

Alaska Space Grant Program
University of Alaska Fairbanks
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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 Program is a Program Consortium funded at a level of \$430,000 for fiscal year 2011.

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 yr affiliate institution per year.
2. By spring 2011 the “Student Opportunities in Alaska” webpage connecting students to NASA “relevant” research projects and faculty will identify opportunities at every 4 yr institution.
3. 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 yr degree program.
4. Every year, at least one fellowship will be awarded at each affiliate institution that has a 4 yr STEM degree program or to a rural student performing summer research at an affiliate 4 yr degree institution.
5. 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: Provide support for professional development of informal education providers and informal education programs that use NASA themes and content and/or Alaska Native "ways of knowing" to enhance participant awareness and knowledge of NASA mission activities, STEM disciplines and career opportunities.

Objectives:

1. Connect informal education providers to NASA relevant research conducted in Alaska through the Alaska Space Grant Symposium to collaboratively develop Alaska/NASA specific informal education programs and professional development opportunities. Identify at least one new informal education activity each year.
2. Facilitate at least one annual training session to equip informal science educators with the knowledge and skills needed to deliver NASA aerospace content that will effectively engage large numbers of participants.

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

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

UAF team participates in NASA Undergraduate Student Launch Initiative (story by Jeremia

Schrock): When people think of halibut, they don't often think of rocketry. For students Andrew Paxson and Wyatt Rehder, however, the bottom-feeding flat fish and the ability to go into space are linked. Both Paxson and Rehder are from the fishing-heavy Kenai Peninsula and both are rocket scientists. Since last summer, Paxson and Rehder have been developing a way to send a rocket precisely one mile into the atmosphere. As team-leaders of the University of Alaska "Heaven Bound Halibut" rocket team, consisting of roughly a dozen students, the one-mile mark is significant. Their project is part of the NASA Undergraduate Student Launch Initiative, a nationwide competition that will bring together 42 teams of student scientists whose goal is to design and launch the best rocket. The team whose rocket is closest to the one-mile mark will received a \$5,000 cash prize and, of course, bragging rights. By April, the Heaven Bound

Halibut team will have constructed a 55 pound rocket that will be roughly 11 feet long, but only 6 inches wide. “It’s obscenely long for most rockets,” Paxson said. The rocket will also be used to test a CubeSat (a miniature satellite) other students in the Alaska Space Grant Program are building. The rocket will be guided by an Attitude Control and Determination System (ACDS), designed and built by Rehder. There are only a few examples of amateurs building such a system and even fewer which were successful, he said. The system will be controlled by a LINUX computer. “You could watch videos on it if you wanted to,” Rehder said. Their rocket is unique in the competition for two reasons: it’s the largest (by six inches) and it has the biggest motor. The motor is so huge, in fact, that Rehder estimates it could easily move a vehicle. At 550 horsepower, it has the thrust of a car built for street racing. However, cars are usually several thousand pounds whereas the Heaven Bound Halibut rocket is just over 50 pounds. “This thing really books it,” Paxson said. In March, the team will hold several test launches. In mid-April, the team will travel to Huntsville, AL – a hub for aerospace engineering – to show off their honed technical craft during the NASA competition. “I think we’ll surprise them with what we’re doing up here,” Rehder said. (<http://www.hbhalibut.org/>)

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

LEGOs make robotics fun for Alaska youth (story by Robert Parsons and Jeremia Schrock): If robots weren’t fun already, Dr. Robert Parsons has found a way to make them even more enjoyable. As part of the Alaska Space Grant Program’s pre-college project, Parsons has reached out to Alaska’s youth in order to make science more fun and interesting. He does so by using a toy familiar to many children: LEGO’s. _The LEGO pieces – small plastic construction blocks originally developed in the late 1940’s – are used to make robots. Students involved in the program learn how to build functional robots, as well as how to move and manipulate their mechanical creations through a specially designed course. The endeavor is aimed at students of all ages, from elementary school through high school. As part of the Hunter Elementary after school program, students from the 4th to the 6th grade are taught programming skills for two months. Topics covered include conditionals, loops and nesting statements. “A fair whack of mathematics is involved and the fun of LEGOs makes this all possible,” Parsons said. The ASGP robotic project was designed to help foster robotics competitions across Alaska. Competitions have been held in the villages of Beaver and Venetie, as well as in Ft. Greely and Delta Junction. Competitions have also been held at Hunter Elementary and Lathrop High School in Fairbanks. _In Fairbanks, Parsons visits Hunter Elementary twice a week in order to take part in the FIRST Lego League (FLL). The league currently includes 16 students. Parsons is aided in the project by his daughter Heather (a Lathrop senior) and Keith Sheard, a UAF undergraduate in mechanical engineering. Chris Watson, a UAF physics graduate student, also assists with the program. The robotics program at Hunter Elementary is a collaboration between ASGP, Black Role Models Initiative (BRMI) and UAF’s Alaska Summer Research Academy (ASRA). Last summer, Parsons spent several hours each day at the Boys & Girls Club (BGC) of Fairbanks. He helped students build bottle rockets and launchers. After assembling a gaggle of brightly painted rockets, many hours of fun was spent launching them again and again. However, the program reaches beyond just training Fairbanks-based students. Parsons oversaw additional robotics training in Beaver and Venetie, villages located along the Yukon and Chandalar Rivers, respectively. In the winter, such rural locations can only be visited by dogsled or aircraft, which can makes outreach both difficult and dangerous. This winter, Parsons and his daughter flew into Beaver and Venetie for three days of FLL training in each village. For the last two years, the robotics team from Beaver has competed in the Fairbanks tournaments. In

Venetie, both high school and middle school students were taught programming before being turned loose in the annual FLL competition. In Alaska, the seat for a bush planes co-pilot is oftentimes used for passengers, said Parsons. This past winter, in his flight out to Beaver and Venetie, more than seventy pounds worth of LEGOs sat up-front, strapped to the co-pilots seat. “If the plane goes down, we won’t be bored,” Parsons said.

(<http://newsminer.com/bookmark/16763806> for newspaper article)

PROGRAM ACCOMPLISHMENTS

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

Diversity: 55% of total fellowship/scholarship awards were given to women (36% scholarships, 64% fellowships). 24% of total fellowship/scholarship awards were given to minority students (27% scholarship, 23% fellowship). 25% of total awards to NASA interns were minority students.

Fellowship/Scholarship Program: 16 NASA internship applications, 4 selected by NASA all from UAF, 50% female, 25% minority. Awarded, fellowships 23 applications (APU, UAA, UAF) 17 awards, 67% female, 22% minority; scholarships 22 applicants (UAA, UAF, UAS) 11 awards, 36% female, 27% minority. Cumulative rate of awards in underrepresented minorities in FY2011 is 24% (compared to 29% in FY10, 17% in FY09, 8% in FY08)

Research Infrastructure: 3rd annual Alaska Space Grant/NASA EPSCoR Education and Research Symposium held in Fairbanks May 2012. Awarded 4 Research Infrastructure mini-grants (UAA, UAF(2), CRCD) to 2 female, 2 male PI’s (0 minority). Three undergraduate students (2 female, 0 minority), one graduate student (male, non-minority), and 4 others (4 male, 3 minority) were provided support under these mini-grants. Three graduate students responded to the NASA Space Technology Research Fellowships. Two of these students have been placed at JPL to jump-start their Master’s work and support building capacity and expertise in Aerospace at UAF in small satellite missions.

Higher Education: 3rd annual Alaska Space Grant/NASA EPSCoR Education and Research Symposium held in Fairbanks May 2012, 60% of funded fellowships presented. Sponsored one student team to participate in NASA University Student Launch Initiative (UAF). Longitudinal tracking of Higher Education students will be compiled this summer after graduation. Three courses were revised or developed to include NASA related topics (APU, CRCD, UAF). Four affiliates (APU, CRCD, UAF, UAS) conducted hands-on authentic research and/or engineering experiences that include NASA relevant topics either through revised/developed courses or extra-curricular programs. One revised course from last fiscal year was delivered face-to-face at UAF and via distance to UAS simultaneously. Second course from last fiscal year (ATMOS 101) was delivered via distance to 21 students in 8 different communities across Alaska.

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

Precollege Program: Pilot of a summer Educator Training program in Robotics. Nine teachers attended. Five teachers responded to email evaluations and indicated that they had used the materials presented at the camp in their classroom (UAF). Provided support for afterschool programs at a high school, title 1 elementary school and Boys and Girls Club (participation 33% minority) (UAF). Presented Educator Training in robotics in rural communities: Valdez, Petersburg, Barrow, Metlakatla, Sitka, Crow Village, Pelican, and Ketchikan (JEDC). Additional training was provided to Venetie and Beaver in collaboration with Alaska Summer Research Academy (ASRA) (UAF). Summer science camp was presented in rural Alaska to 24 Yup’ik high school students from across the Yukon-Kuskokwim Delta (CRCD). Additionally,

two teachers from Kwigillingok and Naknek participated. Camp focused on satellite tracking of Arctic Fox and presented satellite technology and earth observations.

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

Informal Education Program: Did not fund a dedicated informal education program this fiscal year. However, multiple funded higher education and precollege programs have an informal education component. Students in the UAF Space Systems Engineering Program provided hands-on activities (rocket building) to families attending the 2012 Engineering Open House, and presented their design challenges in local public school classrooms and the Boys and Girls Club. New discoveries by students attending the UAS Juneau Icefield Research Program field course are provided to Park Rangers for dissemination to cruise ship tourists who visit the South East glaciers.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- **Student Data and Longitudinal Tracking:** Fellowship/Scholarship: 62 applicants, 33 awards (FY11: 11 scholarships, 17 research fellowships, 1 industry summer internship, 4 NASA summer internships). All but the scholarships are longitudinally tracked and represent 21 individual students (one student received a NASA summer internship and a research fellowship in the subsequent academic year). Research Infrastructure and Higher Education program supported 22 students. Employment longitudinal tracking is accomplished at the end of the semester and is not yet available for this report.
- **Diversity:** 55% of all fellowship/scholarship awards were given to female students, 24% to underrepresented minorities students. 45% of the research infrastructure/higher education program supported students were female, 0% were minority. Additionally, three Yup'ik community members were supported via one of the research infrastructure awards.
- **Minority-Serving Institutions:** College of Rural and Community Development (CRCD) is an Alaska Native minority serving college within UAF, that acts as the umbrella College for multiple rural campuses. The Kuskokwim campus was awarded a research infrastructure, higher education, and pre-college grant during FY11. Results from these awards are described in the appropriate section.
- **NASA Education Priorities:**
 - Authentic, hands-on student experiences:*** APU, CRCD, UAF, and UAS each conduct hands-on authentic research and/or engineering experiences that include NASA relevant topics through space grant funded higher education projects.
 - Use of radio telescopes in an undergraduate environmental science curriculum (APU):** This course incorporated the use of a Very Small Radio Telescope (VSRT) to observe the 11 GHz line of ozone in the mesosphere and introduced students to the basic principles of remote sensing through construction of the radio telescope and subsequent ozone measurements.
 - Higher Ed STEM Training with an Ocean Observation System (CRCD):** Marine autonomous recording unit (MARU) was deployed in several thousand feet of water in the Aleutian Islands and recorded sounds from June, 2011 to September, 2011. Students at the Kuskokwim Campus then used this data as a basis to learn about bioacoustics, signal detection and processing, computation information management, physics, and marine mammal biology. Students learned to retrieve data from NOAA and NASA ocean and earth observation systems for the purpose of evaluating environmental data.

Space Systems Engineering Program (UAF): 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 worked on two projects:

- NASA University Student Launch Initiative
(<http://spacegrant.alaska.edu/content/uaf-team-participates-nasa-undergraduate-student-launch-initiative>)
- Alaska Research CubeSat
(<http://spacegrant.alaska.edu/content/alaska-research-cubesat-arc-selected-launch>)

Field Experience for Undergraduates (UAS): provides support for students to participate in a summer semester glaciology field course on the Juneau Ice Field (JIRP) and a 3 day field experience with the Friends of the Pleistocene (FOP). The glaciology field course provides meaningful, on-ice, glaciological research experiences for undergraduates who are seeking careers in the earth, environmental and climate sciences. The FOP field experience provide students with access to experts in Alaska's climate, soil, geomorphology, oceanography, anthropology, palynology and paleontology to gather and visit sites of interest that have yielded important information about the natural history of the region over the past 2 million years.

Engage middle school teachers in hands-on curriculum enhancement: This year pre-college programs provided Educator Professional Development in robotics both through a summer teacher institute (UAF) and through on-site training at a variety of rural communities (JEDC, UAF).

Community Colleges: ASGP affiliate, the college of Rural and Community Development (CRCD) acts as an umbrella institution for five Alaska Native minority serving rural campuses and one community campus in Fairbanks. Support was provided for several projects (research infrastructure, higher education, and pre-college) conducted at the Kuskokwim Campus.

Environmental Science and Global Climate Change: Most of the research infrastructure and higher education projects supported by Alaska Space Grant 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. Topics include: Predicting Hazard Zones of Airborne Volcanic Ash from Eruptions, Investigation of interior Alaska loess sources: reconstructing Quaternary glacial/interglacial storms, Time Series of Temperature and Salinity Profiles in the Coastal Ocean of the Northeastern Bering Sea, Glaciological Research Experience for Undergraduates, Higher Ed STEM Training with an Ocean Observation System.

Diversity of institutions, faculty, and student participants: Alaska Space Grant Program is comprised of affiliate institutions that represent 90% of the students in the state of Alaska. These institutions

Enhance capacity of institutions to support innovative research infrastructure: Alaska Space Grant Program has been working with CRCD, UAA, and UAS to increase their proposal submission rate. Alaska Space Grant Program has modified its BOD to include the Vice Provost for Research (Marsha Sousa) at UAS. After reviewing this year's project proposals she asked, "Why is UAS not proposing. We can do this!" Exactly!

IMPROVEMENTS MADE IN THE PAST YEAR

- Created improved website (<http://spacegrant.alaska.edu>) with more coherent access to funding opportunities. Still in the process of populating the site with faculty/student project stories.
- Created report templates for our Research Infrastructure, Higher Education, and Pre-College awards to standardize reporting and facilitate roll-up to required NASA reports.
- Modified complement of Alaska Space Grant Board of Directors to be more inclusive of institutions other than UAF. Also added a representative from the Alaska Department of Education and Early Development. (see <http://spacegrant.alaska.edu/About/BOD>)

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. *Participates in fellowship/scholarship, research infrastructure, higher education, and precollege programs.*
- **University of Alaska Anchorage (UAA)** – urban 4-year University serving the population center of Alaska. *Participates in fellowship/scholarship and research infrastructure programs.*
- **University of Alaska Southeast (UAS)** – regional 4-year University serving southeast Alaska. *Participates in fellowship/scholarship, and higher education 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. *Participates in fellowship/scholarship, research infrastructure and higher education programs.*
- **Challenger Learning Center of Alaska** – non-profit corporation focusing on hands-on precollege science programs. *Participates in pre-college and informal education programs.*
- **Anchorage Museum** – non-profit organization focuses on hands-on exhibits and inquiry-based programs in Space and Earth Science and Aerospace technology. *Participates in pre-college and informal education programs.*
- **Juneau Economic Development Council (JEDC)** – non-profit corporation supporting K12 STEM education programs. *Participates in pre-college programs.*