

Alaska Center ICE
at the University of Alaska Fairbanks
and the
Office of Naval Research

Project Title: Alaska Center for Innovation, Commercialization, and Entrepreneurship (Center ICE)

Award Number: N00014-20-1-2799

Principal Investigator: Mark Billingsley

Report Prepared by: Peter Webley, Mark Billingsley

Performance Period: 07-20-2020 - 11-30-2022

Reporting Period: Final Report

This award provided a significant bridge between Center ICE's first ONR award and its current funding under the ARCTIC II grant. Additionally, this award allowed Center ICE to stay on track following quick unexpected expenditures in the wake of Covid 19's arrival in Alaska.

This award supported another round of Center ICE's Startups2Startups program, more Center ICE Seed Fund awards, and allowed for the launch of a Center ICE's growing collaboration with the T3 program in Alaska and especially at the University of Alaska Fairbanks. Center ICE's support for T3 takes the form of sponsoring student projects. T3 is taking pedagogically simple but savvy steps to build the next generation of innovators for the United States. Finally, this award continued building capacity at Center ICE, which started with one part time employee at the start of the first ONR grant and finished this grant with upwards of ten employees (part- and full-time) and projects sponsored by a range of federal, state, and private entities. Additionally, this award supported the launch of Center ICE's Innovation Accelerator.

Students to Startups: 2021 and 2022 summer, integrating students with Alaska Startups

This funding from ONR supported two cohorts of our Students to Startups ([S2S](#)) summer internship program where Center ICE places University of Alaska students with Alaskan Startups. This 12-week program provides students with an unique experience of working with some of Alaska's newest and brightest startups while it provides the startups with access to the UA inspired students who want to make a direct impact today and apply their skills with local companies. Students are also provided training in the local entrepreneurial ecosystem and how to assess the market opportunities from academic technologies and how to perform stakeholder discovery. In the summer of 2021, eight students were supported for the 12-weeks working with six Alaskan Startups. Some of the startups had more than one student and this provided those students with the opportunity to work on parallel projects but also support each other as they worked with the startup. Two students split their time between two startups as they wanted to make a difference to two different companies. With the 2021 cohort, S2S instructor's gained clarity around how successful internships come from a joint passion and connection between the startup lead and the student. (See Figure 1A of a student developing a Lean Launchpad canvas for their startup.) This point was emphasized with the 2022 cohort. The students developed kee interest to learn about startups and how they operate as well as in the company's mission.

The image shows a screenshot of a Lean Canvas for a startup named "Elevated Oats". The canvas is divided into several sections: PROBLEM, SOLUTION, UNIQUE VALUE PROPOSITION, UNFAIR ADVANTAGE, CUSTOMER SEGMENTS, KEY METRICS, CHANNELS, and COST STRUCTURE. The "UNIQUE VALUE PROPOSITION" section contains the text: "New packaging sizes: 1/2 size (small size) and 1/4 size (standard (portability & cost))". The "UNFAIR ADVANTAGE" section is empty. The "CUSTOMER SEGMENTS" section lists: "Users: 1. 3rd graders, active parents", "Protein Buyer", and "Advocates". The "CHANNELS" section is empty. The "COST STRUCTURE" section is empty. The "REVENUE STREAMS" section is empty. The name "Elevated Oats" is written in red in the bottom right of the canvas. To the right of the canvas, there is a list of target markets under the heading "Likely primary market? Other potential target markets?".

Likely primary market? Other potential target markets?

- Hospitals.
- Any business with critical and/or sensitive data.
- Universities.
- Research facilities especially in rural areas with critical and/or sensitive data.

FIGURE 1. (A) 2021 cohort intern [Sarah Olson](#) performed customer/stakeholder discovery for her startup, [Elevated Oats](#). (B) 2022 cohort intern [Alora Greer](#) presents the market opportunity for the UAF intellectual property ([Long-term Uninterruptible Power Supply](#)) that her team was tasked to analyze together.

In addition to their work for a startup, students were divided into two teams to work on a joint research project for the summer. Every three weeks, they provided updates to the full cohort plus Center ICE staff (see Figure 1B). This allowed the students to understand how they need to be able to explain their work to other groups/divisions/departments and provide suggested directions for the next phase of development but also allow stakeholders to select from options. For the final three weeks of their projects, the original team continued the work using the progress made by the second team and only be able to follow their progress and select from their list of follow-on options. Of those who worked with the 2021 cohort startups, several of the students continued to work in the startup community including [Corey Giddings](#) who has become an integral part of Elevated Oats. Corey along with [Jessica Huezo](#) and [Oscar Hernandez](#) have all continued to be a part of the statewide startup community. Jessica continued to work with one of the startups from the 2021 mixer event while Oscar continued to connect with Center ICE and participated in the Techstars Startup Weekend Anchorage in Fall 2022.

With the 2022 cohort, six students were supported to work with six startups, with several startups returning from the previous year. As in 2021, all content for the students was provided virtually, which allowed them to work with their startups from their home location. In the summer of 2022, the students were divided into two teams to work on joint innovation projects. Students selected a specific item of UAF intellectual property from the list of disclosed technologies and performed market research on the developed research. Here students performed patent analysis and assessment, an evaluation of current off the shelf examples of similar products and determined which companies might be interested in licensing the technology and/or working to further develop it. This allowed the students to see how market analysis is performed and the different aspects of the analysis needed to fully understand the opportunities from developed technologies, the size of and type of competitors, and who might be partners to work with together.

UAF Makerspace Mini-Grants: Ideation, Innovation, and Entrepreneurship

Being able to develop new research ideas and transition them to solutions to a specific problem requires some funding and to be able to write up the project results. Through this ONR funding, Center ICE worked with the [UAF Makerspace](#), part of the Teaching through Technologies (T3) community, to develop a process for students to apply for a mini-grant for them and their team to work on their project. Center ICE and UAF Makerspace supported three series of mini-grant awards from students taking 100-level courses at UAF.

[Spring 2022](#) - 8 projects

[Summer 2022](#) - 1 project

[Fall 2022](#) - 21 projects

Across the three series, 30 projects were funded for up to \$500 per team. The students defined the need for their projects, the need for the funding to support their development, and presented on their final project outcomes and minimum viable product. One project focused on the development of a data logger using a Raspberry PI system, Figure 2A. The need was proposed by the Alaska Center for Energy and Power (ACEP) where a ruggedized logger with internal power would support remote-rural data collection and that could survive the environments across rural Alaska. This team had to determine the specific needs of ACEP as well as the ability to miniaturize the available components into a small box. The team ran multiple tests to assess that the batteries and accompanying solar power source worked correctly and that the data logger was operating and recording data. At the end of research under the Mini grant support, the team presented on their outcomes and proposed minimum viable product as well as documented their methodology including alternative designs. This example highlights the skills developed by the students to empathize with the end-users on their needs while also the need to test and evaluate their designs to present a final outcome. Adding in their alternative designs they showed other options that could be pursued by future teams along with following the final outcome of this team.

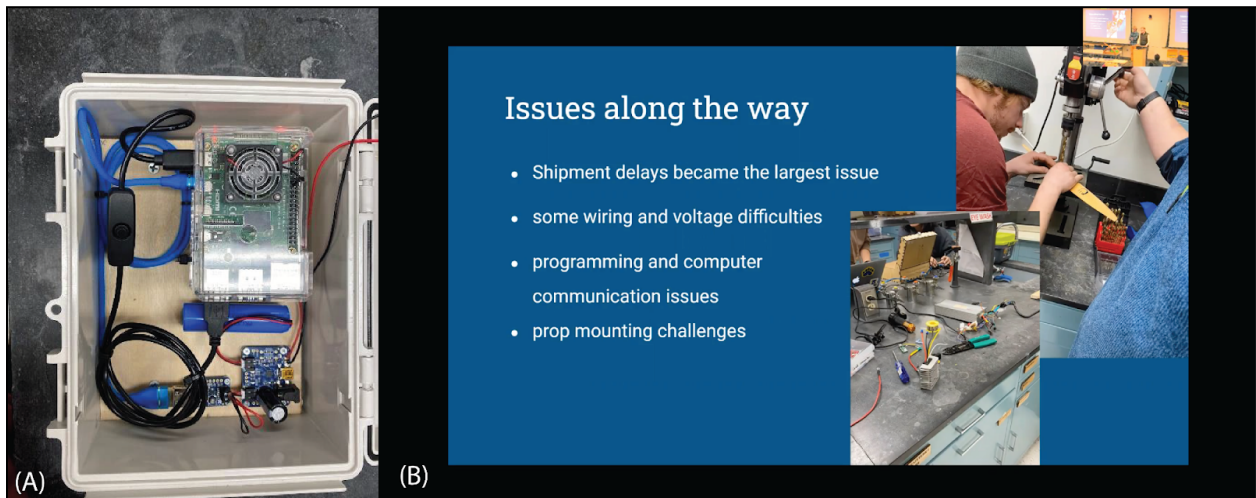
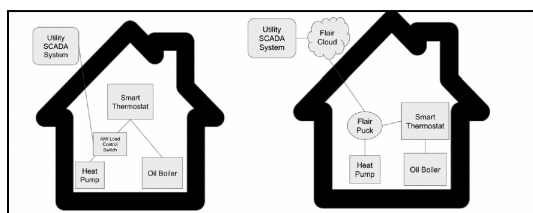


FIGURE 2. (A) Spring 2022 student project from Kai Petrie, John Bernardo and Camille Miller (DLPB-Data Field Pie Box), (B) Fall 2022 students presenting on project work and the issues that occurred while working towards their final solution.

Additionally, the teams across the three mini grant project periods worked on describing the issues that they faced, the hurdles that they faced, and how they overcame them to reach a final outcome from their project work. At the end of pitched their final work to the wider Makerspace community as well as the Center ICE team, Figure 2A. This provides them with the opportunity to present their results as well as build up their skills on presenting to an audience and to answer questions in real-time from the audience.

Academic Seed Awards

Along with the support for undergraduate students on their entrepreneurial journey, this grant provided funds to academic researchers across the state to build up their existing research ideas as well as pitch new ideas to build towards impactful solutions to local, state, regional, and/or national needs. Awards supported undergraduate and graduate students as well as faculty and staff. We provide a summary of five of those funded projects along with the detailed project reports as supplemental material to this final project report for the grant to Center ICE.



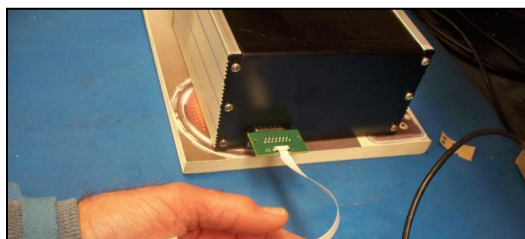
Renewably Warm: Dispatchable heat pumps to enable the balancing of renewable energy on the grid

Principal Investigator: Andrew McDonnell

Email: amcdonnell@alaska.edu

Dr. McDonnell worked with Jeremy VanderMeer on this project to first assess and evaluate the potential of the heat pumps for residential properties and then build a system to benefit those local residents to reduce their costs and the emissions from the homes. The first component of their research focused on building a model of a fleet of the heat pumps to assess their impact and performance when added to the local energy grid. Their model assisted them to determine the number of distributed heat pumps that would utilize all available energy from a wind power supply and optimize the use of renewable energy along with existing oil heating. They found that with 1000 heat pumps installed across local residents then together they would reduce CO₂ emissions by 6000 tons a year as compared to oil heat while also reducing their heating costs by \$1,200 a year, per resident.

The results of the modeling study provided them the opportunity to pitch with local electrical utility companies on the concept. Through these pitches, the team learned a lot about the industry and the opportunities that could be possible from these pumps. As a result, they spun out a company “Alaska Renewables LLC” to develop an early-stage innovation, research, and development project. Dr. McDonnell continues to work with the company as Vice President. In parallel to this startup venture, Andrew and Jeremy continued to work on their seeded research and assessed a range of hardware and software that support a dispatchable heat pump for use in local residential homes. Their chosen combined system supported a cloud-based dispatchable heat pump control system that could be integrated into local homes and as they reached the end of the project they focused on integrating their solution for a proof of concept in-home test.



Development of the first wireless near infrared spectroscopy (NIRS) device for preclinical monitoring of cerebral oxygenation

Principal Investigator: Bahareh Barati

Email: zbarati@alaska.edu

Dr. Barati and her team focused on building a wireless NIRS to monitor oxygenation processes in small animals to support a non-provisional patent application and towards the research to be accomplished under a future small business research grant in collaboration with UAF. Dr. Barati's team implemented some innovative modifications to the system that provides new capabilities to reduce the background noise and increase sensitivity of the NIRS. Additionally, the team developed a modified system to increase the potential for collaborations with the larger scientific community. The new system has a 20-fold reduction in noise and 200-fold increase in speed, and 12-fold reduction in drift of the sensory probe. The newly developed wireless NIRS has increased capability to increase the likelihood of the measured signal being transmitted coming from a biological origin. The award supported Dr. Barati and her team to provide the data for their proof of concept system in a laboratory setting and observations that can support their collaborative small business phase II research grant application.



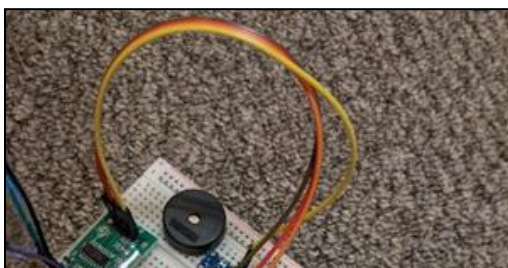
Ice and Fire Podcast

Principal Investigator: Theresa Soley

Email: tesoley@alaska.edu

Thersea Soley is producing a science communication podcast about glacier change. She is interested in connecting her listeners to those who are studying glacier change and witnessing it through storytelling and place-based audio. Ice and Fire podcast will illustrate the costs of glacier change in communities and the state. This will involve a broader narrative of

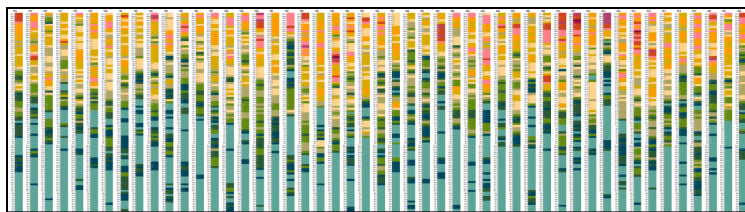
how people even far from glaciers are connected to them and that glacier change and climate change will affect them if it is not already. Soley attended sessions at the International Summer School in Glaciology at the Wrangell Mountain Center and collected field audio for the podcast. She and the podcast's audio producer, Mary Auld, are processing it and scriptwriting episodes. They have also created audio bundles and teasers as marketing material. Soley also audited the University of Washington's I-Corp Program and is enrolled in the University of Alaska Fairbanks I-Corps Program. Soley and Auld are engaged in further customer discovery, commercialization, and marketing through that program and plan to release the first episode during the program.



Bucket Sensor for Dry Cabin Dwellers

Principal Investigator: Mori Hays (Faculty Advisor: Dr. Orion Lawlor)
Email: mehays2@alaska.edu

Mori Hays had seen the need first-hand for an innovative product to assist those residents living in dry-cabins where they had a 'pain' of their "grey water" bucket overflowing. As an undergraduate student, he saw the potential to develop a 'gain' to those pains and make their "jobs" easier. He was already thinking about the value proposition canvas through his initial ideas. He worked on developing an improved system that detects when the bucket is almost full and informs the residents. He followed the innovation process, first empathize, then ideate, develop, test, iterate, develop, test, and finally find a minimum viable solution that could answer the needs of dry-cabin dwellers. He also went through UAF's National Science Foundation I-Corps training program at the same time as his research and development and this provided insight into the size of the market as well as the specific needs of more residents in the Interior of Alaska. He developed an initial design that would provide a solution to the community needs and saw a niche place in the market for his final design. This project highlighted how local Alaskans see personal need, ideate on their design, learn of the pains of others, and work towards a solution that has a greater impact.



Climate Change and Citizen Science: It's a Matter of Degrees

Principal Investigator: Jan Dawe
Email: jcdawe@alaska.edu

Jan Dawe and her team were interested in analyzing data collected around when birch trees in Interior Alaska produce sap, pollen, and "green up". Her team previously developed the Green-Up Index which forecasts when the area around Fairbanks will green up and the Fairbanks Birch Sap Collaborative which is a crowdsourced citizen science group. They wanted to build on their previous work by collecting and digitizing birch sap datasets outside of those collected by the Fairbanks Birch Sap Collaborative. Additionally, they were planning on integrating observational data regarding green-up, birch sap, and pollen and potential layers for data visualization. They planned to explore opportunities for the development of an app to display real time data and fund the contributions of the non-university affiliated members of the Fairbanks Birch Sap Cooperative. They were interested in convening an interdisciplinary working group to consider the next steps based on their efforts during the seed grant funding period. By September's end they planned to make a display that visually illustrated the project in the OneTree Steam Studio. From digitalizing crowdsourced data produced by community members they found birch sap producers' datasets were contingent on their objectives which meant they both stopped sampling the sap at different points which made meaningful comparisons between the datasets difficult though they had high withinset reliability.

After analyzing the data from the Fairbanks Birch Sap Collective they found the data was contingent on the data collectors objectives so while layers could be developed within each data set the differences between them made it “ill-advised” to combine them. Due to their seed funding being active during the summer they held one on one meetings with interest groups instead of a working group. Dawe and Susan Harry, the certified pollen Tanana Valley Clinic’s Allergy, Asthma, & Immunology Department, met with the intent to find ways to collaborate on pollen and sap research. Jessie Young Robertson, IANRE’s Forest Soils Lab, began installing a sap flow and flux site near OneTree Alaska’s sap tubing installation at Stroeker Farm. She and Matt Robertson plan to offer citizen science training to OneTree volunteers in 2023 so they can assist with monitoring. Due to time constraints the team scaled back their efforts to find funding opportunities for developing an app and funding the Fairbanks Birch Sap Cooperative’s efforts. While initially they were interested in how sap is distributed throughout Alaska they pivoted to create more data visualization tools to explain the Green-Up Index like the one pictured above due to public interest. Their “door” pictured above was displayed at the In a Time of Change: Boreal Forest Stories exhibit at Bear Gallery in September 2022. Another visualization was created in collaboration with the National Tapestry Project which represents the maximum daily temperature Spring temperatures from 1974 to now. They have plans to continue to create more multimedia data visualization projects to display a greater amount of data points.

Innovation Accelerator and Other Activities

This grant supported the development and launch of the Center ICE Innovation Accelerator, which is designed to provide a series of services and programs to trace the entire innovation lifecycle, from idea creation to successful commercialization and launch. Each component of the Innovation Accelerator can be taken up a la carte, but its greatest asset is its ability to provide cradle-to-grave support. The Innovation Accelerator has been piloted with three projects. The nine components of the Innovation Accelerator, broken down into 3 segments, are as follows:

- Dream
 - Ideation
 - Seed Funding
- Build
 - Customer Discovery
 - IP Protection
 - Gap Funding
 - Pitch Competition
- Launch
 - SBIR/STTR
 - Commercialization Support
 - Physical Space

Separate from the Innovation Accelerator, Center ICE has been building a broad network and undertaken a wide range of initiatives. Center ICE has partnered with the Alaska Blue Economy Center to develop a strategy for developing innovative solutions in the blue economy sector, started building out a very strong SBIR/STTR support program, sponsored two Alaska Fellows to work alongside Center ICE staff and support individuals' development in the innovation ecosystem, hosted a train-the-trainer session for people in Alaska who deliver customer discovery trainings, launched the first ever business accelerator in interior Alaska - the Alaska Interior Business Accelerator - in collaboration with the Fairbanks Economic Development Corporation and the Small Business Development Center, provided basic support for Alaskan community members seeking help getting a patent, collaborated with the University of Washington to offer a summer I-Corps track focused on alternative energy, and built a strategy for increasing commercialization at UAF. Wow, this has been a lot of work! But we're really excited to be at the point where these efforts are starting to bear fruit. We are grateful for ONR's support and look forward to working together more in the future.

REPORT DOCUMENTATION PAGE

1. REPORT DATE 15-02-2023		2. REPORT TYPE Final		3. DATES COVERED	
				START DATE 20-07-2020	END DATE 30-11-2022
4. TITLE AND SUBTITLE COVID-19- Alaska Center for Innovation, Commercialization, and Entrepreneurship (Center ICE)					
5a. CONTRACT NUMBER		5b. GRANT NUMBER N00014-20-1-2799		5c. PROGRAM ELEMENT NUMBER	
5d. PROJECT NUMBER		5e. TASK NUMBER		5f. WORK UNIT NUMBER	
6. AUTHOR(S) Billingsley, Mark. Webley, Peter.					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) UNIVERSITY OF ALASKA FAIRBANKS 2145 N. TANANA LOOP FAIRBANKS, AK 99775-0001				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Office of Naval Research 875 N. Randolph Street Suite 1425 Arlington VA 22203-1995			10. SPONSOR/MONITOR'S ACRONYM(S) ONR	11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for Public Release; Distribution is Unlimited.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT Alaska Center ICE is spurring development of innovative solutions to real-world challenges and building a culture of innovation and entrepreneurialism. Center ICE's Students2Startups program matches students with Alaska startups while providing parallel complementary education. Center ICE Seed Funds provide early stage seed funding to ideas with commercial potential. The Innovation Accelerator provides cradle-to-grave services and programming for the innovation lifecycle: from ideation through successful launch.					
15. SUBJECT TERMS innovation, commercialization, entrepreneurship, arctic, Alaska					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT		18. NUMBER OF PAGES
a. REPORT	b. ABSTRACT	c. THIS PAGE	UU		9
19a. NAME OF RESPONSIBLE PERSON Mark Billingsley				19b. PHONE NUMBER (Include area code) 907-474-2626	