Alaska Space Grant News

Newsletter of the Alaska Space Grant Program • Winter 2018

Promoting Earth and Space Science and Technology and other NASA relevant teaching, research, and public service throughout Alaska.

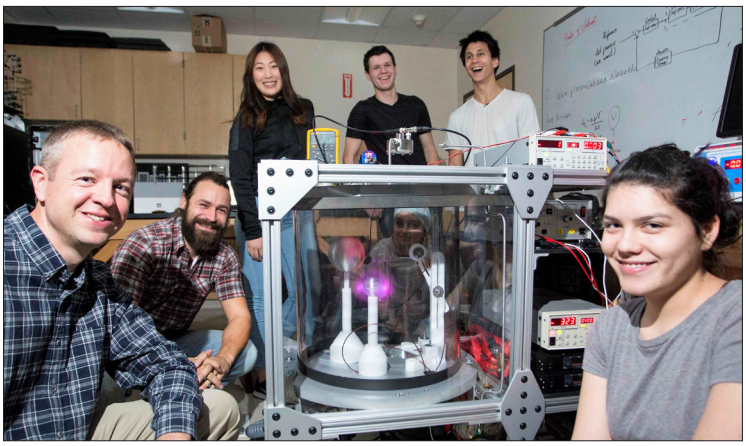
UAA Plasma Lab Opens Educational, Occupational Doors for Students - *by Carol Brzozowski*

Dr. Nathaniel Hicks says he came to the University of Alaska Anchorage (UAA) "with a somewhat complex and ambitious big picture goal for a multidisciplinary plasma research program at an undergraduate institution."

Five years later, Hicks – an assistant professor of physics – directs the UAA Plasma Physics Laboratory (UAA Plasma Lab), a multidisciplinary research facility within the UAA Physics and Astronomy Department where UAA undergraduates study experimental and computational plasma science and engineering.

Hicks is the principal investigator on a variety of plasma research grants to support and mentor undergraduate researchers and collaborate with other UAA faculty from Physics and Astronomy, Mathematics, Biological Sciences, Natural Sciences, Electrical Engineering, Mechanical Engineering, and Computer Systems Engineering departments.

An Alaska Space Grant Program (ASGP) Higher Education grant facilitated the development of laboratory and computer modeling resources to instruct upper division undergraduate students in experimental and computational plasma science and engineering, focusing on space plasma phenomena such as the Sun-Earth environment and interactions and plasma-based spacecraft propulsion.



Courtesy of Nathaniel Hicks.

The grant also provides undergraduate research fellowships to seven of Hicks' students, facilitating their studies of topics such as experimental apparatus for simulation of the aurora, helicon thruster, radio-frequency plasma production, plasma-based sterilization of bacteria, and multipole plasma trapping.

Twenty students have worked in the Plasma Lab since its inception. Currently, 10 students are engaged in the program. Three Anchorage High School students also have conducted research projects there.

Students' research and experience working in the multidisciplinary Plasma Lab have helped them achieve placement in prestigious Ph.D. programs such as at the University of Michigan and Texas A&M as well as employment at top local companies such as BP, Harris Corporation, and GCI.

"My greatest satisfaction in reaching this goal has been the realization that the growth and scope my lab has achieved in a few years' time is only possible because of my students' enthusiastic participation," notes Hicks.

Hicks points out the support and opportunities provided by ASGP "have been absolutely indispensable to the growth of the Plasma Lab and to the success of its students" and coupled with seed funding from UAA has led to growing federal support with a new three-year grant from the National Science Foundation/ Department of Energy Partnership in Basic Plasma Science and Engineering grant to support a new Multipole Plasma Trap project.

NASA / ALASKA SPACE GRANT PROGRAM

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FROM THE DIRECTOR

Denise Thorsen

Alaska Space Grant is committed to engaging and creating ***ACCESS*** for all students and faculty in the state of Alaska to Alaska Space Grant Program's NASA related research and education opportunities. Alaska Space Grant supports a wide variety of opportunities from pre-college to university level. Pre-college examples include Highland Academy Charter School team participation in last year's Real World Design Challenge, and Venetie-based teacher, Micki Adgate's, participation in the LiftOff aerospace workshop. We also provide opportunities for university students through sponsorship of Higher Education enhancements, such as the UAA Plasma Lab and the UAF Space Systems Engineering Program.

Alaska Space Grant is committed to supporting research and educational opportunities that are ***RELEVANT*** to NASA's mission and Alaska's needs. One of NASA's strategic goals is safeguarding and improving life on Earth. For Alaska researchers that translates to understanding water quality and quantity. Alaska Space Grant continues to support APU students monitoring the health of the Eklutna glacier which supplies 80% of Anchorage's drinking water and 10% of the city's hydropower. Additionally, APU graduate student, Kristina Fillman, is monitoring the impacts on erosion and downstream water quality due to off-highway vehicle trails in southcentral Alaska's Nelchina Recreation Area, while UAF graduate student, Barbara Johnson, is researching the economics of water in rural communities where 13% of households lack indoor plumbing and less than half of households in 36 rural communities have access to piped drinking water and sewage systems. In Fairbanks, air quality is a constant problem especially in winter. UAF graduate student, Ragen Davey is studying how sulfate aerosols are catalyzed in the air during the long Fairbanks winter season.

Alaska Space Grant is committed to enhancing ***PERMANENT*** connections between NASA's mission, and Alaska students, faculty, and citizens. Frequently people forget that the first "A" in NASA stands for aeronautics. Alaska Space Grant strives to grown aeronautic research in Alaska, where the basic mode of transportation is aviation given that approximately 90% of Alaska is not served by roads. Steven Ahern (UAA) interned at NASA Ames Research Center developing a UAV concept, LORAX, which could be used to support reforestation efforts. A team of UAF (Carie Navio) and UAA (Collette Kawagley, Ryan Maxwell) students interning at NASA Langley Research Center developed a linked Drone system that could potentially be used to deliver packages. Douglas Keller (UAF) interned at NASA Armstrong Flight Research Center, worked on temperature control and cooling elements to protect the Fiber Optic Sensing System into Quiet Supersonic Technology for a NASA X-plane project.

There are many more examples of ***ACCESS***, ***RELEVANCE***, and ***PERMANANCE***, in this newsletter. In the end Alaska Space Grant is committed to helping all Alaska students find their own unique path to a successful life beyond the university.

HIGHER EDUCATION

APU: Student researchers keep eyes on Eklutna

By Tiffany Thomas

What does a healthy glacier look like? Student participants in Jason Geck's Eklutna Glacier monitoring project have undertaken fieldwork to answer that very question.

The project, which is a collaborative effort with the USGS, gives student researchers the opportunity to determine the glacier's "health" by bringing them on site to measure its mass balance, fluvial discharge and geometry. Up-to-date information about the glacier's status is crucial because Anchorage, Alaska's largest city, is considered critically dependent upon Eklutna Lake. Approximately 80 percent of the city's drinking water supply and 10 percent of the city's hydropower comes from Eklutna's waters. Changes to the health of Eklutna Glacier may result in changes to downstream river discharge.

"This is an obvious trend statewide," said Geck. "For Eklutna, we're seeing both a thinning and retreat: thinning across the glacier and a massive retreat of the terminus." The glacier terminus, also known as the toe of the glacier, is always in motion. "It's dramatic over the past hundred years how far this glacier has retreated in its attempts to adjust to the current climate. Eklutna has been retreating back but now it's retreating up."

As part of the project, students of various disciplines are taught glacier travel skills. For the first time, students not only needed the skills to navigate the surface of Eklutna safely but rock climbing skills as well. "We didn't have time to teach them mountaineering skills and that is what's required to get onto the glacier now," explained Geck. "So when our science and camp gear was airlifted to the terminus, we picked up students and bumped them up to the study site."

Students atop Eklutna Glacier dig a pit to measure snow density. Photo by Jason Geck.

Aside from its direct benefits to Eklutna Lake water managers, the project has worked as a career stepping stone for student participants who have since advanced into glaciology programs at the graduate level, into satellite imaging careers and into federal occupations.

Geck and students will return for their research instruments and collect point data this fall.

Teamwork Leads to Award-Winning UAV Design

by Carol Brzozowski

Photo courtesy of Gabriel Blanco.

Complete a preliminary design for an Unmanned Arial Vehicle (UAV) that could outperform the DJI Agras and the Eebee SQ drones.

Such was the challenge issued for this year's Real World Design Challenge (RWDC), an annual competition where students in grades 9 to 12 work in teams on real-world engineering challenges confronting the nation's leading industries.

The five-person Highland Academy Charter School team from Anchorage – ages 15 to 18 – won the state title in January, then prepared for the national competition in Washington D.C. on April 21, which drew 100 students from 14 states and six teams from China.

"The missions they had to complete were both surveying a one mile-by-one-mile field of corn infested with bill bugs and to spray the infected areas with a pesticide," notes team coordinator Darren Kellerby. "The pre-designated mission would be complete with the surveying drone Eebee SQ and the spraying was to be done with the DJI Agras. Our goal was to do the mission with one UAV."

While the team's first two designs didn't work, its final design, 'The Rival' – inspired by the Boeing V-22 Osprey aircraft – had a tilt-rotor design allowing for VTOL and STOL capabilities and very stable flight while retaining enough power to lift the payload modules, Kellerby says. "It features two tanks inside the wing to hold 11 liters of pesticides and a simple, yet effective baffle system which inflates like a balloon inside the payload tanks to create pressure and keep the pesticide liquids held in place so they do not throw off the UAV center of gravity."

The Highlands team won the Viability Award, given for a 'feasible and unique baffle system'.

Team members say they learned to consider all teammates' ideas, flight basics and making a design fly while also adding necessary payload equipment.

"We had to work together as a team to ensure each part of our UAV would work effectively and efficiently," says one student who has researched new career fields based on aerospace engineering as a result.

Kellerby observed an increase in his students' confidence over the year.

"They took a lot of pride in accomplishing a difficult challenge and came home knowing they successfully did something which most college students and adults would struggle," he says, adding the Alaska Space Grant Program sponsorship enabled his students to focus less on fundraising and more on the project.

LiftOff workshop brings space exploration to Venetie Students

by Jeremia Schrock

"I have always wanted to be a teacher," said Micki Adgate, a Venetie-based teacher. "Teaching is my calling."

Adgate spent part of last summer at LiftOff, an aerospace workshop designed specifically for training teachers. Started in 1990, LiftOff is the brainchild of NASA's Texas Space Grant Consortium. The workshop emphasizes science, technology, engineering, and mathematics (STEM) learning experiences by utilizing a space science theme supported by NASA missions.

"[LiftOff] was nothing short of amazing!" Adgate said. One moment that stood out was when she was able to visit mission control for the International Space Station. "It was surreal for me," she said.

While visiting mission control was an amazing experience, every day during LiftOff was jammed packed with activities. "I was given so much knowledge to share with students in my classroom," Adgate said.

It was just this exchange of knowledge, that what she learned she could bring back to her students in Alaska, that made LiftOff such a rewarding experience.

"I spent a lot more time teaching about space this year," Adgate said. One particular example she gave of teaching her students what she'd been taught at LiftOff came via a lesson on moon phases.

"I had several more activities to use for my students to understand the moon phases," Adgate said. She even had t-shirts purchased that she then used to explain the moon's various phases. It was a lesson that was done at LiftOff and she was even able to share the videos and PowerPoints that she received during her workshop.

"The kids loved it," Adgate added.

While her students benefited the most from what she learned at LiftOff, Adgate was able to spread the good word of space science (so to speak) with the community of Venetie as a whole.

"We brought some teachers up from NASA this past school year and had a 3-day space university for our students," Adgate said. "We even had a space night for the community." She was even given enough solar eclipse sunglasses at LiftOff that everyone in Venetie that wanted a pair to view the partial eclipse could do so.

Adgate, who has spent the past two years in Venetie, will start teaching in Northway this fall. Does she plan on teaching what she learned at LiftOff?

"Most definitely," she said. "I am trying to get more students interested in science!"

Photo courtesy of Michelle Adgate.

FELLOWSHIP AND SCHOLARSHIP RECIPIENTS

Fellowship Recipients

Katherine Aikens (AY17-18)
Mechanical Engineering
University of Alaska Fairbanks

Samuel Bundy (Summer '18)
Environmental Science
Alaska Pacific University

Wyatt Bush (Summer '18)
Electrical Engineering and Physics
University of Alaska Fairbanks

Jacob Butler (AY17-18)
Computer Science
University of Alaska Fairbanks

Richard Chen (AY17-18)
Mechanical Engineering
University of Alaska Fairbanks

Angela Cook (AK17-18)
Natural Science
University of Alaska Anchorage

Katherine Dolman (AY17-18)
Electrical Engineering
University of Alaska Fairbanks

Amy Dowling (Summer '18)
Marine Biology
Alaska Pacific University

Ella Hyland (Summer '18)
English
University of Alaska Anchorage

Kiersten Johnson (AY17-18)
Chemistry
University of Alaska Fairbanks

Zakariyah Karim (Summer '18)
Civil Engineering
University of Alaska Fairbanks

Douglas Keller (AY17-18 and Summer '18)
Mechanical Engineering
University of Alaska Fairbanks

Bryant Klug (AY17-18)
Electrical Engineering
University of Alaska Fairbanks

Dawson Lewandoski (AY17-18)
Mechanical Engineering
University of Alaska Fairbanks

Brandt Lomen (AK17-18)
Electrical Engineering
University of Alaska Fairbanks

Quetzal Luebke-Laroque (AY17-18)
Mechanical Engineering
University of Alaska Fairbanks

Devan Massin (Summer '18)
Electrical Engineering
University of Alaska Anchorage

Carie Navio (AY17-18)
Computer Engineering
University of Alaska Fairbanks

Roman Romanovski (Summer '18)
Electrical Engineering
University of Alaska Anchorage

Sara Rutz (AY17-18)
Natural Science
University of Alaska Anchorage

Elija Simmons (AY17-18)
Mechanical Engineering
University of Alaska Fairbanks

Nicole Sola (AY17-18)
Electrical Engineering
University of Alaska Anchorage

Brendan Stassel (AY17-18)
Computer Systems Engineering
University of Alaska Anchorage

Walter Zimmerman (Summer '18)
Geological Sciences
University of Alaska Anchorage

Scholarship Recipients

Emani Clark (AY17-18)
Mathematics
University of Alaska Fairbanks

Javier De Leon (AY17-18)
Mathematics
University of Alaska Fairbanks

Justis Geerdts (AY17-18)
Civil Engineering
University of Alaska Anchorage

Connor Chamberlin (AY17-18)
Bio Chemical Engineering
University of Alaska Fairbanks

Zion Alioto (AY17-18)
Mechanical Engineering
University of Alaska Fairbanks

Kimberly Swedberg (AY17-18)
Electrical Engineering
University of Alaska Fairbanks

Allie Jarvis (AY17-18)
Biology
University of Alaska Anchorage

Brittney Boney (AY17-18)
Nursing
University of Alaska Fairbanks

Michelle Quillin (AY17-18)
Wildlife Biology
University of Alaska Fairbanks

Riley Maranville (AY17-18)
Computer Science
University of Alaska Fairbanks

Julia Ditto (AY17-18)
Environmental Science
Alaska Pacific University

Zoe Harris (AY17-18)
Computer Science
University of Alaska Anchorage

Carrie Hallinan (AY17-18)
Marine and Environmental Science
Alaska Pacific University

Ryan Daniels (AY17-18)
Geological Sciences
University of Alaska Anchorage

Max Zaki (AY17-18)
Mechanical Engineering
University of Alaska Anchorage

STUDENT HIGHLIGHTS

Ragen Davey of University of Alaska Fairbanks - by Tiffany Thomas

Although Fairbanks' poor winter air quality is well known, little data is available about the chemical transformation processes that occur in its atmosphere. Graduate student Ragen Davey and her undergraduate assistants James Campbell and Kiersten Johnston have embarked on a two-year study to shed light on these processes.

"Fairbanks is number one for fine particulate matter levels right now," explained Davey. "It's hard to picture why when you look at places like Los Angeles or New York but it's little ol' Fairbanks that has the worst." Davey's research team is specifically investigating the mechanism in which sulfate aerosols are catalyzed in the air during the extended winter season. "A lot of the pollution is from emissions like wood smoke but it's also the heating oil. The oil has high concentrations of sulfur to make it worthwhile to heat our homes. We think that plays a role in these large sulfur emissions."

Atmospheric data for Fairbanks related to sulfate is currently limited to the daily averages collected by the EPA — datasets that lack exact, time-relevant figures. By collecting hourly samples of sulfate, iron and copper concentration in the air, Davey's team will be able to pinpoint high pollution peak times. Knowing precisely when pollution figures are highest will help scientists determine precise pollution sources.

"By looking at these hourly cycles we can see what we can do to mitigate some of the emissions. If we have some numbers we can relate back to the EPA, that will help."

Research in interior Alaska comes with unique challenges. "It's been crazy," said Davey. "One time we lost power at the trailer and our sampler froze during the middle of winter. Luckily there was no damage but it would freeze every once in a while."

Although the data collection process has not yet concluded, Davey is optimistic about the solidified methodology the research team has developed over their first year. Having standards of operation in place will make for a smoother second year of study and give fellow researchers a leg up on future sulfate studies.

Mike Geyer of University of Alaska Fairbanks - by Carol Brzozowski

Growing up, Michael Geyer loved playing video games. He became so fascinated with the engineering side of how game consoles worked that he, in his words, "even messed around modifying my Xbox 360's motherboard."

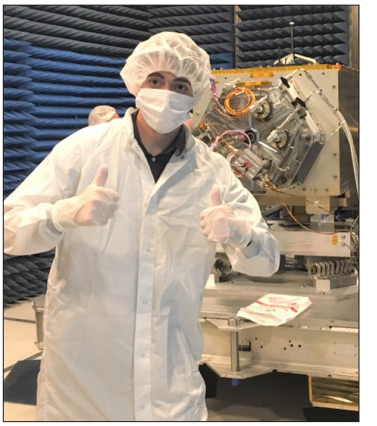
While such tinkering laid the foundation for what would ultimately become a lifelong interest in the sciences, Geyer took a slightly more circuitous route to becoming an electrical engineer. He started pursuing a business degree before taking a year off to play Tier 3 Junior A hockey.

That time off gave Meyer a chance to mull over his future and provided him with the spark of insight he needed. When he returned to UAF, he took an introductory electrical and computer engineering class and knew what he wanted to do. "I fell in love with circuits," Meyer said.

He found his passion for space systems during his undergraduate research at the Space System Engineering Lab at UAF. This grounding in space sciences guided his decision to intern at the NASA Jet Propulsion Lab in California.

"[The] Jet Propulsion Laboratory…is currently working on the most innovative missions for planetary exploration," Meyer added.

Meyer's project during his 10-week internship focused on wireless spacecraft communications. He was tasked with completing environmental and performance tests on wireless units under consideration for NASA's Smart Cabling Strategic Initiative. The initiative is aimed at reducing or eliminating unnecessarily complicated cabling used for connecting spacecraft subsystems.



His internship had him testing the units under a variety of conditions including thermal and vacuum chambers, as well as on a mock rover in the lab's famous Mars Yard. One internship moment that stands out to Meyer was when his group suited-up to watch scientists perform electromagnetic interference tests on an instrument being sent to the International Space Station.

A big takeaway for Meyer was on the importance of communication and documentation. Before each test, he had to document the procedure and then communicate the results during weekly meetings.

"I would highly recommend a JPL internship for any person that is passionate about aeronautics and aerospace research," Meyer said. He added that JPL has opportunities not just for those with a mind toward engineering, but also for those interested in science, business, and technology.

Before he graduated in Spring 2018, Meyer was offered a position at Lockheed Martin as an Electrical Engineer. He is currently working at the firm's Rotary and Mission Systems office in Owego, NY.

Top: courtesy of Ragen Davey. Bottom: courtesy of Mike Geyer.

STUDENT HIGHLIGHTS

Richard Chen of University of Alaska Fairbanks - by Carol Brzozowski

While Richard Chen has spent his undergraduate career at the University of Alaska earning a Bachelor of Science degree in mechanical engineering, his internship last summer at the NASA Ames Research Center in Mountain View, California was weighted more toward biology.

For that he is grateful, he says, as it helped him put his career aspirations into greater focus. At Ames, Chen did bioinformatics as he analyzed differential gene expression data for a permutation of active and metabolically suppressed mice that were irradiated.

At the end, he produced a manuscript outlining the potential underlying mechanisms for why a suppressed metabolism – such as hibernation to an extent – would confer radioprotection in certain animals such as mice.

Chen used a data analysis approach, employing Python through an open-sourced web application, Jupyter Notebook, writing code and analyzing gene expression data and big data sets.

Chen concluded that the mechanism likely isn't due to a whole body genetic response. "Rather, it's probably a select few genes whose expressions are really important in the radioprotective processes," he says.

Next year, the Fairbanks resident will be pursuing graduate studies in biomedical engineering at Duke University.

To students taking an internship outside their field, Chen advises them to "not be daunted about working on different things because once you're there you'll be there for a while and you'll figure it out.

"What I went through shows that even though there technically isn't a biomedical engineering program here, students can craft an experience in that field," Chen adds. He says that although he didn't have extensive coding experience, he was surprised at how quickly he picked it up during the internship.

"One of the important parts of the internship experience is for your resume," says Chen, who encourages other UAF students to apply for NASA internships. "It helps you narrow down what you want and don't want to do. I had a blast last summer at Ames. Through the past year in reflecting on it, I realized bioinformatics isn't what I want to do in biomedical engineering. Without the internship, I would have never known."

Drew Coffin of University of Alaska Fairbanks - by Carol Brzozowski

"Space relates to all of us, since aside from the hydrogen in our water, every atom in our bodies was forged in the nuclear furnaces of stars," notes Drew Coffin, a third-year University of Alaska Fairbanks graduate student studying space physics. "We are literally made of stardust."

That thought has been of ongoing fascination to Coffin, who came from Iowa to explore his vision of Alaska "as a bit of an otherworldly experience to the lower 48 with its extremes of daylight and distance. I wanted to see the aurora and the eternal summer daylight for myself."

Auroras have now become a focus of study for Coffin through his research fellowship studying Jupiter and its moon with advisor Dr. Peter Delamrere. The relevance to NASA operations is that auroras, such as the bands in Alaskan skies, are driven by the dynamics of charged particles within a planetary magnetosphere.

"Comparing our magnetosphere to elsewhere in the solar system helps investigate these dynamics by emphasizing common processes and explaining observed differences," Coffin noted in his research fellowship proposal. "Jupiter has by far the strongest magnetic field of any planet. Its strong gravitational pull creates severe tidal stresses on its inner moons."

By using a physical chemistry model of the plasma torus building upon previous work, the research will investigate longstanding questions about the torus, offering new insight into magnetospheric ionospheric interactions by improving the understanding of the physical chemistry processes within the plasma torus, among other objectives. Investigating the Io plasma torus is expected to provide insight into similar (weaker) transport and diffusion processes in Earth's magnetosphere.

"Space has such enthralling subjects in these incredibly diverse worlds that are so alien than Earth," notes Coffin. "I am studying a moon covered in volcanos, spitting out kaleidoscopic sulfur compounds, orbiting a planet with storms that could swallow Earth itself. There is just so much to investigate that is like something out of a psychedelic dream."

From his research, Coffin says he has learned "the idea of trying to answer an outstanding problem – in my case, the System IV periodicity – by trying different hypotheses. There are current theories, but we are testing a new one by tweaking parameters in our model. There is always room for a different approach and different viewpoint on trying to explain something. The gist of science is exploration and testing. We should always be willing to test a new idea."

Top: courtesy of Richard Chen. Bottom: courtesy of Drew Coffin.

STUDENT HIGHLIGHTS

Kathryn DuFresne of University of Alaska Anchorage - *Carol Brzozowski*

Kathryn DuFresne always loved science and appreciates having had it explained to her in ways that have been age appropriate and engaging throughout her life.

That underscored her desire to be part of that conversation in making it easier for the public to understand the hard work scientists do daily.

DuFresne recently earned a B.A. in English from the University of Alaska Anchorage. In fall 2018, she plans to pursue an M.A. in science writing through Johns Hopkins University Advanced Academic Programs.

DuFresne points out that if there isn't an understanding of why the work scientists do matters to the public at large, it becomes more difficult for them to care enough to fund science projects.

"By bridging these worlds, science can continue to grow and help us understand the world and universe we live in," she adds.

DuFresne scrapped her plans to become an astrophysicist after a "bad run-in with mathematics and I continued along almost reluctantly with my English degree," she says.

She executed an Alaska Space Grant-funded internship at the Goddard Space Flight Center in Greenbelt, Maryland that took her career on another trajectory.

"I had an amazing experience working in the heart of NASA Goddard's newsroom, producing social media posts for Twitter, Facebook and Snapchat, articles for NASA.gov, and various engagement with interns across the center," she says.

"With the upcoming total solar eclipse, it was a great summer working with the video team to engage scientists with local news agencies to spread the word about safety, viewing opportunities and what we can learn from this natural event."

The internship confirmed DuFresne's desire to work in science communications.

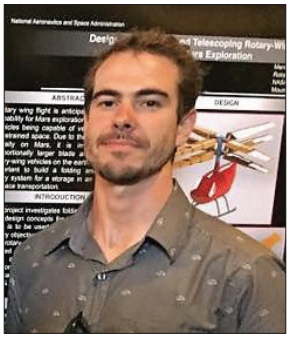
"I want everyone to be as passionate about space, the Earth, the oceans, and everything around us as much as the scientists I've had the privilege of interviewing," she says.

DuFresne says she not only learned a lot about herself in what was her first time away from her Alaska home, but also crafted connections with co-workers and other interns.

Internships enable people to try out desired careers, DuFresne points out.

"I spoke with so many people on my first day who were afraid they weren't qualified to do the work they applied to do with mechanical engineers, computer engineers, system engineers, astrophysicists," she says. "By the end of the internship, they found their place in a job that mattered to them and their field. Internships build confidence."

Steven Ahern of University of Alaska Anchorage - *by Jeremia Schrock*



Steven Ahern's passion for the sciences – specifically mechanical engineering – began the way it does for most, with a real-world catalyst.

"The catalyst that got the ball rolling in the engineering direction was after I did a fair amount of research on the Alyeska Pipeline," Ahern said. "I was in awe of the challenges that the engineers overcame designing [it]."

After flirting with civil engineering, Ahern was drawn to the world of mechanical engineering. "I felt [it] was more challenging and required more creativity, thus making it a more rewarding experience for me," he said.

Fast-forward to 2017 and Ahern found himself with a dream internship: NASA.

"I had a great experience at Ames," he said. Ahern spent several months last summer at the NASA Ames Research Center in California. "It provided a great opportunity to meet and connect with a lot of fun, interesting, and intelligent people."

Ahern's internship experience exposed him to new technology, weekly presentations on current and completed NASA missions, and even the occasional former astronaut. While a huge part of any internship is simply soaking up any and all knowledge available, Ahern also helped design an Unmanned Aerial Vehicle (UAV).

This UAV wasn't built for joy-flying, but with a unique purpose in mind. While NASA is often concerned with affairs extraterrestrial, this particular project had a much more terrestrial emphasis. Ahern's team performed conceptual design work for a UAV that could be used to support reforestation efforts. In this case, the planting of tree seedlings.

"We called the resulting vehicle concept: LORAX," Ahern said.

Although it was a team effort, Ahern helped develop and oversee the project's concept creation, mechanical design, testing and evaluation.

Through developing the LORAX concept, Ahern and his team also identified critical technology needs required for the successful implementation of such a vehicle. One need was a lightweight drill system that could provide high torque for drilling without causing the vehicle to slide or skid.

Since the internship was only 10 weeks, Ahern's team was unable to create a full-scale prototype. However, Ahern's team completed a massive amount of legwork and acquired plenty of data for the UAV's proof-of-concept and, ideally, future construction and use.

Ahern graduated in December 2017 from UAA with a B.S. in Mechanical Engineering. He is currently employed with Siemens, working as a project manager for their fire and security group.

Top: courtesy of Kathryn DuFresne. Bottom: courtesy of Steven Ahern.

STUDENT HIGHLIGHTS

Kristina Fillman of Alaska Pacific University - *Carol Brzozowski*

Trail-based soil erosion near stream crossings represents a non-point source of pollution to streams, with off-highway (OHV) crossings potentially negatively impacting downstream water quality in southcentral Alaska's Nelchina Recreation Area.

In a research project funded through the Alaska Space Grant Program, Kristina Fillman, a second-year graduate student pursuing a Master's degree in environmental science at Alaska Pacific University, is using satellite and aerial imagery to determine erosion rates and water quality impacts from OHV vehicle trails in the popular recreational area.

Fillman's long-term goal is to determine if soil erosion rates on OHV trails near the Eureka Lodge require additional oversight through establishing best management practices (BMPs).

Completing her undergraduate degree with a dual business administration and environmental management major from the University of Maryland University College led Fillman to "the unique insight into both worlds that made me realize the solutions to some of our most critical problems require collaboration across different industries," she says, adding she wants to help close some of the gaps.

Fillman – who has had a lifelong interest in environmental issues -- says her environmental management background drives her passion about water quality and manmade disasters.

Speaking to how her research can be applied to the space program and help her in her own career path, Fillman notes she is constantly learning about how the use of remote sensing is changing across many fields.

"I had no idea going into this how beneficial remote sensing would be to me," she says of her use of aerial imagery, Landsat, and photogrammetry to determine changes in trail density and soil erosion rates for the project.

"As the technology gets better and we are better able to adapt large-scale products like Landsat to small-scale issues, we can create more informed solutions across a broader range of issues," Fillman adds.

Fillman says she had no idea going into the project that it would matter to so many people.

"There are very strong opinions from each side of the board on ATV trail regulation, and a lot of interested stakeholders ranging from salmon habitat to recreational use," she says.

"I've had the great fortune to meet with so many passionate people with a wealth of knowledge. It helped put this project into perspective and give it context. It's really important to not only study something, but also to know the reason behind why you're doing it."

Carie Navio of University of Alaska Fairbanks, Collette Kawagley and Ryan Maxwell of University of Alaska Anchorage - *by Jeremia Schrock*

There's just something about the allure of NASA. No other organization can capture the imagination, nor offer the same opportunity, as the world's preeminent space agency.

For students Carie Navio, Collette Kawagley, and Ryan Maxwell, a summer internship at NASA's Langley Research Center proved to be an incredible experience.

"My NASA internship was probably one of [the] best summers I've ever had," said Maxwell, a graduate in electrical engineering from UAA. "It was the most…interesting work experience I have ever had."

All three students took part in a project to design, build, and test a linked drone system. The project requirements stipulated that the drones had to take-off linked together, detach in the air, and then land. A successful project like this (like theirs was) has a variety of applications, from package delivery to search-and-rescue operations. However, there was a catch – every action the drones took had to be pre-programmed and executed autonomously.

There was also one extra hurdle to overcome.

"We learned that our project had very limited funding," said Kawagley, a graduate in engineering from UAA. Kawagley oversaw design and development of the drones' linking mechanisms.

It would take more than a tight budget to stop a team of can-do science students.

"No one was really fazed by it," Kawagley added, "we just kind of saw it as a challenge to work together and overcome." The team scavenged for necessary parts and even took to the Internet for research purposes.

The internship was Navio's – a graduate in computer engineering at UAF – first experience with drones. "It was the first time I had ever used drones, let alone programmed them," she said. During the internship she became familiar with Python, a high-level computer programming language.

Maxwell, on the other hand, already had drone experience, having built a quadcopter from scratch in 2016. He helped develop an overall takeoff procedure and was the projects lead safety pilot (the person who takes control of the drone if any autonomous features fail).

Since graduating, both Kawagley and Maxwell are considering their options. However, Navio recently took a position with Lockheed Martin Skunk Works, the advanced development program responsible for a number of famous aircraft designs including the U-2, SR-71 Blackbird, and F-35 Lightning II.

"I'm really glad to have had this [internship] because I would never have imagined myself in this position otherwise," Navio said. She began her new job in June.

Top: courtesy of Kristina Fillman. Bottom: courtesy of Collette Kawagley.

Joshua Knicely of University of Alaska Fairbanks - *Carol Brzozowski*

As a child, Joshua Knicely would gather with his family around the television to watch NOVA, PBS and Star Trek: The Next Generation.

"I always loved that," he notes. "I wanted to help make Star Trek a reality: to explore and better understand the universe we inhabit."

These days, Knicely is a third-year doctoral student at the University of Alaska Fairbanks, studying geophysics with a concentration in remote sensing. Using Alaska Space Grant Program funding, he is studying volcanism on Venus to ascertain what it can reveal about the evolution of the planet through geologic time.

Through the project, Knicely seeks to understand the geologic history of several small to mid-sized volcanoes on Venus that span a range of morphologies and topographic shapes, with his key objective to create a photogeologic map.

He also seeks to constrain the mechanical properties of the lithosphere underneath these volcanoes.

Among the reasons Knicely chose to attend the University of Alaska Fairbanks is because "it has an excellent remote sensing program and remote sensing is an important part of studying any terrestrial body, the Earth included," he notes.

Knicely's Master's degree thesis focused on Io, a moon of Jupiter. He read about Mars in his spare time and got to work for NASA at the Marshall Space Flight Center examining lunar regolith, the chewed-up bits of rock and dust covering the Moon.

"But I never learned much about Venus," Knicely says.

Now, in doing so through his research, Knicely says the most important lesson he's learned is how to be a better scientist in "learning what questions to ask to get the biggest scientific bang for my buck, how to write my own proposals and critically examine and effectively use the data from remote sensing platforms and how to properly extract information from the data."

Knicely anticipates presenting his findings at the Lunar and Planetary Science Conference and the NASA EPSCoR Research and Education Symposium in 2019.

Post-graduation, Knicely would like to work for NASA doing planetary research or taking on a faculty research post at a university. Ideally, he says, he'd like to become an astronaut, coming full circle from the days he watched space-related programs on television.

"As long as I am doing something I feel helps advance our understanding of the universe," he says, "I'll be happy."

Chic O'Dell of University of Alaska Fairbanks - *by Carol Brzozowski*

Chic O'Dell notes he has always loved building everything from carpentry to electronics. "I find a meaningful catharsis when I have work," says O'Dell, an Alaska resident since age 11.

O'Dell – who is completing his first semester of a graduate degree in electrical engineering with a focus on embedded systems/communications systems – immersed himself in numerous cathartic activities in early 2018 through an internship at Marshal Space Flight Center in Huntsville, Alabama.

O'Dell was assigned to work with the ES45 group, the Engineering Science department's downlink and telemetry division, which supports Marshal project communications.

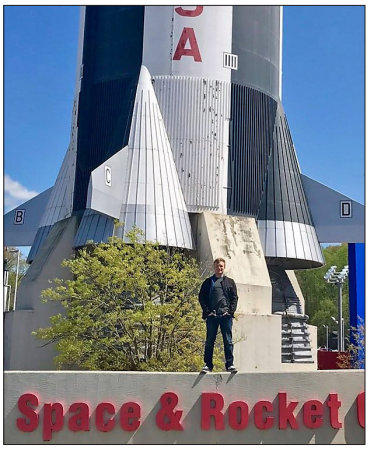
O'Dell supported his mentor Todd Freestone -- a NASA Radio Frequency (RF) engineer in Space Launch System (SLS) GPS threat analysis, CATALYST partner support, and Lunar Pallet Lander (LPL) communications.

O'Dell helped identify and define threats to SLS GPS systems, using RF lab GPS simulation tools to determine the interference thresholds that could prospectively jam the GPS receiver.

O'Dell combined the data on an overlay of the Kennedy Space Center to show a jamming threat range for SLS GPS while it's sitting on the launch pad.

For Astrobotic – a NASA Lunar CATALYST partner currently constructing a lunar rover – O'Dell assisted Freestone in reviewing technical documentation as Astrobotic approaches a Critical Design Review and conducting preliminary testing of its prospective software defined radio (SDR).

O'Dell also worked with SWIFT, an SDR he says is becoming "very important as they are highly configurable and are becoming the new wave of communications technology." He helped resolve hardware and software issues to produce a flight-ready unit that could prospectively be used by all CATALYST partners, LPL, Near-Earth Astroid Scout, and others.



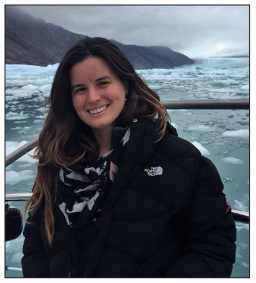
O'Dell also provided similar support to the LPL communications team among other projects.

O'Dell's Alaska Space Grant program-funded opportunity to work on "real flight multibillion-dollar aerospace projects with a welcoming group of engineers" provided him with knowledge about the NASA engineering and design process, experience working and testing in a lab environment, and the ability to speak fluently about technical communications subjects he otherwise would not have had based solely on coursework, he says.

The NASA Pathways program through which O'Dell executed his internship establishes paths to federal employment for students and recent graduates. O'Dell's goal is to "design new and advanced electrical systems, optimize existing systems, and work towards defining standards for and implement technologies on the horizon."

Top: courtesy of Joshua Knicely. Bottom: courtesy of Chic O'Dell.

Barbara Johnson of University of Alaska Fairbanks - *Carol Brzozowski*



While water can be found in all rural Alaskan communities, its quantity, quality and mode of delivery vary, notes Barbara Johnson.

Johnson is in the economics stream in her first year of a doctoral degree program in natural resources and sustainability.

Her Ph.D. thesis is based on her Master's degree research project: developing an affordability indicator for the Alaska Department of Environmental Conservation and the U.S. Environmental Protection Agency to use as one tool to determine whether rural communities can financially sustain their water utilities.

Johnson's research – funded by the Alaska Space Grant Program – indicates 13 percent of Alaskan households lack indoor plumbing. Less than half of the households in 36 rural communities have access to piped drinking water and sewage systems.

Lower rates of access to home water services correlate with significantly higher pneumonia and influenza hospitalization rates, Johnson notes, adding that conversely, the opposite holds true.

Most rural Alaskan communities' mixed economic system combines market exchange and subsistence activities, notes Johnson.

Store-bought food in those areas is expensive, more processed and less healthy, while subsistence activities enable the community to have access to healthier and fresher foods, she adds.

While many state and federal governments have earmarked funding to construct and manage rural water utilities for a half century, Johnson notes a lack of a centralized repository of projects, developed prototypes, and research.

"Determining what has been done, where and when is complex and time-consuming," she adds. "This hinders technology development that fits Arctic and sub-Arctic needs."

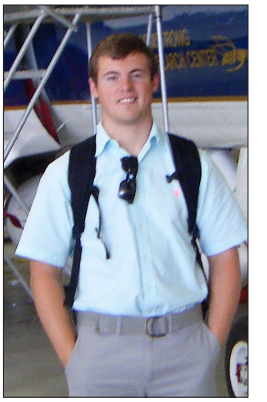
Johnson's project goal is to produce a detailed overview of work done in the Alaskan water-sanitation (Wat-San) field since 1950 and disseminate it to researchers, Wat-San practitioners, and other stakeholders. One literature review is expected to take place at the Annual Alaska Space Grant/NASA EPSCoR Research and Education Symposium.

Johnson notes she has always been fascinated by economics, "drawn to the way models explain the world around us" and credits it for teaching her how to think.

Her interest in water management began during her upbringing in Guinea, where tap water had to be boiled before consumption. That – and subsequent travels – ignited her interest in how resources such as clean water impact various communities globally. She sought to explore the cause.

Johnson says she would like to work as a water economist, "developing tools to enable the sustainable management of water resources and infrastructure for a forward-thinking institution such as NASA."

Douglas Keller of University of Alaska Fairbanks - *Carol Brzozowski*



Working on the temperature control and cooling elements in the development of an enclosure to protect the Fiber Optic Sensing System (FOSS) in its integration into Quiet Supersonic Technology for an NASA X-plane project, Douglas Keller not only learned about FOSS and heat transfer, but his internship confirmed his research and teaching career goals.

The University of Alaska Fairbanks (UAF) student said the internship at the Armstrong Flight Research Center in California last summer helped him develop a strong base in the fundamentals of temperature controlling in a small environment and how NASA operates with its "different exciting projects".

He also gained an appreciation for the work NASA scientists do in the challenging Mojave Desert environment, where temperatures exceeded 100 degrees Fahrenheit during the duration of Keller's internship.

Keller – a Chugiak native who is studying mechanical engineering with a minor in aerospace engineering – is in his final year of UAF's five-year Fast Track BS/MS program. He netted the internship through funding provided by the Alaska State Grant Program (ASGP).

Keller credits the internship for presenting networking opportunities with like-minded individuals driven to aerospace and research. The internship planted the seed for his senior project and Master's degree research: using the FOSS system to determine the effect of electromagnetic interference on another type of sensing system.

Through the internship and his studies, Keller has worked to mitigate time management. Not only did he secure the NASA internship through ASGP, but also obtained a research fellowship through the program. He recently presented posters for both works at the ASGP Annual Symposium.

"It was extremely challenging to push the scope of the research for the FOSS enclosure in only a 10-week time span due to the many small facets of the application," he said. "The obstacle in this situation has been organizing my studies and life so that I can pursue these opportunities with full effort, yet still retain free time for my own endeavors, which is absolutely worth it."

Keller's career plan after a planned fall graduation with a Master's degree in mechanical engineering is to obtain a Ph.D. in applied physics from a prestigious college and become a professor/researcher.

Left: courtesy of Barbara Johnson. Bottom: courtesy of Douglas Keller.

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CALENDAR OF EVENTS 2018-2019

December *2018*

- Graduate Research Fellowship applications due December 1

February *2019*

- Spring National Space Grant Directors Meeting in Washington DC, February 28-March 2

March *2019*

- ASGP Higher Education project proposals due
- NASA Summer Internship Applications due
- Summer Undergraduate Fellowship applications due

April *2019*

- Alaska Space Grant Symposium, April 12

September *2019*

- Undergraduate Fellowship/Scholarship applications due
- Fall Regional Space Grant Directors Meeting in Big Sky, MT, September 12-14