year, UAF – research 4-year, UAS – regional 4-year), CRCD (embedded college in UAF, includes MSI campuses and serves the community college mission) and APU (private 4-year). These institutions encompass 90% of all students attending higher education in Alaska.
- **Minority-Serving Institution Collaborations:** This year we attempted to encourage and support the submission of a proposal to the MUREP program from one of the MSI campuses contained in CRCD. We got as far as a NOI for one submission and actually managed to submit for a second opportunity. That proposal is currently under review.
- **NASA Education Priorities:**
  Authentic, hands-on student experiences: APU, UAA, and UAF each conducted hands-on authentic research and/or engineering experiences that include NASA relevant topics through either space grant funded higher education projects or undergraduate and graduate research fellowships.
  Integrating Unmanned Aircraft Systems into Undergraduate Geoscience Education and Research (APU): This project investigated the legal and technical barriers to

including unmanned aircraft systems (UAS) in undergraduate geoscience education and research at APU with the goal of using UAS in two month-long intensive field courses.

University Student Launch Initiative (UAA): This project supported a capstone design class which developed a rocket and payload for NASA's University Student Launch Initiative.

Wearable Technology Cluster (UAF): This project supported the integration of UAF embedded system capstone design class into the wearable technology cluster coordinated by Johnson Space Center. Students developed a wireless sensor network for soft goods structures.

Space Systems Engineering Program (UAF): This project provides interdisciplinary students with hands-on experience in all aspects of space systems engineering through a design, build, launch paradigm applied to balloon and rocket payloads and small satellites. This year we delivered our first CubeSat: ARC1.

Engage middle school teachers in hands-on curriculum enhancement: Both our education fellowship recipients directly or indirectly engaged middle school teachers in hands-on curriculum. For the project which connected UAF STEM students to local classrooms the teachers were engaged indirectly by participating in the hands-on activity along with their students. For the project which provided additional module for a professional development course, teachers were engaged directly in the material.

Summer opportunities for secondary students on college campuses: As discussed in Program Accomplishments Objective 2, we have provided support for 4 modules at the Alaska Research Summer Academy which specifically provides summer opportunities for secondary students on college campuses.

Community Colleges: ASGP affiliate, the college of Rural and Community Development (CRCD) acts as an umbrella institution supporting the community college mission for five Alaska Native minority serving rural campuses and one community campus in Fairbanks. No projects were supported at CRCD this year. However, we did support the submission of a proposal to the MUREP program.

Aeronautics research: One of the undergraduate research fellowship projects this year was related to Aeronautics research. Specifically this student investigated composite fiber layering in terms of fiber selection and which system of fiber layering optimizes the strength-to-weight ratio for the application aircraft frames.

Environmental Science and Global Climate Change: A large percentage of the graduate research grants and undergraduate research fellowship awards touch on issues surrounding Environmental Science and Global Climate change. These are important topics for the state of Alaska as the rapid climatic change in the arctic is intimately apparent. This year's topics include: The role of biota in snowmelt on glaciers in Alaska; Integrating multiplatform remote sensing and field data to estimate energy fluxes under snow conditions in Arctic ecosystems; Eklutna Alaska Watershed; The Neotectonic framework of the Talkeetna Mountains, southcentral Alaska; Sea ice influence on benthic community variability in the Alaska Arctic shelves; Recent changes in shrub distribution and abundance in the Chugach Mountains, Alaska.

Enhance the capacity of institutions to support innovative research infrastructure: Alaska Space Grant supported six graduate research grants to support the growth of

NASA relevant research in Alaska. Through our Space Systems Engineering Program we have grown our small satellite research capability such that we were one of ten universities awarded a small grant to develop a concept study for a CubeSat tag-along on the Europa Clipper mission. Finally we worked extensively this year with CRCD on two separate submissions to the MUREP program. One actually was submitted!

IMPROVEMENTS MADE IN THE PAST YEAR

- Alaska Space Grant Program had a 50% turn-over in affiliate directors and board of directors. This caused significant disruption in the program. Specifically both UAA and UAS lost both their affiliate representative and member on the board of directors to retirement and/or change of position. Additionally, both the Challenger Learning Center and JEDC also changed their affiliate representatives. Given this dramatic change, the largest improvement this year is educating the new participants on the mission and opportunities of the Alaska Space Grant Program
- Worked with CRCD to submit a proposal to the MUREP program.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

- **University of Alaska Fairbanks (UAF)** – Lead institution, research center for the statewide university system, and only PhD granting institution in the state of Alaska. *Participated in fellowship/scholarship, research infrastructure, higher education, and pre-college programs this year.*
- **University of Alaska Anchorage (UAA)** – Urban 4-year University serving the population center of Alaska. *Participated in fellowship/scholarship and higher education programs this year.*
- **University of Alaska Southeast (UAS)** – Regional 4-year University serving southeast Alaska. *No applicants from UAS for any programs.*
- **Alaska Pacific University (APU)** – Private 4-year University focusing on inquiry based learning in environmental sciences. *Participates in fellowship/scholarship and higher education programs.*
- **College of Rural and Community Development** – Community college serving Alaska Native students in rural Alaska. *No applicants from CRCD for any programs.*
- **Challenger Learning Center of Alaska** – Non-profit corporation focusing on hands-on precollege science programs. *No applicants from CLCA this year.*
- **Juneau Economic Development Council (JEDC)** – Non-profit corporation supporting K12 STEM education programs. *No applicants from JEDC this year.*