# Joint Legislative Public Hearing on 2020-2021 Executive Budget Proposal on Economic Development

Thursday, February 13, 2020
Hearing Room B | Legislative Office Building | Albany, New York

**Written Testimony from**

## CLARKSON UNIVERSITY

**Potsdam, NY | Schenectady, NY | Beacon, NY | Online**
**www.clarkson.edu**

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## SUMMARY

Thank you Hon. Liz Krueger, Senate Finance Committee Chair, and the Hon. Helene E. Weinstein, Assembly Ways and Means Committee Chair; and members of both chambers for calling this hearing and accepting written testimony to examine the Executive Budget Proposal on the topic of economic development.

Clarkson University is a private, national research university and proven leader in technological education and sustainable economic development. Through more than 95 rigorous programs of study

in engineering, business, arts, education, sciences and health professions, we educate more than 4,300 students and with them pursue user-inspired research, scholarship and innovation that creates solutions for society through world-relevant careers and sustainable natural environments. In the last decade, the University has expanded its footprint and industrial-community partnership base through New York campus operations now in Potsdam, Schenectady and Beacon, plus graduate education offered in engineering and management in New York City as well as online.

Clarkson is the designated host institution for the **Center for Advanced Materials Processing (CAMP),** a New York State Center for Advanced Technology (CAT) with a distinguished track-record in research and collaboration with industry and entrepreneurs that leads to job creation and economic development for New Yorkers. **In the last decade, CAMP has reported to NYSTAR a $248,974,031 economic impact: a more than 24:1 return on investment on the contribution from New York State's Budget**.

As of March 2019, Clarkson also co-leads with SUNY ESF the newly designated **Center of Excellence in Healthy Water Solutions**, which is the only public-private partnership among the 14 CoEs bringing together a vast network of industrial and agency partners as well as ecology and engineering system expertise. Together we are taking head on the most pressing issues of our time in protecting and preserving our freshwater ecosystem in the State as a model for national and global solutions. Since the initial designation nine months ago with a starting allocation of $125,000, we have had successful tests of new technology in PFAS/ PFOS destruction in fresh water supplies. Based on our collaborative research and consultations with the Department of Environmental Conservation, CoE faculty have filed provisional patents for new solutions to address Harmful Algae Blooms (HABS) that threaten New York's freshwater lakes and impact tourism and residents alike. We have hosted and attended public workshops on water quality and faculty are fielding questions from mayors, town leaders and municipal representatives from across the State who are dealing with emerging contaminants and infrastructure challenges. **We respectfully request to be included in the New York State Budget's Aid for Localities for $1 million (same as all CoEs) to further expand the reach to communities across the state impacted by freshwater resource issues and the efficacy of user-inspired research solutions.**

**Clarkson University, through the Shipley Center for Innovation, has been the designated New York State Innovation Hot Spot since the inception of the program in 2014**. As one of the first Hot Spots, it has provided support to over 500 aspiring inventors and entrepreneurs including basic business mentorship, prototype assistance, connections to subject matter experts and inventors, ignition grants and much more. The Shipley Center portfolio companies have created more than 30 new jobs in 2019 alone, and more than 60 new jobs since the Hot Spot program contracts launched. The Center has also helped to raise over $22 million in angel/venture funding in that same timeframe and hosts the NYS Regional Business Plan Competition among many other public outreach activities.

**Taken together CAMP, CoE, and the Shipley Center's Hot Spot create a powerful ecosystem that creates knowledge, commercializes innovation, and connects world-class researchers to New York State companies, investors and entrepreneurs**. At a time when the State needs to raise more resources to fund the programs and opportunities that are needed for New Yorkers to compete, these efforts are delivering the ROI to the tax base and future economy. Clarkson University is proud to partner with our elected representatives, public agencies, private companies and all New Yorkers in driving this robust ecosystem achieving results critical to the economic and environmental vitality of New York State.

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CENTER FOR ADVANCED MATERIALS PROCESSING

**Silvana Andreescu, PhD** and **Devon Shipp, PhD,** Co-Directors

The Center for Advanced Materials Processing (CAMP) at Clarkson University is one of the 15 Centers for Advanced Technology (CAT) dedicated to facilitate collaboration between private industry and New York based colleges to advance technology-based applied research and to transfer technology to businesses and industry throughout New York State. CAMP is built on Clarkson's recognized expertise and over 40 years reputation in colloid and surface science and fine particles, expanding into advanced materials, manufacturing processes and devices. **CAMP related activities receive several million dollars in funding from large and small NYS industry, and federal government, with a $248,975,031 million economic impact, 128 jobs created and 154 jobs saved in NYS over the past decade: an average 24:1 return on every dollar of the State's investment.**

Over the past 30 years, CAMP has developed a strategic portfolio designed to increase collaborative research and technology transfer with industry, championing economic development in Northern New York. The Center manages state-of-the-art laboratories, including the Biomaterials Characterization Laboratory (BMCL), which enable faculty to pursue innovative research with industry and are accessible to our industrial partners for technology development and prototyping. CAMP also provides industry-oriented education and training in advanced materials and processing for the next-generation workforce. This innovation ecosystem provides State companies and entrepreneurs a collaborative trusted place in which to engage in applied research enabling them to advance innovation, improve products, solve manufacturing challenges and develop new products.

**Center for Advanced Materials Processing (CAMP)**

- Champions economic development in Northern New York and across New York State through partnerships with economic development councils, industries, innovation centers and research institutes.
- Has helped companies, particularly New York-based companies, with **$285 million in positive economic impact** and **351 jobs created and retained** over the past decade through research collaborations with industry.
- Produces research that combines applied science with innovation and engineering to transfer unique solutions from the lab to practical applications.
- Is a collaborative partner resource with the ability to work cooperatively with CATs and COEs across New York State to meet industry needs.
- Works with start-up companies helping them to develop their businesses and secure funding for technology development and commercialization, e.g. federal SBIR/STTR, industry partners and seed investors.

## CAMP CORE RESEARCH EXPERTISE

CAMP faculty is world-renowned and experienced in working with industry in the following areas:

**MATERIALS SYNTHESIS & FUNCTIONALIZATION**
- Colloids, polymers, metals and composites.
- Surfaces and interfaces.
- Micro- and nano-particles.
- Metal organic frameworks.
- Metamaterials.

**MATERIALS PROCESSING**
- Removal of sub-micron particles from waste streams.
- Plasma treatments.
- Additive manufacturing.
- Metrology, non-destructive testing and quality assurance.
- Wastewater treatment

**MATERIALS CHARACTERIZATION & COMPUTATIONAL MODELING**
**MATERIALS BY DESIGN**
- Metamaterials.
- Advanced battery construction.
- Wearable electronic devices.
- Lightweight structures.
- Infrastructures.
- Medical devices.
- Sensors and Sensor Systems

**CHEMICAL MECHANICAL PLANARIZATION (CMP)**
- Colloidal slurries for planarization and controlled material removal.
- Novel substrates (SiC, GaN, Sapphire, Germanium).
- Cleaning of wafer surfaces.

## CAMP TESTIMONIALS

CAMP's expertise in colloids, surface science, and nanomaterials is leveraged in projects that support a wide range of NY State companies including Corning, Global Foundries, Harris, Xerox, Estee Lauder. Testimonials from several of our industry partners are provided in Annex 1, as examples.

## CAMP ENTREPRENEURSHIP AND CLARKSON FACULTY STARTUP COMPANIES

CAMP supports small companies and faculty start-ups, encouraging and assisting them in their efforts to seek SBIR/STTR funding. Startups lead by CAMP faculty were successful in securing federal SBIR funding including Phase 1 and Phase 2 NSF, NASA and EPA, providing opportunities for the development of new businesses with potential for job creation in the North Country. A list of faculty startups and local businesses supported by CAT, CoE and the Shipley Center for Innovation is provided in Annex 2.

## CAMP OUTREACH & WORKFORCE DEVELOPMENT

CAMP provides outreach opportunities for high school and college students and assists companies throughout the state, addressing their workforce development needs in advanced materials processing and related technologies.

**Outreach.** Clarkson's External Relations Office maintains outreach activities with over 20 K-12 school districts. Through CAMP, we have created an extensive network of educators and teachers from area schools in Northern NY and organize visits of their students to Clarkson for workshops and technology demonstrations. About 200 high school students and their teachers have been engaged in these activities over the past 2 years. In addition, CAMP scientists are regularly visiting their classes, delivering lectures on advances in science and technology that improve and/or save peoples' lives, and presenting employment opportunities and engagement in STEM.

**Workforce Development workshops**. CAMP is offering an annual two-day workshop and training sessions throughout the year with the goal of introducing our industry partners, faculty and students to the broad spectrum of analytical capabilities available for materials characterization. These workshops are open to industry and include hands on training on instrumentation available in CAMP facilities. Activities include presentation and overview of major instruments in the facility (XRD, SEM, TGA, DMA, TMA, DSC, Rheometer, Particle sizer, Profilometer, TEM), microscopy sample preparation and hands on analysis.

**Training next generation workforce**. CAMP scientists involve graduate and undergraduate students in industry projects (on average 40 students annually). These opportunities provide students with the necessary experience to develop the skills, tenacity and creativity to pursue careers in industry and high tech fields. For corporations, such relationships become a source for talented graduates to fill high-tech positions in corporations across New York State and the nation. CAMP also provides support for 2-4 graduate industry-research fellows to work on short-term projects to develop preliminary proof-of-concept data necessary to initiate new collaborations with industry and develop competitive proposals for industry projects, or externally funded research, such as GOALI and SBIR/STTR applications.

**Exposing students to industry-relevant work**. CAMP is organizing a yearly technical meeting, sponsoring participation of 45-55 students to present their work and interact with industry. About 30 companies are represented at these meetings. Company participants include large companies such as Global Foundries, Xerox, Corning, Harris, Lockheed Martin, etc., as well as medium-sized businesses and faculty startups.

CAMP sponsors participation of students in industrial internships. These experiences expose students to the corporate working environment. Success stories:

- *Example 1. Estée Lauder hosted Clarkson student Ronak Ansaripour, a student in the Chemical and Biomedical Engineering Department who worked on a faculty-industry project as a practical trainee, to implement the standard protocol developed from collaboration between Prof. Krishnan's group and the company to expand data collection. Ronak's involvement in CAMP projects resulted in an industrial summer internship opportunity where she saw how academic research translated to a practical application. Toward the end of her Master's research, Ronak received two offers—one of a permanent industrial position and the other of the admission to a Bioengineering Ph.D. program. Both of these offers were a result of the research expertise she developed while working on CAMP-related projects in the Krishnan group.*

- *<u>Example 2.</u> Xerox Corporation Visiting Scientist Appointments. Lina Bian (Chemistry Department) and Ngoc-Tram Lee (Chemical and Biomedical Engineering) traveled to perform research on particular subject matters important to the corporation, i.e materials development for functional surface design and coating methodologies for device fabrication.*


**Co-Directors: Stefan J. Grimberg PhD, Clarkson and Steve Shaw PhD SUNY ESF**

**In March 2019, New York State designated Clarkson University and SUNY College of Environmental Science & Forestry (ESF) to co-lead a new Center of Excellence (CoE) in Healthy Water Solutions to deliver synergistic problem-solving on the wide-range of water issues impacting the Empire State.** Clarkson's world-class technical and engineering innovation expertise in healthy water systems and ESF's renowned expertise in monitoring, watershed ecosystem management and solution development uniquely position the CoE to create and leverage partnerships across the public-private sectors.

Since this CoE is the only center that is shared by two institutions as well as a public-private partnership, faculty members leveraged their respective experiences to identify key issues of need to improve NY water. These key issues were identified through the use of stakeholder meetings in collaboration with faculty from both institutions and in communities in various parts of the State.

The Center has primarily focused its initial activity on two primary areas: (1) Leveraging its experience in PFAS treatment to develop economical processes that can be applied throughout NY State the U.S. and (2) to develop an emergency response process mitigating harmful algae blooms (HAB) in NY State lakes. It is also exploring the challenges and innovation in technology needed to address flooding caused by ice jams among other requests coming in from communities needing assistance.

PFAS research efforts are currently supported through external funding by DOE, NSF and NY State. Most notable two teams at Clarkson formed startup companies (RemWell LLC, founded by Dr. Michelle Crimi and Ms. Fiona Laramay, and DMAX Plasma LLC, founded by Thomas Holsen and Selma Mededovic Thagard). Each of the companies have received SBIR 1 funding. In addition, DMAX Plasma has also received SBIR Phase 2 funding to bring their technology to the market place.

Through an initiative formed by Governor Cuomo, the Center for Healthy Water Solutions has been developing emergency response technologies to mitigate HABs. The fast-tracked program has resulted in the filing of provisional patents of two processes, that will be field tested through the coming HAB season. The Center was instrumental in facilitating the two processes that have the potential to significantly improve NY State's water quality during HAB blooms and ensure both tourism commerce and residential quality of life.

In addition, the Center with the initial $125,000 in funds designated in the NYS 2019-2020 budget has awarded seed grant funding to three collaborative research teams, who will further develop technologies for improving water quality in NY State. **The full funding of $1 million to the Center of Excellence in Healthy Water Solutions would enable activities and the economic impact on par with those reflected above in the discussion of CAMP.**

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SHIPLEY CENTER FOR INNOVATION

**Clarkson's Shipley Center for Innovation is a business incubator and entrepreneurial support center serving Clarkson's campuses in Potsdam, Schenectady and Beacon. It is designated as the Innovation Hot Spot for the North Country region.** The Shipley Center was one of the first designated Hot Spots in NYS, and for the last seven years our Center has provided **support to over 500 aspiring inventors and entrepreneurs.** This support includes basic business mentorship, prototype assistance, intellectual property assistance, connection to subject matter experts and inventors, ignition grants and much more.

The primary purpose of this economic development program is to stimulate economic activity in the region and support new startups that have the opportunity to provide outstanding employment opportunities and strengthen our communities. To this point, **Shipley Center portfolio companies have created more than 30 new jobs in 2019 alone, and more than 60 new jobs since the Hot Spot program began** in 2014. While these jobs are vitally important, so too is the thriving community of entrepreneurs that now exist in our communities as result of the support that now exists for them. Approximately 20 companies now occupy Clarkson's former "downtown campus" located in the heart of Potsdam. Some of these buildings sat vacant for nearly two decades and bringing them back to life has greatly enhanced the quality of life for our residents and the attractiveness of our community.

In addition to creating employment opportunities for our region, Shipley Center companies have raised over $22M in angel and/or venture funding since 2014. These funds have been generated both by small investors such as the Point Positive Angel Investment group in Saranac Lake, NY and by large investors such as Koch Ventures. This funding not only helps startups move their business models forward, but it validates the outstanding work that is taking place on our campus with the assistance of the Shipley Center for Innovation.

While much of our work is centered on the research and business opportunities coming out of Clarkson's main Potsdam campus, our focus is on a much broader geographic region. We regularly support unaffiliated entrepreneurs and inventors located in the Adirondacks, Champlain Valley, Saratoga Region, and throughout the St. Lawrence Valley. In 2018 we began partnering with the Point Positive Angel Investment group to hold regional workshops that help entrepreneurs and inventors get started with their business. To date we have held workshops in Tupper Lake, Clayton, Massena, and Lake Placid, and have served more than 100 community members at these events. In 2020 we plan to hold workshops in Canton, Plattsburg, and in the Watertown area. These workshops provide the foundation and confidence that these soon-to-be business leaders require in order to successfully launch and grow their companies.

Clarkson also serves as the host for the NYS Regional Business Plan competition, which the Shipley Center provides strong financial and operational support. This year the event will be moved off campus and will instead be held at the newly renovated Hotel Saranac in Saranac Lake. This is a further attempt to support the region by encouraging greater participation from colleges and universities throughout the North Country. Staff from the Shipley Center and Clarkson Ignite are also traveling to these colleges and universities to hold informational sessions and workshops aimed at giving these students the confidence and support needed to participate in the event.

As mentioned above, the Shipley Center also supervises a sprawling business incubator on our downtown campus. There are three separate buildings that form this business incubator, with each serving a specific and valuable purpose. Peyton Hall was our first incubator building and contains a mix of office space, conference rooms, and wet labs. There are thirty separate spaces in this building spread out over three floors and 30,000 sq/ft. Damon Hall was our second incubator building and is focused exclusively on an open manufacturing concept. This 3-story building has approximately 40,000 sq/ft of space available, much of which is currently being used by LC Drives, mentioned below. Finally, Clarkson's oldest building, Old Main, houses a handful of incubator companies. The current business incubation space in Old Main is focused on customer-facing companies that require high-end office space. This beautiful and historic building is perfectly suited for such a use and is regarded as one of the nicest buildings in our community.

Through all of these activities, the Shipley Center has grown into a highly respected economic development partner for the region. We regularly field calls from other economic development agencies, Universities, and non-profits to assist with a particular entrepreneurial challenge. We are seen as the subject matter experts in the North Country region when it comes to supporting entrepreneurship. Members of our staff participate and often present at regional and statewide events such as the NEXT Conference, MedTech events, Central NY Biotech Accelerator events, Upstate Capital events and much more.

Some of the Shipley Center's recent success stories include:

**NexID**: This company was launched based on technology commercialized on Clarkson's Potsdam campus related to finger print identification. This company was recently to sold to the Swedish company Precise Biometrics for $3.5M. Despite this sale, Precise has opted to maintain a presence in Potsdam where they currently have five full-time employees.

**Enduraphin:** This company was launched by a Clarkson alumus after working with the Shipley Center 3-years as an undergraduate. They focus on a unique protein delivery system for athletes. In 2018 this young company raised over $300,000 in funding to support its official launch, and they have sold out of their product after making sales to more than 10 division I universities.

**LC Drives:** This company has experienced phenomenal success and growth over the last 2-years. Their product is a motor with a unique cooling system that allows it to be much smaller, up to ½ the size, of existing motors. As a Clarkson alumnus, founder Russ Marvin approached the Shipley Center in 2015 in an attempt to get his company off the ground. It should be mentioned that one of the primary reasons for Mr. Marvin to approach Clarkson was because of the availability of the incentives offered by the Innovation Hot Spot program and the START-UP NY Program. This company has made incredible progress since that time and now employees more than 40 full time workers here in Potsdam, many of them engineers. LC Drives has raised over $15M in investment and they are looking to build a factory in Potsdam that will allow them to grow to over 300 full time employees.

**In order for the Shipley Center for Innovation to continue providing outstanding leadership in the area of innovation and entrepreneurship to the North Country of New York, we will continue to rely on the invaluable funding provided by New York State's Innovation Hot Spot program**. This program provides funding that allows us to travel and connect to inventors and entrepreneurs throughout the region, host workshops, provide ignition grants, build early-stage prototypes, hire students to assist portfolio companies, and much more! The funding provided by Empire State Development has provided an outstanding return on investment through the creation of jobs, retention of jobs, investment raised, and perhaps most importantly, by helping to build the outstanding ecosystem that now exists across the North Country region to attract and support the inventors and entrepreneurs.

## 2020-2021 BUDGET IMPACTS

Clarkson University appreciates and applauds the Governor, the Assembly and Senate for New York State's commitment to economic development initiatives and the investments that are building the economy of the future as well as returning dividends today for the tax base that fuels the programs needed to compete in today's marketplace. We share the commitment for ROI across all of the State's investments that intersect with higher education.

Clarkson's Center for Advanced Materials Processing, the Center of Excellence in Healthy Water Solutions and Shipley Center for Innovation that hosts Innovation Hot Spot have strong working relationships with the economic development community, including IDAs, Chambers and municipal leaders in attracting companies and engaging in workforce development needs.

Governor Cuomo's 2020-2021 Executive Budget proposal eliminates all 14 CoEs and would consolidate all of the CATs and CoEs into a single pool of applicants with CATs. The proposal would require CoEs to apply to become CATs through a competitive process. According to the governor's memorandum in support, "migrating Centers of Excellence to the Centers for Advanced Technology structure along with the creation of a new Statewide Innovation Hub

would allow New York State to better capitalize on the Centers with the highest performance that promote priority markets and job creation." Under this proposal, funding for the combined program would be cut by 27%--from $26.7 million in 2019-20 to $19.5 million in 2020-21.

While it is reasonable to establish performance criteria for CATs/CoEs and coordinate with a Statewide Innovation Hub, the current proposal includes no metrics on how CATS/CoEs would be evaluated. Since each CAT/CoE has its own technology focus and imperative to address both emerging and critical areas impacting our State, some metrics may be more relative to those impacts. Establishing consistent and transparent performance criteria is needed before suggesting to consolidate CATs/CoEs into one new program.

The proposed cut and consolidation in the executive budget proposal will heavily impede the economic growth these Centers generate by weakening investment in academic-industry collaborations, including commercialization and workforce development. We respectfully request that the State Senate and Assembly reinstate in the executive budget proposal the 14 Centers of Excellence.

Based on the pressing issues coming forward from municipalities in freshwater protection and preservation impacting communities around the State and across the nation, and the pressing need for innovation in the technologies that address these issues, we further request the Center of Excellence in Healthy Water Solutions be funded fully in Aid to Localities for services and expenses related to the operation of the Clarkson and SUNY ESF Center of Excellence in Healthy Water Solutions at $1 million, the same as the other CoEs addressing opportunities to advance New York's global leadership position.

These funds for the CoE in Healthy Water Solutions will enable faculty research teams to continue to expand the outreach already initiated and work with NYS, municipal, industry and start-up leaders to develop freshwater protection and preservation solutions that will drive and sustain jobs as well as ensure healthy water resources for families, industries and visitors alike.

# CONCLUSION

Thank you again to the Hon. Liz Krueger, Senate Finance Chair, and the Hon. Assemblywoman Helene E. Weinstein, Assembly Ways and Means Committee Chair, for the opportunity to present testimony at this hearing on the economic development priorities in the Executive Budget. As educators of the next generation of technology leaders, Clarkson takes very seriously the public trust from investments it receives. We believe that together we must show the world what New Yorkers can do in this important work in sustainable economic development – it's the work the rest of the world is depending upon New Yorkers to lead.

**CAMP Annex 1.**

**EXAMPLE TESTIMONIALS**

*"**Ames Goldsmith** continued to work with … CAMP to develop new technologies for silver-based materials in order to compete in the global photovoltaic market. In 2018, Prof. Dan Goia assisted Ames with the development of new and novel silver powders for photovoltaic applications. This work led to $2 million in value-added sales to Ames Goldsmith … Ames is confident that as we continue to receive support from CAMP, we will be able to increase that impact in subsequent years. Thank you for all your support."* Michael S. Herman, PhD, VP Global Quality Systems Ames Goldsmith Corp.

*"**XEROX** Innovation, XEROX Materials Manufacturing & Supply and XEROX Global Delivery Groups in Rochester, New York, continue to engage in research collaborations and technology transfer with the Center for Advanced Materials Processing. The cooperation between our two organizations continues to build on a growing historical relationship that relies on the outstanding and synergistic research expertise residing at CAMP and the trust in CAMP's capabilities. XEROX continues collaboration with Clarkson's CAMP to develop a fundamental understanding of material properties and resulting functional surfaces and manufacturing processes for printing applications."* Dr. Santokh Badesha, XEROX Fellow and Open Innovation Manager XEROX CORPORATION

*"As a result of the collaborative efforts, **GLOBALFOUNDRIES** has gained valuable insight into CMP wastewater and associated treatment options, and cobalt metallization CMP challenges. This work will be a foundation for future cost-savings activities in waste treatment and technology advances for semiconductor contact metallization … The utilization of the NYSTAR assets mitigated the need for using in-house staff and external contract services, thereby saving on personnel costs."* Jason Mazzotti, Sr. Director, Thin Films and CMP Module Engineering GLOBALFOUNDRIES

*"As a result of the collaborative effort between **The Estée Lauder Companies** Inc. (ELC) and the Center for Advanced Materials Processing (CAMP), ELC has moved forward with developing easy-to-implement diagnostic methods to characterize and predict emulsion stability. The methods can help significantly expedite product stability assessment, which is a key part of product quality control. During the summer of 2018, ELC hosted a Clarkson student who worked on the project as a practical trainee and has since implemented the standard protocol developed from this collaboration to expand data collection. Based on the promising results, the Company has also decided to invest in new instrumentation to expand the research on rapid stability characterization."* Snehal Shah, Vice President, Skin Care The Estée Lauder Companies Inc.

CAMP **Annex 2.**

**EXAMPLE LIST OF UNIVERSITY START UPs**

**AM Innovations LLC, Ajit Achuthan.** AM Innovations LLC is providing computational solutions to challenges in advanced manufacturing, materials design and processing.

**Potsdam Sensors LLC, Suresh Dhaniyala www.potsdamsensors.com.** Potsdam Sensors LLC is developing next-generation sensors for air quality measurements. Unlike sensors that rely on optical light scattering and that are insensitive to particles below the wavelength of light, these new sensors, called Miniature Electrical Aerosol Spectrometers (MEASs), use electric fields to capture a much wider range of particles.

**DMAX Plasma LLC, Thomas Holsen and Selma Mededovic Thagard www.dmaxplasma.com.** DMAX Plasma develops cutting-edge electrical discharge plasma reactors to remove per- and polyfluoroalkyl substances (PFASs) from water. The enhanced contact DMAX Plasma reactor degrades PFASs and other non-oxidizable compounds, requiring no chemical additions and producing no residual waste. This results in higher efficiency at lower costs than any other treatments currently available, including granular activated carbon.

**RemWell LLC, Michelle Crimi and Fiona Laramay.** RemWell is a company addressing public health and energy issues associated with groundwater contaminated by an emerging class of chemical contaminants especially focusing on PFAS in situ treatment technology. The company has been funded by SBIR and a grant from FuzeHub, a not-for-profit organization assisting small- to medium-sized manufacturing companies in New York State by matching them with technical and business resources.

**SensoLife LLC, Silvana Andreescu.** Founded by Professor Silvana Andreescu, SensoLife focuses on the commercialization of sensing technologies, custom-made electrodes and reagents for chemical and biological sensors.

**Ducted Turbine International, Kenneth Visser** ductedturbinesinternational.com/about. Ducted Turbines International (DTI) is a wind turbine company with a focus to provide the lowest cost per kWh in the small turbine market. DTI's wind turbine design produces more than two times the energy of a conventional wind turbine of the same rotor diameter, which translates into a lower cost per kWh for the customer, and reduces the time for return on investment to half of what it takes for small wind turbines on the market today.

**ADAPTABLE ORTHO INNOVATIONS, Laurel Kuxhaus** www.adaptableortho.com. Adaptable Ortho Innovations has developed, tested and refined an adjustable length tibial nail, or Adjustable Length Orthopedic Device (ALOD). This innovation will provide optimized treatments for patients and cost savings to clinics and hospitals engaged in intramedullary nailing.

**PHOEBUS OPTOELECTRONICS LLC, David Crouse.** phoebusopto.com**.** Phoebus Optoelectronics LLC is a small firm focusing on custom design and advanced materials and device development in the technology fields of metamaterials, photonic crystals and plasmonic crystals. Phoebus specializes in advanced optical design, nano/micro fabrication and testing and uses the extensive resources at the NSF Industry/University Center for Metamaterials.