



**Division of
Science, Technology
& Innovation**

A Division of Empire State Development

Centers of Excellence

2022 Report

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PROGRAM OVERVIEW AND PURPOSE

Empire State Development (ESD) is New York's chief economic development agency. The mission of ESD is to promote a vigorous and growing economy, encourage the creation of new job and economic opportunities, increase revenues to the State and its municipalities, and achieve stable and diversified local economies. Through the use of loans, grants, tax credits and other forms of financial assistance, ESD strives to encourage private business investment and growth to spur job creation and support prosperous communities across New York State.

ESD's Division of Small Business & Technology Development (SBTD) supports the growth of small businesses, defined as firms with 100 or fewer employees, providing and implementing programs and services that facilitate access to capital, technical assistance, technology assistance, and venture funding.

Empire State Development's Division of Science, Technology & Innovation (NYSTAR), located within SBTD, manages the Centers of Excellence ("CoE") program with a goal of fostering collaboration between the academic research community and business sector to develop and commercialize new products and technologies; to promote critical private sector investment in emerging high-technology fields in New York State; and to create and expand technology-related businesses and employment. This program enhances and accelerates the university research centers' operations, which facilitates joint university-industry research and development, product commercialization, and workforce training.

This report covers the 2020-2021 reporting period.

| CENTERS of EXCELLENCE SUMMARY STATISTICS | |
|---|----------------------|
| Number of CoEs | 14* |
| Number of Companies Served | 541 |
| Number of Projects On-Going | 801 |
| Number of Projects Completed | 136 |
| Number of Students Engaged with Companies | 771 |
| New Jobs | 412 |
| Retained Jobs | 141 |
| Increased Revenues | \$64,150,634 |
| Cost Savings | \$152,377,853 |
| Government Funds | \$13,613,257 |
| Non-Government Funds | \$52,144,084 |
| Capital Improvements | \$4,102,811 |
| Total Impacts | \$286,388,639 |

*The Center of Excellence in Digital Gaming Development is one CoE, although it is across three universities.

The following information is provided for each CoE in their individual reports on the following pages:

1. Technology Focus
2. Importance to NYS
3. Purpose
4. Impacts
5. Designations and Recognitions
6. Operating Budget
7. Capital Expenditures
8. Companies Served and Projects
9. Actual or Anticipated New Products or Processes with Commercial Application
10. Start-ups Formed
11. Licensing Agreements
12. Science and Technical Activities with Students
13. Strategic Plan

SMALL SCALE SYSTEMS INTEGRATION AND PACKAGING CoE
BINGHAMTON UNIVERSITY
Bahgat Sammakia, Director

Technology Focus:

Electronics and Energy Storage Manufacturing

Importance to NYS:

This technology aligns with the global economy’s strongest growth sectors, attracting significant federal and private investment to New York. Highly profitable industries offer meaningful, well-paying jobs to a workforce of skilled manufacturing labor, highly educated professionals, and new college graduates, and enable a high quality of life to New Yorkers.

Purpose:

The Small Scale Systems Integration and Packaging (S3IP) CoE provides laboratory capability and expertise that assists companies with problem solving and manufacturing process improvement for their electronic products. The CoE offers design investigation and optimization, prototype manufacturing, failure analysis, reliability improvement, and performance testing for electronic systems and advanced Li-ion batteries. Key technologies being advanced for products and processes on behalf of industrial clients include thermal management for electronics; electronic manufacturing materials characterization including solder and heat transfer compounds; prototyping of AI-assisted surface mount (SMT) electronics manufacturing processes; hybrid flexible electronics materials and manufacturing processes; heterogeneous integration design and thermal management; energy efficiency design and management techniques for large scale electronic systems (data centers); liquid and two-phase heat exchanger technology for cooling of high power electronics; materials and process for thin-film deposition of electronics materials for solar cells and supercapacitors; advanced materials, design, prototyping, and performance analysis of Li-ion batteries.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 12 | 4 | \$31,779,623 | \$1,234,000 | \$57,022 | \$142,290 | \$805,000 | \$34,017,935 |

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|------------------------------|-------------------------------|--------------------------------|---|
| 30 | 52 | 43 | 50 |

Designations and Recognitions

| Awards / Recognition | Date Received | Recognizing Organization | Link |
|---|---------------|---|--|
| Paul A. Robert Award to Prof. Daryl Santos | 2020 | American Society for Quality, Section 205 | |
| IEEE Senior Member Grade Notification to Benson Chan | Nov. 23, 2020 | IEEE | https://eps.ieee.org/images/files/newsletter_archives/EPS_Jan2021_web.pdf page 8 |
| IMAPS 2020 Society Award, Benson Chan | 2020 | IMAPS | https://www.imaps.org/imaps_2020_society_award_winne.php |
| Member of the Electronics Packaging Society board of Governors, Mark Poliks | January 2021 | Electronics Packaging Society | https://eps.ieee.org/images/files/newsletter_archives/EPS_Jan2021_web.pdf page 5 |
| IEEE Regional Contributions Award to Prof. Seungbae Park | 2020 | IEEE -Electronics Packaging Society Region 1-7 & 9, | https://eps.ieee.org/images/files/newsletter_archives/EPS-Jul2020_web.pdf page 4 |

Operating Budget

| Operating Budget Description | Matching Funds | | | Total Budget |
|------------------------------|------------------|--------------------|--------------------|--------------------|
| | NYSTAR Funding | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$744,552 | \$44,106 | \$1,248,321 | \$2,036,979 |
| Indirect Costs | \$111,683 | \$4,411 | \$185,682 | \$301,775 |
| Equipment | \$0 | \$5,693 | \$283,578 | \$289,270 |
| Materials & Supplies | \$7,995 | \$11,151 | \$165,733 | \$184,879 |
| Tuition | \$6,411 | \$8,889 | \$91,794 | \$107,095 |
| Travel | \$4,269 | \$0 | \$2,365 | \$6,634 |
| Subcontractors | \$0 | \$0 | \$115,897 | \$115,897 |
| Other | \$28,936 | \$1,903 | \$588,171 | \$619,011 |
| Total | \$903,846 | \$76,153 | \$2,681,541 | \$3,661,540 |

Capital expenditures

None

Commercialization Plan

The S3IP CoE provides laboratory capability and expertise that assists companies with problem solving and manufacturing process improvement for their electronic products. The CoE offers design investigation and optimization, prototype manufacturing, failure analysis, reliability improvement, and performance testing for electronic systems and advanced Li-ion batteries. Key technologies being advanced for products and processes on behalf of industrial clients include thermal management for electronics; electronic manufacturing materials characterization including solder and heat transfer compounds; prototyping of AI-assisted surface mount (SMT) electronics manufacturing processes; hybrid flexible electronics materials and manufacturing processes; heterogeneous integration design and thermal management; energy efficiency design and management techniques for large scale electronic systems (data centers); liquid and two-phase heat exchanger technology for cooling of high power electronics; materials and process for thin-film deposition of electronics materials for solar cells and supercapacitors; advanced materials, design, prototyping, and performance analysis of Li-ion batteries.

Actual or Anticipated New Products or Processes with Commercial Application

| Patent Name | Inventor | Co-inventor | Patent Number | Description |
|---|---------------|------------------|---------------|---|
| Microenvironments for self-assembly of islet organoids from stem cell differentiation | Prof. Sha Jin | Prof. Kaiming Ye | 10,767,164 | This invention may lead to therapeutic endocrine cells for diabetes treatment |

| | | | | |
|--|----------------------|--|------------|---|
| Low Temperature, Nanostructured Ceramic Coatings | Prof. Junghyun Cho | | 10,828,400 | Commercialization possibilities: ceramic-coated plastics, plastic films; air and water filtration; self-cleaning windows and surfaces; light activated surfaces and self-powered devices. |
| Optoelectronic Semiconductor Light Source and Bragg Mirror | Prof. David Klotzkin | | 10,808,400 | This device could be used in fiber optic communication systems to increase the maximum data rate. |
| Apparatus and Method for Efficient Estimation of the Energy Dissipation of Processor Based Systems | Prof. Kanad Ghose | | 10,831,253 | Efficiently estimate server power dissipation without use of meters. For use in software techniques to reduce data center energy needs. |

Start-up Companies Formed

NONE

Licensing and Other Agreements

| Project | Inventor | Licensing or Industry Partner |
|--|--|--|
| Stretchable Papertronics | Principal Investigator: Prof. Ah-Young Koh | Sponsor: NSF |
| Multiple-Energy- Assisted Ultrasharp Probe-Based Nanomanufacturing for High-Resolution and High-Efficiency Nanopatterning | Principal Investigator: Prof. Jia Deng | Sponsor: NSF |
| Collaborative Research: Exploiting Nanoscale Interfaces to Enhance Bulk Mechanical Response of Additively Manufactured Boron Nitride Nanotube-Metal Composites | Principal Investigator: Prof. Changhong Ke | Sponsor: NSF |
| Rational Design of Oxide Cathode Coating for High Performance Li-ion Batteries | Principal Investigator Prof. Hao Liu | Sponsor: NSF |
| Next generation, high energy density, lightweight capacitors | Principal Investigator: Prof. Tara Dhakal | Sponsor NSF Partnership for Innovation |

| | | |
|---|--|---|
| Liquid to Air Data Center Cooling Lab Development | Principal Investigator Prof. Bahgat Sammakia | Sponsor: NVIDIA Corp. |
| SRC Undergraduate Research Program (Matt Heitner) | Principal Investigator: Prof. Scott Schiffres | Sponsor: Semiconductor Research Corporation |
| I-Corps: Preventing Rolling Veins During IV Insertion | Principal Investigator: Prof. Guy German | Sponsor: NSF |
| AeroBing Rocketry Research Group | Principal Investigator: Prof. Bahgat Sammakia | Sponsor: NASA NY Space Grant Consortium |
| Radiation-Hard Microelectronics Workforce Development Consortium | Principal Investigator: Prof. Bahgat Sammakia | Sponsor: Purdue University |
| ACS Summer Undergraduate Research Fellowship- John Talbott | Principal Investigator: Prof. Erik Rozners | Sponsor: American Chemical society |
| Application Engineering Support for Technical Solutions in Battery Energy, RF Award 90343 | Principal Investigator: Prof Yong Wang and Prof Soongeol Kwon | Sponsor: EOS Energy Enterprises |
| Standard Work Documentation and Performance Improvement in Raymond Logistics | Principal Investigator: Prof. Hari Srihari and Prof Yong Wang | Sponsor: Raymond Corporation |
| Research in Quality Engineering in Electronics Packaging and Manufacturing | Principal Investigator: Prof. Hari Srihari | Sponsor: Sanmina Corporation |
| Digital Transformation of Smart Manufacturing Using an AI/ML - based Approach | Principal Investigator: Prof. Hari Srihari and Prof Daehon Won | Sponsor: Sapphire Automation |
| Electronic Assembly Solder Alloy Development | Principal Investigator: Prof. Junghyun Cho | Sponsor: Universal Instruments Corporation |
| Mail-Order Pharmacy Analysis and Design: Simulation, Quotation Process, and Industry 4.0 Implementation | Principal Investigator: Prof. Sangwon Yoon and Prof. Soongeol Kwon | Sponsor: Innovation Associates Inc. |
| Development of a Simulation-Based Pharmacy Automation System Test Environment Integrated with Virtual Machine Emulators | Principal Investigator: Prof. Sangwon Yoon and Prof Soongeol Kwon | Sponsor: Innovation Associates Inc. |
| Development of Closed-Loop Control and Optimization Modules of the Printed Circuit Board Assembly Processes in Surface Mount Technology | Principal Investigator: Prof. S. B. Park | Sponsor: Koh Young Technology |

| | | |
|---|---|--|
| Continual Process Improvement for the Assembly of Advanced Complex Surface Mount Devices Assemblies Utilizing Advanced Process Research | Principal Investigator: Prof. Christopher Greene | Sponsor: Smart Modular Technologies Inc. |
| Advancement in the Assembly Process of Complex Surface Mount Devices | Principal Investigator: Prof. Christopher Greene | Sponsor: Smart Modular Technologies Inc. |
| Interactive Data Management Platform to Drive Smart Manufacturing in Fabless Semiconductor Manufacturing Chains | Principal Investigator: Prof. Sangwon Yoon and Prof. Daehan Won | Lattice Semiconductor |

Science and Technical Activities with Students

Restrictions in place due to COVID-19 prevented training sessions in the CoE labs during the July 1, 2020-June 31, 2021 period. Energy Smart Electronics Systems (ES2), one of the centers under the S3IP umbrella held a Girl Scout STEM Day via Zoom on September 26, 2020. 23 Girl Scouts attended the event. Professors Gretchen Mahler and Tracy Hookway made presentations and Dr. Jenny Amey and Benson Chan took the Scouts on a virtual tour of the labs.

Strategic plan

The broad focus of the center is support to the electronics manufacturing and advanced energy storage industries in New York via application of university laboratories, skills (research faculty, professional staff, and graduate students) to generate economic impact. Faculty research activities and contacts with industry are used to inform the long-term technical directions and focal areas of the center, acquisition of instruments, and staff hiring based on industry trends. Center leadership and staff are participants in NYSTAR outreach activities to industry (e.g., “manufacturing forums” organized by NYSTAR contractor FuzeHub, and NYSTAR’s National Science Foundation (NSF) Innovation Engines proposal preparation). S3IP constituent research centers receive funding from NSF, the NextFlex National Manufacturing Innovation Institute, and most recently, the federal Build Back Better Regional funding initiative to perform R&D, technology transition, and commercialization work with industry. S3IP is active with several industry consortia planning proposals to the forthcoming National Semiconductor Technical Center calls for proposal under the U.S. CHIPS Act. The S3IP engages with and is funded in part by the Semiconductor Research Corporation (SRC), which represents leading global manufacturers of integrated circuits and many manufacturers of electronics systems to perform advanced technology research in the area of heterogeneous integration (HI), the next emergent generation of electronics manufacturing technology. The S3IP is active authoring sections of the IEEE’s HI roadmap, a definitive document laying out the course of heterogeneous integration in electronics manufacturing for the next decade and beyond. The Center assists the university in capital investment proposals to local and state economic development agencies including the Southern Tier Regional Economic Development Council (REDC), the Upstate Revitalization Initiative (URI), and Empire State Development (ESD). The Center also assists faculty in pursuit of grants from state agencies such as the New York State Energy Research and Development Agency (NYSERDA).

Being a bridge between academia and industry, key CoE business-oriented performance metrics include the economic impacts reported by industry partners, the quantity of industrial member companies and projects, the level of industrial project activity in CoE labs, and patent activity; academically oriented metrics include number of CoE-affiliated students graduated with MS and PhD degrees, and scholarly publication activity for CoE-affiliated faculty and researchers.

The S3IP executive leadership and leadership in key research centers has extensive industrial experience to ensure cognizance and sensitivity to industry expectations. In addition, the Center features an advisory board comprising senior industry executives and leaders from academia for independent review and advice concerning Center performance and strategic directions. The advisory board meets twice annually to review CoE progress and directions.

Governance Structure

The S3IP CoE director is the university's vice president for research and is responsible for the overall management and strategies of the Center; he is assisted by an associate director responsible for day-to-day operations, management of the administrative and professional staff, and implementation and evolution of the strategic plan. Each of the six constituent research centers is directed by a tenured faculty member assisted by professional and administrative staff, depending on constituent center size. The S3IP has an industrial advisory board. The Integrated Electronics Engineering Center (IEEC) CAT has a well-established industrial advisory and technical advisory board to review and advise the research center directors. The FlexMed CAT (part of the Center for Advanced Microelectronics Manufacturing, or CAMM) has a newly established industrial advisory board. The IEEC utilizes a paid-membership business model; member companies appoint representatives to the Technical Advisory Board that works with CAT leadership to charter research projects aligned with the interests of industrial member companies and faculty capabilities. The FlexMed CAT uses a project subsidy model for funding its projects. The ES2 research center also utilizes a paid-membership business model and advisory board structure to define the research project portfolio. CoE labs are managed directly by S3IP leadership or research center directors, with ultimate review by the university chargeback committee for pricing policies, and by the S3IP advisory boards for operational policies. A combined faculty advisory board shaped the formation of the Health Sciences Core Facility, and a faculty / industry advisory board will be established to advise the Analytical and Diagnostics Laboratory (ADL) on its recapitalization program.

**COE FOR FOOD AND AGRICULTURE AT CORNELL AGRITECH
CORNELL UNIVERSITY**

Catharine Young, Executive Director

Technology Focus:

Farm robotics and automation including sensors, drones, autonomous vehicles; controlled environment agriculture (large indoor growing facilities); systems to strengthen local supply chains and food safety; breeding of new varieties of fruits and vegetables; novel crop protection technologies to control pests and diseases in farmers’ fields and boost productivity; developing biomaterials such as hemp; soil health scientific breakthroughs; reduction of food waste; food safety and traceability; developing new food and beverage products and cutting edge processing techniques.

Importance to NYS:

The CoE for Food and Agriculture at Cornell AgriTech is the gateway to Cornell University’s food and agriculture assets, enabling clients to grow their businesses while putting New York state on a global stage for innovation with agrifood.

Purpose

Cornell University is a global leader in discovery related to agrifood, and the CoE is focused on connecting agrifood advancements to the private sector to invigorate the state’s economy. The CoE uses a “push, pull, grow” strategy to expand New York’s economy by pushing startups and entrepreneurs to scale up their companies, pulling agrifood businesses into New York from other states and countries, and growing existing New York food, beverage, and ag tech companies. The CoE connects private sector companies to Cornell research, innovation, and technology to achieve commercialization. They provide business mentoring and make connections to business-to-business partnerships, supply chain assets, sources of capital, and government incentives. The CoE’s team includes industry experts that provide companies with advice and linkages to resources that help them be successful.

CoE facilities are being utilized to provide laboratory, office and co-working space to private sector companies that wish to co-locate on the Cornell AgriTech campus to commercialize Cornell research, innovation, and technology, thereby growing jobs and opportunities in New York. Grant funds have been secured to establish an R&D Test Kitchen in partnership with the Cornell Food Venture Center (CFVC) and Pilot Plant to help entrepreneurs and companies develop new food and beverage products. The CoE has invested in state-of-the-art food development equipment to aid in the discovery of new food products and techniques for manufacturing.

Impacts¹

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 23 | 13 | \$288,110 | \$28,400 | \$1,248,237 | \$1,124,820 | \$220,500 | \$2,910,067 |

¹ In 2020, Cornell changed their reporting period mid-year to align with impact collection from other Centers. The 2020-2021 impacts represent a six-month period from 1/1/21 – 7/1/21.

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|-----------------------|------------------------|-------------------------|--------------------------------------|
| 183 | 600 | N/A | N/A |

Designations and Recognitions

None

Operating Budget

| Operating Budget Description | Matching Funds | | | Total Budget |
|------------------------------|------------------|--------------------|------------------|--------------------|
| | NYSTAR Funding | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$569,829 | \$0 | \$548,001 | \$1,117,830 |
| Indirect Costs | \$85,474 | \$0 | \$0 | \$85,474 |
| Equipment | \$0 | \$0 | \$0 | \$0 |
| Materials & Supplies | \$39,036 | \$0 | \$25,961 | \$64,997 |
| Tuition | \$0 | \$0 | \$0 | \$0 |
| Travel | \$12 | \$0 | \$88 | \$100 |
| Subcontractors | \$81,634 | \$0 | \$28,216 | \$109,850 |
| Other | \$6,524 | \$0 | \$373,376 | \$379,900 |
| Total | \$782,509 | \$0 | \$975,642 | \$1,758,151 |

Capital expenditures

| Capital Equipment Purchases | NYSTAR Funding | Federal | Other Sources | In-kind | Total |
|--|----------------|---------|---------------|---------|-------|
| SS Brewtech fermentation and carbonation system to expand research and services at the Pilot Plant | \$9,833 | \$0 | \$0 | \$0 | \$0 |
| Milainox Industrial filler for food solids to expand research and services at the Pilot Plant | \$35,000 | \$0 | \$0 | \$0 | \$0 |
| | \$44,833 | \$0 | \$0 | \$0 | \$0 |

Commercialization Plan

The support of the CoE has spurred innovation and economic growth in the areas of agricultural technology, food, and beverage research for members to commercialize and launch their products. The CoE’s close connection with Cornell assets supported research projects as the two described below. During the 20-21 period there were over 13 research projects.

Spare Foods is a company whose mission is to discover creative, delicious, chef-inspired strategies toward the elimination of food waste. Through collaboration with the CoE, the Spare Food Co. cofounders were successful at developing a unique manufacturing process that allows the creation of a nutritious, probiotic, and delicious beverage from acid whey. Connections made with service suppliers (Afttek Filters in Rochester NY), potential ingredient suppliers, and co-packers in New York (yogurt manufacturers, breweries, and beverage co-packers) propelled Spare Food Co. toward recognition for their innovation and commitment to sustainability.

Whip & Whimsy founders have been working extensively with the CoE/CFVC pilot plant to develop their products and design their innovative dispenser appliance. The CoE has reviewed their pitch deck and assisted with developing a packing process, and conducted test runs of materials. The startup has prepared a pilot run of their products in the Fall 2021. Cornell has taken part in multiple meetings and has led two separate trials to produce small-volume samples to provide to filler equipment manufacturers. The pilot plant has tested the filler and High Temperature Short Time (HTST) Pasteurizer viability.

Actual or Anticipated New Products or Processes with Commercial Application

| Patent Name | Inventor | Co-inventor | Patent Number | Description |
|---------------------|---|---|--------------------|---|
| Whipnotic | Whip & Whimsy/Over. the Top Foods, Inc. | Tracy Luckow, Lori Gitomer, Elissa Harman, Robyn Scheck, Brent Lindberg, Martin Short, Robert Croft | US 2021022 9121 A1 | This disclosure discloses various dispensation devices for dispensation of various volumes of content. For example, some of such content can include cream. |
| Spare Tonic Process | Spare Food Co. Adam Kaye | Jeremy Kayne | US 2021012 0836 A1 | A method of preserving a flavor profile of a fermented beverage and controlling an alcohol content within the fermented beverage are provided. A desired alcohol content for the fermented beverage may be determined. The fermented beverage may be flash pasteurized to kill substantially all of a yeast used for fermenting the fermented |

| | | | | |
|--|--|--|--|--|
| | | | | beverage. The flash pasteurized fermented beverage may be rapidly chilled. |
|--|--|--|--|--|

Start-up Companies Formed

| Company Name | City | Product/Service | Sector |
|-------------------------------------|------------------------|--|-------------|
| Bandida, LLC | Brooklyn, NY | Coffee horchata | Food |
| Cassie's Cocktails | Auburn, NY | Cocktails | Beverage |
| Chewma | Westchester County, NY | Crackers | Food |
| Dirty Gourmand | New York, NY | Vegan pasta sauces | Food |
| FEAST Kitchen | Auburn, NY | Vegetable and fruit purees | Food |
| FoodFul Inc. | New York, NY | Dairy digital monitoring technology | Agriculture |
| GoodHuman, Inc. | New York, NY | Sugar-free tea/lemonade beverage | Beverage |
| Greenovation | Trumansburg, NY | Farming technology | Agriculture |
| LIVWELL Foods, Inc. | Brook, NY | Pasta sauces | Food |
| Reef Crops, LLC | Syracuse, NY | Organic and non-organic hydroponics/CEA grower | Agriculture |
| Smoother Nutrition, LLC | Rochester, NY | Food delivery and internet sales | Food |
| WeRadiate | Getzville, NY | Monitoring instruments for compost/ag waste | Agriculture |
| Whip & Whimsey (Over the Top Foods) | New York, NY | Proprietary packaging for specialty dessert product | Food |
| Forte Protein | Trumansburg, NY | Plant-based animal proteins | Food |
| Buffalo Cocktail Company | East Aurora, NY | Cocktail mixes | Beverage |
| Clean Label Solutions | Ithaca, NY | Soybean Meal | Food |
| Planet Provision | Ridgewood, NY | Healthy and ecologically friendly ice pops | Food |
| The Crop Project | Brooklyn, NY | Kelp Processing | Food |
| Winand Products | Auburn, NY | Garlic-based grilling sauces | Food |
| Hello Agriculture | Ithaca, NY | Microgreens and hydroponic vegetable production | Agriculture |
| Atolla Tech | Rockville Center, NY | Field or greenhouse-based insect detection and identification system | Agriculture |

| | | | |
|--------------------------------|-----------------|--|-------------|
| Boney T | Trumansburg, NY | Hot Sauce | Food |
| Agcess | Ithaca, NY | digital agriculture applications | Agriculture |
| Keima's Healing Hot Sauce | New York, NY | Herbal Hot Sauce | Food |
| Packhouse Technology Solutions | Elma, NY | Automated post-harvest produce handling | Agriculture |
| Amish Agriculture | Waterloo, NY | Processed food products and fresh mushrooms | Food |
| Firenze Food Group | Geneva, NY | Plant-based milk, cheese, meat, and frozen novelties | Food |
| Grumpy Ginger | New York, NY | Malaysian-style Curries | Food |

Licensing and Other Agreements

None

Science and Technical Activities with Students

CoE Executive Director Catharine Young gave a presentation at the SUNY Fredonia Technology Incubator, given the shared mission to fuel economic growth. The CoE continued discussions with Jamestown Community College and Cornell Cooperative Extension director to explore programming to give students access to careers related to agriculture and food. CoE members served as mentors for students involved with the statewide NYS Business Plan Competition.

The CoE explored and strategically planned for the development of an internship program that would be open to collaborative partners, such as Hobart and William Smith Colleges, Finger Lakes Community College, Monroe Community College, and Genesee Community College.

Strategic Plan

The CoE is focused on growing the agriculture, food, and beverage economy in New York by working with entrepreneurs, startups and existing food, beverage, and agriculture technology companies. Strategies include connecting businesses with Cornell University research, services, technology, and innovation; providing business mentoring; establishing business-to-business partnerships; connecting with supply chain assets and distribution methods; linking to government economic development incentives and sources of private capital funding; providing expertise on manufacturing sites and plant layouts.

The CoE works across systems at Cornell University to determine current and emerging high-tech opportunities and to bring Cornell excellence into the marketplace. Strategic partnerships to Cornell assets such as the CFVC and Pilot Plant provide access to businesses of all sizes to grow food and beverage manufacturing companies in New York. In addition, the CoE interfaces with other Cornell entities such as: the Cornell Dairy Program, Cornell Institute for Digital Agriculture, Cornell School of Integrative Plant Science, and more broadly the Cornell Cooperative Extensions. Other partnerships span

economic development entities and the neighboring incubator and industrial park known as The Technology Farm.

Metrics for ensuring the CoE is maintaining its focus and fulfilling its mission include number of companies served, number of contacts with each company, and increases in company jobs; revenues; federal, state, and local funding; and capital investment.

Governance Structure

The CoE is part of the Cornell College of Agriculture and Life Sciences, a premier institution of scientific learning that connects the life, agricultural, environmental, and social services to provide world-class education, spark unexpected discoveries and inspire pioneering solutions. The CoE is located at AgriTech in Geneva, NY and operates under the guidance of Jan Nyrop, Goichman Family Director of Cornell AgriTech. Agritech is an experimental station that creates future food and agriculture systems by working across disciplines to discover practical solutions that help growers and businesses thrive. The CoE is in the process of establishing an Advisory Board of key advisors from the food and agriculture industry. The success of the CoE is continually being evaluated and adjusted as necessary, and input is given from the various Cornell programs that partner with the CoE.

**CoE IN DIGITAL GAME DEVELOPMENT
THE NYU GAME CENTER AT NEW YORK UNIVERSITY**

Naomi Clark, Director

Technology Focus:

Software and Digital Media – Game Development

Importance to NYS:

The software, digital media, technology, and electronics industries are integral to New York’s economy. The CoE in Digital Game Development at NYU targets these industries sectors as well as small business development and workforce development. Part of the CoE’s strategy is to raise the profile of the presence of the game industry in NYS nationally and globally. The NYS CoE in Digital Game Development, along with the other CoEs, presented a joint booth and reception at the Game Developers Conference in San Francisco in 2022. The move represents a major shift in outreach efforts, and the CoE anticipate that it will highlight the presence of game developers in New York State and encourage companies to move to or expand here.

Purpose

The NYU Game Center is a program with more than 250 undergraduate and graduate students enrolled, working to complete degrees in game design. In addition to that, the Center has been running a game-specific Incubator since 2014 and a free event series open to the public. The Center has a strong network of local and international companies in and around game development through both initiatives. The Center is an incredible resource for companies looking to hire students with backgrounds in technical and artistic aspects of game design. Through the Internship Matching program, both Take-Two and industry partners gain access to students eager to gain experience in the industry, and students gain the necessary skills to succeed in the industry. The Center has significant experience determining which teams and projects are most likely to succeed with continued funding, thanks to experience running a project incubator. The goal is to support and grow companies working to make games in New York State.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 0 | 0 | \$0 | \$83,000 | \$0 | \$0 | \$0 | \$83,000 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students Engaged with companies |
|----------------------|------------------------------|-------------------------------|--------------------------------|---|
| 2021 | 16 | 10 | 4 | 25 |

Designations and Recognitions

| Awards / Recognition | Date Received | Recognizing Organization | Link |
|--|---------------|--------------------------|---|
| 3rd Ranked School for Game Design - Bachelors / 2nd Ranked School for Game Master Design | 03/23/2021 | The Princeton Review | https://www.princetonreview.com/press/game-design-press-release-2021 |

Operating Budget

Matching Funds

| Operating Budget Description | NYSTAR Funding | Company Cost Share | Other Sources | Total Budget |
|------------------------------|------------------|--------------------|-----------------|------------------|
| Salaries & Fringe | \$81,893 | \$0 | \$63,690 | \$145,583 |
| Indirect Costs | \$6,299 | \$0 | \$21,838 | \$28,137 |
| Equipment | \$0 | \$0 | \$0 | \$0 |
| Materials & Supplies | \$0 | \$0 | \$0 | \$0 |
| Tuition | \$0 | \$0 | \$0 | \$0 |
| Travel | \$0 | \$0 | \$0 | \$0 |
| Subcontractors | \$0 | \$0 | \$0 | \$0 |
| Other | \$73,168 | \$0 | \$11,620 | \$84,788 |
| Total | \$161,360 | \$0 | \$97,148 | \$258,508 |

Capital expenditures

None

Commercialization Plan

The NYU Game Center CoE in Digital Game Development is made up of a wide variety of competencies and capabilities that have established them as a leader in the field of both game design and development, higher education, and developing academy to industry pipelines. Specifically, competencies include the world-class faculty and program staff, as well as a robust and growing group of alumni. Combined, faculty, staff, students, and alumni have worked in every aspect of digital game development, from large AAA commercial teams to successful indie hits, to hardware development, to academic research and writing.

NYU has run a successful game incubator since 2014, helping dozens of developers make their start in NYS by providing workspace, support, and connecting them to publishers. Before the pandemic, they provided free dedicated workspace for NYC-based developers, the first game-specific co-working space of its kind. Since the pandemic NYU has maintained their public programming (entirely virtually) including the Incubator program. Through these public outreach programs, they have developed a

unique relationship to not only stakeholders in the business side of game development in NYC, but also local companies hoping to grow and expand, game players and consumers, and up and coming entrepreneurs and creatives. They plan to expand co-working space as well as maintaining a variety of free public events, a presence at industry events, and continued university-specific events to maintain this important ecosystem.

Actual or Anticipated New Products or Processes with Commercial Application

None

Start-up Companies Formed

| Company Name | City | Product/Service | Sector |
|-------------------|--------------|-------------------------------|--------------------------|
| Baconeggandchees | Brooklyn, NY | Digital game (Crown Delights) | Software & Digital Media |
| Perfect Hat Games | Brooklyn, NY | Digital game (ELUDO) | Software & Digital Media |
| Heavy Meadow | Brooklyn, NY | Digital game (Rewilding) | Software & Digital Media |
| Moon Lagoon, LLC | Brooklyn, NY | Digital game (Loddlenaut) | Software & Digital Media |

Licensing and Other Agreements

None

Science and Technical Activities with Students

During the period of February through April, 16 students completed over 100 hours of game design and development coursework while participating in the Future Game Designer’s Program. This program is a free 14-week program for local high-school students from under-represented backgrounds in the game industry. In March 2021, Gigantic Mechanic invited the CoE team to act as subject matter experts to give feedback and advice to middle and high school computer science students at the Department of Education’s Hack League. The Summer High School Program for Game Designers ran from July – August 2021. The program is an intensive (remote) summer course for high school students around the world. 16 students earned six college credits in game design and development coursework and learned about careers in the game industry.

Strategic plan

The NYU Game Center is a program with more than 250 undergraduate and graduate students enrolled, working to complete degrees in game design. In addition to that, they have been running a game-specific Incubator since 2014 and a free event series open to the public. The Center has a strong network of local and international companies in and around game development through both initiatives. The goal is to support and grow companies working to make games in New York State. The CoE will measure its success through the growing attendance in their public programming in response to their emergence from the pandemic, and through the successful game launches of student and incubator teams. The Center will assess these metrics through information gathered by maintaining connections to alumni and program participants, both in their individual project successes and evaluating which methods worked best for them.

Governance Structure

In 2021, the CoE's governance included three team members who were supported by other administrators around the university. In addition, our 12-person faculty is involved in decision making, planning, and evaluating CoE progress. The team is listed below:

Naomi Clark - Departmental Chair, NYU Game Center – A game industry veteran and co-author of A Game Design Vocabulary (2014).

Dylan McKenzie - Program Coordinator, NYU Game Center - NYU Game Center Incubator founder and external partnerships manager.

Toni Pizza - Project Coordinator, NYU Game Center - Published game designer, small business owner, and career advising/workforce development professional.

Margaret Robertson - Interim Incubator Director & Former Director of Game Development at Dots - Co-founder of game development company Hide and Seek, including expansion of the company from the UK to the USA. Took over incubator responsibilities in 2021 after Dylan's departure.

**COE IN DIGITAL GAME DEVELOPMENT
ROCHESTER INSTITUTE OF TECHNOLOGY
Dr. David Long, Center Director**

Technology Focus:

Digital media research, production, and publication, including games, film, virtual reality (VR), augmented reality (AR), and eXtended Reality (xR) and more.

Importance to NYS:

The RIT Center for Media, Arts, Games, Interaction & Creativity (MAGIC) fosters collaboration between the academic research community and the business and technology sectors while developing and commercializing new media and technologies; promoting investment in digital media production in New York State; helping to create and/or expand technology-related businesses and employment and retain a highly educated student workforce.

Purpose

MAGIC utilizes resources, equipment, facilities, and personnel to grow the digital media field and specifically the games industry in New York State by fostering community and talent in K12; by supporting students who are interested in publishing games through their Maker Program; supporting indie developers through their Community Incubator program; showcasing and playtesting games being developed in the community at the annual Rochester Game Festival; at conferences/festivals and events in around New York State and across the country (virtually) and creating and retaining jobs in digital media production.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|----------|---------------|--------------------|--------------|------------|----------------|------------------|---------------|
| 0 | 0 | \$0 | \$13,813 | \$0 | \$0 | \$1,000 | \$14,813 |

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|-----------------------|------------------------|-------------------------|--------------------------------------|
| 10 | 4 | 1 | 15 |

Designations and Recognitions

| Awards / Recognition | Date Received | Recognizing Organization | Link |
|--------------------------|---------------|--------------------------|---|
| MOU w/ Vicarious Visions | 7/22/20 | Vicarious Visions | https://www.rit.edu/news/rits-magic-center-and-vicarious-visions-sign-agreement-expand-collaborations |

| | | | |
|--|---------|-------------------------|---|
| RIT Game Design and Development program ranked by Princeton Review | 3/3/20 | Princeton Review | https://www.rit.edu/news/rit-game-design-programs-ranked-among-best-world |
| David Long wins RIT Golden Brick Award | 2/13/20 | RIT Alumni Association | https://www.rit.edu/news/four-rit-faculty-and-staff-alumni-acknowledged-golden-brick-award |
| RIT ranked a best college to study game design | 2/12/20 | Animation Career Review | https://www.rit.edu/news/rit-named-one-best-colleges-study-video-game-design |

Operating Budget

| Operating Budget Description | Matching Funds | | | Total Budget |
|------------------------------|------------------|--------------------|------------------|------------------|
| | NYSTAR Funding | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$240,065 | \$0 | \$215,898 | \$455,963 |
| Indirect Costs | \$36,010 | \$0 | \$0 | \$36,010 |
| Equipment | \$0 | \$0 | \$0 | \$0 |
| Materials & Supplies | \$0 | \$0 | \$0 | \$0 |
| Tuition | \$0 | \$0 | \$0 | \$0 |
| Travel | -\$15,966 | \$0 | \$0 | -\$15,966 |
| Subcontractors | \$0 | \$0 | \$0 | \$0 |
| Other | \$37,247 | \$0 | \$89,650 | \$126,897 |
| Total | \$297,356 | \$0 | \$305,548 | \$602,904 |

Capital expenditures

None

Commercialization Plan

The CoE plans to focus on the promotion of all digital game activities in the Rochester region and play a leadership role in developing the narrative of digital games in NYS while establishing RIT and the MAGIC Center as the recognized resource (hub) for game-related activity and the starting point for game development in the Rochester region. They have continued their leadership of the Digital Games Industry Association, an organization founded to help grow and influence the economic growth of the local digital games industry by increasing the local studio and community groups' participation and collaboration. They are positioning the MAGIC Community Incubator Program (now in its 4th cohort) to become a vital community asset and support new projects on an annual basis. Finally, the Center will help to develop

and disseminate a viable entrepreneurship roadmap for local independent game developers, start-up studios, and students and create a shared view on the pipeline of student talent to NYS studios.

Actual or Anticipated New Products or Processes with Commercial Application

| Patent Name/ Game Name | Inventor | Co-inventor | Patent Number | Description |
|---------------------------|----------------|---|---------------|-------------|
| Hoodlings | Stefan Fella | Kent Reese, Chris Brown, Vansh Pahuja | N/A | Video Game |
| Space Cat 9 | Rohit Crasta | N/A | N/A | Video Game |
| Grindblood Gauntlet | Peter Lazarski | N/A | N/A | Video Game |
| How to make a Killing | Tyler Wilson | N/A | N/A | Video Game |

Start-up Companies Formed

None

Licensing and Other Agreements

| Project | Inventor | Licensing or Industry Partner |
|--|-------------------|-------------------------------|
| Nintendo Developer Agreement | David Kilmer | MAGIC Spell Studios |
| UNICEF | Stephen Jacobs | MAGIC Center |
| Repetition Rebellion Trial | Stephen Jacobs | MAGIC Center |
| A Multimodal System for Data Visualization | Chao Peng | MAGIC Center |
| CRII: CSR: GPU-Accelerated | Chao Peng | MAGIC Center |
| Resistance Mapping | Whitney Sperrazza | MAGIC Center |
| EPIC: Coursera EdX Course | Shaun Foster | MAGIC Center |
| EPIC: Augmented Reality Theatre Production | Joe Geigel | MAGIC Center |
| EPIC: Multimodal Interactions for Photo Mgmt. | Chao Peng | MAGIC Center |
| EPIC: Previsualization and Virtual Production Curriculum Development | David Long | MAGIC Center |

There are several “in progress” video game projects (anticipated 2023 and beyond release dates) through our MAGIC Maker Program and Community Incubator Programs, as well as their own internal game project “That Damn Goat” that each have their own intellectual property ownership agreements.

Science and Technical Activities with Students

MAGIC continues to engage the K12 population by raising awareness of career opportunities in the digital media fields and specifically the games industry. Outreach efforts included multiple K-12 workshops (in person and virtual), as well as with several community organizations including The Strong Museum and ROC Game Dev and by hosting the annual Rochester Game Festival.

Strategic Plan

MAGIC is a resource for the RIT and Rochester communities and beyond. The Center leverages their state-of-the-art facilities, professional and academic networks, faculty and student expertise in digital media research and production. MAGIC provides unique facilities that were built for delivering hands-on curriculum in game design, 2D and 3D animation, filmmaking, and digital design. RIT students learn using the same hardware and software platforms found in industry while honing their technical and creative skills. A fully outfitted sound stage and post-production studios further enhance experiential education opportunities and permit faculty to introduce real-world film, animation, and digital media workflows to the classroom.

Center activity and engagement in the community spans the physical studio and post-production spaces to co-work suites available to host companies for long-term engagements. MAGIC's strengths and strategic priorities are teaching, scholarship, exhibition, entrepreneurship, and commercial and economic development. MAGIC is a catalyst for economic growth throughout the Rochester region and New York State. Students are hired to work as co-ops/interns and full-time employees at MAGIC to develop their own IP as well as research and contracted for-hire services in digital media production for external clients wishing to engage with RIT. MAGIC facilities serve to showcase the creative output of RIT students and faculty and provide a performance platform for the campus and the Rochester community.

MAGIC provides a home for start-up incubation and the commercialization of digital media products. Students bring their ideas and are supported with funding, business start-up mentorship, and access to a full suite of technical tools. Core to entrepreneurial support is the MAGIC Maker Program, a competitive program that allows students to pitch digital media product ideas and can earn both experiential education co-op credit and start-up funding for publication and commercialization. The Center supports indie developers in the Rochester community through the Community Incubator Program. The Community Incubator Program is modeled after the successful student maker program.

RIT's nationally ranked academic programs from the School of Film and Animation, School of Interactive Games and Media, and School of Design helped build MAGIC. Faculty from all three programs live and work in the building, developing curriculum and engaging students at the undergraduate and graduate levels. MAGIC is an RIT-designated Research CoE housed within the Office for the Vice President of Research.

Governance Structure

MAGIC does not have a governance structure (i.e., board), but instead a staffing structure that includes:

Dr. David Long, Director

Jennifer Hinton, Associate Director

Brenda Schlageter, Manager of Financial Operations

Amanda Hughes, Studio and Technology Manager

Aaron Nieboer, Digital Game Hub Associate

Rob Mostyn, Digital Game Hub Coordinator

Digital Game Hub Coordinator (position is open at this time)

**COE IN DIGITAL GAME DEVELOPMENT
 RENSSELAER POLYTECHNIC INSTITUTE
 Benjamin Chang, Director**

Technology Focus:

Digital Game Development, Analog Game Design, Virtual Reality, Augmented Reality, Artificial Intelligence

Importance to NYS:

Games are a transformative medium, a new way of telling stories, and a new way to connect. The ongoing COVID-19 pandemic has continued to positively impact the growth of the medium as a means of remote connection; however, increased availability of vaccines and higher vaccination rates have also contributed to the tentative return of in-person games-related gatherings (e.g., conventions) in the region. Meanwhile, New York remains home to a strong and growing community of game studios, including numerous independent game developer (i.e., indie) studios that regularly succeed in driving innovation by pushing the creative boundaries of the industry. Similar innovative growth stems from the application of game technologies – including virtual reality, game-based learning, and graphics processing units (GPUs) – to non-entertainment-related purposes. The sector thus persists in evolving along multiple fronts, and New York State finds itself well-positioned to capitalize on future development.

Purpose:

The CoE in Digital Game Development works to grow the games industry in New York State, establish the Capital Region and the state as a hub in the global games industry, and advance research in games. The Center leverages the expertise of Rensselaer’s Games and Simulation Arts and Sciences Program and works with industry partners, community organizations, economic development agencies, and other partners.

Impacts:

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 10 | 0 | \$0 | \$136,700 | \$23,100 | \$10,500 | \$0 | \$170,300 |

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|------------------------------|-------------------------------|--------------------------------|---|
| 6 | 3 | 3 | 17 |

Designations and Recognitions:

None

Operating Budget:

| Operating Budget Description | NYSTAR Funding | Matching Funds | | Total Budget |
|------------------------------|------------------|--------------------|------------------|------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$119,338 | \$0 | \$40,544 | \$159,882 |
| Indirect Costs | \$0 | \$0 | \$0 | \$0 |
| Equipment | \$0 | \$0 | \$268,885 | \$268,885 |
| Materials & Supplies | \$12,499 | \$0 | \$0 | \$12,499 |
| Tuition | \$36,140 | \$0 | \$126,863 | \$163,003 |
| Travel | \$3,884 | \$0 | \$0 | \$3,884 |
| Subcontractors | \$60,000 | \$0 | \$0 | \$60,000 |
| Other | \$44,502 | \$0 | \$124,916 | \$169,418 |
| Total | \$276,363 | \$0 | \$561,208 | \$837,571 |

Capital Expenditures:

None

Commercialization Plan

The CoE in Digital Game Development leverages broad faculty experience in digital games, analog games, and related technologies and methods from virtual reality to game-based learning. The interdisciplinary team has expertise in areas, including AAA and Indie game production; serious games and games for learning; virtual reality, augmented reality, and mixed reality; artificial intelligence and intelligent virtual agents; interactive narrative and AI storytelling; computer graphics; data visualization; analog and tabletop game design; wargaming; and 3D modeling and animation. Specialized infrastructure includes a CAVE virtual reality environment, performance motion capture suite, digital fabrication lab, and audio production studio.

The Center’s primary sector focus is the games industry, and they provide indie developers and new startups support to launch and gain traction. They provide technical and business expertise to early-stage developers and connect faculty research expertise with industry needs. They provide workforce development, outreach, and expanding access to careers in games. They support the game development community and promote the work of game studios in the Capital Region.

Key initiatives include Level Upstate, a six-week summer intensive entrepreneurship program for indie developers and games startups; GameFest, an annual festival showcase of talented game design students and indie developers; representing the region at global events, such as the Game Developers Conference; and working with community partners on game jams, mentoring, and other programs to advance diversity and access. As game technology has continued to evolve, it has also found uses in other fields. Virtual reality and augmented reality have wide applications beyond entertainment, and the Center can provide consultation and expertise for companies interesting in using or developing applications with these technologies.

Over the next twelve months, the Center’s objectives include expanding Level Upstate to a full hybrid mode in order to support full-time teams in residence, as well as remote teams outside of the immediate region. They will complete the installation of the MechDyne CAVE-type virtual reality system on the main campus for improved access and usability over the current location in the Rensselaer Tech Park. They will expand participation in GameFest, whether in-person or online.

And finally, they will continue to work with local partners on workforce development.

Actual or Anticipated New Products or Processes with Commercial Application:

| Patent Name | Inventor | Co-inventor | Patent Number | Description |
|---|-------------|----------------|---------------|--|
| Pseudo-Volumetric Display Apparatus and Methods | Eric Ameres | Gordon Clement | 20190094678 | A pseudo-volumetric display apparatus includes a first inwardly facing image display surface having a continuous geometry, with an open upper end, for presenting an interior panoramic image. A second upwardly facing image display surface presents a second image that is correlated and synchronized to the first image, and the first image display surface is sized and positioned to facilitate simultaneous viewing of both images from outside of the first surface via the open upper end |

Start-up Companies Formed:

| Company Name | City | Product/Service | Sector |
|--|----------|--|---------------|
| Ironsilk Games (Formerly Chain Spider Games) | Troy, NY | Multiplayer games with an emphasis on innovative audio systems. | Digital Games |
| Aestronauts | Troy, NY | Single-player games with an emphasis on light-hearted and engaging gameplay. | Digital Games |

Licensing and Other Agreements

None

Science and Technical Activities with Students

The Center works with local partners to foster student interest in the technical innovation, imagination, and teamwork involved in creating games. The Center continued to partner with Tech Valley Game Space, which offers after-school programs in game design and youth game jams and hackathons in addition to their work supporting independent game developers. They also worked with Games in Education and Troy-based game studio 1st Playable Productions on the Teen Game Workshop. Started

in 2014, the Teen Game Workshop's mission is to provide a free program focused on allowing underprivileged students the opportunity to learn about programming and STEM-related fields through the creation of video games in an experimental learning environment. Teen Game Workshop remained on hiatus this year due to the pandemic.

A key workforce development need in the Capital Region games cluster is in networked games. Companies in the region develop popular online multiplayer games, as well as core services, tools, and platforms for networked games. There is a need for skilled network engineers able to apply the principles of scalable services and robust real-time networking to the unique needs of online games, a set of skills that requires real-world experience in addition to classroom learning. We continue to explore ways to meet this need in both our own curriculum and supporting education and training in the broader community.

Strategic Plan

The broad focus and mission of the Center is to advance research in games, support and grow the games industry in the Capital Region. The Center works closely with local companies, economic development entities, and community groups to identify needs and opportunities. The overall strategy includes (1) cultivating the talent pipeline, (2) supporting new companies and independent developers, (3) promoting the work of developers in the Capital Region and the outstanding games made in New York, (4) advancing research in games and connecting research to industry, and (5) expanding opportunity and diversity in games. The Center's activities and collaborations include incubators and entrepreneurship programs, public events, internships, mentoring, STEM and STEAM educational programs, teacher training, game jams and hackathons, graduate student research in games, and exhibitions at trade shows and conferences. The Center and associated faculty advance research in games pertaining to a variety of topics, including game AI, virtual reality, educational and serious applications of games, wargaming, historical simulation, and the connections between visualization, perception, and cognition.

Governance Structure:

The CoE in Digital Game Development is housed in the School of Humanities, Arts, and Social Sciences (HASS). The Director reports to the Dean of the School of HASS. The Center is closely aligned with the Games and Simulation Arts and Sciences Program (GSAS), an interdisciplinary program in the School of HASS with connections to the School of Science and the Lally School of Management. The Center and the GSAS Program work closely with industry and community partners in the Capital Region on curriculum design; workforce development; the entrepreneurship ecosystem; diversity and inclusivity; public events; and promoting the Capital Region and New York State game development sector.

**COE IN HEALTHY WATER SOLUTIONS
CLARKSON UNIVERSITY AND SUNY ESF
Stefan Grimberg and Stephen Shaw, Co-Directors**

Technology Focus:

Healthy Water Systems (HWS)

Importance to NYS:

Access to clean water is vital to NYS tourism, agricultural and manufacturing industries. The mission of the Center is to generate solutions that help protect and improve waters for sustainable, natural environments, healthy populations, resilient communities, and sound economies.

Purpose:

The Center provides access to state-of-the-art analytical facilities located at Clarkson and SUNY ESF to quantify contaminants in natural and treatment waters. In addition, the Center provides access to a range of experts to characterizing natural and engineered water systems. Through its grants program the Center is engaging industry to work with faculty to develop relevant technologies to improve water quality in NYS. The Center is further providing training opportunities for students in industry through its internship program and is developing workforce development programs for water and wastewater treatment operators.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 1 | 0 | \$0 | \$125,000 | \$175,000 | \$0 | \$0 | \$300,000 |

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|------------------------------|-------------------------------|--------------------------------|---|
| 1 | 1 | 0 | 2 |

Designations and Recognitions

None

Operating Budget

| Operating Budget Description | Matching Funds | | | Total Budget |
|------------------------------|-----------------|--------------------|-----------------|------------------|
| | NYSTAR Funding | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$24,127 | \$0 | \$0 | \$24,127 |
| Indirect Costs | \$3,524 | \$0 | \$0 | \$3,524 |
| Equipment | \$0 | \$0 | \$0 | \$0 |
| Materials & Supplies | \$8,812 | \$10,000 | \$0 | \$18,812 |
| Tuition | \$0 | \$0 | \$0 | \$0 |
| Travel | \$0 | \$0 | \$0 | \$0 |
| Subcontractors | \$22,979 | \$0 | \$0 | \$22,979 |
| Other | \$3,122 | \$0 | \$48,779 | \$51,901 |
| Total | \$62,564 | \$10,000 | \$48,779 | \$121,343 |

Capital expenditures

None

Commercialization Plan

The HWS CoE provides the diverse expertise essential to addressing the transdisciplinary nature of many pressing water resource problems. Namely, the HWS CoE has a team of experts in chemistry, process engineering, modeling and analytics, ecology, biology, and social science.

While many companies and organizations have some elements of this expertise, they often have gaps that limit their ability to fully address critical problems. For example, an organization may have modeling and analytics expertise but not ecological expertise to collect and characterize input data. Or an organization may be able to collect sample but not have chemical analytical facilities to run the samples.

Through its grants program the Center supports commercialization efforts for faculty and industry developed products. The Center has funded participation to NSF funded I-Corps workshops, the cofounding of projects with FuzeHub to manufacture prototypes for harmful algae treatment.

Actual or Anticipated New Products or Processes with Commercial Application

| Patent Name | Inventor | Co-inventor | Patent Number | Description |
|--|-----------|-------------|---------------|--|
| Electrochemical process to mitigate Harmful Algae Blooms (HAB) | Yang Yang | | | Invention has been disclosed and nonprovisional patent has been filed and Center is awaiting a decision on that patent Spring'23 |

Start-up Companies Formed

| Company Name | City | Product/Service | Sector |
|------------------|---------|--|--------------------|
| ResET Water, LLC | Potsdam | Technology to mitigate harmful algae bloom | Water quality |
| Bloomoptix | Utica | Algae detection | Lake water quality |

Licensing and Other Agreements

| Project | Inventor | Licensing or Industry Partner |
|---|--|-------------------------------|
| Assessing the ecotoxicity of mixtures of per- and polyfluoroalkyl substances | Roxanne Razavi and Christopher Whipps (ESF), Sujun Fernando (Clarkson University), and Philip Goodrum (GSI Environmental Inc.) | GSI Environmental Inc. |
| Development of Energy-efficient Wastewater Treatment for Removal of Pharmaceutical contaminants | Gyu Leem and Chang Geun Yoo (ESF); Yang (Clarkson) | |
| High-Capacity Sustainable Sorbents for Treatment of Per-Fluoroalkyl Substances (PFAS) in Contaminated Waters | Mario Wriedt (CU), Deepak Kumar (ESF), and Bandaru Ramarao (ESF) | |
| Forecasting Shoreline Erosion Using Deep Learning to Restore Coastal Ecosystem Services | Abul Baki (Clarkson), Weiming Wu (Clarkson), and Sharon Moran (ESF) | |
| Wetland and Sediment Plume Monitoring using Advanced Remote Sensing and Machine Learning Techniques | Bahram Salehi (ESF) and Sean Banerjee (Clarkson) | |
| High-Capacity Sorbents for Rapid and Efficient Removal of Phosphorous from Nonpoint Sources of Runoff | Douglas Daley (ESF) and Silvana Andreescu (Clarkson) | |
| Non-targeted screening of drinking water disinfection byproducts and their degradation and detoxification using a continuous flow photoelectrochemical cell | Leanne Powers (ESF), Gyu Leem (ESF), and Jingyun Ye (Clarkson) | |

| | | |
|---|--|-----------------------------|
| Development of Sustainable and Renewable Photovoltaic System for Perfluorooctanoic Acids Removal in Aqueous Environment | Chang Geun Yoo (ESF), Gyu Leem (ESF), Yang Yang (Clarkson), and Ian T. McCrum (Clarkson) | |
| Advanced Sequencing to Assess Risks Associated with Antibiotic Resistance as An Emerging Contaminant in Great Lakes Sediment and Fish | Yaqi You (ESF), Susan Bailey (Clarkson), and Thomas Holsen (Clarkson) | |
| Electro-oxidation of HABs | Grimberg & Yang | Square One Coating |
| Supporting the Development of an Automated HAB Classification Software | Boyer & Razavi | BloomOptix |
| Pilot Testing of Ammonia Vacuum Stripping and Absorption | Tao | NSF commercialization funds |

Science and technical Activities with Students

Co-Director Grimberg and Dr. DeWaters are working with the middle and high school at Canton, NY to teach about resource recovery efforts from solid waste. Clarkson students learn how to develop lesson plans in the subject area and teach students in the public schools about anaerobic digestion, composting of solid waste to recover energy, and nutrients. In addition, students at the public school separate organic wastes at the cafeteria, which is then treated at the anaerobic digester operated by Clarkson students at the Cornell Cooperative Extension Farm in Canton, NY. Approximately 200 students annually visit the farm digester system.

Strategic plan

Over the initial phase of existence, the HWS CoE has identified research focus areas (emerging contaminants e.g., harmful algal blooms and PFAS treatment), funded a portfolio of projects with potential for private industry partnerships or commercialization, and initiated an external advisory council. The vision of the Center is to ensure a healthy and sustainable future through the protection and conservation of water resources while the Center’s mission is to generate solutions that help protect and improve waters for sustainable natural environments, healthy populations, resilient communities, and sound economies. With recent significant increases in Center funding, the Center has embarked in a comprehensive strategic planning process. The final strategic plan will be available Spring ’23.

Governance Structure

The Center is the only CoE that is administered by two academic institutions (Clarkson University and SUNY ESF). A Steering Committee consisting of three faculty of each institution together with the two co-directors determine the agenda and priorities of the Center. The committee meets at least monthly

to discuss Center progress. In addition, the Center has established an Advisory Committee consisting of representatives from industry (consulting), government agencies (NYDEC, USGS) and non-for-profit organizations (e.g., Finger Lakes Institute). The advisory committee meets with the steering committee at least twice per year to provide input and guidance to Center activities. As Center funding levels increase, the Center will hire administrative staff that will increase efficiency in financial accounting and increase industry – center outreach/interactions. Most importantly administrative staff will help us more efficiently coordinate stakeholders within the two institutions to assist industrial/municipal stakeholders within NY State.

COE IN PRECISION MEDICINE AND RESPONSES TO BIOTERRORISM AND DISASTERS

**New York Medical College
Dr. David Markenson, Director**

Technology Focus: Training for response to disasters, terrorism, and public health emergencies.

Importance to NYS:

The Center is a major advance in the fight against chemical and biological terrorism, mass casualty incidents and disasters. The Center’s expertise encompasses natural disasters, terrorism, operational and tactical medicine, and public health preparedness, with a competence in the needs of children, persons with disabilities, healthcare systems, and facility preparedness.

Purpose

The Center is a unique and widely sought resource for law enforcement, EMS, fire services, healthcare, public health, business, and education sectors. Offering education and training, structured simulation exercises with feedback, drills, and expert consulting. The Center combines New York Medical College’s globally recognized assets in disaster, tactical, and infectious medicine. It seeks to translate research findings to protect Americans from the threat of catastrophic bioterrorism, mass casualty incidents and natural and man-made disasters.

Since the onset of COVID-19 in early 2020, the Center for Disaster Medicine (CDM) has conducted research, synthesized the latest available evidence and guidance, and offered ongoing information to the healthcare, first responder, public health, education, and business sectors. Examples from COVID-19, in addition to the training that is offered for years includes but is not limited to: analyzing and presenting to all sectors served key information about COVID-19; offering in-person and distance learning opportunities to the healthcare and first responder communities to enhance their care to the ill and injured; and continuing to offer pandemic-related courses for health professions.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 0 | 0 | \$0 | \$23,135 | \$0 | \$0 | \$0 | \$0 |

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|------------------------------|-------------------------------|--------------------------------|---|
| 50 | 6 | 6 | 500 |

Designations and Recognitions

None

Operating Budget

| Operating Budget Description | Matching Funds | | | Total Budget |
|------------------------------|------------------|--------------------|------------------|--------------------|
| | NYSTAR Funding | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$500,045 | \$0 | \$990,303 | \$1,490,348 |
| Indirect Costs | \$75,006 | \$0 | \$0 | \$75,006 |
| Equipment | \$42,283 | \$0 | \$0 | \$42,283 |
| Materials & Supplies | \$2,373 | \$0 | \$0 | \$2,373 |
| Tuition | \$0 | \$0 | \$0 | \$0 |
| Travel | \$1,887 | \$0 | \$0 | \$1,887 |
| Subcontractors | \$39,560 | \$0 | \$0 | \$39,560 |
| Other | \$70,899 | \$0 | \$0 | \$70,899 |
| Total | \$732,053 | \$0 | \$990,303 | \$1,722,356 |

Capital expenditures

None

Commercialization Plan

The Center has developed a dedicated multi-function facility with advanced capabilities in virtual-reality and real-time simulations of response and recovery. Emphasis on human response factors utilize dramatized patients, critical decision making, responders' overload and fatigue, artificial intelligence models, augmented and virtual reality training in a metaverse environment, and tactical capabilities.

In addition, the center has begun development and further refinement of medical care under austere conditions for victims, responders, and suspected offenders. Advanced simulations will utilize the most technologically advanced educational approaches including augmented reality/metaverse and virtual-reality sensors embedded in the walls that change environments in real time. Additional tactical hardware and devices will provide under-fire and gas-release training. Innovative disaster management modules will be provided for senior executives in government and business to engender advanced competencies in incident command and control, as well as continuity of operations (COOP).

Actual or anticipated new products or processes with commercial application

None

Start-up Companies Formed

None

Licensing and Other Agreements

None

Science and Technical Activities with Students

The Center continued to provide education to student physicians, public health students, allied health students and dental students at New York Medical College. The didactic and hands-on emergency, prehospital and disaster medicine education provided by the Center allows student physicians, dental students, and public health students to apply their new clinical skills at hospitals, healthcare institutions, public health departments and corporations in the Westchester County and New York City area. These students are representative of the over 200 healthcare and public health providers produced by New York Medical College each year, many of which choose to remain in New York.

In addition, the Center continues to provide center developed and customized multiple casualty incident (MCI), operational and tactical medicine, trauma, hemorrhage control, emergency management education for healthcare, EMS, Law Enforcement, Fire Service, Public Health, and Emergency Management. This education leads to workforce development in all these sectors as well as scope and capacity increases for these employees.

Lastly, the Center supports programs at local colleges and schools in Disaster Medicine to stimulate interest in this area of Science and Technology.

Strategic plan

The Center for Disaster Medicine is a specialized asset that promotes resilient communities by enhancing preparedness for mass-casualty emergencies, such as severe weather, and the effects of climate change, active shooters and mass violence, disease outbreaks, terrorism and cyber-attacks, chemical spills, nuclear accidents, opioid rescues, and other life-threatening events. The Center's greatest strength is its focus on principles of preparedness instead of rigid protocols. The Center brings unique and specialized expertise to inform the critical strategies and tactics required for broad community-based preparedness and response. These include vital analytic proficiencies, site-specific education, training, and drills. The Center places a special emphasis on equity and underserved populations, as well as medically indigent, disabled, children, and elderly. The Center houses advanced capabilities, informed by years of earlier research, in an applied educational facility with designated training modules for personnel from diverse community sectors –first-responders, health providers, fire services, hospital systems, and the public health, education (K-12 and higher education), law enforcement, government, and business communities. The Center also provides consultative resources to augment State and community planning and guidance creation.

The center annually develops metrics guided by its advisory board and approved by the director. Quarterly these metrics are reviewed against targets and then presented to the Advisory Board. The 20-21 fiscal year included planning for an expansion of the physical plan to allow an increased delivery of programs both in terms of numbers of students accommodated and types of programs offered. This planning included identification of the financial support for expansion.

Governance Structure

The New York Medical College CoE in Precision Responses to Bioterrorism and Disasters is a division of the New York Medical College Center for Disaster Medicine (CDM). CDM is a college level center authorized by the New York Medical College Board of Trustees. Day to day to management rests with the Center's Director. The Director reports to the Dean of the School of Health Sciences and Practice who in turn reports to the Chancellor and Chief Executive Officer, New York Medical College, and Provost for Biomedical Affairs, Touro College and University System.

The New York Medical College CoE in Precision Responses to Bioterrorism and Disasters has an Advisory Board comprised of representatives from the sectors served, stakeholders in the community and partners. The Advisory Board provides input on the strategic plan and annual metrics. The Advisory Board also provides input on annual review of the Center's success and achievement of annual metrics.

**COE IN ADVANCED AND SUSTAINABLE MANUFACTURING
ROCHESTER INSTITUTE OF TECHNOLOGY
Michael Thurston - Director**

Technology Focus:

Advanced and Sustainable Manufacturing

Importance to NYS

The NY State CoE in Advanced and Sustainable Manufacturing (“the Center” or “CoE-ASM”) provides technical assistance, technology development, and technology transfer expertise to NYS manufacturing companies in order to improve the sustainability of their products and processes as well as enable adoption of advanced manufacturing technologies. CoE-ASM works closely with start-up companies in many industries across NY, with particular focus on green technology companies, by supporting advancement of their technology and manufacturing readiness. These two activities increase the economic competitiveness of partner companies and helps to grow the number of value-added manufacturing jobs in the State.

Purpose

The research and development focus of the Center includes: reducing manufacturing energy intensity; product design improvement, including reducing product material and energy usage over the life cycle; developing advanced manufacturing process technologies to improve the efficiency and effectiveness of both products and processes. Activities include applied research to address common technology problems, supply chain integration, comprehensive metrics for sustainable manufacturing, technology proof-of-concept demonstration and evaluation, and product deployment and commercialization support. The Center also developed an Industry 4.0 initiative under an ESD High Tech Matching Grant to advance the integration of digital technologies, such as machine learning, business intelligence and robotics, in manufacturing operations-particularly with small and medium sized manufacturers.

Deployment activities include but are not limited to: licensing of technology that results from research; technical and economic assessments for candidate technologies; and technical training (e.g., training in sustainable design, manufacturing readiness, and digital manufacturing).

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 80 | 17 | \$11,035,445 | \$223,666 | \$2,499,999 | \$2,336,260 | \$2,216,958 | \$18,312,328 |

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|------------------------------|-------------------------------|--------------------------------|---|
| 57 | 8 | 16 | 4 |

Designations and Recognitions

None

Operating Budget

| Operating Budget Description | Matching Funds | | | Total Budget |
|------------------------------|------------------|--------------------|------------------|--------------------|
| | NYSTAR Funding | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$272,324 | \$15,965 | \$372,271 | \$660,560 |
| Indirect Costs | \$40,848 | \$9,207 | \$200,240 | \$250,295 |
| Equipment | \$0 | \$259 | \$16,320 | \$16,579 |
| Materials & Supplies | \$19,702 | \$775 | \$10,166 | \$30,643 |
| Tuition | \$0 | \$0 | \$17,820 | \$17,820 |
| Travel | \$7,059 | \$56 | \$2,843 | \$9,958 |
| Subcontractors | \$0 | \$0 | \$1,495 | \$1,495 |
| Other | \$4,488 | \$243 | \$49,382 | \$54,113 |
| Total | \$344,421 | \$26,505 | \$670,537 | \$1,041,463 |

Capital expenditures

None

Commercialization Plan

The CoE-ASM commercialization plan considers four primary commercialization pathways: 1) identifying and applying under-utilized technologies to resolve specific business challenges faced by NYS manufactures (this may include established or emerging technologies); 2) researching and developing new technologies that improve Advanced and Sustainable Manufacturing, and, 3) licensing technologies that have unique intellectual property (IP) and/or disseminating those technologies more broadly. The Center puts a priority on licensing and disseminating within NYS; working with specific NYS companies to design and develop product and process technologies that address a particular product or manufacturing opportunity or challenge, facilitating adoption of the technology within the company while considering other broader license opportunities; and providing support to companies to get new technologies ready for commercialization. The Center works with start-ups and existing manufacturers to address technology and manufacturing readiness challenges.

Actual or Anticipated New Products or Processes with Commercial Application

| Patent Name | Inventor | Co-inventor | Patent Number | Description |
|--|--|-------------|----------------------------------|--|
| Temperature Measurement by Infrared Analysis | Timothy Johnson, Infrared Medical Technologies | N/A | Client Patent # US2018004 5573A1 | CoE provided Proof of concept testing of client device in environmental chamber. CoE contributors DePalma/Thurston |

| | | | | |
|----------------------------|----------------|---------------|-----|---|
| Portable Manufacturing Pod | Gerry Hurley | Mike Thurston | N/A | Concept design for solar powered portable manufacturing (stamping) pod in shipping container. Note: partially funded by CoE-ASM and by company sponsor R&B Design |
| Battery Failure Detection | Kyle DePalma | N/A | N/A | Concept optimization for AgreatE related to detection of battery failures. Note: partially funded by NextCorps |
| Fuel Cell membrane | Thomas Trabold | Mark Walluk | N/A | Manufacturing process for high-temperature proton exchange membrane assemblies |

Start-up Companies Formed

None

Licensing and Other Agreements

| Project | Inventor | Licensing or Industry Partner |
|--|--|-------------------------------|
| IP license agreement for RIT Patent # US 10,622,654 B2: Apparatus, System and Method for Compact Mobile Fuel Cell System | M. Waller, M. Walluk, T. Trabold, M. Bradley | Falcon Fuel Cells |
| <i>Sponsored Research: Ducted Enclosure Cooling Simulation</i> | Brandon Baker | Peko Precision Products |
| <i>Sponsored Research: Packaging Operations Assessment and Improvement Assistance</i> | Gerry Hurley | Air Innovations |
| <i>Sponsored Research: Thermal-PV Panel Reliability Assessment</i> | Brandon Baker | Tyll Solar |
| <i>Sponsored Research: Thermal-PV Panel CAD Model Revision Assistance</i> | Brandon Baker | Tyll Solar |
| <i>Sponsored Research: Energy Harvester Evaluation</i> | Mark Walluk | Enetics |
| <i>Sponsored Research: New Facility – Manufacturing Layout Planning Support</i> | Gerry Hurley | RBW Studios |

| | | |
|--|----------------|-------------------------------|
| <i>Sponsored Research: Environmental Testing of M1500HP Communications Unit</i> | James Larrabee | Council Rock |
| <i>Sponsored Research: Enclosure Cooling Simulation Continuation</i> | Brandon Baker | Peko Precision Products |
| <i>Sponsored Research: Probe Assembly Revision Assistance</i> | Brandon Baker | WeRadiate |
| <i>Sponsored Research: Modeling of Pressure Plate Assemblies</i> | Kyle DePalma | AGreatE |
| <i>Sponsored Research: Assessment for Markin Tubing</i> | Gerry Hurley | Markin Tubing |
| <i>Sponsored Research: Portable Manuf Pods Commercialization Assessment</i> | Gerry Hurley | R&B Designs |
| <i>Sponsored Research: Flow Simulation Analysis of Manifolds for Multi-Heat Exchanger Air Sterilization System</i> | Allen Luccitti | You First Services |
| <i>Sponsored Research: Light Lace Circuit Design Support</i> | Chris Piggott | Organic Robotics Corporation |
| <i>Sponsored Research: Infrared Thermometer Testing</i> | Kyle Depalma | Infrared Medical Technologies |
| <i>Sponsored Research: Validation of Geothermal Vertical Ground Loop Installation Comparison</i> | Brandon Baker | Dandelion Energy |
| <i>Sponsored Research: Electrical Testing of 10KW DC-DC Bi-Directional Converter Phase 2</i> | Chuck Faisst | Combined Energies |
| <i>Sponsored Research: Evaluation of Membrane Electrode Assemblies</i> | Mark Walluk | Plug Power |
| <i>Sponsored Research: ThermApparel Pouch Analysis</i> | Mark Walluk | ThermApparel LLC |
| <i>Sponsored Research: Technology and Design Reviews</i> | Chris Piggott | Meltek Inc. |
| <i>Sponsored Research: Enclosure Design Technical Assistance</i> | Brandon Baker | Bead Digital Technology |
| <i>Sponsored Research: Battery Cell Design Review</i> | Brandon Baker | Salient Energy |
| <i>Sponsored Research: Packaging Operations Assessment and Improvement Assistance</i> | Gerry Hurley | Air Innovations |

| | | |
|---|--------------|-------------|
| <i>Sponsored Research: New Facility – Manufacturing Layout Planning Support</i> | Gerry Hurley | RBW Studios |
|---|--------------|-------------|

Science and Technical activities with Students

The Center continues discussions with Monroe Community College on opportunities to support integration of Industry 4.0 concepts into the new Finger Lakes Workforce Development Center at the Rochester Downtown Campus, as well as in other locations that support training of manufacturing technicians. The Center also collaborated with the RIT College of Engineering and MCC on an NSF proposal targeted towards advanced manufacturing and sustainability training for manufacturing technicians in the Rochester area.

Strategic plan

The Center focuses on activities that directly enhance the competitiveness of NY State companies resulting in economic growth in the State and that promote increased federal funding for Advanced and Sustainable Manufacturing in NY State. Specific strategies employed include: Strengthening and building relationships with industrial partners; Developing/maintaining a diverse and highly qualified advisory board; Partnering/collaborating with existing programs to facilitate outreach and marketing; Supporting/advancing growth of green technologies in NY State, including support for manufacturing readiness level (MRL) and technology readiness level (TRL) assessments for clean-tech startups and microgrid deployment; Engaging in Manufacturing USA institutes in aligned technology areas; Identifying opportunities for new company creation or existing company job creation, supporting smart products and systems, and providing value added sustainability services to industry.

To determine how to tailor support of companies and outreach to the community related to the Center’s mission, CoE-ASM will continue to collect, analyze, and react to the ESD-required metrics from companies assisted.

Governance Structure

CoE-ASM is governed by the terms of the contract between NYS Department of Economic Development and RIT. RIT’s Sponsored Research Services and Sponsored Program Accounting departments ensure contractual and financial compliance, respectively.

CoE-ASM is led by its Director, Dr. Michael Thurston. Dr. Thurston is engaged in development and outreach, over-all program leadership, project review, and educational activities. He is responsible for developing relationships with other CAT and CoE Centers in NYS, as well as national initiatives, such as engagement in the Manufacturing USA Institutes. Dr. Thurston is responsible for ensuring the Center goals and contractual requirements are met, including progress and metrics reporting, effective allocation of state funds, and cost share requirements. Dr. Thurston reports organizationally to Dr. Nabil Nasr, GIS Director and Associate Provost for Academic Affairs.

CoE-ASM is advised by an industry advisory board led by Dr. Nasr. The board consists of a cross-section of business leaders from different types of commercial ventures, as well as representation from Empire State Development’s NYSTAR division. Advisory Board industry members include representatives from

OptoPro, Sweetwater Energy, Inc., Applied Image Group, inc., Torvec, Inc., Complemar, Buffalo Armory, LLC, and Gleason Corporation (as of November 1, 2022).

The function of the board is to provide a review of Center progress and advise Center leadership regarding strategy and new ideas to achieve Center goals.

**ADVANCED ENERGY RESEARCH AND TECHNOLOGY CENTER
STONY BROOK UNIVERSITY
David Hamilton**

Technology Focus: Sustainable energy production, bulk energy transmission, local distribution, and energy efficiency to reduce demand and emissions.

Importance to NYS:

Advanced Energy Research Technology Center’s (AERTC) activities address technical challenges that support the achievements of NY State’s clean energy and climate targets. This has a positive impact on the economy in NYS by increasing jobs and business growth via cutting edge research and development, accelerated product commercialization, and establishment of a sustainable energy ecosystem.

Purpose

The purpose of the AERTC is to drive leading research, new technology development, and commercial deployment, along with workforce development related to the energy sector. As a NY State CoE , AERTC is uniquely positioned to leverage the physical and human resources from Stony Brook University (SBU), Brookhaven National Laboratory (“BNL”), the AERTC advisory board, and an extensive network of academic and industrial contacts to establish a world-class sustainable energy ecosystem. Resources are applied in multiple ways to advance projects that contribute to meeting NYS’s clean energy and climate targets including energy storage (e.g., grid scale applications), energy harvesting, alternative and renewable energy sources, transmission and distribution systems, Smart Grid/Micro infrastructure/systems/devices, as well as energy efficiency and conservation.

AERTC provides leadership, critical infrastructure, specialty trained personnel and a network of strategic partners to drive efficient and sustainable technologies towards commercialization. The AERTC team supports project identification, collaborations, proposals, and project management. Private sector investment is promoted through relationships in energy utility and general industrial markets. The AERTC LEED Platinum building provides unique laboratory and office space for several associated centers, SBU faculty, staff, students, and partner companies. Project scope extends past activities in the building to collaborative projects residing in other locations.

Community outreach for education, awareness and training include the biennial Advanced Energy Conference (AEC), website, active social media presence and workforce development programs. A robust internship program allows students to acquire valuable work experience and industrial partners gain access to a pool of qualified future employees.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 19 | 12 | \$359,133 | \$8,000 | \$225,000 | \$8,400,594 | \$2,000 | \$8,994,727 |

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|-----------------------|------------------------|-------------------------|--------------------------------------|
| 5 | 8 | 2 | 16 |

Designations and Recognitions

| Awards / Recognition | Date Received | Recognizing Organization | Link |
|--|---------------|-------------------------------|---|
| Sustainable Engineering Forum Industrial Practice Award Dr. Alexander Orlov | 2021 | AICHE | https://live-faculty-websites.pantheonsite.io/orlov/career#Sec6 |
| American-Made Solar Prize Finalist Dr. Alexander Orlov | 2021 | US DOE | https://live-faculty-websites.pantheonsite.io/orlov/career#Sec6 |
| Induction – SBU Chapter Dr. Amy Marschilok Dr. Kenneth Takeuchi | 2021 | National Academy of Inventors | efaidnbmnnnibpcajpcglclefindmkaj/https://www.sonybrook.edu/commcms/nai/2021%20NAISBU%20Annual%20Meeting%20Ojima.pdf |
| R&D 100 Dr. Alexander Orlov | 2020 | R&D 100 | https://www.rdworldonline.com/rd-100-2020-winner/new-generation-of-electrostatic-based-self-cleaning-technology-for-increasing-energy-yield-from-dusty-solar-panels/ |

Operating Budget

Matching Funds

| Operating Budget Description | NYSTAR Funding | Company Cost Share | Other Sources | Total Budget |
|------------------------------|--------------------|--------------------|--------------------|--------------------|
| Salaries & Fringe | \$1,147,675 | \$0 | \$0 | \$1,147,675 |
| Indirect Costs | \$55,437 | \$0 | \$0 | \$55,437 |
| Equipment | \$0 | \$0 | \$0 | \$0 |
| Materials & Supplies | \$0 | \$0 | \$0 | \$0 |
| Tuition | \$0 | \$0 | \$0 | \$0 |
| Travel | \$0 | \$0 | \$0 | \$0 |
| Subcontractors | \$0 | \$0 | \$0 | \$0 |
| Other | \$0 | \$0 | \$1,506,985 | \$1,506,985 |
| Total | \$1,203,112 | \$0 | \$1,506,985 | \$2,710,097 |

Capital expenditures

None

Commercialization Plan

AERTC focuses on advancing a targeted range of sustainable energy technologies. The team goals are accomplished by leveraging the competencies of the AERTC staff, associated faculty, students, board members and business leaders along with the physical capabilities within the facility to foster cooperative relationships between industry and academia. The resultant projects produce technical advancements and commercial products for clean energy production, smart grid transmission, storage, distribution, and efficient utilization.

Faculty led activities, typically in collaboration with at least one industry partner, include targeted research for fast charging batteries, advanced battery design, machine learning for secure distributed energy systems, large-scale energy storage, renewable natural gas and efficiency enhancing processes. These projects will include both technical and commercial objectives, as defined by industry. Achievement of commercial development milestones, outlined in research projects, are currently managed by faculty researchers and principal investigators. New projects will identify a project coordinator for communication, coordination, and efficient execution. Analysis of these projects will include economic impact along with impact on carbon emissions, energy utilization and/or grid stability.

Industry partners advance business and product development as per their business plans and through the assistance of the AERTC staff and programs. Specifically, AERTC staff provides valuable operational support, and interactive collaboration to help guide business development. Access to an extensive network of commercial contacts including the AERTC advisory board provides valuable exposure to new customers, applications, and markets.

Actual or Anticipated New Products or Processes with Commercial Application

| Patent Name | Inventor | Co-inventor | Patent Number | Description |
|--|-----------------|---|-----------------|---|
| Thermal Treatment Method for Formation and Recycling of Regenerable Electrodes | Amy Marschilok | Esther Takeuchi, Kenneth Takeuchi | 63/040,359 | This battery technology is co-developed with Brookhaven National Labs and is directed to a regenerable battery electrode. |
| Molybdenum Oxide Composition for Use in Zinc-ion Battery | Amy Marschilok | Esther Takeuchi, Kenneth Takeuchi, Lei Wang | 63/140,318 | An aqueous zinc-molybdenum oxide battery. Market needs for batteries based on environmentally sustainable materials with high cycle life and stability. |
| Systems and Methods for Self- | Alexander Orlov | | 10-2020-7010596 | This Foreign patent application is directed to |

| | | | | |
|---|------------------|---|-------------------|---|
| Cleaning Solar Panels Using an Electrodynamic Shield | | | | novel Electro-Dynamic Shield systems for aerospace use and commercial development. |
| HVAC Control Fine-Grained Occupancy Pattern Estimation | Shan Lin | Munir Sirajum | 16/850,860 | A method for controlling HVAC operation of a building to minimize energy consumption using predicted occupant-counts. |
| Method and Apparatus for Treating Wastewater Using Non-Chemical Process | Devinder Mahajan | | 16/890,567 | A novel solution to separate water from wastewater without chemical use by using propane gas that is recycled. |
| Method for Control of Advanced Combustion through Split Direct Injection of High Heat of Vaporization Fuel or Water Fuel Mixtures | Brian Gainey | Benjamin Lawler, Mozhgan Rahimi Boldaji | PCT/US2020/041914 | This technology is directed to a method for controlling compression ignition combustion phasing in an internal combustion engine. |
| Device and Method for Fast Charge of Batteries | David Bock | Amy Marschilok, Esther Takeuchi, Kenneth Takeuchi | 16/962,970 | The overpotential for Li-metal deposition at the electrode surface is increased, thus inhibiting Li metal deposition during extremely fast charging. |
| Electrode Materials for Group II Cation-Based Batteries | Amy Marschilok | Esther Takeuchi, Kenneth Takeuchi | 17/006,682 | The preparation, characterization of Mg _{0.1} V ₂ O ₅ prepared by a novel sol gel method with no high temperature post processing. |
| Composition and Method for Rechargeable Battery | Amy Marschilok | Esther Takeuchi, Kenneth Takeuchi | PCT/US20/54194 | A rechargeable material combined with a high-capacity primary battery material; lithium vanadium oxide was combined with carbon monofluoride. |

| | | | | |
|--|----------------|--|-------------------|--|
| Liquid Crystal-Guided Anisotropic Porous Composition and Method for Electrochemical Energy Storage | Amy Marschilok | Kenneth Takeuchi, Guihua Yu | 63/116,967 | Liquid crystals guided through electric-field alignment or exotic phases-liquid states, for the formation of low tortuosity porous electrode. |
| Ceramic Matrix Composites Enable Through Metal Halide Assisted Sintering | Lance Snead | David Sprouster, Jason Trelewicz | PCT/US2021/014296 | Produce compact small modular reactors using advanced moderating materials. The invention is fabrication of a new class of composite moderators. |
| Composite Superhydrophobic Membrane for Membrane Distillation from Hydrophilic Lignocellulosic Materials | Benjamin Hsiao | Ritika Joshi, Tom Lindstrom | 63/144,771 | Superhydrophobic membrane using renewable materials. This may lead to the manufacture of a non-toxic superhydrophobic membrane derived from biomass. |
| Method for Nitrogen Removal and Nitrogen Salts Recovery Using Carboxylate Cellulose Extracted by Nitro-Oxidation | Benjamin Hsiao | Ken Johnson, Priyanka Sharma, Sunil Sharma | 17/267,683 | A method for removing ammonium and nitrogen impurities from water. Aggregates converted into organic elements to use as plant fertilizer. |
| Membrane Distillation System and Method | Dufei Fang | Benjamin Hsiao | 63/159,519 | The development of new materials for hollow fiber membrane distillation that may provide large energy savings over existing technologies. |

Start-up Companies Formed

None

Licensing and Other Agreements

None

Science and Technical Activities with Students

A key mechanism for AERTC community outreach is to provide industry-oriented training and workforce development through the hosting of seminars and workshops. These virtual and live events are open to AERTC companies, industry partners and researchers and students.

The following events were held during the reporting period: a roundtable workshop on crowd funding; a roundtable workshop on setting up corporate structure; a workshop on employee/people strategy; and a seminar on immigration law 101 designed for companies and entrepreneurs hiring foreign nationals.

Strategic plan

AERTC core mission is to drive economic impact by advancing sustainable energy technologies through research, development, collaboration, and commercialization. Associated faculty are recognized leaders in their respective fields. Leaders from the utility and other industries, including members of the advisory board, are engaged by the Center to identify critical sectors and market needs.

New projects, which include industrial collaborations and funding, will be first identified by analysis of clean energy and climate change roadmaps. A “critical path” strategy will identify technology driven pathways to fill gaps in the roadmap required to meet NY State’s Climate Leadership (“CLCPA”) targets. A business development style approach to collaborations will promote the value of current faculty research, staff expertise, AERTC’s resources, facilities, and network of contacts. Teams will pursue federal, state, and industrial funded projects which focus on solutions with a clear pathway to commercialization.

Key metrics are the number, value, and impact of projects. Impact includes the number of students employed, resultant IP, new products, and companies. Specific focus on industrial collaborations where the objectives include clean energy and climate specific goals as per the CLCPA targets.

Direct participation by AERTC staff and associated faculty provides the oversight required to achieve the technical and contractual requirements of the projects. Common metrics across the project portfolio will be measured and tracked with progress towards these goals frequently reviewed by AERTC’s leadership team. A quarterly meeting held with the advisory board provides a forum for feedback and alignment with changes to the market environment.

Governance Structure

For the reporting period 4/1/2020 through 3/31/2021 the governance structure is:

Robert B. Catell, Board Chairman, AERTC

Peter Donnelly, Associate Vice President, Technology Partnerships, Stony Brook University

David Hamilton, Chief Operating Officer, AERTC

Shruti Sharma, Program Manager, AERTC

Adam Ortiz, Operations Administrator, AERTC

Carol Duprez, Administrative Assistant

**CoE IN WIRELESS AND INFORMATION TECHNOLOGY(CEWIT)
STONY BROOK UNIVERSITY
Dr. Satya Sharma, Director**

Technology Focus: Wireless and information Technology

Importance to NYS:

Working with industry partners, CEWIT continues to pursue innovation, enable partners to create high-quality jobs, maximize the commercial potential of university research, and develop next-generation workforce. CEWIT offers unparalleled resources for developing innovative products and services in industries such as healthcare, defense, energy, and digital manufacturing.

Purpose

CEWIT provides unique and much-needed technical assistance to industry partners, large and small, as well as many startup companies in the NYS innovation ecosystem. In addition to offering CEWIT’s state-of-the-art research facilities and the expertise of leading researchers and talented students, CEWIT leverages the entire Stony Brook University (SBU) network and creates many opportunities for cross-pollination of ideas and developing transformative solutions. CEWIT also supports entrepreneurs in the region to develop and grow new startups, seek funding and business opportunities, and accelerate their technology commercialization process by leveraging Stony Brook University’s vast intellectual portfolio.

CEWIT’s 100,000-square-foot facility is home to 40 laboratories, a data center with multiple high-performance clusters, an optical network infrastructure, and state-of-the-art visualization facilities, including the SMART Cluster (a hardware-accelerated ray-tracing cluster for real-time cinematic-quality rendering); Reality Deck (the largest immersive display in the world); and Silo (a cylindrical immersive stereo display with 600 million pixels). These resources support research and development in cancer imaging, drug discovery, climate modeling, infrastructure planning, architectural design, homeland security, and other application areas, and are available to our 83 affiliated faculty members, over 200 student researchers, and external collaborators.

CEWIT hosts an annual international conference featuring leading researchers and practitioners and provides a forum for sharing ideas and best practices and building new partnerships. CEWIT is also engaged in many workforce development initiatives, including internship programs with our industry partners, summer research programs for K-12 students, student hackathons, and on-site training programs for local companies.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 20 | 5 | \$2,590,000 | \$150,000 | \$2,631,839 | \$2,260,000 | \$22,386 | \$7,654,225 |

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|-----------------------|------------------------|-------------------------|--------------------------------------|
| 22 | 33 | 5 | 66 |

Designations and Recognitions

| Awards / Recognition | Date Received | Recognizing Organization | Link |
|--|---------------|-------------------------------|---|
| Michael Ferdman: Young Academic Inventor's Award | 2020 | National Academy of Inventors | https://www.stonybrook.edu/commcms/nai/2021%20NAISBU%20Annual%20Meeting%20Ojima.pdf |
| Xianfeng Gu: National Academy of Inventors Member | 2020 | National Academy of Inventors | https://news.stonybrook.edu/facultystaff/sbu-chapter-of-national-academy-of-inventors-inducts-15-new-members/ |
| Samir Das: National Academy of Inventors Member | 2020 | National Academy of Inventors | https://news.stonybrook.edu/facultystaff/sbu-chapter-of-national-academy-of-inventors-inducts-15-new-members/ |
| Joseph Marino: National Academy of Inventors Member | 2020 | National Academy of Inventors | https://news.stonybrook.edu/facultystaff/sbu-chapter-of-national-academy-of-inventors-inducts-15-new-members/ |
| Erez Zadok: National Academy of Inventors Member | 2020 | National Academy of Inventors | https://news.stonybrook.edu/facultystaff/sbu-chapter-of-national-academy-of-inventors-inducts-15-new-members/ |
| Wei Zhu: National Academy of Inventors Member | 2020 | National Academy of Inventors | https://news.stonybrook.edu/facultystaff/sbu-chapter-of-national-academy-of-inventors-inducts-15-new-members/ |
| Danny Bluestein: National Academy of Inventors Member | 2021 | National Academy of Inventors | https://www.stonybrook.edu/commcms/nai/2021%20NAISBU%20Annual%20Meeting%20%20General%20.pdf |
| Milutin Stanacevic: National Academy of Inventors Member | 2021 | National Academy of Inventors | https://www.stonybrook.edu/commcms/nai/2021%20NAISBU%20Annual%20Meeting%20%20General%20.pdf |

| | | | |
|---|------|---------------------------------|---|
| Emre Salman: National Academy of Inventors Member | 2021 | National Academy of Inventors | https://www.stonybrook.edu/commcms/nai/2021%20NAISBU%20Annual%20Meeting%20%20General%20.pdf |
| Aruna Balasubramanian: ACM SIGMOBILE Rockstar Award | 2021 | ACM SIGMOBILE | https://www.sigmobile.org/grav/awards/rockstar-award |
| Aruna Balasubramanian: Google Research Scholar Award | 2021 | Google | https://research.google/outreach/research-scholar-program/recipients/?category=2021 |
| Klaus Mueller: Visualization Technology Hall of Fame Inductee | 2021 | IEEE VGTC Visualization Academy | https://tc.computer.org/vgtc/awards/visualization-academy/ |
| Erez Zadok: ACM Distinguished Member | 2021 | ACM | https://www.cs.stonybrook.edu/about-us/News/Computing-Honors-Prof-Zadok-Named-ACM-Distinguished-Member |

Operating Budget

| Operating Budget Description | NYSTAR Funding | Matching Funds | | Total Budget |
|------------------------------|------------------|--------------------|--------------------|--------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$756,469 | \$0 | \$0 | \$756,469 |
| Indirect Costs | \$113,470 | \$0 | \$0 | \$113,470 |
| Equipment | \$0 | \$0 | \$0 | \$0 |
| Materials & Supplies | \$0 | \$0 | \$131,566 | \$131,566 |
| Tuition | \$0 | \$0 | \$0 | \$0 |
| Travel | \$0 | \$0 | \$0 | \$0 |
| Subcontractors | \$0 | \$0 | \$0 | \$0 |
| Other | \$0 | \$0 | \$1,115,892 | \$1,115,892 |
| Total | \$869,939 | \$0 | \$1,247,458 | \$2,117,397 |

Capital expenditures

None

Commercialization Plan

CEWIT aims to lead, initiate, foster, and manage the transfer of technologies from research laboratories to the marketplace, and to facilitate interaction between industry and university faculty and students.

The Center focus on partnering with companies to develop technical competencies and create high quality jobs; maximizing the commercial potential and societal impact of university research; and developing the next generation workforce for our region and the entire New York State. The Center is recognized for its work in computer vision, immersive visualization, machine learning and artificial intelligence. CEWIT will continue to support the regional and statewide economy through R&D projects, internships, hackathons, conferences/symposiums, and other programs. CEWIT will develop partnerships with companies in the defense and energy sectors and jointly compete for federal funding for applied research and demonstration projects. CEWIT’s commercialization target for the next 12 months include: developing collaboration with 20 industry partners; engaging in 25 research and development projects with industry partners; employing 75 student researchers/interns in these projects; generating 15 patent applications and/or issued patents; assisting industry partners to create 50 new jobs.

Actual or Anticipated New Products or Processes with Commercial Application

| Patent Name | Inventor | Co-inventor | Patent Number | Description |
|---|----------------------|---|---------------|--|
| Enhanced Virtual Pancreatography | Konstantin Dimitriev | Shreerai Jadhav, Arie Kaufman | 63/073, 122 | (Unpublished) |
| Composition and Method for Inhibition of Fungal Sterol Glucosidase 1 | Michael Airola | Maurizio Del Poeta, Iwao Ojima, Nivea Pereira de Sa, Robert Rizzo | 63/088, 642 | (Unpublished) |
| A Dynamic Intrasaccular Biodegradable Polymer for Curative Vascular Remodeling of Cerebral Aneurysm | Daniel Cohn | Juyi Li, Miriam Rafailovich, Chandramouli Sadasivan, Aaron Sloutski | 63/114, 821 | (Unpublished) |
| System And Method Associated with Expedient Determination of Location of One Or More Object(s) Within A Bounded Perimeter Of 3D Space Based on Mapping and Navigation to A Precise POI Destination Using a Smart Laser Pointer Device | Fan Ye | Bing Zhou | 17/055, 876 | An object mapping system and method associated with expedient determination of a location of one or more coordinate points of interest (POI) in a bounded 3D environment is disclosed. |

| | | | | |
|--|-----------------|--|-------------|---|
| Method for Passive Wireless Channel Estimation in Radio Frequency Network and Apparatus for Same | Akshay Athalye | Samir Das, Petar Djuric, Yasha Karimi, Jihoon Ryoo, Milutin Stanacevic | 16/972, 829 | A method, system and apparatus are provided for estimating characteristics of a wireless communication channel between at least two passive radio frequency (RF) nodes. |
| Methods of Detection of Mechanically Activated Platelet Activation and Uses Thereof | Danny Bluestein | | 17/252, 577 | Biochemical markers that can be measured to determine the level of mechanical activation of a population of platelets are provided, and their use to prepare molecular signatures thereof are provided. |
| System and Method Associated with Generating an Interactive Visualization of Structural Casual Models Used in Analytics of Data Associated with Static or Temporal Phenomena | Klaus Mueller | Jun Wang | 16/973, 319 | System performs operations that include receiving time series data in the analytics of time-based phenomena associated with a data set. |
| System and Method for Identifying Human Activity Using WIFI Data and Camera Data | Hongkai Chen | Shan Lin, Munir Sirajum | 63/147, 966 | (Unpublished) |
| System and Method for Real-Time Emotion Recognition | Shan Lin | Shahriar Nirjon | 63/149, 701 | (Unpublished) |

| | | | | |
|--|------------------------|---|----------------|--|
| System and Method for Augmenting Colonoscopy Using Machine Learning | Arie Kaufman | Shawn Mathew, Saad Nadeem | 63/155, 135 | (Unpublished) |
| Membrane Distillation System and Method | Dufei Fang | Benjamin Hsiao | 63/159, 519 | (Unpublished) |
| Leveraging FPGA Layout to Minimize Jitter in Statistical Time-to-Digital Converters | Michael Ferdman | Peter Milder | 63/172, 155 | (Unpublished) |
| Leveraging FPGA Layout to Minimize Jitter in Statistical Time-to-Digital Converters | Michael Ferdman | Peter Milder | 63/172, 161 | (Unpublished) |
| System and Method for 3D Image Scanning | Xianfeng Gu | | PCT/US21/26799 | (Unpublished) |
| System and Method Associated with Determining Physician Attribution Related to In-Patient Care Using Prediction-Based Analysis | Vikas Ganjigunt eAshok | Todd Griffin, Erin Healy, IV Ramakrishnan | 17/399, 511 | A system associated with determining physician attribution related to in-patient care based at least on prediction of attribution values associated with patient-physician attribution is disclosed. |

Start-up Companies Formed

None

Licensing and Other Agreements

| Project | Inventor | Licensing or Industry Partner |
|---|-------------|-------------------------------|
| System and Method for 3D Image Scanning | Xianfeng Gu | Orchid Imaging, Inc. |

Science and Technical Activities with Students

CEWIT, our affiliated researchers, and many companies in our partner network offer summer research/internship opportunities to students in secondary schools and community colleges. CEWIT regularly hosts students, clubs, and non-profit organizations from the community to tour our facility and learn about technology and STEM education. For example, with CEWIT's support and funding provided by the National Science Foundation, the Departments of Computer Science and Biomedical Informatics, offers a summer-long program called Computer Science and Informatics Research Experience (CSIRE) to high school students from NY and other states. CEWIT also supports a summer robotics program in partnership with a startup company Mechanismic. This 3-week program prepares 7-12th grade students from diverse backgrounds for STEM education.

Strategic Plan

CEWIT's mission is to conduct first-class interdisciplinary research and development in wireless and information technology in collaboration with industry leaders; foster new enterprise development; address the skilled technology worker shortage. It is a next generation research and educational facility to lead, initiate, foster, and manage the transfer of technologies from laboratories to the marketplace. CEWIT, along with affiliated researchers and students, assist companies in developing technical competencies and creating high quality jobs; initiate and expand public-private partnerships; maximize the commercial potential and societal impact of university research; and develop next generation workforce for the region and New York State.

CEWIT measures the impact of our programs by the number of joint projects with industry and outreach activities; research and training opportunities for students; jobs created and retained by industry partners. The Center collects economic impact data from industry partners annually, including increased revenues, increased expenditures, government, and non-government funding received, and cost savings. They track the productivity of R&D teams by the numbers of partners attracted; invention disclosures; patent applications and issued patents; licensing agreements executed with industry partners. They conduct surveys and seek feedback from participants of outreach programs and other events, such as the annual CEWIT conference, student hackathons, incubator showcase, innovation bootcamp, etc. Quarterly and annual program reviews and strategic planning sessions are conducted by CEWIT's management team along with Economic Development leadership and advisory board members.

Governance Structure

CEWIT is part of Stony Brook University's Division of Economic Development and conducts its operations under the leadership of Dr. Richard Reeder, Vice President for Research, Peter Donnelly, Associate Vice President for Technology Partnerships, and Dr. Satya Sharma, Executive Director of CEWIT. The center management team includes the Executive Director; Chief Scientist; Division Directors overseeing R&D programs in strategic areas including Software Systems, Network Technologies, Systems and Infrastructure, and Medical Technologies; and the Associate Director of Computing Services.

CEWIT's research, development and commercialization efforts are informed and guided by an Industrial Advisory Board (IAB) which consists of members from industry leaders such as Asurion, Deloitte, Demand Solutions, Feinstein Institute for Medical Research, Henry Schein, IBM, Northrop Grumman, Magine, NY Academy of Sciences, Ringlead, Softheon, Zebra Technologies, as well as other organizations deeply

engaged in CEWIT's programs and initiatives. The IAB is chaired by Russell Artzt, co-founder of CA Technologies. On a quarterly basis, CEWIT's management team works with Economic Development leadership and board members to assess the center's progress, evaluate areas for improvement, identify new opportunities, and set short-and long-term work plans.

COE IN NANOELECTRONICS AND NANOTECHNOLOGY (CENN)
SUNY POLYTECHNIC INSTITUTE
Fatemeh (Shadi) Shahedipour-Sandvik, Director

Technology Focus: Nanoelectronics and nanotechnology, mostly focused on transitioning NYS companies to commercialize semiconductor and related technologies such as integrated photonics, power electronics, and neuromorphic computing (AI hardware).

Importance to NYS: SUNY Polytechnic Institute's College of Nanoscale Science and Engineering (CNSE), is home to the CoE is Nanoelectronics and Nanotechnology (CENN) and scores of global corporate partners. With tens of billions of dollars in high-tech investments, CENN has been an integral part in establishing the most advanced nanotechnology research, development, and deployment complex in the world serving as a component in attracting companies such as GlobalFoundries, Wolfspeed, and Micron to the State.

Purpose: CENN’s mission is to enable a robust innovation pipeline by supporting applied research while operating manufacturing scale-up facilities to enable the commercial deployment of these innovations. This mission is key to catalyzing a nanotechnology eco-system that results in significant job creation and private sector investment. The manufacturing scale-up facilities that are supported by the CENN include the only fully integrated, 300mm computer chip pilot prototyping and demonstration lines within 135,000 square feet of Class 1 capable cleanrooms. This fully integrated research, development, prototyping, and educational facility provides NYS companies of all sizes strategic support through outreach, technology acceleration, business incubation, pilot prototyping, and test-based integration support.

During this reporting period, the CENN continues to work with the New York Center for Research, Economic Advancement, Technology, Engineering and Science (NY CREATES) to collaborate with New York based industry and universities in continuance of its mission and objectives as defined in the CoE Program statute.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 18 | 0 | \$2,094,000 | \$146,556,112 | \$1,160,000 | \$0 | \$0 | \$149,810,112 |

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|------------------------------|-------------------------------|--------------------------------|---|
| 16 | 26 | 11 | 5 |

Designations and Recognitions

None

Operating Budget

| Operating Budget Description | NYSTAR Funding | Matching Funds | | Total Budget |
|------------------------------|--------------------|--------------------|------------------|--------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$477,348 | \$0 | \$409,814 | \$887,162 |
| Indirect Costs | \$71,525 | \$0 | \$61,472 | \$132,997 |
| Equipment | \$330,776 | \$0 | \$0 | \$330,776 |
| Materials & Supplies | \$275,283 | \$0 | \$0 | \$275,283 |
| Tuition | \$16,000 | \$0 | \$0 | \$16,000 |
| Travel | \$1,543 | \$0 | \$0 | \$1,543 |
| Subcontractors | \$21,292 | \$0 | \$0 | \$21,292 |
| Other | \$266,378 | \$0 | \$0 | \$266,378 |
| Total | \$1,460,145 | \$0 | \$471,286 | \$1,931,431 |

Capital expenditures

None

Commercialization Plan

CENN's dual mission to enable a robust innovation pipeline by supporting applied research while operating industry-compliant manufacturing scale-up facilities to enable the commercial deployment of this innovation is key to catalyzing a nanotechnology eco-system that has resulted in significant job creation and private sector investment. Combined with SUNY Poly's CATN2 with its' focus on the formation of technology platforms, alignment initiatives, and business programs that enable the "Development-phase", industry partners are supported through each phase of the RD&D commercialization continuum. This approach supports a highly integrated continuum of support for technology commercialization projects, entrepreneurial support initiatives, workforce education programs, and regional development strategies all operated under the SUNY Poly CNSE umbrella.

Industry is increasingly confronting the need for multi-disciplinary collaboration, access to capital-intensive nanofabrication infrastructure, adoption of industry-wide standards, access to a highly skilled workforce and tighter coupling to end applications. In response, the CENN has and will continue to target three technology focus areas due to their dependence upon access to expensive infrastructure, need for tighter coupling within the supply chain and end manufacturers, openness to collaboration among small and large companies, and their potential to impact NYS economic growth. These three technology focus areas are: **nanoelectronics**- advanced [complementary metal-oxide-semiconductor \(CMOS\)](#), advanced device packaging, metrology, process control, and reliability assessment; **nanobiohealth**- nanomaterial characterization and correlation with toxicological bioassays, high throughput screening using bioassays for pharmacological assessment, portable & low-cost laboratory testing, and wearable real time health monitoring; and **clean energy technologies**- Silicon carbide (SiC) power electronics, energy creation, and energy storage.

Actual or Anticipated New Products or Processes with Commercial Application

| Patent Name | Inventor | Co-inventor | Patent Number | Description |
|---|-------------------|--|---------------|---|
| Wafer Scale Bonded Active Photonics Interposer | Douglas Coolbaugh | Douglas La Tulipe, Gerald Leake | 10,698,156 | The shortcomings of the prior art are overcome, and additional advantages are provided, through the provision, in one aspect, of a photonics structure. |
| Metallic Gratings and Measurement Methods Thereof | Alain Diebold | Nick Keller, Sam O'Mullane, Brennan Peterson | 10,883,924 | The shortcomings of the prior art are overcome, and additional advantages are provided, through the provision, in one aspect, of a metallic grating. |

Start-up Companies Formed

| Company Name | City | Product/Service | Sector |
|-------------------|--------|---|--|
| NoMIS Power Group | Albany | Custom design and fabrication of Silicon Carbide (SiC) based power electronic devices | Clean energy, power electronics, energy efficiency |

Licensing and other Agreements

None

Science and Technical Activities with Students

CENN Noneducation efforts have focused on the establishment and development of programs that support the growth of an industry centric workforce pipeline that focuses on 1) Engagement; 2) Enrichment; and 3) Education (K-12 Education, Technical Skills Training & Certificate Training). The CENN Noneducation efforts have allowed SUNY Poly to develop robust programs and activities that address the needs of the regional workforce by creating a continuous supply of interested and excited students with the appropriate aptitude to succeed in the high-tech workforce. A sampling of activities that occurred during this period were Nano Career Days, Women in STEM, Greater Capital Region STEAM Exposition, Samaritan/RPI summer camp, Rensselaer Park Elementary earth science activities, Virtual STEM night, After school STEM club at Okte Elementary School, National Nano Days 2020, Albany High School NanoHigh, NEATEC K-12 Teacher Training, NEATEC K-12 student involvement, The 15-Love Program's Summer Sessions and NESTEC workforce training.

Strategic plan

The CENN's strategic plan remains focused on open innovation within the RD&D technology transitioning process that targets specific commercialization targets that include the expansion of: RD&D Infrastructure to Support Innovation Pipeline, the National Network for Manufacturing Innovation, Technology Standardization (design enablement, standards), and Securing the Talent Pipeline (scientist and engineering education). Specifically, this can be accomplished by activities such as the following:

In order to accomplish these activities, the CENN will provide a technology commercialization "bridge" by focusing on the deployment-phase with manufacturing scale-up process support by: identifying potential technology solutions either deployed in adjacent markets or incubating in academic and government laboratories; specifying manufacturing requirements; demonstrating potential solutions in relevant demonstration testbeds.

The CENN will support undergraduate, masters and doctoral study through SUNY Poly's unique multi-disciplinary hands-on training curriculum combined with access to industry-compliant infrastructure and unmatched characterization equipment,

The CENN is supporting the CATN2's recent launch of the Advanced Manufacturing Performance Center (AMP) with its focus on RD&D testbeds to support the advanced manufacturing supply chain. These component, sub-systems and site-service companies are under increasing pressure to achieve more stringent control of contamination, purity, variability, reliability, and health/safety. The CENN provides the necessary access to specialized, industry-compliant test beds for applications research and demonstration. Such programs then transition to one of several manufacturing scale-up lines operated by the CENN on industry-compliant AM platforms.

Governance Structure

The award of a CAT and a CoE in a single field, nanotechnology, to SUNY Poly CNSE is unique and allows a unique governance structure. Combined, the CATN2 and the CENN provides NY companies with a highly integrated continuum of programmatic support and facility test-bed operations for technology commercialization projects, hands-on workforce education programs, and regional development strategies.

The CENN has created various Industrial Advisory Boards (IABs) with a focus on identifying major gaps in nanofabrication capabilities including required investment and allocations of resources, timing, and opportunities. CENN will also incorporate the guidance and input from NY-CREATES with a focus on product platforms and market roadmaps to capture input on necessary downstream investment and activities for deployment of the fully integrated system for targeted emerging technology areas.

**COE IN ENVIRONMENTAL AND ENERGY SYSTEMS
SYRACUSE UNIVERSITY**

Dr. Jianshun “Jensen” Zhang, Director

Technology Focus: Energy and Environmental Systems

Importance to NYS:

The CoE in Environmental and Energy Systems (SyracuseCoE) develops industry-university teams to shape projects, attract external funding, commercialize new products, and establish relationships with global leaders as strategic partners related to project development. It offers technical expertise, outreach opportunities to connect industry with university faculty, undergraduate and graduate students, and economic development programming to bring their capabilities and competencies to bear on industry challenges. Areas of key capabilities and competencies include advanced building and community systems, clean and renewable energy, and water resources.

Purpose:

SyracuseCoE engages academic and industry partners to accelerate development and commercialization of innovations for healthier buildings and cleaner, greener communities. SyracuseCoE strategically targets opportunities for innovations that: improve indoor environmental quality and energy efficiency in buildings; provide clean and renewable energy; and improve resilience to storms, grid blackouts, epidemics, and other disasters in urban communities. In addition, SyracuseCoE targets opportunities to engage New York State firms in four key industry sectors: clean technology; digital and electronic devices; advanced manufacturing; and research and engineering services. In the five-county Central New York region alone, firms in these four sectors employ more than 15,000 workers.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 25 | 88 | \$105,000 | \$15,000 | \$1,230,023 | \$6,772,621 | \$753,967 | \$8,876,611 |

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|------------------------------|-------------------------------|--------------------------------|---|
| 20 | 16 | 20 | 52 |

Designations and Recognitions

None

Operating Budget

| Operating Budget Description | Matching Funds | | | Total Budget |
|------------------------------|------------------|--------------------|--------------------|--------------------|
| | NYSTAR Funding | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$587,183 | \$0 | \$125,286 | \$712,469 |
| Indirect Costs | \$88,076 | \$0 | \$3,588 | \$91,664 |
| Equipment | \$0 | \$0 | \$0 | \$0 |
| Materials & Supplies | \$12,875 | \$0 | \$5,832 | \$18,707 |
| Tuition | \$0 | \$0 | \$0 | \$0 |
| Travel | \$0 | \$0 | \$0 | \$0 |
| Subcontractors | \$28,357 | \$0 | \$87,682 | \$116,039 |
| Other | \$54,783 | \$0 | \$955,504 | \$1,010,287 |
| Total | \$771,274 | \$0 | \$1,177,892 | \$1,949,166 |

Capital expenditures

None

Commercialization Plan

SyracuseCoE strategically targets opportunities for innovations that: improve indoor environmental quality and energy efficiency in buildings, provide clean and renewable energy, and improve resilience to storms in urban communities. In addition, SyracuseCoE targets opportunities to engage New York State firms in four key industry sectors: clean technology, digital and electronic devices, advanced manufacturing, and research and engineering services.

SyracuseCoE's headquarters facility has earned international recognition for its innovative design and its unique laboratories, such as the Willis H. Carrier Total Indoor Environmental Quality (TIEQ) Laboratory, which has been used to conduct groundbreaking research on the impact of indoor air quality on the cognitive function of knowledge workers. TIEQ is currently the site of academic and industry research related to COVID-19, IAQ and occupancy sensing-based smart building controls. The entire headquarters building, and the three-acre site are designed to serve as a laboratory and a testbed for research, development, and demonstration projects relating to environmental and energy systems in urban environments. In addition, SyracuseCoE engages dozens of faculty members at its partner institutions—Syracuse University, SUNY College of Environmental Science and Forestry, and SUNY Oswego—to access additional resources including over 20 associated laboratories and personnel for collaborative projects.

SyracuseCoE offers technical expertise, outreach opportunities to connect industry with university faculty, undergraduate and graduate students, and economic development programming to bring their capabilities and competencies to bear on industry challenges.

Actual or Anticipated New Products or Processes with Commercial Application

| Patent Name | Inventor | Co-inventor | Patent Number | Description |
|--|------------------------------|-------------|------------------------------|--|
| Technology Innovation and IoT for Sports | Joe Casper | Chris Nolan | Invention disclosure | Thermally Dissipative Unibody Lighting Structure |
| Toward an All Solid-State Calcium Ion Battery | Ian Hosein | | Invention disclosure | Electrochemical energy storage system based on a calcium metal battery. |
| Optimal HVAC Controller | Bing Dong and Jianshun Zhang | | Patent application submitted | The invention discloses system and method to address health-energy nexus in medium sized commercial buildings with roof-top units, based on an optimal, predictive control strategy. |
| Scroll-type machine | James W. Bush | | Patent #: 10774833 | Design details of a microScroll refrigerant compressor to be used in the microChiller unit. |
| Thermally dissipative unibody lighting structure | Joe Casper | Chris Nolan | Patent #: 20211015796 | Sports Lighting system for municipal market that has integrated cross arm assembly |

Start-up Companies Formed

| Company Name | City | Product/Service | Sector |
|-----------------------|-------------|------------------------------------|-------------------------------|
| Well Building Control | Manlius, NY | AI-driven predictive HVAC controls | Intelligent Building Controls |

Licensing and Other Agreements

| Project | Inventor | Licensing or industry Partner |
|--|--|-------------------------------|
| Honeywell Syracuse University research agreement | Prof. Jianshun Zhang, Bing Dong, Dacheng Ren | Honeywell |
| Carrier Corporation Syracuse University research agreement | Prof. Jianshun Zhang and Bing Dong | Carrier Corp. |
| Pyure Company, Inc Syracuse University research agreement | Prof. Jianshun Zhang | Pyure Company, Inc. |

| | | |
|---|--|--|
| DoE Building Technology Office Syracuse University research agreement | Prof. Bess Krietemeyer, Jianshun Zhang | DoE, TKFabricate, and Cocoon Construct |
| NYSERDA Syracuse University research agreement | Prof. Nina Sharifi, Bing Dong and Jianshun Zhang | NYSERDA, Taitem Engineering |

Science and Technical Activities with Students

During the period of 7/1/2020 – 6/30/2021, SyracuseCoE held a competitive application process to provide funding support for six summer internships at companies. They continued to recruit and support area companies that sponsor teams of undergraduate senior mechanical engineering students from Syracuse University as part of the Capstone project offered at SU’s College of Engineering and Computer Science. SyracuseCoE staff also served as a mentor for two of the Fall 2020 teams working with SyracuseCoE Partner companies Air Innovations, Inc., and Bush Technical, LLC. SyracuseCoE organized and hosted two digital Research & Technology forums. SyracuseCoE co-hosted the annual NYS Green Building Conference online throughout the Fall as part-day sessions due to the pandemic.

Strategic plan

SyracuseCoE is a hub for innovation: It researches, develops, and demonstrates innovations for healthy and efficient buildings, clean energy and resilient and low-carbon communities and cities; It tackles the most challenging problems across multi-scales of the built environment and urban ecosystems, resulting in economic development. SyracuseCoE accelerates the transfer of technologies from labs to market.

SyracuseCoE offers technical expertise, outreach opportunities to connect industry with university faculty, undergraduate and graduate students, and economic development programming to bring their capabilities and competencies to bear on industry challenges. Key capabilities and competencies include advanced building energy and environmental systems, clean and renewable energy, and water resources.

SyracuseCoE tracks its contributions to jobs (created and retained), partner products exported out of the region owing to a SyracuseCoE program result, patent filings from SyracuseCoE-funded R&D, academic expenditures of SyracuseCoE-engaged sponsored projects, and investments secured by SyracuseCoE partnered companies.

Governance Structure

SyracuseCoE is structured as a public-private partnership, led by Syracuse University. Created in 2022, SyracuseCoE combines activities of the New York Indoor Environmental Quality (NYIEQ) Center, Inc. (a non-profit organization) and the Environmental Quality Systems Strategically Targeted Academic Research (EQS STAR) Center (a multi-institutional research center). Governance of SyracuseCoE activities is led by Syracuse University, with advice from CenterState Corporation for Economic Opportunity (CenterState CEO) and industry and academic partners. Members of SyracuseCoE’s Industry Partner Council provide guidance on activities that are supported using funding provided by partner firms and institutions.

CoE & CLIMATE ANALYTICS
THE STATE UNIVERSITY OF NEW YORK AT ALBANY
Dr. Christopher Thorncroft, Director

Technology Focus: Atmospheric Science’s (Weather’s) impact on NYS Industry

Importance to NYS:

The NYS CoE in Weather and Climate Analytics is critical to the NYS economy. The NYS economy’s estimate of weather sensitivity is 3.4% of our \$1.7 Trillion economy or \$58 Billion per year. The Center expands weather-climate-emergency preparedness in the new Emerging Technology and Entrepreneurship Complex (ETEC) building, grows graphics processing unit (GPU) based high performance Artificial Intelligence (AI) weather prediction modeling, and claims eminence for New York in the global weather and climate analytics arena.

Purpose

The CoE’s purpose is to develop and maintain partnerships to support NYS industries including, but not limited to, Energy (Renewable Energy, Outage Management), Transportation (Autonomous Vehicles, Unmanned Aerial Systems (UAS)), Agriculture, Finance, Healthcare, Advanced Communications, and AI. The Center also continues to build a core research facility within ETEC that is easily accessible to weather-sensitive businesses and able to quickly solve business problems with research solutions. The CoE supported the creation of the xCITE laboratory (ExTreme Collaboration, Innovation, and Technology) which is a state-of-the-art software development and data/visual analytics innovation facility. The lab equips the scientific weather community with the tools and resources they need to take their research to the next level with high-end GPU-based scientific visualization and Machine Learning (ML) platforms. The CoE also collaborates with the New York State Mesonet, a network of 126 weather stations across the state, with at least one site in every county and borough. The New York State Mesonet collects, archives, and processes data in real-time every 5 minutes, feeding weather prediction models and decision-support tools for users across the greater New York region.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 6 | 0 | \$498,357 | \$199,000 | \$44,857 | \$1,000,000 | \$0 | \$1,742,214 |

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|------------------------------|-------------------------------|--------------------------------|---|
| 10 | 11 | 4 | 6 |

Designations and Recognitions

None

Operating Budget

| Operating Budget Description | NYSTAR Funding | Matching Funds | | Total Budget |
|------------------------------|----------------|--------------------|---------------|--------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$117,794 | \$0 | \$0 | \$117,794 |
| Indirect Costs | \$17,669 | \$0 | \$0 | \$17,669 |
| Equipment | \$0 | \$0 | \$0 | \$0 |
| Materials & Supplies | \$332 | \$0 | \$0 | \$332 |
| Tuition | \$0 | \$0 | \$0 | \$0 |
| Travel | \$326 | \$0 | \$0 | \$326 |
| Subcontractors | \$0 | \$0 | \$0 | \$0 |
| Other | \$0 | \$0 | \$0 | \$0 |
| Total | \$136,121 | \$0 | \$0 | \$136,121 |

Capital expenditures

None

Commercialization Plan

The Center works with companies to jointly develop, evaluate, and improve atmospheric sciences technologies. This evaluation and improvement will help companies with atmospheric sciences-based technologies reach a technology readiness level (TRL) that the commercial sector is looking for, i.e., the technology is ready to generate revenue.

As one of the world's leading atmospheric sciences research institutions, evaluating a technology and publishing the results in a peer-reviewed journal provides technical validation helping commercialization gain industry traction. Gaining industry traction i.e., acquiring customers and partners will accelerate commercialization.

The Center will collaborate with the Innovate 518 Hot Spot (i518), and when possible, engage in a concerted effort to assist i518 Companies. The Center has the capacity to provide technical oriented advisory services to i518 companies that will help companies navigate the due diligence and commercialization process.

The Center works with the UAlbany Office of Innovation Development and Commercialization to manage the commercialization of promising technologies. The Center also works directly with the Research Foundation on commercialization and uses the Research Foundation's Research Agreement Contract (RA) materials which includes legal provisions covering most implications for commercialization.

Actual or Anticipated New Products or Processes with Commercial Application

None

Start-up Companies Formed

None

Licensing and Other Agreements

None

Science and Technical Activities with Students

The Science and Technology Entry Program (STEP) prepares historically underrepresented and economically disadvantaged elementary and secondary school students to acquire the aptitude and skills necessary to pursue post-secondary degree programs that lead to professional careers in the scientific, technical, health-related, or other licensed professions.

The Education Program Center helps to promote STEM education at local schools by supporting elementary school bus trips to NYS Mesonet weather stations where students engage in a hands-on learning experience while being taught by University at Albany atmospheric sciences faculty. Additionally, elementary school students are invited on an annual basis to visit the University's Atmospheric Sciences Research Center, where students learn about weather modeling, forecasting, instruments and get to watch a weather balloon launch. The Girls Inc. program at U Albany provides girls with an introduction to STEM while encouraging personal development, sportsmanship, and career exploration.

The University hosts a week-long series of events to promote Earth Day culminating in a weekend of activities encouraging school-aged children to pursue STEM degrees. Activities exposing children to atmospheric sciences include creating arctic creature mobiles; a traveling nitrogen game where students learn how clouds are formed; a glacier then and now demonstration. Additionally, celebrity meteorologists have face to face meetings with children and discuss careers as atmospheric scientists.

Other events include the Weather & Climate Camp, a free weeklong day camp open to Capital District teens. The Camp provides high-school aged children with a unique opportunity to learn to forecast, visit a weather observatory, conduct experiments, and learn about careers and college opportunities in the atmospheric sciences field. The Center also supported the October NYS Mesonet Annual Symposium, it is a chance for people from academia, government, and the private sector to present on research, operational uses, or other topics relating to the NYS Mesonet.

Strategic plan

The Center's strategic plan targets partnerships in the high priority Energy and Transportation Industries. The Center plans to increase its presence developing partnerships in the segments of the Energy Industry (Renewable Energy, Outage Management, Grid Resilience, etc.) and in the Transportation Industry (Autonomous Vehicles, Unmanned Aerial Systems (UAS), Space, etc.). The Center plans to expand its strong momentum in the Energy and Transportation Industries with additional positioning in the Agriculture, Finance, Healthcare, Advanced Communications, AI, etc. The weather costs the US Economy \$485B every year.

The Center is executing a four-phase strategy for expanding into new sectors. Phase I, is industry analysis. The Center has analyzed many weather-sensitive industries and prioritized target sectors. The Center gives priority to the Energy and Transportation Industries. The Center plans to expand its strong momentum in the Energy and Transportation Industries with additional positioning in the Agriculture, Finance, Healthcare, Advanced Communications, AI, etc.

Phase II is customer discovery. In each of the target markets, the Center engages in a customer discovery process aimed at gaining a deep understanding of the industry's weather-related problems, the value of potential solutions, how R&D money is spent, and stakeholders from whom buy in is needed.

Phase III is use case development. After Customer Discovery and understanding an industry's weather-related problems, the Center develops use cases that define solutions for problems and demonstrate the return on investment a partner will experience if the Center is engaged to develop the solution.

Phase IV is business development. The Center is executing a business development approach that leverages well-defined use cases and promotes solutions to stakeholders in target industries. The Center maintains focus by using the following metrics and goals: Develop and maintain 3-5 high profile enterprise partnerships, 6-8 partnerships with small- to mid-size companies, and expand other Weather Energy initiatives and public private partnerships; Engage the weather-sensitive business community with weather-energy discussion in the Spring of 2022 to support the Falconer lectures and support disadvantaged communities with Weather Health Initiatives; Continue "Mind the Gap" to promote engagement with secondary schools and community colleges designed to foster student interest in scientific and technical careers; Continue to monitor and promote internships with its business partners.

Governance Structure

The Center's governance structure includes an Internal Oversight Committee, the Industry Advisory Board, Director, Interdepartmental Research Groups, Operations Management and Research and Development.

The Center is a business unit within the Vice President of Research's Office; as such, the Vice President for Research oversees the Center from a high-level. The Director is responsible for determining the Center's objectives and guiding Center staff as staff executes objectives.

The Internal Oversight Committee conducts monthly meetings to ensure the Center is on track to realize its economic development mission. The Industry Advisory Board provides strategic guidance with respect to the Center's engagement with prospective business partners. Interdepartmental Research Groups are comprised of faculty who work together to address problems based on business partner needs. The solutions to these problems often cut across academic departments, and interdepartmental faculty groups are working together to solve those problems. The Operations Unit manages day-to-day operations, finance, marketing, partner engagement, marketing. The Research and Development unit manages and supports research for the Center.

COE IN BIOINFORMATICS & LIFE SCIENCES
UNIVERSITY AT BUFFALO
Dr. Norma Nowak, Executive Director

Technology Focus

Bioinformatics and Life Sciences

Importance to NYS

The University at Buffalo’s (UB) New York State CoE in Bioinformatics & Life Sciences (CBLIS) leverages the University’s expertise and cutting-edge capabilities in genomics; bioinformatics; proteomics; and supercomputing to partner with industry to drive life sciences innovation and to commercialize new technologies that strengthen the region and the state’s economies.

Purpose

The CBLIS serves life science companies across the state through access to faculty experts, student talent, incubator space and advanced technology infrastructure with the primary mission of driving ideas to market and creating economic impact in NYS.

Together with UB’s Center for Advanced Technology (UB CAT) and the New York State CoE in Bioinformatics & Life Sciences (CBLIS), the CMI anchors UB’s technology-based economic development (T-BED) infrastructure. The three NYSTAR-supported Centers bring critical and unique assets to the region in terms of both technologies and teams with scientific, business development, economic development, finance, and legal expertise.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 166 | 0 | \$4,497,459 | \$756,179 | \$836,537 | \$5,233,999 | \$0 | \$11,324,174 |

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|------------------------------|-------------------------------|--------------------------------|---|
| 25 | 15 | 8 | 6 |

Designations and Recognitions

| Awards / Recognition | Date Received | Recognizing Organization | Link |
|--|---------------|--|-------------------------------|
| CBLs Faculty Dr. Laura Feltri named SUNY Distinguished Professor in recognition of her international prominence and reputation in the field of neurodegenerative diseases. | March 17 | SUNY Board of Trustees | Press release |
| CBLs workforce development team in partnership with UB Faculty Dr. Stephen Koury was awarded the Science Education Partnership Award-SEPA | June 2020 | National Institute of General Medical Sciences | NIHSEPA |

Operating Budget

| Operating Budget Description | Matching Funds | | | Total Budget |
|------------------------------|------------------|--------------------|-----------------|------------------|
| | NYSTAR Funding | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$448,719 | \$0 | \$36,489 | \$485,208 |
| Indirect Costs | \$67,308 | \$0 | \$0 | \$67,308 |
| Equipment | \$0 | \$0 | \$0 | \$0 |
| Materials & Supplies | \$5,703 | \$0 | \$0 | \$5,703 |
| Tuition | \$0 | \$0 | \$0 | \$0 |
| Travel | \$0 | \$0 | \$0 | \$0 |
| Subcontractors | \$168,449 | \$0 | \$0 | \$168,449 |
| Other | \$2,044 | \$0 | \$21,711 | \$23,755 |
| Total | \$692,223 | \$0 | \$58,200 | \$750,423 |

Capital expenditures

None

Commercialization Plan

The following industry partners leveraged CBLs Genomics and Bioinformatics Core and the Proteomics Core in this reporting period: NeuroVascular Diagnostics – blood-based biomarker development to detect Brain Aneurysm; Rheonix – Automated technology for application in cancer, infectious diseases; ThermoFisher (Grand Island) – manufacturer of cell culture products; CH3 Biosystems (UB Spinoff, and CAT award recipient) – supplier of laboratory reagents; Nextgen Biologics – wound healing using decellularized biomaterial from Axolotl.

The UB Biorepository facility is an attractive resource for companies to partner with the University to access high quality biological samples and collaborate on R&D projects that require collection and processing of biological specimens. The Ultra-low temperature freezers in the facility provide the ideal

cold storage temperature in a regulated space as well as physical and IT security critical for the stability and security of the vaccines.

In its first year of operation the Empire Discovery Institute (EDI) scientific advisory board selected four technologies from its institutional partners for development, including one from the laboratory of a CBLS resident scientist, for the treatment of Multiple Sclerosis. The Business Development team connected the EDI to the laboratory of another researcher, resulting in a productive collaboration. The lab will support the early stages of drug discovery, utilizing the High-Performance Computing cluster at the Center for Computational Research located in the CBLS.

Actual or Anticipated New Products or Processes with Commercial Application

Confidential

Start-up Companies Formed

| Company Name | City | Product/Service | Sector |
|---------------------|-------------|---------------------------|-----------------|
| QAS A.I. | Buffalo, NY | Imaging Analysis Software | Healthcare |
| AmritX, Inc. | Buffalo, NY | Pharmaceuticals | Pharmaceuticals |

Licensing and Other Agreements

Confidential

Science and Technical Activities with Students

CoE Professors were awarded funding from The Cullen Foundation to pair UB students with Living Environment teachers in Buffalo Public Schools (BPS). The fellows contributed to the planning and execution of lessons, providing a new perspective to teaching scientific concepts and were integral in supporting online learning of Buffalo Public Schools students. They developed videos of demonstrations and lab activities for teachers to use with their online students.

CBLS supported the creation of the Research Laboratory High School (RLHS) in BPS district through which they provide a science-focused after-school program for students enrolled in RLHS. The program focuses on inquiry-based learning to reinforce concepts learned in the students' science classes.

During the CDC's "Get Smart About Antibiotics Week", CBLS organized students from the School of Pharmacy and Pharmaceutical Sciences to use the multimedia room in the museum to read to and walk with third and fourth grade students. They learned about microbes and the important role they play in our lives. CBLS hosted a series of online chats on vaccines in an effort to clarify misconceptions and to boost vaccination rates.

The CBLS supports multiple other K-12 science education programs such as the Health Sciences Symposium, Science Exploration Day, and UB's Genome, Environment and Microbiome Community of

Excellence with the primary goal of providing exposure and hands-on learning opportunities in a variety of scientific disciplines.

Strategic plan

The CBLs serves life science companies across the state through access to our faculty experts, student talent, incubator space and advanced technology infrastructure with the primary mission of driving ideas to market and creating economic impact in NYS.

The Center will pursue an economic development strategy including but not limited to: Drive economic development through supporting innovation and commercialization; Increase and enhance collaborative relationships with state, federal industry, and academic partners; Increase corporate and public funding for research and commercialization efforts; Provide workforce development, business development & commercialization programming and services; Advance the state-of-the-art through interdisciplinary, collaborative, life sciences translational research.

Several strategies are deployed in achieving strategic goals. These include leveraging expert guidance from the Industry Advisory Committee, Faculty Experts, Consultants with domain expertise and State economic development groups on emerging technologies and markets. The CBLs BD team, with support from the marketing team, does extensive internal and external outreach to attract new businesses and to deepen relationships with existing companies. The University's Internal network includes complementary programs such as the Center for Advanced Technology in Big Data and the Health Sciences, Start Up NY, Buffalo Institute of Genomics and Data Analytics, CoE in Material Informatics, Office of Technology Transfer, NSF I-Corps programs; external outreach includes other NYSTAR assets, CoEs, CATs, local Techstars, Buffalo Niagara Medical Campus partners, FuzeHub, Medtech networking events, Upstate Capital to name a few.

They have also adopted Business Friendly University commercialization policies which include modified IP terms and ease of access to university resources, faculty expertise and student interns. These are designed to reduce friction in the partnering process, and to enhance the University's reputation as a good industry partner.

Governance Structure

Dr. Norma Nowak serves as the CBLs Executive Director reporting to Christina Orsi, UB's Associate Vice President for Economic Development and the head of the Office of Business and Entrepreneur Partnerships (BEP). At the CBLs, Dr. Nowak is supported by a comprehensive team of scientific, operational, business development and marketing experts. Jeff Dunbar serves as Director of UB's Office of Technology Transfer. Additional start-up support personnel and Entrepreneur-In-Residence's have been hired to enhance the team's capabilities to fulfill its objectives.

The IAB comprised of industry-based strategic advisors provides the CBLs team with guidance and recommendations on emerging technologies, markets and how CBLs facility can continue to meet industry partner needs. Advisory Board members represent various businesses including RUCDR Infinite Biologics, Applied Sciences Group, Tactiva, Coach Me Plus, Multisorb Technologies, Circuit Clinical, iiMED, AHRM, Zeptomatrix, Athenex, and Jacobs Institute.

In addition to receiving advice and guidance from the Directors, Dr. Nowak has empaneled CBLs Core Facility Advisory Committee consisting of the below CBLs faculty members:

- Chair: Norma Nowak, PhD – Executive Director, CBLs, Professor of Biochemistry
- Co-Chair: Jun Qu, PhD - Associate Professor, Pharmaceutical Sciences
- Michael Buck, PhD - Associate Professor, Director WNYSTEM Stem Cell Sequencing/Epigenomics, Biochemistry; Biomedical Informatics, Dept. of Biochemistry
- Xiuqian Mu, M.D. - Associate Professor, Ophthalmology; Biochemistry
- Laurie Read, PhD – Professor, Dept. of Microbiology & Immunology
- Omer Gokcumen, PhD - Assistant Professor, Department of Biological Sciences
- Satrajit Sinha, PhD - Associate Professor, Department Biochemistry
- Gerald Koudelka, PhD – Professor, Department Biological Sciences
- Donald Yergeau, PhD – Senior Research Scientist
- Sriram Neelamegham, PhD – Co-director, Center for Bioengineering Department Chemical and Biological Engineering
- Robert Straubinger, PhD – Professor, Department of Pharmaceutical Sciences Pharmacology and Toxicology

CoE IN MATERIALS INFORMATICS
UNIVERSITY AT BUFFALO
Dr. Alan Rae, Director

Technology Focus:

Cutting-edge materials science and informatics

Importance to NYS:

UB’s New York State CoE in Materials Informatics (CMI) has importance to New York State because it leverages the University’s cutting-edge materials science, big data analytics, and advanced manufacturing expertise and infrastructure to drive critical R&D activities that directly impact private sector growth.

Purpose

The CMI’s purpose complements many of UB’s and New York State’s goals. It raises awareness of local industrial capabilities and needs and drives collaboration among UB faculty to address these needs. The Center provides funding opportunities to UB faculty who are partnering with industry to find solutions to materials informatics related challenges and enables student experiential learning opportunities within local companies. The CMI contributes to the university’s translational research, which enhances UB’s visibility and economic impact, locally, statewide, and globally. In addition, the CMI collaborates with several UB initiatives in the fields of advanced manufacturing and materials innovation including the Sustainable Manufacturing & Advanced Robotic Technologies (SMART) Community of Excellence, the Research and Education in eEnergy, Environment & Water (RENEW) Institute, the Computational and Data-Enabled Science & Engineering (CDSE) Program, and the rapidly growing Department of Materials Design & Innovation (MDI).

Together with UB’s Center for Advanced Technology (UB CAT) and the New York State CoE in Bioinformatics & Life Sciences (CBLS), the CMI anchors UB’s technology-based economic development (T-BED) infrastructure. The three NYSTAR-supported Centers bring critical and unique assets to the region in terms of both technologies and teams with scientific, business development, economic development, finance, and legal expertise.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 21 | 2 | \$9,243,000 | \$610,848 | \$2,560,900 | \$6,143,000 | \$65,000 | \$18,622,748 |

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|------------------------------|-------------------------------|--------------------------------|---|
| 83 | 7 | 7 | 0* |

Designations and Recognitions

None

2020 -2021

| Operating Budget Description | Matching Funds | | | Total Budget |
|------------------------------|------------------|--------------------|--------------------|--------------------|
| | NYSTAR Funding | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$725,106 | \$0 | \$815,129 | \$1,540,235 |
| Indirect Costs | \$108,766 | \$0 | \$0 | \$108,766 |
| Equipment | \$0 | \$0 | \$0 | \$0 |
| Materials & Supplies | \$39,842 | \$0 | \$0 | \$39,842 |
| Tuition | \$11,556 | \$0 | \$0 | \$11,556 |
| Travel | \$745 | \$0 | \$0 | \$745 |
| Subcontractors | \$265 | \$0 | \$0 | \$265 |
| Other | \$26,153 | \$0 | \$485,001 | \$511,154 |
| Total | \$912,433 | \$0 | \$1,300,130 | \$2,212,563 |

Capital expenditures

None

Commercialization Plan

UB's New York State CoE in Materials Informatics (CMI) leverages the University's cutting-edge materials science, big data analytics, artificial intelligence, machine learning and advanced manufacturing expertise and infrastructure to drive critical R&D activities that directly impact private sector growth.

The CMI works with over 100 materials research faculty with extensive funding from federal agencies and private industry with expertise in domains such as: Development of advanced nanomaterials for plasmonic nanostructures, graphene, carbon nanotubes, and upconverting nanoparticles, batteries, fuel cells, printable electronics, sensors, catalysts, for example.

The CMI Industrial Advisory Board provides recommendations for research directions based on industry trends and needs, assists with strategic pursuit of federal funding opportunities and new center designations, and serve as ambassadors in the Western New York region within the community and the greater industrial base.

The CMI annually funds Faculty-Industry Applied Research (FIAR) program with Industry. The FIAR program's objective is to align university research expertise and resources with industry needs and commercial interests. This alignment is a critical criterion in vetting and evaluating FIAR funding proposals. To date, 33 FIAR projects, totaling approximately \$1,162.5K have been awarded to faculty with industry collaborations. Examples of FIAR projects from the period include superconducting films for quantum computing, magnetic metamaterials, dental implants, additive manufacturing, conductive inks, battery anodes, and MRI contrast agents.

The CMI's strategy for expanding its existing base of companies includes business development and scientific participation in materials and related engineering symposia, events, and trade expositions across New York State and nationally.

Actual or Anticipated New Products or Processes with Commercial Applications

| Patent Name | Inventor | Co-inventor | Patent Number | Description |
|---|-----------------|--------------------|----------------------|---|
| Periodic Cellular Structure Based Design for Additive Manufacturing Approach for Light Weighting and Optimizing Strong Functional Parts | Rai | | | Related to additive manufacturing as a way to make complex lightweight structural parts for medical, dental aviation and automotive applications. |
| Method for Automated 3D Print Quality Assessment and Redesign | Rai | | | Automated quality control for the \$12B structural parts market is critical to its further development. |
| Graphene Material-Metal Nanocomposite and Processes of Making and Using Same | Ren | | | Graphene supplies enhanced strength, thermal conductivity and electrical conductivity to metal alloys improving their high temperature performance. |
| Field Effect Transistors Including Quantum Layers | Li | Yao | | 2D semiconductors based on graphene extend computing power due to the unique properties of these ultra-thin materials. |
| Quantum Devices and Methods Using Entangled Photons and Phonons | Perebeinos | Li, Bird | | Coupling phonons (atomic vibrations) with photons(light) is a promising way to detect entangled photons for fast and secure quantum communications. |
| Printed Conformal High Temperature Electronics Using Copper Nanoink | Ren | | | This invention extends conductive inks usability to higher temperatures for aviation and other applications |

| | | | | |
|---|--------------|--|------------|---|
| System and Method for Promoting Osseointegration of Implants | Ehrensberger | | | Dental and orthopedic implants depend on successful integration of bone and implant is addressed to improve bone-implant integrity |
| Iron (III) Macrocyclic Complexes With One or More Tri(Hydroxy) Butyl Pendant Groups as MRI Contrast Agents | Morrow | | | Low toxicity MRI contrast agent. Contrast media market size is \$2.8B |
| Platinum Group Metal (PGM)-free Ternary Metallic Water Oxidation Electrocatalysts for Anion Exchange Membrane Electrolyzers | Wu | | | Catalysts for more efficient electrolysis of water will reduce energy consumption and improve economics relative to fossil fuel hydrogen production |
| High-Temperature Cu Ink-Based Conductor with Oxidation and Corrosion-Resistance | Ren | | | This invention extends conductive inks usability to higher temperatures for aviation and other applications |
| Iron-Free Active Carbons Supported Ordered Platinum-Cobalt Intermetallic Alloy Fuel Cell Catalysts | Wu | | | This technology reduces the platinum requirements and thus the costs for vehicle and stationary fuel cells |
| Iron (III) Macrocyclic Complexes with Mixed Hydroxyl | Morrow | | | Low toxicity MRI contrast agent. Contrast media market size is \$2.8B |
| Macrocycles, Cobalt and Iron Complexes of Same, and Methods of Making and Using Same | Morrow | | US10960088 | Low toxicity MRI contrast agent. Contrast media market size is \$2.8B |
| Serum-Stable Compositions and Methods for Light-Triggered Release of Materials | Lovell | | US10918599 | Controlled-release vesicles for pharmaceuticals. A \$37.8B market |

Start-up Companies Formed

None

Licensing and Other Agreements

| Project | Inventor/PI | Licensing Partner |
|--|---|---|
| Rapid-Prototype Writable/Printable Flexible Electronics Based Chemical Sensor | Shenqiang Ren | Tapecon, Inc. |
| Rapid-Prototyping Magnetic Metamaterials for Vibration Control | Mostafa Nouh Shenqiang Ren | ITT Enidine Buffalo Manufacturing Works |
| Harnessing Materials Informatics to Accelerate the Development of Restorative Dental Materials | Baishakhi Mazumder Olga Wodo | Ivoclar Vivadent, Inc. |
| Capacitance-Based Three-Dimensional Metal Printing Monitoring Technology | Deborah Chung | Norsk Titanium US Inc. |
| Ultrahigh Performance Supercapacitor Using Two-dimensional CN Crystals | Huamin Li Fei Yao Kristofer Reyes | Custom Electronics Inc. |
| Combinatorial metal-organic polyhedral materials as MRI contrast agents | Janet Morrow Timothy Cook | Ferric Contrast Inc. |
| Development of metal nitride superconductors for future generation of superconducting qubits” | Quanxi Jia, Hao Zeng | Sunny Clean Water LLC Applied Materials Inc. |
| In vivo sensor | Qiaoqiang Gan | Garwood Medical |
| Wind Turbine Blades | John Hall | Atrevida Science |

Science and Technical Activities with Students

The K-12 programs with Buffalo City schools continued online and programs for educators and students transitioned back to in-person during the second half of the year. UB Professors were awarded funding from The Cullen Foundation to pair UB students with science teachers in Buffalo Public Schools. The fellows contributed to the planning and execution of lessons, providing a new perspective to teaching scientific concepts.

Science Exploration Day (SED) is a science conference for high school students, held annually in March. Students spend a day on UB’s North Campus attending lectures, demonstrations, and hands-on activities from a variety of scientific disciplines. Corporate funding was secured for 300 Buffalo Public School students to attend. This event was scheduled for March 18 and was postponed due to the COVID-19 pandemic.

Strategic plan

The CMI’s broad focus and mission is to serve as a critical nexus between industry and faculty expertise to solve technical and business-related challenges. The CMI, through its business development efforts, connects companies-to-faculty and faculty-to-companies and student experiential learning engagements through its Career Experience Program (CEP). The CMI’s strategy for expanding its existing base of companies includes business development and scientific participation in materials and related engineering symposia, events, and trade expositions across New York State and nationally. The CMI

employs a Key Account management strategy to maximize the Center's overall value proposition, including UB as an institution, and the regional and statewide resources CMI represents.

The CMI Industrial Advisory Board provides recommendations for research directions based on industry trends and needs, assists with strategic federal funding opportunities and new center designations, and serve as ambassadors within the community and the greater industrial base.

The CMI tracks its commercialization performance metrics with the goal of engaging UB's applied research expertise and capabilities for the advancement of manufacturers in NYS as well as supporting industry-oriented education and training. Engagements are tracked for companies, faculty and students who have worked with the Center. The outcomes measured by these metrics are dependent on many factors beyond the immediate control of CMI, and that they are subject to large year-to-year fluctuations. Rough numerical targets are set, with the emphasis on positive outcomes over the long-term including licenses executed, patents, research agreements, additional funding achieved, for example.

Governance Structure

Dr. Alan Rae is Director and PI overseeing administrative and technical aspects of the Center's activities. He reports to Rick Gardener, Associate Vice President, Economic Development, Business and Entrepreneur Partnerships, University at Buffalo.

The CMI Industrial Advisory Board provides recommendations for research directions based on industry trends and needs, assists with strategic federal funding opportunities and new center designations, and serve as ambassadors within the community and the greater industrial base. Advanced Manufacturing International, Buffalo Manufacturing Works, Harper International Corp, Linde, Moog, Omikron, S. Howes, Inc, Tapecon, Inc., Unifrac, Viant Medical, and Washington Mills are represented on the IAB.

**CoE IN DATA SCIENCE
UNIVERSITY OF ROCHESTER
Mujdat Cetin**

Technology Focus: Data Science, artificial intelligence (AI), machine learning

Importance to NYS:

The CoE in Data Science is part of a unified strategy to establish the region and the state as a hub for new talent and a leader in analyzing and commercializing the limitless uses of data, to improve quality of life and to fuel economic growth.

Purpose

The Rochester CoE in Data Science is dedicated to supporting businesses in New York through the application of data science methods and tools that solve challenges and deliver critical insights. The CoE leverages and further supports the data science expertise at the University of Rochester’s Goergen Institute for Data Science (GIDS). The CoE interacts with faculty across disciplines of computer science, medicine, brain and cognitive sciences, biomedical engineering, optics, electrical and computer engineering, chemistry, business, and other fields. The CoE is focused on developing and expanding industry partnerships on a broad range of data science related research areas and technologies including but not limited to artificial intelligence (AI), machine learning, data mining, and statistical and computational methods.

The CoE leverages University infrastructure and expertise in data science and high-performance computing, while building collaborations with other academic partners, industry, and government agencies. With support from New York State and IBM, the University is among the most powerful university-based supercomputing sites in North America. Major investments have developed a high-performance computing infrastructure supporting data science research and analytics. The Center for Integrated Research Computing provides support services for computational and data analytics technology. The Health Sciences Center for Computational Innovation at the University hosts a Linux cluster, BlueHive 2, one of the most powerful university-based supercomputing sites in the nation. The VISTA Collaboratory houses a 1,000-square-foot interactive wall that renders massive data sets in real time, allowing visualization of complex data instantaneously.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improv's | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-------------------------|----------------------|
| 11 | 0 | \$1,660,507 | \$2,215,000 | \$920,743 | \$18,720,000 | \$16,000 | \$23,532,250 |

Companies Served and Projects

| # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|------------------------------|-------------------------------|--------------------------------|---|
| 7 | 1 | 6 | 7 |

Designations and Recognitions

| Awards / Recognition | Date Received | Recognizing Organization | Link |
|--|---------------|---|---|
| CoE faculty researcher Mitch Lovett named a 2020 Marketing Scholar | 08/28/2020 | Marketing Science Institute (MSI) | https://www.msi.org/article/2020-msi-scholars-announced/ |
| CoE faculty researcher Jiebo Luo received the 2021 NAACL Best Long Paper Award | 06/09/2021 | North American Chapter of the Association for Computational Linguistics (NAACL) | https://2021.naacl.org/blog/best-paper-awards/ |

Operating Budget

| Operating Budget Description | Matching Funds | | | Total Budget |
|------------------------------|------------------|--------------------|------------------|--------------------|
| | NYSTAR Funding | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$342,538 | \$0 | \$572,001 | \$914,539 |
| Indirect Costs | \$49,437 | \$0 | \$85,800 | \$135,237 |
| Equipment | \$150,000 | \$0 | \$0 | \$150,000 |
| Materials & Supplies | \$1,179 | \$0 | \$2,372 | \$3,551 |
| Tuition | \$330 | \$0 | \$0 | \$330 |
| Travel | \$0 | \$0 | \$148 | \$148 |
| Subcontractors | \$0 | \$0 | \$0 | \$0 |
| Other | -\$1,372 | \$0 | \$6,440 | \$5,068 |
| Total | \$542,112 | \$0 | \$666,761 | \$1,208,873 |

Capital expenditures

| Capital Equipment Purchases | NYSTAR Funding | Federal | Other Sources | In-kind | Total |
|---|----------------|---------|---------------|---------|----------|
| RPDU Metered upgradeable 60A 2 o8V17.2 W QTE2430 Dell Power Edge R750X/R650 QTE 2430 Dell Melanox HDR InfiniBand networking resources | \$75,000 | \$0 | \$0 | \$0 | \$75,000 |
| Lenovo – IB Switch PSE Min QM8790 40pHDE IB Switch, Spectrum Scale for Lenovo Storage, Think System SR650 | \$75,000 | \$0 | \$0 | \$0 | \$75,000 |

Commercialization Plan

The CoE in Data Science creates regional and statewide economic impact by supporting research, training, and business development partnerships in data science. The CoE in Data Science has a funding program that supports academia-industry collaborative projects and currently works with more than 20 New York State companies to achieve technology transfer and economic growth based on data science research. The Center also connects businesses in New York to the Goergen Institute for Data Science for access to student talent, partnerships on data science practicum projects, and collaboration with faculty on research, technology transfer, and commercialization.

Actual or Anticipated New Products or Processes with Commercial Application

| Patent Name | Inventor | Co-inventor | Patent Number | Description |
|--|-------------------|--------------------------------|---------------|--|
| Ising Machine Based on Coupled Bistable Nodes for Solving Combinatorial Problems | Zeljko Ignjatovic | Michael Huang, Richard Afoakwa | PCT/US21/7042 | The present invention enables energy-efficient, low-cost, and small format computation on an Ising machine for solving combinatorial and optimization problems in edge-devices and server-farms. |
| Creating Automatic WiFi Direct Networks | Wendi Heinzelman | Cristiano Tapparello | | Work has been completed on supporting WiFi Direct network automation and maintenance for multi-group networks. Our results confirm the feasibility of multi-group WiFi Direct networks using real devices. This is the first work to show operational multi-group WiFi Direct networks that are automatically created. |
| Data Science for Pandemic Monitoring | George Vigelette | | | We developed a user interface for the pandemic monitoring platform for use by the end user. This has been distributed to one external customer for testing and allows that customer to access the data in the system while |

| | | | | |
|--|--|--|--|---|
| | | | | providing full control to Common Ground Health on what data is accessible by the customer. We have also implemented basic visualization tool for data analysis. |
|--|--|--|--|---|

Start-up Companies Formed

None

Licensing and Other Agreements

None

Science and Technical activities with Students

The University became the Educational Partnership Organization (EPO) for East High School in 2015 and is in the process of renewing that arrangement. The CoE works closely with the Warner School of Education at the University of Rochester to identify opportunities for partnerships and collaborations in data science that can help advance interest in STEM fields.

Strategic Plan

The CoE in Data Science is strategically housed within the Goergen Institute for Data Science (GIDS) at the University of Rochester, which provides the academic foundation and expertise for the CoE. This generates a unified data science initiative whose mission contains research, learning, economic impact, and community outreach. The CoE also draws academic expertise from other universities in New York based on industry needs. The CoE interacts with faculty and businesses through several mechanisms including requests for proposals, practicum projects, student internships, as well as externally funded collaborative research. Applications and domains of interest are driven by institutional, regional, and statewide strengths and opportunities identified through these interactions. Recent application domains include but are not limited to health analytics and digital health; imaging and image understanding; optics; computer/human vision; life sciences and biomedicine; human-computer interaction; robotics; economics and business data analytics; AI-augmented learning and work; security and defense. The Center evaluates its success both by quantitative economic impact metrics, and also by assessing efforts on industry-academia partnership creation and workforce development in data science. The University’s Data Science Administrative Committee provides feedback on the Center’s activities.

Governance Structure

The CoE is managed by a director, who also directs the Goergen Institute for Data Science (GIDS). GIDS is the academic home for data science programs at the University of Rochester and the CoE is housed in GIDS. An internal Administrative Committee comprising the Senior Vice President for Research (SVPR), Dean of the School of Arts and Sciences, Dean of the Hajim School of Engineering & Applied Sciences, and Vice Dean of the School of Medicine and Dentistry also provide guidance and oversight to the CoE Director regarding the Center’s activities. The CoE also receives advice and feedback from an External Advisory Committee, whose membership currently includes recognized leaders from the Allen Institute

for Artificial Intelligence, Bright House Networks, Cornell University, Harris Corporation, MIT, Microsoft, Wegmans, Xerox, and other leading companies and institutions.

The Center is currently directed by Mujdat Cetin with assistance from Mike Kennerknecht, Cathy Adams, Brendan Mort, and Margaret Urzetta. University leadership is briefed regularly on pertinent updates via biweekly meetings of the Data Science Administrative Committee.