

## ABOUT CREARE



Creare develops innovative technology and products for clients across a wide range of fields: aerospace, biomedical, cryogenics, and more. Since 1961, Creare has served both industry and government on the frontiers of product and process technology. Our *People & Technology* newsletter provides just a sampling of our 100+ active engineering projects.

Creare engineers work on challenging problems requiring multi-disciplinary solutions for improved energy efficiency at a time of global need, increased national security, improved medical assessment and delivery systems, and much more.

We are a company of approximately 180 people, including 80 engineers. Find more *People & Technology* newsletters on our website.

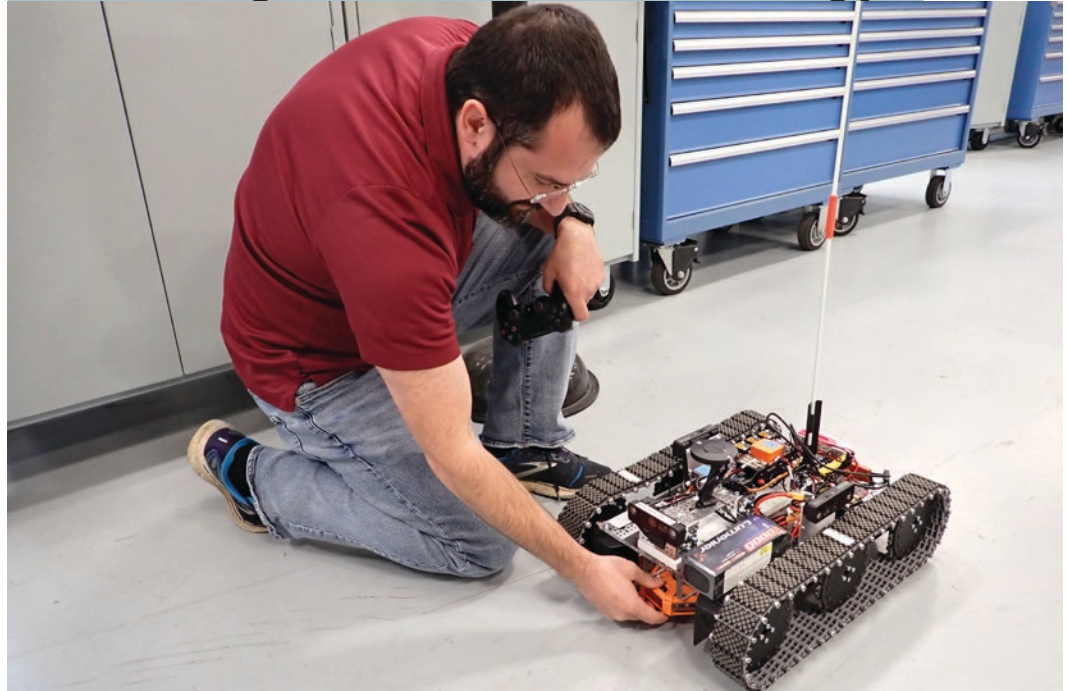


To learn more, please contact: Human Resources at [careers@creare.com](mailto:careers@creare.com)

Creare is an Equal Opportunity Employer. Female/Minority/Disabled/Veteran



## Advancing Autonomous Technology



Autonomous vehicles bring opportunities and challenges specific to a driverless future. The development of autonomous semi-trucks and other large commercial motor vehicles, or CMVs, offers the ability to operate 24/7, improve efficiency, and alleviate the persistent shortages of qualified drivers. However, autonomous CMVs face the challenges of meeting existing safety and regulatory requirements for traditional, driver-operated commercial vehicles.


Creare is developing a tool to help CMVs meet important safety requirements. CMVs must place warning markers around trucks stopped on the travel or shoulder portion of the roadway, so Creare is creating the Automated Marker Deployment for Autonomous Trucks, or AMDAT, system. Department of Transportation (DOT) regulations specify placement locations depending on the details of the roadway, such as the type of roadway (divided vs. undivided) and whether there are any view obstructions within 500 feet of the truck. These marker placement tasks, while simple for a human driver to complete, are challenging for an autonomous CMV.

The AMDAT system is composed of a base station that lives on the CMV and an autonomous rover that carries and deploys the warning markers. When the



truck pulls over to the side of the road, the rover deploys automatically from the base station. Once on the ground, the rover assesses the environment, calculates the appropriate location for the markers, and deploys them autonomously.

Creare has developed custom hardware for system-level testing, including two rovers affectionately nicknamed Speedbump and Roadkill. Using two stereo cameras mounted to the front and back of the rover, we are writing and testing navigation algorithms to help the rovers navigate safely on the roadway. Later this year, we plan on running a complete demonstration that will show the entire marker deployment process, from leaving base station to deploying the last marker.

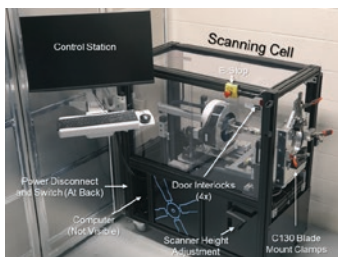
In addition to overcoming this regulatory challenge, this technology can be used with driver-operated commercial vehicles to allow drivers to remain safely in their vehicles while the rover deploys warning markers. This rover offers exciting potential for continued development of autonomous vehicles and increased safety on our roadways. 

*Eric Desjardins has been a Mechanical Engineer and Project Engineer at Creare for 8 years. He has worked on a wide variety of projects at Creare, using acoustics to characterize bubbles in media from human tissue to fresh concrete and using UAV's to automate biomedical lab tasks. He has a BS in Mechanical Engineering and a BS in Business Administration, both from the University of New Hampshire.*



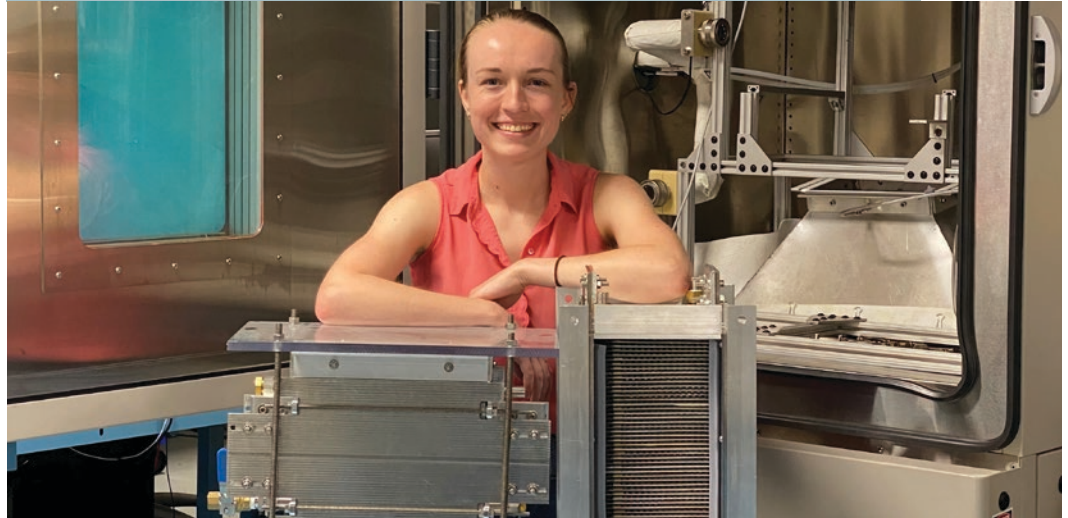
## INNOVATING INSPECTION TECHNOLOGY

Creare is a leader in development of advanced optical inspection technologies. Our prior successes include devices to inspect F-35 fasteners and detect cracks in rail road lines, and we continue to support and expand this suite of technologies.



Recently we developed optical inspection methods for C130 propellers. C130 propeller bore inspection is a critical step to ensure the integrity of the aircraft. An investigation subsequent to a fatal crash in 2017 found that failure to detect and remove corrosion pitting and intergranular cracks on a propeller caused blade detachment. This finding spurred the adoption of advanced inspection techniques at the C130 propeller refurbishment facility at Commodities Maintenance Group (CMXG) in Robins Air Force Base. In response, Creare designed, fabricated, and transitioned a BoreVision scanner to Robins Air Force Base. The BoreVision scanner gathers higher resolution images under two lighting directions to enhance the visibility of pits, and it includes a multi-line laser to qualitatively assess surface roughness. Unlike prior systems at Robins, our scanner is fully automated and does not require user adjustments of lighting and focus during a scan.

## Combating Climate Change



Creare engineers are working to combat climate change caused by carbon dioxide. The atmosphere now contains around 420 parts per million (ppm) of carbon dioxide (CO<sub>2</sub>), up from 280 ppm in the 1700s. These concentrations may sound small, but the atmosphere is huge. Making any significant reduction in CO<sub>2</sub> concentration takes a monumental effort using all practical approaches. To contribute to this effort, and with sponsorship from the US Department of Energy and the Advanced Research Projects Agency – Energy (ARPA-E), Creare is developing new technologies to quickly and efficiently remove CO<sub>2</sub> from the air.

Creare’s “DAC Cycle” project is part of a family of projects that aims to advance Direct Air Capture (DAC) of CO<sub>2</sub>. Our partners at the RTI International in North Carolina have developed a coating that captures atmospheric CO<sub>2</sub> in pores in the coated surface through a process called adsorption. Creare has designed a structure to support the coating made of thin metal plates with features specifically designed to promote evenly distributed flow, low pressure losses, and efficient heat transfer. This modular contactor structure is one unit in what will eventually be a mile wide array of millions. In other words, the contactor is like a tree and the whole system is like a forest, but one that requires a lot less space. The final system can be installed in a location with a favorable climate (humid and somewhat windy, like the southeastern U.S.) and paired with other industrial processes to make use of waste heat or green energy.

In the DAC Cycle program, our goal was to demonstrate that one contactor module can repeatedly capture and release CO<sub>2</sub> under the right conditions during months-long cyclic testing. The main challenge was automating the

test system so it could operate safely and reliably without 24/7 monitoring.

To switch from capturing to releasing CO<sub>2</sub> for storage or other uses, the coating must be heated to temperatures above roughly 80C. In our test system, this required high heater power and a large tank of near-boiling water. Thus, we included multiple safety sensors and interlocks in the system to ensure that tank water levels were sufficient and that the tank did not overheat.

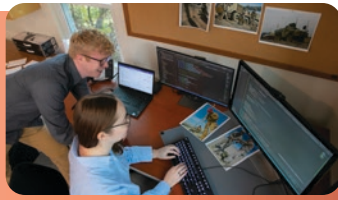
Another automation challenge was controlling the CO<sub>2</sub> concentration in the air flow through the contactor. To achieve consistent temperature and humidity levels, we tested the contactor inside an environmental chamber. However, the chamber does not control CO<sub>2</sub>. We developed a control system to monitor chamber CO<sub>2</sub> levels then automatically add CO<sub>2</sub> or air to maintain the correct level.

After months of development and testing, our results showed that the contactor can repeatedly capture and release CO<sub>2</sub> without its performance degrading after roughly 1,500 hour-long cycles. These results put the Creare/RTI contactor at the forefront of DAC technology. While a contactor may not be as beautiful as a tree, it might be a crucial building block in a future strategy to combat climate change. 🌀

*Jess Elliott holds B.S. and M.Eng. degrees in Mechanical Engineering from Cornell University. Since joining Creare in 2019, her work has spanned a broad array of technology areas including control system development, analysis and testing of both combustion and carbon capture systems, non-invasive ventilation mask development, and personnel hydration monitoring equipment.*







## Inside Perspective



As I finished my master's degree in mechanical engineering, I was eager to start my career. When I found Creare, I was impressed by the company's reputation and opportunity to work on a variety of research and development projects. It felt like the perfect place to begin my professional journey and it gave me the opportunity to move to a state I have always loved.

Moving from Providence, Rhode Island, to the Upper Valley was a transformative experience. The tranquility of the region stood




in stark contrast to the constant buzz of city life. As an avid climber, I love the proximity to Rumney's world-class cliffs. This climbing area attracts climbers from across the United States, Canada, and even internationally, so it's truly a delight to be so close by. Living here also has been helping me work towards my goal of hiking the AMC's 48 4,000-footer peaks in New Hampshire and 67 4,000-footer peaks in New England.

At Creare, my experience has been both enriching and impactful. I've had the opportunity to work on a diverse range of projects, including cryocoolers, thermoelectric generators (TEGs), and particle collectors. This variety has challenged me to expand my skill set and pushed me to grow as an engineer.



One of the greatest assets at Creare is the team itself. My colleagues are a fantastic group – intelligent, motivated, and always willing to collaborate. Their diverse technical expertise fosters a supportive environment where I've thrived under their mentorship.

Creare and the Upper Valley offer an amazing combination for me: stimulating work, exceptional people, and a stunning backdrop. It's a truly fantastic place to be and I'm grateful for the opportunity to contribute to such a dynamic and innovative team. 

*Miguel Lopez holds both a BS and MS in Mechanical Engineering from the University of Rhode Island. Since joining Creare, Miguel has contributed to a variety of projects that align with his engineering interests, including computational fluid dynamics (CFD), thermal and structural analysis, and other modeling work.*

## POWER ELECTRONICS FOR ELECTRIFIED VEHICLES

The Army's next-generation electrified vehicles need advanced power electronic technologies that offer increased power density, enhanced functionality, higher voltage, and higher operating temperatures. For over a decade, Creare has been at the forefront of developing and delivering these enabling technologies. Our successful products include low- and high-voltage solid-state circuit breakers for single and multi-channel applications, high-voltage power controllers, and power converters.



One of the first power electronics packages developed by Creare for Army electrified vehicles is the Low-Voltage Power Controller (LVPC), which we continue to produce and support. The LVPC is a programmable solid state circuit breaker that provides fault protection and achieves six times the power density of legacy technology. More recently, Creare developed the bi-directional Universal High-Voltage Controller (UHVC), which transfers up to 120kW of power between standardized 600V devices and a variable voltage battery onboard the vehicle. This unique technology achieves higher operating temperature and power-density compared to competing technology.

Beyond the military market, Creare's power electronic technologies are at the cutting edge of capabilities for the Electric Vehicle (EV) market. Creare's power electronics could be used in charging stations to support a wider range of voltages resulting in more rapid adoption of higher efficiency battery packs in EVs. In addition, Creare's programmable solid state circuit breakers can replace fuses and electromechanical contactors to provide faster response time and higher reliability. Fast response time minimizes fire risk and protects vehicle components. As demand for innovative EV technologies continues to grow, Creare's Power Electronics group is excited to expand their innovative solutions to broader markets.





## Hearing Tests for Demanding Environments



protection fit testing device, add the ability to measure bone conduction threshold, and develop telehealth functionality.

The demand for WAHTS had shifted by 2020; customers were interested in FDA-registered medical devices. The Department of Defense needed over 150 WAHTS systems to perform hearing testing during the COVID pandemic. Creare's sister company, Edare, licensed the WAHTS technology

What started as an SBIR project in 2013 has grown to become a standalone company, WAHTS Hearing. WAHTS Hearing's mission is to provide the most mobile and efficient hearing test and hearing protection fit test system in the world. The Wireless Automated Hearing Test System (WAHTS) has already tested the hearing of over 10,000 people around the world and been used by the US Department of Defense and the UK Ministry of Defence in some of the most demanding environments. Now WAHTS Hearing is expanding its market to occupational health applications.


Research started in 2013 after Creare received SBIR funding from the National Institutes of Health (NIH) to develop a portable audiometer with specially designed earcups that would attenuate the ambient noise so hearing tests could be performed outside of sound treated booths. Working with expert audiological collaborators, we were able to test prototypes and demonstrate that WAHTS performed as well in conference rooms as other commercial devices did in sound treated rooms.

Meanwhile, Creare was also engaged in supporting extensive human studies of hearing in active-duty service members, and researchers at the Walter Reed National Military Medical Center were keen to expand use of the WAHTS to other hearing tests. The WAHTS allowed them to conduct these tests in the field, which enabled them to enroll thousands of study participants, greatly increasing the impact of their research.

By late 2019, WAHTS was a complete boothless audiometry solution with many research groups looking to use the WAHTS in their studies. Creare received additional funding to investigate the use of the WAHTS as a hearing

from Creare in June of 2020 to meet the increased demand. Edare stood up production processes for higher volume, batch production of WAHTS, established a Quality Management System, and registered with the FDA. The Edare team also built a services business, with the ability to calibrate and support devices.

By late 2023, Edare had manufactured over 400 WAHTS, and small businesses and Fortune 500 companies were expressing interest in WAHTS to meet OSHA requirements. Edare had transitioned a promising technology to an FDA-registered product with a reliable supply chain and solid production systems. The future of WAHTS now rested more on the business' ability to successfully market and sell the product. This required meaningful investment to increase sales, marketing, and customer support resources.

In April 2024, WAHTS Hearing LLC became an independent spinoff company, after a successful first round of fundraising. With substantial private investment, an independent board of directors, and additional resources, WAHTS Hearing is accelerating its efforts to become a significant player in both the military and the occupational health hearing assessment markets, and eventually, in the medical diagnostics market. 

*Dan Weinstein is President at Edare, where he is responsible for the company's growth, overall strategic direction, and business success. Prior to joining Edare in 2017, Dan led the private sector consulting practice at RSG, a marketing strategy consultancy focused on applying advanced quantitative analytics and statistical modeling to business decision making. Dan has a BS from Harvard College and an MBA from the Tuck School of Business at Dartmouth.*

## UPPER VALLEY LIVING



Creare's location in Hanover, New Hampshire, offers the best of four-season living in a New England college town. The area offers excellence in medical centers and schools, a wide range of affordable housing options, and cultural amenities offered by Dartmouth College and the community.

Creare's location in the midst of this pristine area offers a wonderful array of fun activities for all ages and interests and a beautiful drive to work for all.

Activities change with the seasons. The casualness of Creare promotes collegial opportunity to enjoy hiking trails on our back 30 acres, mountain biking, cycling, running, skiing, or snowshoeing during lunch, after work, and on weekends. Lunchtime activities include on-site exercise classes and team sports like volleyball, football, and soccer. After work, paddling is a favorite summertime outing.



Travel to and from the area is made easy by the I-89/91 interstates, Dartmouth Coach daily service to Boston and New York, the Lebanon airport (a small jetport), and easy access to Manchester, New Hampshire, and Boston Logan international airports.

You can balance lifestyle and personal interests with a challenging and rewarding engineering career at Creare.