

## **FY15 Year 1 APD**

**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.**

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**LOB: NASA Internships, Fellowships, and Scholarships; STEM Engagement; Institutional Engagement; Educator Professional Development**

### **A. PROGRAM DESCRIPTION**

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The Alaska Space Grant Consortium is a Program Grant Consortium funded at a level of \$430,000 for fiscal year 2015.

### **B. PROGRAM GOALS**

#### ***Diversity:***

- Goal: Encourage participation of female and underrepresented minority students and faculty in Alaska Space Grants Programs (ASGP).
- Objective 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. Ensure that we meet or exceed our goal for female and underrepresented minority student participation.

- Objective 2: Continue to expand our affiliate organization to include the diversity of institutions in Alaska, focusing on minority institutions and those serving a community college mission. Add one additional higher education affiliate organization.

***Fellowship/Scholarship Program:***

- Goal: Provide a program that supports workforce development by pumping the STEM “pipeline” through offering a sequence of competitive scholarships (to engage students early in their career), fellowships (to provide “authentic” research and engineering experiences), and internships (to provide connections to NASA and Alaska’s aerospace industry) to Alaskan students from diverse populations in STEM, and related education disciplines at Affiliate member institutions. All internships, fellowships and scholarships will be provided equitably across the state with an emphasis on achieving and maintaining diversity in numbers of applicants and awardees.
- Objective 1: Every 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.
- Objective 2: 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.
- Objective 3: Recruit at least five applicants per year for a summer internship program at a NASA center or Alaska aerospace industry.
- Objective 4: Every year we will meet or exceed our stated minority goal for scholarship, fellowship, and internship awards.

***Higher Education Program:***

- Goal: Provide support for interdisciplinary team activities and events that act to synthesize 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.
- Objective 1: Through higher education projects, develop authentic connections with NASA. At least one new authentic NASA connection will be made every year.
- Objective 2: 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.
- Objective 3: 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.

***Research Infrastructure Program:***

- Goal: Provide research initiation graduate student awards 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.

- Objective 1: Connect Alaska graduate students to NASA researchers to support the development of collaborations between NASA and Alaska. At least one authentic connection per year between NASA and Alaska researchers will result in the successful submission of a follow on proposal and/or published paper.
- Objective 2: Support the professional development of graduate students. 90% of all graduate students participating in Research Initiation programs will continue in a STEM career.

***Precollege Program:***

- Goal: Provide support for Alaska precollege STEM education with emphasis on NASA content, teacher training, and delivery to underrepresented group.
- Objective 1: Support STEM education in rural districts through developing and delivering NASA related content through a stable suit of hands-on student-centric educational enrichment programs. Provide measureable positive impact to one additional rural school district per year.
- Objective 2: Connect university students majoring in STEM degrees with precollege students to conduct STEM activities and share their enthusiasm for their discipline. At least five different short-term activities per year. Impact 30+ students per activity.

***Informal Education Program:***

- Goal: Make informal education an integral part of all higher education and research infrastructure awards.
- Objective 1: All higher education and research infrastructure awards will contain a public outreach component.
- Objective 2: All higher education and research infrastructure awards will acknowledge NASA's and Alaska Space Grant's support of their project.

**C. PROGRAM/PROJECT BENEFITS TO PROGRAM AREAS**

The Space Systems Engineering Program (SSEP) provides interdisciplinary engineering and science 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. Patrick Wade recently graduated with a BS in Mechanical Engineering through UAF and participated in a variety of projects in the SSEP program, culminating in our CubeSat mission. We recently received an email from Patrick describing “*My Experience So Far*”

*My experiences at Space Grant were amazing and I, again, have to let you know how much you and the lab have helped me. I want to draw the parallels between what I am doing now and what I did in the lab, for the benefit of your current and future students.*

*There are many things that I am doing now during testing which are almost identical to what we did in the lab. In fact, we have the same 3-D printer that's in the mechanical department and the same (but much bigger) shaker table. I spend a lot of time writing documents, which is something we did a lot of [in the lab], and the format is almost identical. When it comes to design, my colleagues and I go to McMaster to look at bolts, and download CAD models.*

*We use both SolidWorks and Catia, but the emphasis is much stronger for Catia. Good and fast drawing skills is also expected, along with some basic understanding of Geometric Distancing and Tolerancing (GD&T), although the general belief is that it's confusing so you're just going to confuse the machine shop. We put a Bill of Materials on the first sheet of the drawing, and then put one part per sheet. We work closely with the machine shop to make sure they know exactly what we want when we send them the drawings, so communication and understanding machining processes is important. Due to the nature of my particular job, my work relies on many other people to do their job, so communication across disciplines is also extremely important. Speaking with the machine shop and with other engineers are both skills I learned in the lab. The many hours in the machine shop have made a huge difference (even though I don't touch any machines anymore), as well as talking with Jesse and Morgan about what they do on the electrical side.*

Patrick now works for The Spaceship Company (TSC) as an Associate Test Engineer for Integrated Vehicle Ground Test.

#### D. PROGRAM ACCOMPLISHMENTS

- NASA Internships, Fellowships, and Scholarships (NIFS): NIFS target metrics for year 1 included 10 scholarships, 13 undergraduate research fellowships, and 5 undergraduate internships. Although we funded students during FY15, they were funded through the no-cost extension of the 2010 award and therefore will not be reported here (NIFS: Objectives 1-2, 4 not met for this grant). We did recruit 13 applicants for 2016 summer internships at NASA and Alaska aerospace industries (NIFS: Objective 3 met).
- Higher Education (HE) projects: HE target metrics for year 1 include funding of 4 HE projects, including the Space Systems Engineering Program (SSEP) at UAF, which lead to: one authentic NASA connection, one student team participating in NASA related competition, and continued support of HE projects at each affiliate institution that contribute to overall STEM employment rates. Through the SSEP project we have (i) developed an authentic connection with NASA by infusing JSP projects into a capstone class in electrical engineering (HE: Objective 1 met), and (ii) developed our first AISES team to participate in Wisconsin Space Grant's First Nations Launch (HE: Objective 2 met). Additionally, we (i) facilitated the submission of a USIP proposal; (ii) continue to support the UAF CubeSat program; (iii) developed a collaboration with Bristol Bay campus in Dillingham to jointly design and manufacture small satellite components; and (iv) developed a collaboration with UAF ASME student group to support a team participating in the 2016 AIAA aircraft design competition.
- Research Infrastructure (RI) projects: RI target metrics for year 1 include funding 2 graduate student research grants that connect Alaska graduate students to NASA researchers and support graduate student professional development. Although we funded graduate students during FY15, they were funded through the no-cost extension of the 2010 award and therefore will not be reported here (RI: Objectives 1-2 not met).
- Precollege (PC) projects: PC target metrics for year 1 include funding 1 PC project which either supports STEM education in rural districts and/or connects university students majoring in STEM degrees with precollege students. Although we did not fund a specific PC project through this grant we did (i) organize and host UAF Math day which brings 6<sup>th</sup> grade students

to campus for a day of exploring how we use math everyday (see <http://spacegrant.alaska.edu/PreCollege/mathday> for topics); and (ii) facilitate engineering student involvement in rocket launches and other engineering activities in the Fairbanks public schools (PC: Objective 2 met).

- Informal Education (IE) projects: IE projects are not separately awarded. However, we do require that HE and RI awards contain a public outreach component. During year 1, the SSEP students (i) participated in the UAF engineering open house, building and launch paper rockets with over 400 children and parents attending the event; and (ii) participated in a variety of outreach activities related to the ARC1 launch including CEM advisory group presentations and newspaper and magazine articles (IE: Objective 1-2 met).

E. PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE GOALS

- **Diversity:** Alaska Space Grant does not currently have diversity numbers for FY15. The diversity numbers for NIFS will be reported on the 2010 grant final report. Diversity numbers for the HE project are not collected until end of the academic year, i.e. in May, and will be reported in OEPM.
- **Minority-Serving Institution Collaborations:** Alaska Space Grant participated in the 9<sup>th</sup> Western Alaska Interdisciplinary Science Conference and Forum (2016) (<https://seagrant.uaf.edu/conferences/waisc/2016/>) at the Bristol Bay Campus (BBC) in Dillingham where we presented at the Plenary session on Alaska Space Grant and participated in a Rural Science Education Panel. During this conference I met with faculty at the Bristol Bay Campus and developed the partnership between UAF main campus and UAF BBC campus to collaborate on the design and manufacturer of CubeSat components.
- **Office of Education Annual Performance Indicators:** Provide numerical values for consortium contributions to APIs.
  - APIED-15-1          0                          (Number of NIFS to racially or ethnically underrepresented students, women, and persons with disabilities.)
  - APIED-15-2          0                          (Number of educators.)
  - APIED-15-4          4                          (Number of informal education events.)
  - APIED-15-5         600                         (Number of K-12 students.)

F. IMPROVEMENTS MADE IN THE PAST YEAR

This year we focused on creating a more active affiliate organization and developing external collaborations.

After many years of working with UAA, we are seeing increased engagement as measured by the number of student application to the NIFS programs both internally and through OSSSI. This year UAA also submitted their first graduate student research initiation grant and their first higher education project grant. Additionally, we have developed a cadre of reviewers for our undergraduate and graduate research awards. This has made making the awards more efficient and timely.

Also this year we have developed several collaborations at the national level. Specifically, we have connected a UAF Electrical Engineering capstone design class with Johnson Space Center through the *Wearable Technologies CLUSTER*. Through this collaboration, JSC embeds NASA relevant projects into the capstone course. Students then present their designs at JSC during the Wearable Technology Symposium. Last spring there was one project presented, and this spring, there will be three projects presented. We are now trying to extend that collaboration to the Mechanical Engineering capstone design class.

Finally, we have developed a collaboration with the Oregon Space Grant to bring together the unique resources from each consortium to host a Student CubeSat Workshop during the summers of 2016 and 2017. The vision of the workshop is that students who are working on CubeSats and students who want to work on CubeSats would come together and talk about their systems, science missions, and trials and tribulations, to effectively learn from each other. The workshop would be BYOH (bring your own hardware). The intent is that it be a student workshop, led by students, for students. More updates will be available in the future for this project!

#### G. CURRENT AND PROJECTED CHALLENGES

Alaska's size and low population creates perpetual challenges in running the Alaska Space Grant Program. The vast distances between institutions makes everything more difficult including meeting on a regular basis and developing collaborations. The cost of travel, in both money and time, is frequently prohibitive. Our inability to visit with each institution annually makes it difficult to help them manage their projects, think of new projects, and understand how they can participate in the program. This education comes slowly, frequently taking years of constant discussions, and then the affiliate representative for an institution changes and the years of education starts all over again. These are perpetual challenges that we do not see changing in at any future time.

We are however trying to mitigate the impact of these challenges. Ideas have frequently come from the national meeting Interactive Flipped Meeting sessions. One idea that we will be trying out is to have more than one affiliate representative at each institution. Low population means a lack of critical mass for a vibrant organization. Multiple affiliates at each institution will help us achieve critical mass and will help with the inevitable transitions of the affiliate representatives. Instituting this change will be discussed at the upcoming affiliate meeting.

There is some confusion on which Alaska post-secondary institutions can be classified as minority-serving. According to the list of Eligible Institutions for Title III and Title V Programs FY2015, certain UA campuses qualify. Specifically, UAF Interior Aleutians campus in Fairbanks qualifies, but UAF main campus and UAF CTC campus, both also in Fairbanks, do not qualify.

Lastly, the state of Alaska is currently experiencing significant fiscal difficulties due to a downturn in the oil industry. This has adversely impacted the state's budget which has impacted the universities budget. After last year's cuts, the UA budget has been further reduced by nearly \$51 million from the current level of state funding. This impacts UA's ability to (i) finish the UAF engineering building which would provide Alaska Space Grant SSEP lab with 50% more space, (ii) provide travel match for Alaska students attending NASA competitions (travel being the largest

cost for Alaska students to participate and difficult to fully fund from ASGP), and (iii) reduction in general support for the operation of the program.

#### H. PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

The Alaska Space Grant partners include the institutions listed below and represent the diversity of institutions in Alaska (Diversity: Objective 2 met). This year we were in a no-cost extension on our 2010 grant and so NIFS awards, RI graduate student grants, and most project execution were related with the 2010 grant in terms of budget expenditure and not reported here.

- **University of Alaska Fairbanks (UAF)** – Lead institution, research center for the statewide university system, and only Ph.D. granting institution in the state of Alaska. Facilitates Space Systems Engineering Program which acts as an umbrella for student team projects: CubeSats, AIAA competition, AISES First Nations Launch, JSC-UAF capstone engineering partnership. UAF partners with local school district for Math Day. UAF students present value added to STEM activities in local schools.
- **University of Alaska Anchorage (UAA)** – Urban 4-year University serving the population center of Alaska. Student team rocket launch reported on 2010 grant final report.
- **University of Alaska Southeast (UAS)** – Regional 4-year University serving southeast Alaska. No projects this year.
- **Alaska Pacific University (APU)** – Private 4-year University focusing on inquiry based learning in environmental sciences. Higher education project reported on 2010 grant final report.
- **College of Rural and Community Development** – Community college serving Alaska Native students in rural Alaska. Developing partnership with Bristol Bay Campus for collaborative design and manufacturer of CubeSat components.
- **Challenger Learning Center of Alaska** – non-profit Corporation focusing on hands-on precollege science programs. Pre-college projects reported on 2010 grant final report.
- **Juneau Economic Development Council (JEDC)** – non-profit Corporation supporting K12 STEM education programs. Pre-college projects reported on 2010 grant final report.