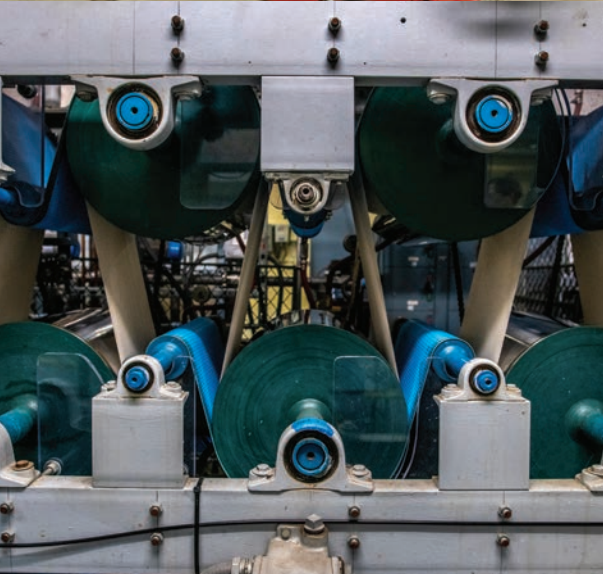




UNIVERSITY OF MAINE



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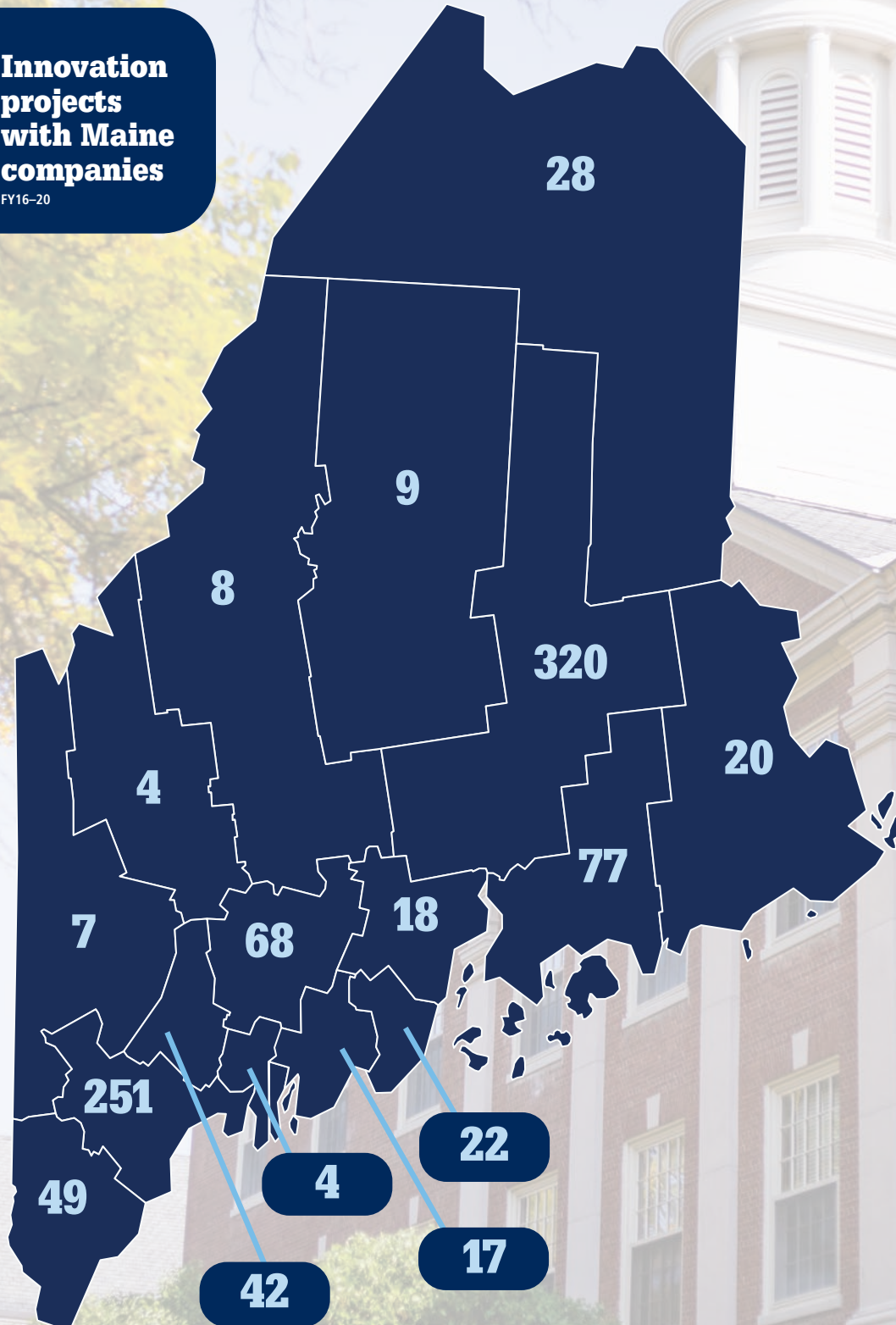
Office of
Innovation
and **Economic**
Development



**Wherever you are,
we're there to help.**

944 Innovation
projects
with Maine
companies

FY16-20





James S. Ward IV

While 2020 was not the year any of us expected, it has served to underscore important aspects of our assignment in the University of Maine Office of Innovation and Economic Development (OIED).

Put simply, our office supports existing businesses and the creation of new businesses in the state of Maine by facilitating relationships with the university. This work takes many forms — from contract work with UMaine centers that helps companies solve problems today to the research and workforce development that will help them innovate for tomorrow.

Our efforts are informed and driven by state and institutional priorities and bolstered by many partners, all of whom share the same vision for a flourishing and prosperous Maine. We are committed to supporting traditional industries and encouraging the growth of new sectors, a modern-day embodiment of UMaine's land grant mission.

The importance of that mission has been clearer than ever as Maine has confronted the local implications of the COVID-19 pandemic. The University of Maine systemwide response has been as inspiring as it has been instinctive — our institutions have a duty to serve the state and the robust infrastructure and wide-ranging expertise to make it happen.

From the perspective of our office, pandemic response has highlighted the strategic partnerships that are so critical to OIED's four-part foundation, along with accelerating businesses, engaging students and licensing and commercialization.

In the pages that follow, you will read stories about all four areas as they apply to our regular business. It is a snapshot of our activities, but by no means all-encompassing. First, a brief overview of the rapid innovation team that was convened to answer emerging COVID-19-related health care needs. This group exemplifies what we strive to do daily: make connections and solve problems to help move Maine forward. Solutions will be in high demand as our state rises to meet the ongoing challenges introduced by the public health crisis.

In closing, a word of thanks to our many collaborators, both within the university and outside. We are grateful for your partnership and look forward to continuing and expanding our work with you as we all take steps to build Maine's bright future.

Sincerely,

James S. Ward IV
Vice President
Office of Innovation and Economic Development



Office of
**Innovation
and Economic
Development**

Total
Revenue
\$492,258
from
Commercialization

FY2020 By the Numbers

Accelerating Businesses
Engaging Students
Licensing & Commercialization
Strategic Partnerships

12

U.S. Patents
Issued

23

Invention
Disclosures Filed

16

Total Patents
Filed

319

Projects with
Industry

\$3,358,461

*Total Value of
Industry Contracts*

229

Industry
Partners

135 Students Paid for
Work on DIC Projects

COVID Innovation

One aspect of the University of Maine's systemwide response to the COVID-19 pandemic was a rapid-response innovation team convened to evaluate and address health care needs arising across the state.

While the focus was support for the health care sector, this broad-based coalition reinforced existing bonds and forged strong new links in its quest for solutions.

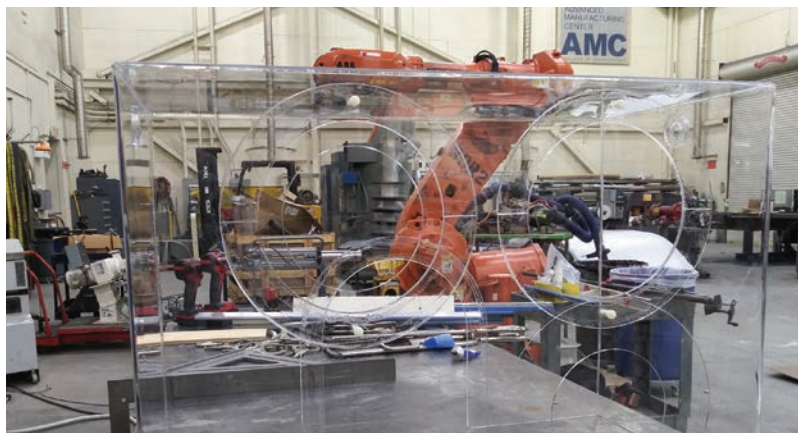
Spearheaded by OIED vice president Jake Ward, the innovation team first came together in late March to respond to immediate needs being communicated by longtime UMaine health care partners, among them PPE shortages and equipment sterilization challenges. Members included faculty, staff and students, representatives from the Maine Department of Economic and Community Development, the Maine Manufacturing Extension Partnership (Maine MEP), MaineHealth, St. Joseph Hospital and Northern Light Health. Other collaborating partners included the Manufacturers Association of Maine and Maine Procurement Technical Assistance Center.

A central accomplishment was the production of hospital-grade hand sanitizer at UMaine's Process Development Center. Efforts by UMaine helped health care centers avert pressing shortages in the early days of the pandemic. Later, UMaine partnered with the state's craft distillers and brewers to obtain a steady supply of ethanol, and then helped distillers ramp up their own production to form an in-state supply chain. Maine-made sanitizer was able to meet health care needs and beyond, buoying Maine's brewing and craft distilling industries at a time of great uncertainty. More than 3,000 gallons of sanitizer was produced on the UMaine campus alone and distributed to more than 100 health care facilities.

The innovation team also worked closely with hospitals to research sterilization and decontamination protocols for PPE, prototyped new equipment to help protect medical workers and support patient care (which was then manufactured in Maine), and helped coordinate on-campus blending of chemical solutions needed to conduct fit tests of N95 masks for frontline medical workers.

These efforts were governed by an umbrella agreement between the University of Maine System and the Maine Emergency Management Agency (MEMA), allowing the system to provide goods and services to Maine health care facilities and agencies as coordinated by MEMA.

As Maine has moved on to reopening and recovery, a core innovation group continues to meet weekly to address ongoing challenges related to the public health crisis. An offshoot task force is examining ways to apply the rapid innovation model to address other regional health care issues. ■



New England Aqua Ventus: a global partnership for renewable Maine power



A joint venture between Diamond Offshore Wind and RWE Renewables has brought the University of Maine's floating offshore wind demonstration project another step closer to fruition.

Diamond Offshore Wind, a subsidiary of the Mitsubishi Corporation, and RWE Renewables, the second largest company in offshore wind globally, have joined forces to form New England Aqua Ventus, LLC (NEAV). The new entity, working closely with UMaine, will own and manage all aspects of permitting, construction and assembly, deployment and ongoing operations for the project, which will consist of a single semisubmersible concrete floating platform that will support a commercial 10–12 megawatt wind turbine and will be deployed in a state-designated area 2 miles south of Monhegan Island and 14 miles from the Maine coast.

Since 2008, led by Dr. Habib Dagher, the University of Maine has researched floating offshore wind technology as a solution to Maine's overdependence on imported fossil fuels. After winning funding from the U.S. Department of Energy (DOE), the university deployed the first grid-connected offshore wind turbine in the U.S. in 2013, a one-eighth scale prototype of its VolturnUS floating hull technology. The success of the project led to additional DOE funding to further advance the technology, which has been issued 43 patents to date. UMaine's Advanced Structures and Composites Center, where the VolturnUS

technology was invented, will continue with design and engineering, research and development and post-construction monitoring for the Monhegan project.

Diamond Offshore Wind and RWE Renewables, with years of collective offshore energy experience and success, will invest \$100 million to build the project and help demonstrate the technology at full scale. Combined, the two new partners are responsible for nearly a quarter of the world's offshore wind capacity. The project provides an opportunity to further evaluate the VolturnUS floating technology, monitor environmental factors and develop best practices for offshore wind to coexist with traditional marine activities.

The project will supply clean, renewable electricity to the Maine grid. Construction, following all permitting, is expected to be completed in 2023.

Under the Mills administration and with a long history of bipartisan support, Maine has moved boldly ahead on renewable energy and offshore wind development, including enacting legislation authorizing approval by the Maine Public Utilities Commission of the power purchase contract for Aqua Ventus, and initiating a study of the port at Searsport as a potential site to support and develop offshore wind.

"This new public-private partnership joins world-class offshore wind developers and the University of Maine, and puts us on track to be home to the nation's first floating offshore wind project, reflecting the major economic growth opportunity of the clean energy economy," says Gov. Janet Mills. "I am pleased this project is moving forward, and encouraged by the partners' strong commitment to work collaboratively with Maine fishermen to protect

and support our traditional industries as we chart a greener future for our state."

NEAV will continue to involve Maine companies in permitting, construction and assembly, deployment, and ongoing operations and maintenance of the project. In addition, NEAV has committed to working with the University of Maine on research, development and design to take the technology elsewhere in the U.S. and the world. The project is projected to produce more than \$150 million in total economic output and create hundreds of Maine-based jobs during the construction period.

The developers also will work with the University of Maine System, the Maine Community College System and Maine Maritime Academy to attract K–12 students to science, engineering and business programs, prepare college students and help to create a skilled workforce in Maine with the technical skills necessary to support offshore wind development and operation.

"As Maine's research university, UMaine is continually advancing its broad land grant, sea and space grant mission," says UMaine President Joan Ferrini-Mundy. "The path from fundamental research to economic realization is complex, and success takes incredible innovation, persistence and strategic partnerships. Many faculty, staff and students have participated in the development of this technology, and will continue to support the energy and marine economy as this project transitions to the private sector. This collaboration exemplifies our role and commitment to creating and supporting the future of Maine." ■



NEW ENGLAND
AQUA VENTUS



Hive monitoring technology humming along commercialization path

Most people would associate bees with honey, but few probably realize how critical the flying insects are to food production as a whole.

According to the United States Department of Agriculture (USDA), bees pollinate approximately 75 percent of the fruits, nuts and vegetables grown in the United States, and one out of every four bites of food people take is courtesy of bee pollination. The USDA calculates that bee pollination is responsible for more than \$15 billion worth of increased crop value each year. In Maine, their role is especially significant, as bees exclusively pollinate the state's wild blueberry bushes, a \$23 million industry for the state.

A pair of UMaine researchers are now commercializing radar-based technology that tracks the activity of bees around a hive and can help beekeepers monitor overall hive health. The system can offer early warning about signs of colony decline — including Colony Collapse Disorder, when the majority of worker bees disappear from a hive — that can have dire consequences for agriculture.





9
Teams in first
two cohorts

5
Startups
Incorporated



\$2 MILLION +
raised in
external funding
and prototype
sales

3
Teams to
National I-Corps

4
Patents filed
or in process

Nuri Emanetoglu and Herbert Aumann, both faculty members in the Department of Electrical and Computer Engineering, have developed the technology over the last several years with support from commercialization programs offered through the Office of Innovation and Economic Development.

"We started out thinking we could use the radar to listen to the bees and try to get some information about the beehive's health by listening to what the bees are doing, the frequency at which they're buzzing," Emanetoglu says. "After several years, the research progressed — now we're essentially looking at beehive activity, how many bees are flying in and out of the hive, and from there trying to correlate that with the hive's past behavior and current behavior with other hives in the same area, weather conditions, etc., to estimate what's going on."

Initially funded through the Research Reinvestment Fund and the National Science Foundation's Research Experiences for Undergraduates site program, Emanetoglu and Aumann's project was one of five selected in 2018 for the first cohort of MIRTA, an accelerator program that seeks to move UMaine

research along the path from discovery toward commercialization. The Maine Technology Institute provided a \$22,000 seed grant in 2018 to support its development.

"The MIRTA program was very intense and a learning experience for me," Emanetoglu says. "Solving problems with a customer's needs in mind requires a different mindset than trying to find the best technical solution. They're not contradictory, it's just a different way of thinking."

As a result of participation in the 2019 Bangor-region class of the Top Gun accelerator — a statewide program administered locally by OIED — Emanetoglu and Aumann decided to form a startup company, Maine Biosensors, LLC, to work on bringing the technology to market.

"The best thing about Top Gun was the networking and learning what local resources are available to support a startup," Emanetoglu says. "We got to meet with different people, anywhere from marketing people to attorneys, and it really gave us an idea of how to move forward." Since completing Top Gun in May 2019, Maine Biosensors has been granted an exclusive license for the patent-pending technology. They are continuing to refine the

product design, which consists of monitors that attach to each hive and transmit data back to a base station that links up with a central server where all the data is aggregated. The team is also developing a web interface that would allow users to see the data on their hives. Their target customers include industrial beekeepers who contract with farmers for pollination services, as well as the farmers themselves.

Once the design is finalized, Maine Biosensors plans to apply for additional funding through the Small Business Innovation Research (SBIR) grant program to hire staff and begin the contract manufacturing process for the units. Emanetoglu expects manufacturing will be completed in Maine.

Meanwhile, the two researchers, collaborating with faculty from the School of Biology and Ecology, continue to explore new ways to apply the technology to provide even more comprehensive data.

"As engineers, we like when our toys end up being used for a good purpose," Emanetoglu says. "We can create a lot of gizmos, but if nobody is using them then that's sort of a pointless exercise." ■



Locally Grown: KinoTek's journey from UMaine to a leading Portland startup



KinoTek, a student start-up seeded in Orono just two years ago, is now a firmly rooted member of Portland's tech scene with an emerging national profile.

The company's journey to this point reflects the work and determination of 23-year-old co-founder and CEO Justin Hafner — a University of Maine graduate leading a young team that includes two other alumni — and the promise of an innovative product powered by a statewide entrepreneurial network dedicated to moving Maine forward.

KinoTek develops movement analysis software that can deliver a real-time full-body assessment in seconds, showing a person's range of motion, asymmetries, muscle-firing patterns and more. The idea was borne of Hafner's undergraduate studies in Kinesiology at UMaine, but he did not set out to start a business.

The summer before his senior year, Hafner, a member of the UMaine swim team who was majoring in Kinesiology, decided to stick around

campus. He planned to take some classes, and also got a job as a research assistant in the Virtual Environment and Multimodal Interaction (VEMI) Lab. The job gave Hafner his first real exposure to research, and it inspired him to think differently about his major.

"I started learning about virtual reality and 3D modeling while working at the VEMI Lab," Hafner says. "I really got excited and started thinking there had to be a better way to learn Kinesiology. I had this idea — I thought 'Oh man, if you put a VR headset on, you could learn anatomy and retain more skills.'"

KinoTek was born — well, not quite. Hafner knew he was on to something, but wasn't sure what to do about it. As summer wound down, he started asking around, talking to Dr. Robert Lehnhard, director of the School of Kinesiology, Physical Education, and Athletic Training, VEMI Lab director Richard Corey, and Jason Harkins, associate professor of management at Maine Business School.

"They said 'You could start a company,' and I said 'Well, I have no idea how to do that,'" Hafner remembers.

The Maine Advantage

KinoTek co-founder and CEO Justin Hafner grew up in New York state, but when he was selecting a location to grow his business, the answer was unequivocally Maine.

After all, Hafner started KinoTek as a UMaine undergraduate student in 2018 and incubated the business first at UMaine's Foster Center for Innovation and then through a series of university-supported accelerator programs in the greater Bangor area.

Hafner is quick to credit that local network for his company's rapid development, especially the initial encouragement he received at UMaine, both from the Foster Center team and at the Virtual Environment and Multimodal Interaction (VEMI) Lab where he worked as a research assistant.

"At the Foster Center, I really learned how to bring a product to market — just the iterative process of customer discovery, product-market fit, all of these little things that are vital," Hafner says. "The VEMI Lab taught me how to work with anyone and collaborate on a bunch of different projects, and provided the experience and the ability to explore my own research.

"Without the Foster Center, I would have never done Big Gig or Greenlight Maine, probably would never have written a grant. There were so many little things they plugged me into — they immediately put me into the Bangor entrepreneurial network. Instantly. The second I started being incubated there, I was already tuned in with everyone."

Hafner has also come to especially value the preparation he received in the Top Gun and Scratchpad accelerator programs, both affiliated with UMaine.

"The accelerators taught me about business. Scratchpad basically gave me an accelerated MBA that is way more applicable than a traditional MBA program where you sometimes can't make connections to the real world, Hafner says.

"That's honestly irreplaceable — those three things: The VEMI Lab, the Foster Center, and the accelerators — I don't know where KinoTek would be without them."

Beyond UMaine, Hafner says Maine's supportive entrepreneurial environment, burgeoning tech scene, and relatively low cost of living all make it an ideal place for a young business to locate. Plus, his location and education have proven to be useful differentiating factors when KinoTek is competing for investors.

"We're getting more interest from being in Portland, Maine, and going to the University of Maine and being really scrappy kids than the Stanford and the Harvard boost that's like a dime a dozen out there. And that was all the Foster Center, that iterative process, that way of thinking. It's right on par with every top institution, if not better, and you don't even realize it. You don't realize it until you start living it." ■



Enter Hafner's cofounder, David Holomakoff, and UMaine's Foster Center for Innovation.

"David was working at the time for another startup that was based in the Foster Center, Hafner says. He was in and out of the VEMI Lab related to that business, and I just started talking to him one day. He said, 'Oh, you should come to the Foster Center, and you should meet some people there and just hang out.'"

Holomakoff introduced Hafner to Veena Dinesh, director of business incubation, and Matthew Hodgkin, commercialization program professional, on his first visit. From them, Hafner got a preliminary overview on grants and other funding options, and then stuck around the Foster Center until 2 a.m. that night in July talking things over with Holomakoff and a few others.

"It was crazy, Hafner remembers. We were there all night just thinking about ideas, and then by the end of it we said 'We should start a company.'"

Hafner's business education built rapidly from there. That fall, he took a course in Innovation Engineering offered through the Foster Center, and became fully immersed in Maine's entrepreneurial ecosystem. He applied for and received a \$5,000 grant from the Libra Future Fund, a program that seeks to combat youth out-migration from Maine and promote in-state economic development and job creation. Around the same time, he participated in the Big Gig pitch competition for local innovators and entrepreneurs in the Penobscot River Valley, receiving coaching from the Foster Center team ahead of the event. After winning a Big Gig pitch-off in October 2018, KinoTek began to gain momentum.

"That's when I realized I had an opportunity here in front of me," Hafner says. Hafner decided to graduate a semester early, finishing his degree in December



rather than May, and pursue KinoTek full time. It meant an early end to his swimming career at UMaine, a bittersweet milestone for Hafner, who initially majored in Kinesiology to better understand the physiological and biomechanical aspects of athletic performance in order to improve his form.

Graduating ahead of schedule did not mean Hafner left the UMaine community. Far from it. In late fall, he was accepted as a contestant on the Greenlight Maine Collegiate Challenge, a televised pitch competition for local student entrepreneurs. After additional coaching from the Foster Center team, KinoTek went on to win the \$25,000 grand prize the following spring, and received matching funds

from the Maine Technology Institute (MTI) to begin to really build out their software platform. Hafner and his partners also participated in the UMaine-facilitated Bangor cohort of the statewide business accelerator Top Gun in 2019, and from there moved to the Bangor-based Scratchpad Accelerator.

In summer 2019, KinoTek moved their base of operations to Portland, and also began to explore opportunities outside of Maine. The team was selected to apply to the prestigious national seed accelerator Techstars. Although they were not accepted to the program, they reached the final section round as the youngest company competing by several years. Through the process, they were introduced to the professional sports world, and realized their product-market fit in assessment of athletes at the highest levels. In October 2019, they joined a StartUp Maine contingent of eight companies at TechCrunch Disrupt, a major start-up conference in San Francisco.

"There were about 10,000 people there. It was so cool," Hafner says. "We made some great connections, and that's when we started getting interest from major companies, Fortune 500 companies. It really put us on the radar."

KinoTek rolled into 2020 with that momentum. After finishing Scratchpad late last year, they received immediate investment from several sources, including \$60,000 from MTI. They signed a \$100,000 strategic partnership with Microsoft in early March, allowing them to accelerate the timeline for their beta launch.

"Formalizing that partnership really was the turning point from 'Hey, these are some kids that graduated college,' to 'Hey, these guys have got a company that can do something really cool.'"

All this before KinoTek's second birthday — and then came COVID-19.

"Worst timing," says Hafner, who had in-person meetings scheduled in March and was on track to close some significant deals in the pro-sports arena before leagues were forced to suspend play.

But even a global pandemic has not been enough to halt KinoTek's forward progress. While developing sports business is on hold for now, KinoTek's software has obvious applications related to physical therapy and the company has been able to shift focus in that direction.

In June, an additional \$150,000 in MTI funding came through, allowing KinoTek to bring on another full-time employee, with plans for another hire soon. Five out of the six current team members are UMaine grads. Hafner expects to finalize some venture capital funding in the near term, and the company is moving forward with their beta release phase.

"We've been able to raise a lot more than I thought we could get during a pandemic," Hafner says. "It's just been an absolute rollercoaster."

While COVID-19 marked a steep dip in the wild ride that has defined KinoTek's first two years, the young team is already poised for the next ascension. ■



Fellows in Innovation

Another key factor in KinoTek's growth has been the Innovate for Maine Fellows program, which allowed the company to bring on two partially subsidized interns during the summer of 2019.

Haftner does not mince words about the benefits the program provided.

"Innovate for Maine? One word: amazing," Hafner says.

The Innovate for Maine program exists to provide Maine college students with meaningful internship experiences with exciting in-state companies. The program is supported by strong training and networking components, and the goal is to help students gain perspective on the innovative opportunities available in Maine while simultaneously helping to accelerate businesses. The Office of Innovation and Economic Development coordinates the program, matching students with suitable companies and guiding both through the process. The student fellows are hired and paid through the OIED, and companies can apply for a subsidy to help cover the cost of paying their fellows.

For an early-stage startup such as KinoTek, hiring two interns in their first full year of operation would have been impossible without some form of financial assistance. A year after taking on their first summer fellows, KinoTek is a case study in the program's benefits. Not only did they retain one of their fellows, creating a job in Maine, but that fellow, Dan Lesko, is now KinoTek's chief technology officer.

"Dan went from an intern who was just building his software development skills to running circles around some of the best freelance developers we've hired," Hafner says. "If not for Innovate for Maine, we never would have been able to pay him, and he might not be working with us today."

Lesko, too, knows he wouldn't be where he is without Innovate for Maine.

"It really did facilitate what has grown into the KinoTek team," Lesko says. "The Innovate for Maine program allowed me to get a whole crash course in innovation, and it was eye-opening to shift my perspective from a very academic-focused and engineering mindset during college to a very innovation-focused and entrepreneurial mindset." ■

Supporting The Kingfish Company's U.S. expansion

As the Kingfish Company began to pursue expansion plans in the United States, they considered 22 sites along the East Coast to host a land-based recirculating aquaculture system farm for yellowtail.

In the end, The Netherlands-based company selected Jonesport, Maine, for construction of their new facility, and in the process, they found the University of Maine's Center for Cooperative Aquaculture Research (CCAR).

The connection was made by Maine & Co., which provides free and confidential consulting services to businesses looking to relocate to Maine or expand within Maine. As part of an introduction to the state's extensive aquaculture network, the team at Maine & Co. brought Kingfish Company executives to tour CCAR. The facility met all of the company's basic requirements for an intermediate site where they could build broodstock and establish a fish hatchery ahead of opening their Jonesport facility, and offered one significant perk.

In addition to customizable and established infrastructure, as well as a direct link to UMaine's deep aquaculture expertise, CCAR was also already home to a breeding population of *Seriola lalandi* – yellowtail – the same warm-water species The Kingfish Company produces.

"Our CEO and COO came to CCAR on a tour arranged by Maine & Co. and found our species

of broodfish already here," says Megan Sorby, an operations manager for The Kingfish Company in Maine. "CCAR's facility offers massive benefits in terms of infrastructure, and the existence of these fish presents a unique opportunity for us. Globally, *Seriola lalandi* captive broodstocks are limited in number and genetic diversity, and this population can add to the genetics we already have available."

Establishing a relationship with UMaine also appealed to company leadership, who had previously partnered with the Wageningen University in The Netherlands on a broodstock selection program. That collaboration was and continues to be important to the ongoing success of Kingfish's Netherlands operation, Sorby said.

"In developing a new species, such as yellowtail, and starting new facilities, it's not always possible to simultaneously manage research and development and production

as part of the same operation," Sorby says.

"Working with a university allows us to pursue more R&D, but it's not always the case that you have a university close by or have other non-profit research entities or government-backed support of industry development. All of that is available here in Maine."

Immersion in Maine's increasingly broad aquaculture support network has been another key differentiator as The Kingfish Company begins to build their U.S. stock.

"We have found an extremely welcoming aquaculture and larger community here in Maine that has basically said 'How can we help?' at every turn, Sorby says. Not just here at UMaine, but throughout the state – in addition to Maine & Co., we've also connected with the Maine Aquaculture Association, Maine Technology Institute, Finance Authority of Maine, CEI, and a number of different government agencies. Having that network has been hugely beneficial."

Founded in 2015, The Kingfish Company has reported surging international demand for its yellowtail products, which include a line of cold-smoked, individually vacuum-packed portions and split fillets, since their Netherlands facility opened in 2018. By developing broodstock at CCAR ahead of opening their U.S. facility, Kingfish can get a head start on raising market-ready fish and accelerate their timeline for U.S. sales. ■





Eel aquaculture scaling up in Maine

When Sara Rademaker began considering plans to build her own land-based aquaculture business, she knew she wanted to do it in Maine.

Rademaker, who has extensive global aquaculture experience, first came to Maine in 2009 when working for Americorps. What was meant to be a short assignment turned into a nearly three-year stay, and Rademaker developed a strong connection to the state.

"I realized quickly that there's a lot going on here with aquaculture — a really great community and a lot of opportunity," Rademaker says. "I decided that if I was going to start an aquaculture business, which has always been on my radar, that Maine would be a good spot to do it."

With that plan in the back of her mind, Rademaker left Maine for a job in Africa, returning in 2012 and beginning to develop the business that would become American Unagi.

Rademaker settled on raising American eels, which she sources as juveniles — also called glass eels — from Maine's well-managed fishery. From there, she raises the fish in a land-based recirculating system, feeding them a high-quality diet and eschewing any antibiotics or hormones. When they reach market weight, they are sold exclusively in the U.S. to consumers looking for a traceable alternative to eels imported from Asia. This business model is unique, as the eels typically served in American restaurants have been exported and raised abroad, then shipped back for consumption. Rademaker provides a more sustainable and transparent alternative, and consumers in the U.S. have responded positively.

American Unagi was founded in 2014, and Rademaker started growing her first eels in tanks in her basement. She quickly outgrew that setup, transitioning the following year to an incubator program coordinated by the Maine Aquaculture Innovation Center at the University of Maine's Darling Marine Center in Walpole. From there, she moved to the business incubator at UMaine's Center for Cooperative Aquaculture Research (CCAR) in Franklin, which allowed her to scale up

production as she prepares to transition to her own dedicated facility in Waldoboro.

Every step has been deliberate, based on Rademaker's careful analysis of Maine's aquaculture landscape and available resources during the years she spent working here before starting American Unagi.

"I had always envisioned really tapping into the resources that were available in Maine, from the facility down at the Darling Center to CCAR," Rademaker says. "I actually first came to CCAR almost 10 years ago on a tour with some students that I was teaching aquaculture to, and my jaw dropped."

Rademaker, who studied fisheries and aquaculture at Auburn University, said she couldn't believe she'd never previously heard of the facility and immediately filed it away for future reference. The infrastructure available at CCAR and the Darling Center combined with funding support available through Maine Sea Grant and the Maine Technology Institute have been central to American Unagi's development.

"Raising investment can be a challenge with any startup. Proof of concept and teams with experience really builds the investor confidence needed to drive these large infrastructure projects," Rademaker says. "That is where a place like CCAR is such an advantage for aquaculture start-ups — it allows companies to really demonstrate the viability of their business without having to invest in intermediate infrastructure themselves."

The ability to build her business incrementally, and the ability to plug in to Maine's expanding aquaculture network have helped Rademaker prepare American Unagi for its next chapter.

"I tapped into every single resource that I could, and at each phase of my company's growth those groups have helped with different needs," Rademaker says. "You gain access to resources that can support you in market research, or proof of concept, and as your business grows, you end up having this support system and network that builds long term resilience into your business." ■

Realizing an innovation vision at Camden Hills Regional High School

In 2018, administrators in the Five Town Community School District had begun to contemplate incorporating innovation into the curriculum at Camden Hills Regional High School (CHRHS).

The conversations were still in their nascent stages when the district, which serves students in grades 9-12 from Appleton, Camden, Hope, Lincolnville and Rockport, found itself unable to fill an opening for an industrial arts teacher for the 2018-19 school year.

The dilemma led to a conversation about other uses for the industrial arts space at CHRHS, and the idea to create an innovation center that included a maker space began to take shape.

District officials, led by superintendent Maria Libby, got to work researching and visiting university innovation programs and innovation centers throughout New England, including the Foster Center for Innovation at UMaine.

"We really did a lot of legwork in developing our ideas in order to understand the potential and help shape our vision," says Libby, who coordinated an innovation tour of Boston as part of the work, with stops at the Cambridge Innovation Center, BUILD Boston, the Roxbury Innovation Center, District Hall, and the NuVu school. In addition to UMaine, the group also connected with UNH, College of the Atlantic, and Thomas College.

After a year of research, Libby said the vision for what would become "The Hatchery" began to crystallize.

"We saw The Hatchery representing a place and an opportunity for students to really be able to pursue their own interests and gain the self agency to recognize that anything is possible in their lives," Libby says. "The vision is fairly grand – it includes coursework, but we want to host events and we want the community and students to really network and interact around topics of innovation. We're in the early stages of developing and realizing our vision, but it's all very exciting."

Establishing an innovation course at CHRHS was part of The Hatchery's first phase, and for that aspect of the project, the district turned to the Foster Center at UMaine to train Tom Gray, a social studies teacher and the school's gifted and talented coordinator, in Innovation Engineering.

Gray's class, called "Innovation Engineering: Agency and Changemaking" is a dual enrollment course, meaning that students earn both high school and college credits upon successful completion. Libby said partnering with UMaine to develop the course was an easy choice.

"It was attractive to be able to fairly quickly offer a well-developed course to our students that was already tried and tested and that would have the added benefit of allowing our students to be dually enrolled and get college credit," Libby says. "It was a win-win. We admire a lot of what is happening at UMaine around innovation and we were able to offer a really high quality product to our students without having to develop that curriculum on our own."

The 2019-20 school year was the first in which the course was offered. Enrolled students get an overview of Innovation Engineering, which they then apply to a project of their choosing using resources available in the maker space. The year-end goal is a functional prototype.

"It went in the course catalog and was instantly overfilled," Gray says of the course, which is open to students in grades 9-12. That

year, he started with eight ninth graders, two sophomores, and eight seniors. Student projects ranged from a sensor-driven flotation device designed to sit atop the mast of a sailboat to a reimagined automobile muffler.

"A successful professional and even a personal life at this point really requires people to be willing to find workarounds, to rethink the way they're approaching a problem," Gray says. "So much in education is not that right now — it's didactic, it's absorb and repeat. We need to reframe the learning model to bring in design thinking across all content areas. And by design thinking, I mean an iterative learning process where kids try an idea, see how far it can go, find workarounds, and get comfortable with pivoting and going in a new direction."

Gray's class was given a real-life lesson in pivoting when the coronavirus pandemic forced a transition to remote learning just as the students were gearing up to build their functional prototypes. They lost access to the maker space at CHRHS and had to transition to virtual prototyping and finish their projects at home. While it was a disappointing way to end the year, Gray said the students took the format change in stride.

"The magic bullet is not so much what they create, it's how the creating makes them think differently about it," Gray says. "It's really about

changing the focus of education from the product to the process. The learning is the process." ■

"It's really about changing the focus of education from the product to the process. The learning is the process."

— Tom Gray, CHRHS teacher





Dual appointment targets nursing workforce development

When Dr. Deborah Saber joined the University of Maine faculty as an assistant professor of nursing in January 2016, she already had a clear vision for a joint position with a local hospital that would allow her to conduct nursing research and support its implementation through evidence-based practice, simultaneously bringing real-world practice knowledge back to the student nurses she was instructing.

Saber had left a similar position at the University of Miami, where she worked as assistant professor of clinical and split time in the University of Miami Health System. While there was no precedent for such a role at UMaine, Saber knew the mutual benefits it could provide for both nursing students and working nurses, and she set about making it happen.

"I learned a lot being in that joint position in Miami and I learned what I wasn't going to do if I created another one," Saber says. "I thought, 'How can I do this?'"

Her first step was to join the critical care nursing staff at Northern Light Eastern Maine Medical Center in Bangor on a per diem basis during the summer of 2016. Saber, who has more than two decades of experience in critical care nursing, also conducted research at EMMC. Through her research endeavors, she connected with hospital administrators who were looking to develop the hospital's formal process for evidence-based practice implementation. That led to a new position at EMMC as part of the hospital's clinical education team focused on the Nurse Residency program.

Arranging a joint position with UMaine proved more complicated, and was eventually accomplished through the Department of Industrial Cooperation, which worked closely with both EMMC and UMaine to develop a contract outlining the framework and responsibilities for the role, which Saber officially assumed in January 2020.

"Although a research-focused joint appointment between the School of Nursing and a healthcare institution was uncharted territory, we knew the nature of the relationship mirrored other contract partnerships on campus," says Kelley Strout, director of the School of Nursing. "The Department of Industrial Cooperation has

"To me, it's about teaching students that research and evidence-based practice and implementation are all part of being a nurse."

— Deborah Saber,
assistant professor of nursing

experience negotiating contractual agreements between industry and academia in other units, and they helped us navigate the process and made executing the agreement seamless."

One of the most significant challenges was reconciling the differing sets of regulations that govern university vs. health care interactions.

"UMaine, historically, has not been heavy on the health care side," says Saber. "That is changing now, but the whole contract part was new and I think people initially had a hard time seeing how the relationship was going to happen. I knew what a joint position looked like and I wasn't worried. I've been very steadfast about what I do and what I don't do at Northern Light, and I was able to develop relationships through working as a nurse there that helped me get where I am today."

Now, Saber's time is split 50-50 between the university and the hospital. At EMMC, she teaches the nursing staff how to do research and how to translate their findings into evidence-based practice to improve patient care. The research is grassroots in nature, driven by trends and challenges the nurses encounter in their

work. Saber also works closely with the Nurse Residency program that helps transition new nurses into the workforce during their first year.

"Just like every field, you learn a lot of theory when you're in school, but once you get out practice can be difficult — there's a lot you don't learn in school and nurses are ramped up really quickly," Saber says. "This Residency program helps ease the transition into professional practitioners, and as part of that I teach them about evidence-based practice as well."

Her work at EMMC also helps Saber lay the groundwork for that transition with her students at UMaine. A big part of that is role modeling, Saber says, showing students not only the different career paths available in nursing, but also setting expectations about what the profession really entails.

"To me, it's about teaching students that research and evidence-based practice and implementation are all part of being a nurse," Saber says. "Taking blood pressure and giving meds are not the only things nurses have to worry about. You have to keep up with the evidence and help move the practice forward. Nursing is not about someone telling you what to do, it's about taking ownership of your own self-development and being part of the movement to keep the organization current. Health care information and technology moves at an incredibly rapid rate, and we have to keep up." ■



Maine beef — it's what's for dinner

A key aspect of Dumas' outreach efforts involves work with Cooperative Extension to support and promote Maine's agricultural sectors.

In FY20, Dumas joined Extension efforts with the Maine Beef Producers Association, offering several cooking demonstrations featuring Maine-raised beef.

"Working with Cooperative Extension has been really fun and is a great platform," says Dumas. "It's allowed me to do several demonstrations and connect people with food in the way that everybody wants to connect with food — by tasting it."

Dumas' demonstrations focused on preparing less expensive cuts, such as flank steak and ground beef, and aimed to showcase their versatility and deliciousness.

Dumas first presented at the Maine Cattlemen's College, an annual event co-hosted by Extension designed to provide up-to-date information to Maine beef cattle producers and promote innovation and idea sharing. After making chicken fried steak for that group, he gave a similar presentation at the Maine Agricultural Show, preparing fajitas and Lebanese meatballs (kofta).

"Beef is a great example of the high-quality food being raised and grown right here in Maine," says Dumas. "When consumers buy locally raised meat not only do they have supply chain confidence, they also get a superior product and support local farmers." ■



Putting Maine on the

A little more than a year after joining UMaine in the newly created role of food science innovation coordinator, chef Rob Dumas sees nothing but possibility.

Dumas manages UMaine's Dr. Matthew Highlands Food Pilot Plant, a well-equipped research facility home to a sensory lab, a state-licensed commercial kitchen and a wide array of food processing equipment. While the Pilot Plant is not a new facility, Dumas was hired to take it in a new direction, expanding education, outreach and contract work for Maine's food industry writ large.

The Pilot Plant has a mission to help food processors, entrepreneurs, farmers, researchers and students in the food industry. Together with Cooperative Extension





food innovation map

and the School of Food and Agriculture, the unit can assist with product and process reviews, sensory evaluations, grant writing support, analytical consulting, product development assistance, applied research for troubleshooting issues and much more.

So far, Dumas is finding a ready market for UMaine's services and appreciating how many doors have opened thanks to his ties with the state's research university. He has dug in to project work for industry partners, collaborating with well-established Maine brands such as Wyman's and up-and-comers such as Maine Grains.

"Being affiliated with UMaine has put me in a unique position," says Dumas. "Here, I'm someone who can provide or coordinate unbiased assistance to anyone who comes through the door. I have no real stake in the game other than their success is my success, and that's a really cool way to come at a relationship with someone. It's very different from my prior experiences in the food industry."

Dumas, a native of Slidell, La., started his career in restaurants around New Orleans with a plan to attend culinary school on the GI Bill. To make it happen, he joined the Navy, spending five years as a cook aboard the U.S.S. Oklahoma, a submarine based out of Norfolk, Va.

In 2009, Dumas joined the Presidential Food Service, serving as a chef in the White House Navy Mess located in the West Wing. He began the job shortly after Barack Obama was inaugurated as the nation's 44th president and stayed in the role until the beginning of Obama's

second term in 2013. In addition to cooking in the White House, Dumas traveled with the first family, and he credits former first lady Michelle Obama with helping to shape his outlook on food.

"I started out really focused on cooking and working in restaurants, and first became entranced with the culture of restaurants and hospitality more than the food itself," says Dumas. "As I've moved through my career, thanks to different inspirations and different mentors, I've become more and more connected to the food itself and its journey from seed to table."

When he left the White House and separated from the Navy, Dumas decided it was time to immerse himself in that mindset, relocating to Vermont to teach and study as a fellow at the New England Culinary Institute (NECI). Dumas' time at NECI only strengthened his interest in seasonal cooking and local agriculture, and it was Maine's diversity in these areas that lured him to the state in 2016.

"I'm from away and I was attracted to the bounty of natural resources and agricultural products that Maine has," says Dumas. "The work I'm getting to do now around agricultural products from Maine — things like wild blueberries, grains, and seaweed — is really fantastic. The caliber of the products is through the roof and there's an amazing culture and history here in Maine around food and around people's connection to food. Getting to dive into that story is really exciting."

Through his first year, Dumas has worked

closely with Cooperative Extension, leveraging his passion for local and seasonal food to serve as a resource to the state's agricultural industries. A "Meat Science Series" of public workshops at the Pilot Plant run with Dr. Colt Knight of Cooperative Extension proved popular, and Dumas has showcased Maine products in cooking demonstrations at events throughout the state.

The connection to local food systems carries through to Dumas' product development work with Maine companies and has taught him new skills, he says.

"When you're cooking in restaurants, food is kind of ephemeral," says Dumas. "You might make something for a month and then that product goes out of season. There's a lot of emphasis on creativity and the process is more unbounded. Product development is the opposite — it's all about precision and replicability. I need to have the utmost confidence I'm delivering products that can be made over and over again with great results. It's been a beneficial growing experience for me."

Looking ahead, Dumas has a clear vision, one that involves drawing on all the resources and expertise available at UMaine to support local food innovation from its infancy.

"We, collectively, are truly the center for experience and expertise in food systems in the state," says Dumas. "I see an opportunity to use my experience, enthusiasm and understanding about our food system to help tell and develop that story and really highlight UMaine's strengths in this area." ■



Securing the future of global shipping



While Old Town, Maine, is not home to a major port, it is home to a company that is changing the face of shipping by keeping critical cargo safer.

That company is Global Secure Shipping, and the patented composite materials and manufacturing technology behind their Global Secure Container was developed at the University of Maine's Advanced Structures and Composites Center (ASCC).

The container is the first secure intermodal composite shipping container that provides six-sided intrusion detection, real-time tracking, door opening alerts, and secure global communication. Its wall, door, and roof panels are made from a fiberglass composite, while the floor is constructed out of a wood composite. Sensor grids embedded throughout the panels link up with a web-based security system that offers satellite tracking and communication capabilities. While the Global Secure Container is markedly lighter than a traditional steel container, tests have shown it to be more impact resistant. Visually, it is indistinguishable from a conventional container.

Global Secure Shipping answers U.S. government needs for better cargo protection across a range of operations. In 2016, UMaine researchers Dr. Habib Dagher and Dr. Anthony Viselli founded Global Secure Shipping in response to a U.S. Department of Defense Title III Defense Production Act Request for Proposals to establish a manufacturing facility to produce 1,000-3,000 secure containers per year. In 2018, the company was awarded a \$16.8 million contract to set up manufacturing and scale up production. In late 2019, due to the need to accelerate the production schedule for the Global Shipping Container, GSS spun out from the ASCC to establish an independent manufacturing facility in Old Town.

"The Department of State and other government agencies ship things around the world that often include sensitive materials or important supplies," says Robert Lindyberg, CEO of Global Secure Shipping, former Assistant Director of the ASCC, and graduate of UMaine



Civil Engineering (MS 1997, PhD 2000). "These shipments currently go into basic shipping containers and onto the ships, and really aren't tracked or monitored in any way. So, sometime between when the container is packed and it eventually arrives at its destination, there are multiple opportunities for the container to be tampered with in some way by terrorist organizations or our adversaries."

With the ISO-certified Global Secure Container, shippers are never left wondering.

"If you open the door or if you try to penetrate any of the six sides, that will set off an alarm and will notify the person who's making the shipment. You can have real-time notification if your shipping container has been broken into," says Lindyberg.

That kind of awareness is essential to the U.S. government, and Lindyberg said other industries have also expressed interest in the container, for example pharmaceutical companies and produce shippers.

For now, Global Secure Shipping is focused on fulfilling their initial government order for 24 containers at their new 17,500 sq. ft.

manufacturing facility in Old Town. The company is headquartered there to be close to UMaine, which continues to provide critical support as well as access to a strong pipeline of qualified engineering graduates. Lindyberg himself returned to Maine last year to lead the company and coordinate with UMaine.

"There is a seriously robust testing program involved in designing and fabricating our first set of containers," says Lindyberg. "The university is supporting us with advanced analysis and design, with materials testing and environmental testing, and with the extremely important ISO-certification testing process. The Composite Center built and tested the original prototypes, so having that knowledge base for the tech transfer close by is absolutely critical for the company being successful. We've now grown to 17 people and we just hired in our manufacturing staff – one of the junior engineers is a recent UMaine grad and another is a former Composites Center employee. Being close to that sort of talent pool is very important." ■



GLOBAL SECURE SHIPPING

Supporting timely research for Maine's aging population

The University of Maine Center on Aging focuses on a key Maine population demographic: older adults. According to U.S. Census data, 21 percent of Maine's population is over 65, and, with a median age of 44.9 years, the state ranks as the oldest in the nation.

The center works to maximize the quality of life for older citizens and their families, promoting and facilitating activities on aging including research for community and other organizations that serve older Mainers.

The center's work is funded almost exclusively through external grants and contracts, and is increasingly community engaged, according to Dr. Jennifer Crittenden, associate director for the Center on Aging. Those projects with community-based foundations and non-profits tend to be smaller in scale and often function on tight budgets and tight timelines.

"We were looking for an internal mechanism that would allow us to swiftly execute contracts for smaller scale projects so we didn't see any delays in starting the work," says Crittenden. "We sometimes get requests for really targeted technical assistance — facilitating focus groups to inform larger projects, for example — and we need to be able to respond quickly."

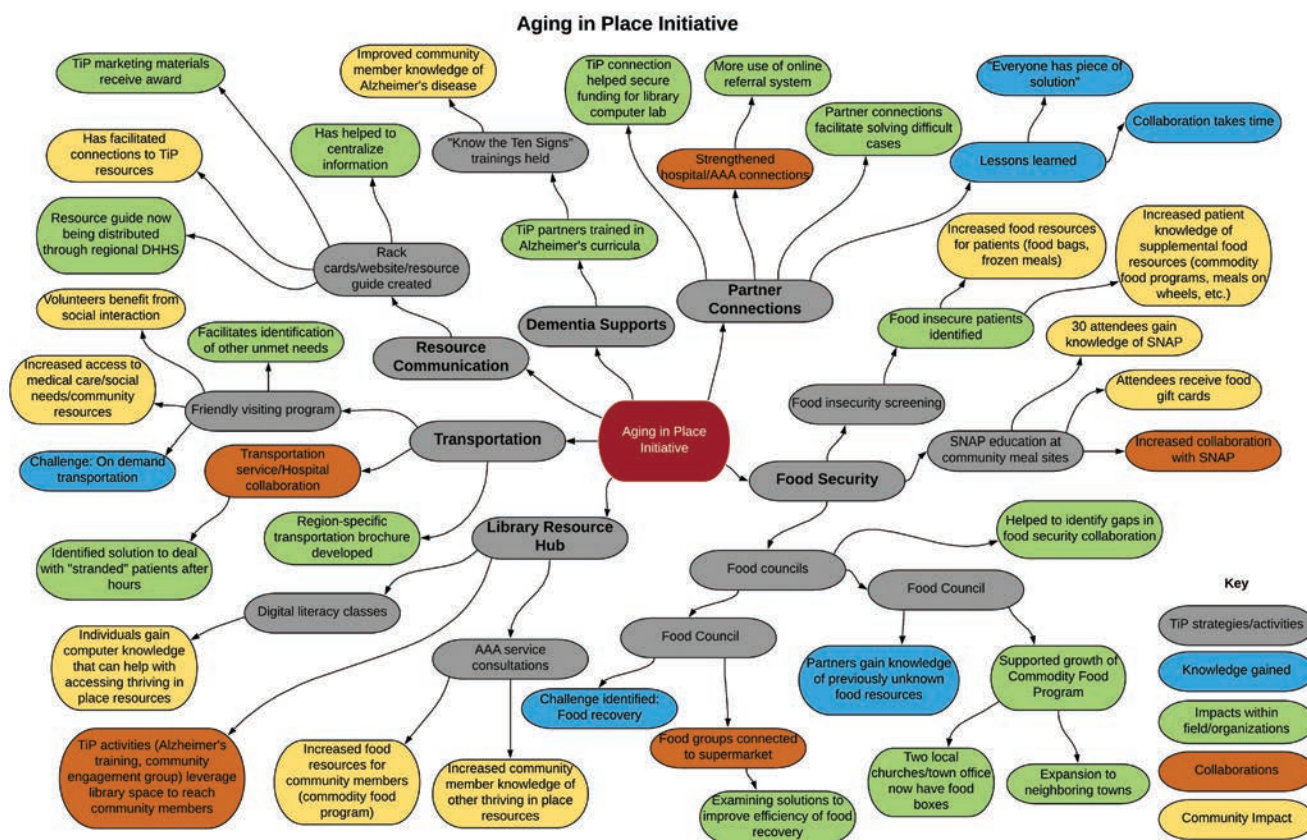
Enter UMaine's Department of Industrial Cooperation (DIC), which began facilitating contract work for the Center on Aging in 2018.

"DIC has helped us streamline the contracting process in a way that's beneficial for us and for our partners," says Crittenden. "If I've got a community partner that wants to start a project, I know I can reach out and get that set up within a few weeks' time. These groups are often working on grant funding themselves and have a very short timeframe. When we can quickly come in and do what we need to do, our partners can quickly respond to pressing community needs and issues."

One way the Center on Aging provides support is through a process called Ripple Effects Mapping, which can help groups tangibly measure the impact of more qualitative community outreach efforts. Crittenden says that service can help organizations plan and solve problems.

A recent partnership with the Maine Bureau of Veterans' Services has seen the center conduct qualitative data analysis for a project that explores oral health issues impacting Maine veterans. That contract was run through DIC.

"Our work really does tie back to improving quality of life for Maine people, which is central to our own mission, but also the university's land grant mission of giving back to the state," says Crittenden. "We really want to understand, and help our partners understand, those everyday problems that people face." ■





TrustedRentr reimagining residential leasing

In the spring of 2018, John Peters was looking to buy a new car.

As he was pulling together the needed documentation and checking his credit score, he watched his father, who co-managed several apartment complexes, confront some tenant-related problems, including property damage. The confluence of events made him think, especially as he reflected on his own experiences renting apartments during and after college.

"This idea clicked in my head that there should be some sort of rental history score that could be used by tenants and landlords," Peters says. "I did some research and couldn't find anything like it, so I thought 'I could do that — why not try it?'"

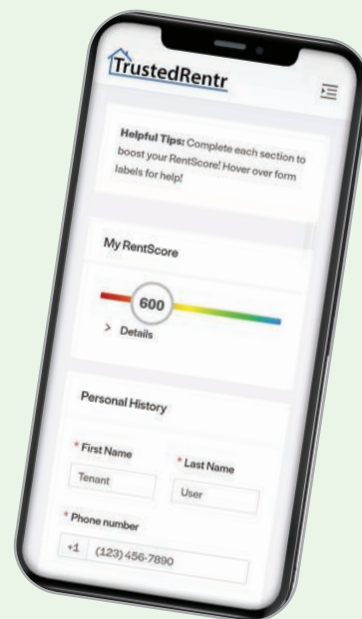
Late that summer, Peters enlisted his friend and fellow UMaine alum Steve Doman as a partner on the project, and the pair set out to make the concept real. Both were familiar with the commercialization support programs available through the Foster Center for Innovation from their undergraduate experiences, and that was where they first turned for help with their new venture.

With support from the Foster Center team, Peters and Doman — who had enrolled that

fall in a dual MBA and Global Policy master's program at UMaine — applied to participate in the 2018-19 Greenlight Maine Collegiate Challenge, a televised pitch competition that pits student entrepreneurs from area colleges and universities against one another. They began applying for grant funding, and in the spring of 2019 joined the first cohort of UMaine's I-Corps program, which helps inventors identify the market opportunities for their STEM-based research.

I-Corps helped Peters and Doman zero in on how they could make applying to rent an apartment smoother for both tenants and landlords. As part of the program, the pair interviewed scores of people on both sides of the process.

"The number one way people find apartments is through Craigslist, and that can be kind of sketchy," Doman says. "We're trying to create protection for renters, but we definitely set out to build a balanced platform that serves tenants and landlords equally. You can live in an apartment for two years and have everything be great, but the moment you move on to the next apartment you're basically a complete stranger and you have to jump through all these hoops. We wanted to streamline that process and create a community where those tenant-landlord relationships can build on one another."



Another factor is cost — the application process for an apartment typically includes multiple fees, most of which fall on tenants and are not transferable between prospective properties.

"A lot of landlords require prospective tenants to pay for background and credit checks, and if you apply for multiple apartments that can really add up," Doman says. "On our platform, the background check is stored along with your rental history, so when you find an apartment you want to rent, you apply through the platform

The screenshot displays the TrustedRentr application interface for a tenant. The top navigation bar includes links for Dashboard, Application (highlighted), Search, Message Center, and Account Settings. The main content area is titled "Helpful Tips: Complete each section to boost your RentScore! Hover over form labels for help!".

Personal Information

- First Name: John
- Last Name: Smith
- Phone number: +1 (123) 456-7890
- Email: john.smith@example.com
- SSN: 000-00-0000

My RentScore

A progress bar shows a score of 721 out of 850. Below the bar, five categories are listed with their respective counts:

- Time Renting: 4y 6m
- Payment History: 27
- Eviction History: 0
- Late Payments: 0
- Property Damage: 0

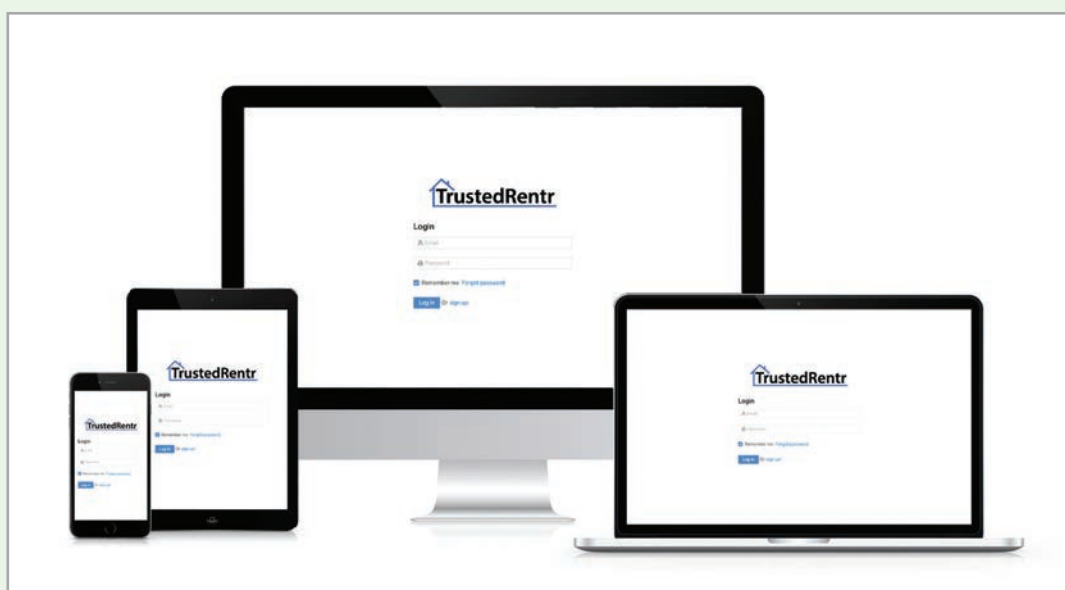
Residential History (Add button)

No residential history has been recorded!

Employment History (Add button)

No employment history has been recorded!

At the bottom right, there is a "Save" button. The footer includes links for Terms of Service, Privacy Policy, and "Made in Maine".



and your application and rental history are sent directly to the landlord for review."

The platform Doman and Peters created is called TrustedRentr, and in its beta release they are targeting college towns, including Orono, with rental markets that cater mainly to students. They have plans to develop the product into one that can offer multiple services, including allowing tenants to pay rent over the platform, which could then be reported to the major credit bureaus and help tenants build their credit, an opportunity few people take advantage of now.

Following I-Corps, Doman and Peters have made steady progress. TrustedRentr made it to the finals in the 2019 Greenlight Maine

Collegiate Challenge. While they lost the top prize in that contest to another UMaine student business, Kinotek, TrustedRentr received key grants from both the Libra Future Fund (\$5,000) and Maine Technology Institute (\$15,000) in 2019 to support their software build, which is being worked on by a team of UMaine students led by principal engineer Nick Braukhoff. This spring, TrustedRentr took part in the UMaine-facilitated Top Gun Accelerator program, maintains an office at the Foster Center, and this summer hired their first intern, Dylan Bulmer, a UMaine student. For the founders, both of whom participated in the Innovate for Maine Fellows program as undergraduates, ties to the university remain strong and valued.

"The common thread between all these programs is a focus on building networks, relationships, and practical skills," Peters says. "You become part of a community, and it's all really valuable."

For Doman, participating in UMaine's programs has offered an opportunity to learn from his fellow entrepreneurs, whatever their focus might be.

"I think the benefit of creating a startup is surrounding yourself with really interesting people trying to solve really interesting problems," Doman says. "It's just an awesome environment to be a part of and working with the team at the Foster Center has been a great experience." ■

Acknowledgments

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