



**Division of
Science, Technology
& Innovation**

A Division of Empire State Development

Centers of Excellence

2023 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), a division of SBTD, manages the Centers of Excellence (CoE) program with the 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 2021-2022 reporting period.

The information for each CoE is provided in each of the following categories:

1. Technology Focus
2. Importance to NYS
3. Purpose
4. Impacts
5. Designations and Recognitions
6. Operating Budget
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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

Summary Statistics

Centers	New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
14*	341	88	\$46,321,272	\$215,165,042	\$11,793,189	\$196,913,906	\$12,150,375	\$482,343,784

Centers	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with Companies
14*	539	353	319	146	520

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

**Small Scale Systems Integration and Packaging Center of Excellence
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 Center of Excellence (S3IP) 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	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
3	2	\$18,316,650	\$1,502,500	\$170,000	\$50,016,000	\$650,000	\$70,655,150

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with companies
2021-2022	20	1	16	4	17

Designations and Recognitions

Awards / Recognition	Date Received	Recognizing Organization	Link
Seungbae Park, ASME fellow	October 2021	American Society of Mechanical Engineers (ASME)	https://www.binghamton.edu/news/story/3327/watson-professor-named-asme-fellow-for-three-decades-of-electronics-packaging-innovations

2021-2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$616,386	\$28,230	\$1,650,719	\$2,295,335
Indirect Costs	\$92,458	\$2,832	\$244,590	\$339,880
Equipment	\$0	\$0	\$0	\$0
Materials & Supplies	\$14,743	\$7,446	\$198,803	\$220,992
Tuition	\$1,926	\$0	\$107,066	\$108,992
Travel	\$8,349	\$1,134	\$37,880	\$47,363
Subcontractors	\$0	\$0	\$87,606	\$87,606
Other	\$40,514	\$10,194	\$598,132	\$648,840
Total	\$774,376	\$49,836	\$2,924,796	\$3,749,008

Total Federal: \$2,422,026

Total In-kind: 0

Capital Expenditures: None

Commercialization Plan

S3IP's commercialization plan is to provide technical analyses, materials and process development, and product prototyping in partnership with companies of all sizes. The CoE has deep competency in electronics manufacturing and advanced batteries via a set of six individual research centers, each directed by a faculty member. Through these activities, S3IP maintains close ties with the faculty of the Watson College of Engineering and Harpur College. As a CoE, they research and apply advanced thermal management methods for electronics and develop advanced Li-ion battery chemistries. They perform thermal analyses, failure analysis, and reliability improvement for manufactured items, characterization of materials, components, interfaces, and constructed devices using materials science research instruments. They leverage faculty and student research effort in six research centers and supplement them with the experience and skills of professional engineering and science staff. Ten research labs are under purview of the S3IP, and in addition space is made available for startup company labs. They use New York State and federal funding to subsidize industry projects along with industry cost sharing, resulting in prototype materials, processes, and products. Several of their centers use a membership model in which companies set the research portfolio for the centers and share equally in the results obtained. Their labs also perform work for hire to address immediate

problem solving and analysis needs of client companies. As needed, they engage the capabilities of other academic institutions to supplement in-house technical capabilities.

Actual or anticipated new products or processes with commercial application

Patent Name	Inventor	Co-Inventor	Patent #	Description
Electrolytic Capacitorless, Selectively Dimmable LED Driver	Pritam Das		11,013,083	OLEDWorks is interested commercializing this patented LED driver for application in White Tunable OLED Luminaire and Segmented OLED Luminaires

Start-up Companies Formed

Company Name	City	Product/Service	Sector
Pinwheel Solar	Binghamton, NY	Perovskite-based solar cells	Electronics Manufacturing

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Project	Inventor	Licensing Partner
I/UCRC in Energy-Efficient Electronic Systems	Principle Investigator: Prof. Kanad Ghose	Sponsor: NSF
DMREF: Collaborative Research: A Blueprint for Photocatalytic Water Splitting: Mapping	Principal Investigator: Louis Piper	Sponsor: NSF
Institutional Partnership to Create Successful Student Transition in Smart Energy and Materials	Principal Investigator: James Pitarresi	Sponsor: NSF
MURI – Cross Disciplinary Electronic-Ionic Research Enabling Biologically Realistic Autonomous Learning (CEREBRAL)	Principal Investigator: Louis Piper	Sponsor: Georgia Institute of Technology
Toward Twenty Year Lifetime Hermetic Sealing for Perovskite Solar Cells	Principal Investigator: Tara Dhakal	Sponsor: NSF
REU Site: Renewable Energy Generation and Storage	Principal Investigator: Jeffrey Mativetsky	Sponsor: NSF

Project	Inventor	Licensing Partner
Supercapacitive Micro- Bio-Photovoltaics for Sustainable Wireless Sensor Networks	Principal Investigator: Seukheun Choi	Sponsor: ONR
Cell cycle-specific recognition of the cell nucleus as cargo for dynein-dependent transport	Principal Investigator: Sozanne Solmaz	Sponsor: National Institute of General Medical Sciences
Manipulating and Exploiting Lattice Strain as a Novel Platform to tune the surface work Function of Metallic Nanocatalysts	Principal Investigator: Jiye (James) Fang	Sponsor: NSF
Engineering a Small Intestinal Microbiome to Evaluate Food Additive Exposure	Principal Investigator: Gretchen Mahler	Sponsor: National Institutes of Health
MEMS High Voltage Triboelectric Levitation: A Generactuator	Principal Investigator: Sharzhad Towfighian	Sponsor: NSF
CNS Core: Small: Language Runtime Support for Energy-Aware Applications	Principal Investigator: Yu David Liu	Sponsor: NSF
Molecular Mechanisms of Tissue Specific Signaling for Islet Self Assembly	Principal Investigators: Sha Jin and Kaiming Ye	Sponsor: NSF
Mechanobiology of Myfibroblast Behavior in Health and Disease	Principal Investigators: Gretchen Mahler, Mei-Hsiu Chen, Bruce T. Murray and Pong-Yu Huang	Sponsor: NSF
MRI: Acquisition of a Hard X-Ray PhotoElectron Spectroscope (HAXPES) for the Institute for Materials Research at Binghamton University	Principal Investigators: Louis Piper, Natalya Chernova, Mark Poliks, Guangwen Zhou, Tara Dhakal	Sponsor: NSF
MRI: Acquisition of a High-Throughput Flow Cytometry for Health Science Research and Training	Principal Investigators: Sha Jin and Erik Rozners	Sponsor: NSF
Three-Dimensional Valve-on-a-Chip Models of the Aortic Valve Fibrosa	Principal Investigator: Gretchen Mahler	Sponsor: American Heart Association, Western State Affiliate
SRC CHIRP Fine Pitch Cu-Sn Based Interconnection Below Temperatures of 180 degrees centigrade	Principal Investigator: Nik Dimitrov	Sponsor: Purdue University

Project	Inventor	Licensing Partner
SRC CHIRP: Conformal Polymeric Thin Films Manufacturing Using Electrospray Printing	Principal Investigator: Paul Chiarot	Sponsor: Purdue University
SRC CHIRP Design Fabrication and Testing of Metal Porous Media for Thermal Capacitor and Immersion	Principal Investigator: Bahgat Sammakia	Sponsor: Purdue University
Heterotypic impacts on epicardial cells on Engineered Cardiac Micortissue function	Principal Investigator: Tracy Hookway	Sponsor: National Heart, Lung and Blood Institute
Epifluidics for Stress Monitoring	Principal Investigator: Ahyeon Koh	Sponsor: Nano-Bio Materials Consortium
Stretchable Papertronics	Principal Investigator: Ahyeon Koh	Sponsor: NSF
PFI-TTT: Enhanced Electronic Cooling via 3D Printing from Additive Laser Fabrication of Heat Removal Devices	Principal Investigator: Scott Schiffres	Sponsor: NSF
Multiple-Energy Assisted Ultrasharp Prob-Based Nanomanufacturing for High-Resolution and High-Efficiency Nanopatterning	Principal Investigator: Jia Deng	Sponsor: NSF
Collaborative Research: Exploiting Nanoscale Interfaces to Enhance Bulk Mechanical Response of Additively Manufactured Boron Nitride Nanotube-Metal Composites	Principal Investigator: Changhong Ke	Sponsor: NSF
Rational Design of Oxide Cathode Coating for High Performance Li-ion Batteries	Principal Investigator: Hao Liu	Sponsor: NSF
Next Generation, High Energy Density, Lightweight Capacitors	Principal Investigator: Tara Dhakal	Sponsor: NSF Partnership for Innovation
Liquid to Air Data Center Cooling Lab Development	Principal Investigator: Kanad Ghose	Sponsor: NVIDIA Corporation
Thin-Filmed Thermal Characterizations for AMAT	Principal Investigator: Scott Schiffres	Sponsor: Applied Materials

Project	Inventor	Licensing Partner
Design, develop and Demonstrate a True 3D Packaging	Principal Investigator: Bahgat Sammakia	Sponsor: SUNY Applied Materials Research Institute
SRC Undergraduate Research Program (Matt Heitner)	Principal Investigator: Scott Schiffres	Sponsor: Semiconductor Research Corp.
Controlled Synthesis of Multi-Metallic Nanoscale Alloys	Principal Investigator: CJ Zhong	Sponsor: BASF Corp
Radiation-Hard Microelectronics Workforce Development Consortium Sub Agreement No. 13000844-021	Principal Investigator: Bahgat Sammakia	Sponsor: Purdue University
I-Corps: Preventing Rolling Veins During IV Insertion	Principal Investigator: Guy German	Sponsor: NSF
AeroBing Rocketry Research Group	Principal Investigator: Bahgat Sammakia	Sponsor: NASA NY Space Grant Consortium
ACS Summer Undergraduate Research Fellowship- John Talbott	Principal Investigator: Erik Rozners	Sponsor: American Chemical Society
Application Engineering Support for Technical Solutions in Battery Energy	Principal Investigator: Yong Wang and Soongeol Kwon	Sponsor: Photochemical transformations of multicomponent aggregates containing photolabile small molecules, heavy metal ions, and/or nanoparticles in biological environments Energy Enterprises
CAS: Role of Dynamic Surface/Subsurface Oxygenation of Noble Metal/3D Transition Metal Alloy Nanoparticles in Oxidation Reactions	Principal Investigator: CJ Zhong	Sponsor: NSF
I-Corps: Self-Adhesive, Nanofibrous, Silicone Elastomer to Replace Current Adhesive Bandages	Principal Investigator: Ahyeon Koh	Sponsor: NSF
Battery Performance Degradation Prediction and Market Bidding	Principal Investigator: Hari Srihari	Sponsor: GE Grid Solutions

Project	Inventor	Licensing Partner
Optimization Using Artificial Intelligence Machine Learning and Stochastic Optimization		
Allegro Microsystems Materials Testing Agreement	Principal Investigator: Peter Borgesen	Sponsor: Allegro Microsystems
Adhesives Characterization – Project 702010, Revised	Principal Investigator: Junghyun Cho	Sponsor: Honeywell Federal Manufacturing
Generation of Islet Organoids in Oxygenated Scaffolds	Principal Investigators: Sha Jin and Kaiming Ye	
RAPID: Ultraviolet Germicidal Irradiation for Disinfecting and Reuse of N95 Respirators	Principal Investigator: Kaiming Ye	Sponsor: NSF
NASA NY space Grant Consortium	Principal Investigator: Changhong Ke	Sponsor: Cornell University
Low-Power Stimulated Raman Time-Lapse Microscope for Tracking Dynamics and Fate of Lipid Droplets in Glioma Cells	Principal Investigator: Fake (Frank) Liu	Sponsor: National Institute of General Medical Sciences
Photochemical transformations of multicomponent aggregates containing photolabile small molecules, heavy metal ions, and/or nanoparticles in biological environments	Principal Investigator: John Swierk	Sponsor: National Institute of General Medical Sciences
Development of a Smartphone based infrared fluorescence imaging intra-oral device (SMART-IR-ID) for dentist- guided real-time self-monitoring of periodontal disease	Principal Investigator: Kaiming Ye	Sponsor: National Institute of Dental and Craniofacial Research
CAREER: Enabling High-performance Na-ion Battery Cathodes Via Structural Pillaring	Principal Investigator: Hao Liu	Sponsor: NSF
Additive Manufacturing of Titanium Thin-wall Structures	Principal Investigator: Fuda Ning	Sponsor: Additive Technologies LLC

Project	Inventor	Licensing Partner
CHIRP 2021: Printed Conformal Metal Films for electromagnetic Interference (EMI) Protection Semiconductor Research Corporation Prime Agreement 2019-PK-2878	Principal Investigator: Paul Chiarot`	Sponsor: Purdue University

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

During the reporting period, the Center supported tours of the labs for students from the Vestal, NY school district, and the local Boy Scouts and Girl Scouts organizations. The Center also partnered with 7x24 Exchange International, a data center industry consortium, to develop a video for secondary school and community college students explaining career opportunities in the data center field.

Strategic plan

The Center supports the electronics manufacturing and advanced energy storage industries in New York. Faculty research activity and contacts with industry informs the focal area. They are active participants in NYSTAR outreach activities to industry and participate in FuzeHub forums. They are a resource for the local Manufacturing Extension Partnership (MEP) office. S3IP research centers receive funding from NSF, the NextFlex national manufacturing innovation institute, and most recently, the federal Build Back Better Regional funding. S3IP is supporting several teams preparing for funding under the U.S. CHIPS Act. 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. S3IP is authoring sections of the IEEE’s Heterogeneous Integration (HI) roadmap, which lays out the course of HI in electronics manufacturing for the future. The Center assists the university in capital investment proposals to local and state economic development agencies including the Southern Tier Regional Economic Development Council, the Upstate Revitalization Initiative, and Empire State Development investments. The Center also assists faculty in pursuit of grants from state agencies such as the New York State Energy Research and Development Agency.

The CoE’s business-oriented performance metrics include the economic impacts reported by industry partners, the number 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.

Governance Structure

The S3IP CoE director is responsible for the overall management and strategies of the Center. He is assisted by an associate director who is responsible for day-to-day operations. The constituent research centers are managed by tenured faculty assisted by staff as needed. The S3IP has an industrial advisory board. The Integrated Electronics Engineering Center (IEEC) CAT uses a paid-membership mode. It has an industrial advisory board to advise the Center director. Member

companies appoint representatives to the Technical Advisory Board (TAB). The TAB advises on research projects of interest to industrial members. The Energy Smart Electronics Systems Research Center also utilizes a paid-membership business model and advisory board structure to choose the research projects. The FlexMed CAT has an industrial advisory board, and it uses a project subsidy model for funding its projects. CoE labs are managed directly by S3IP leadership or research center directors.

Center of Excellence for Food and Agriculture at Cornell AgriTech
Cornell University
Catharine Young, Executive Director

Technology Focus: Food and Agriculture technology

Importance to NYS

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

Purpose

Cornell University, a global agrifood pioneer, drives economic resurgence through its Center of Excellence (CoE). Employing a dynamic “push, pull, grow” strategy, the CoE propels startups to scale, attracts agrifood enterprises to New York State, and nurtures existing companies. The CoE serves as a crucial link, connecting private sector entities with Cornell's research, innovation, and technology for impactful commercialization. Its expert team provides strategic advice and valuable linkages to resources, facilitating success statewide.

The CoE's cutting-edge facilities on the Cornell AgriTech campus offer private sector companies laboratory, office, and co-working spaces, transforming research into real-world applications. Simultaneously, the CoE collaborates with the Cornell Food Venture Center to fortify the entrepreneurship ecosystem, establishing new facilities that bolster the food industry, and foster innovation in New York State.

In essence, the CoE is a transformative catalyst, seamlessly blending academic excellence with private sector dynamism, driving economic growth and innovation in New York. Through strategic partnerships and state-of-the-art facilities, it positions Cornell and the state at the forefront of global agrifood advancements.

Impacts

New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
44	3	\$4,433,127	\$99,910	\$68,400	\$23,471,650	\$8,930,960	\$37,004,047

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with Companies
2021-2022	124	124	124	**See below	0

**All companies receive continued support

Designations and Recognitions: None

2021-2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$546,931	\$0	\$466,494	\$1,013,425
Indirect Costs	\$82,040	\$0	\$0	\$82,040
Equipment	\$36,630	\$0	\$15,841	\$52,471
Materials & Supplies	\$110,431	\$0	\$20,138	\$130,569
Tuition	\$0	\$0	\$0	\$0
Travel	\$11,757	\$0	\$728	\$12,485
Subcontractors	\$89,719	\$0	\$0	\$89,719
Other	\$12,939	\$0	\$342,851	\$355,790
Total	\$890,447	\$0	\$846,052	\$1,736,499

Total Federal: \$403,942

Total In-kind: 0

Capital Expenditures: None

Commercialization Plan

The CoE's support has fostered innovation and economic growth in agricultural technology, as well as research in the food and beverage sectors, empowering members to commercialize and launch their products. The CoE's close connection with Cornell food science assets has played a pivotal role in supporting numerous research projects, two of which are described below.

- VM Agritech, from July 2022 report – A company started in the United Kingdom has moved to Geneva, NY because of collaboration with the Center of Excellence and Cornell’s School of Integrated Plant Science (SIPS). SIPS conducted in-vitro research, field trials and mode of action research into Curezin, a proprietary copper-and-zinc-based fungicide. Future research includes veterinary and human medical applications. The company has invested more than \$2 million in research at Cornell.
- Levelle, from July 2022 report - Women-owned entrepreneur team created a gel-free energy puree formulated for women athletes. The CoE business development team worked to conduct scale-up trials with the CFVC Pilot Plant for three different products to produce marketing samples. The CoE guided the co-packer search for Levelle.

Actual or anticipated new products or processes with commercial application: None

Start-up Companies Formed

Company Name	City	Product/Service	Sector
Atolla Tech	Rockville Centre, 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 product 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
Winand Products	Auburn, NY	Garlic-based spice rubs	Food

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

None

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

The CoE hosted the Cattaraugus-Little Valley Center School Future Farmers of America (FFA) visit to the Cornell AgriTech campus in May of 2022. This campus-wide tour involved direct involvement from the CoE including a visit to the Cornell Food Venture Center Pilot Plant. Students were provided insight into food safety careers with expert Cynthia James and sampled varieties of apples developed by the apple breeding program. In addition, they toured the greenhouse on campus and were able to visit the Cornell Agriculture and Food Technology Park (Tech Farm) and conduct a taste test with Siena Development, a CoE member company.

Summer 2022 launched the CoE's first two internships in food and beverage entrepreneurship with the Summer Scholars Program. Funding from the Emerson Family Foundation provided the CoE with two scholars: Nathan Hesler (Geneva, NY native and senior at Hobart and William Smith Colleges) and Justina Jenkins (Dryden, NY resident and senior at Thiel College). The CoE exposed the students to several interactive learning opportunities including field trips and mentor luncheons from June until August of 2022. Site visits included Headwater Food Hub, Pure Functional Foods, apple farms and Farm

Fresh First, Wegmans Organic Farm, East Coast Crush and Pack, The Spotted Duck, LiDestri Foods, Cornell Dairy Pilot Plant in Ithaca, Hosmer Winery, and Brewery Ardennes. Mentor meetings included Ashton Yoon and Jason Goodman from Antithesis, Bill Strassburg from Wegmans, Maureen Ballatori from 29 Design, former New York State Senator Mike Nozzolio, and former Cornell AgriTech Director Jan Nyrop.

Strategic Plan

The CoE is dedicated to fortifying New York's agriculture, food, and beverage economy through collaboration with entrepreneurs, startups, and established companies in these sectors. Strategies involve facilitating connections with Cornell University's research, services, technology, and innovation, offering business mentoring, establishing B2B partnerships, and accessing supply chain assets. The "push, pull, grow" methodology urges startups to scale up, attract companies to New York, and support the expansion of existing businesses.

Utilizing this approach, the CoE stimulates the growth of entrepreneurs and startups, draws companies to New York State, and nurtures the development of established businesses. Operating within Cornell University systems, the CoE identifies high-tech prospects, channeling Cornell's excellence into the market. Collaborations with entities like the Cornell Food Venture Center and Pilot Plant facilitate the expansion of food and beverage manufacturing in New York. The CoE engages with diverse Cornell entities, including the Cornell Dairy Program, Cornell Institute for Digital Agriculture, and 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 the 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 Center of Excellence operates within the Cornell College of Agriculture and Life Sciences at Cornell University and is situated at Cornell AgriTech in Geneva, NY. It functions under the leadership of Chris Smart, the Director of Cornell AgriTech, an experimental station dedicated to shaping the future of food and agriculture systems by collaborating across disciplines to find practical solutions that enhance the success of growers and businesses.

The effectiveness of the CoE is regularly assessed and adapted as needed, with valuable input from various Cornell programs collaborating with the CoE and Executive Director Catharine Young. Under her leadership, the CoE team comprises three business development specialists, an administrative assistant, a project manager, and a marketing and communications coordinator.

**Center of Excellence in Digital Game Development
New York University
Naomi Clark, Director**

Technology Focus: Software and Digital Media -- Games

Importance to NYS

The NYU Game Center (the Center) efforts are primarily targeted at small business development and workforce development. Part of their strategy is to raise the profile of the game industry in NYS, nationally and globally.

Purpose

The Center is a program with more than 250 undergraduate and graduate students enrolled, working to complete degrees in game design. They are the #1 program in the US as ranked by the Princeton Review. They are an incredible resource for companies looking to hire students with backgrounds in technical and artistic aspects of game design. For both Take-Two and the companies they work with in the Internship Matching program, they provide companies access to students who are eager to gain experience in the industry, and companies provide students with the professional training they need to thrive in the game industry.

Furthermore, with the Incubator program the Center is able to support new teams and small businesses entrepreneurs get the professional development they need to start successfully in the industry right after college. Even with an entrepreneurial attitude it's hard for fresh graduates to orientate themselves in the game development market. With the access that NYU has to industry veterans, they were able to offer a time buffer and a professional development opportunity to the selected teams.

Impacts

New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
0	0	\$0	\$102,000	\$0	\$0	\$0	\$102,000

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with Companies
2021-2022	13	10	8	5	38

Designations and Recognitions

Awards / Recognition	Date Received	Recognizing Organization	Link
Named #1 Grad and Under Grad program in the US	03/21/23	Princeton Review	https://www.princetonreview.com/press/game-design-press-release-2023

2021-2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$0	\$0	\$40,838	\$40,838
Indirect Costs	\$0	\$0	\$12,425	\$12,425
Equipment	\$0	\$0	\$600	\$600
Materials & Supplies	\$0	\$0	\$0	\$0
Tuition	\$0	\$0	\$0	\$0
Travel	\$0	\$0	\$0	\$0
Subcontractors	\$52,120	\$0	\$4,225	\$56,345
Other	\$120,802	\$0	\$14,295	\$135,097
Total	\$172,922	\$0	\$72,383	\$245,305

Total Federal: 0

Total In-kind: 0

Capital Expenditures: None

Commercialization Plan

In 2008, the department began organizing free game-related events for the community, such as Strategy Guide, the annual career fair. Since 2014, NYU has also run a successful game incubator that provides workspace, support, and connections to publishers for dozens of developers in NYS. As the first game-specific co-working space in NYC, they provided free dedicated workspace for NYC-based developers before the pandemic. The public programming and incubator program have been maintained virtually since the pandemic, but they will again offer in-person programming in 2022. This public outreach has given us the opportunity to create a unique relationship with not only businesses involved in game development in NYC, but also local companies, consumers, and up-and-coming entrepreneurs. This ecosystem will be maintained by expanding the co-working space, hosting free public events, exhibiting at industry events, and holding university-specific events.

During this period, the main goals were to:

1. Make one key hire of a new director for the Incubator program.
2. Restructure the Incubator program. After eight years of running a game-specific incubator, and two years of remote/pandemic working, they have enough information to implement changes

to the current incubator model that will lead to an increase of game launches, publishing contracts, and success stories for the teams they support. Once the new hire is onboarded, they will be surveying past and present incubator participants to analyze this data and execute changes.

3. Fully transition to in-person events and programming now that NYU’s guest restrictions have been lifted.

Actual or anticipated new products or processes with commercial application: None

Start-up Companies Formed

Company Name	City	Product/Service	Sector
Baconeggandcheese	Brooklyn, NY	Crown Delights Deli	Digital Game
Heavy Meadow	Brooklyn, NY	Rewilding	Digital Game
Perfect Hat Games	Brooklyn, NY	Eludo	Digital Game

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

None

Description of any relationships with secondary schools and community colleges

The Center held the Future Game Designers program. Sixteen New York high school students from under-represented backgrounds in the arts participated in a 14-week game design program. They also held the Tisch Game Designers Summer Program. Where 16 high school sophomores and juniors took college-credit granting classes at NYU. Many of these students end up applying to the NYU Game Development undergraduate program.

Strategic Plan

The broad focus of the NYU Game Center CoE is to keep the incredible pool of talents that graduate at the Game Center both at the graduate and undergraduate level to stay in NY and make a career in game design and development here.

At the moment, the CoE is supporting various aspects of the game development community. First, through the Incubator, they feed new talent to the community, supporting 4 to 5 companies to get their games out and professionalize. Second, they bring content and networking opportunities to the alumni and game design community at large, with public events, showcases and playtest nights. The KPIs that they will track in these areas (attendance, company success rate, etc.) are what ultimately define their success.

Governance Structure

The CoE’s governance structure is agile and expands when needed for special events, planning and decision making. The core group is composed of three colleagues supported by other administrators, faculty, and technicians around the University:

- Naomi Clark – Departmental Chair, NYU Game Center – A game industry veteran and co-author of *A Game Design Vocabulary* (2014).
- Kyra Wills-Umdenstock - Center of Excellence Administrator & Industry Liaison, NYU Game Center & Co-founder of nonprofit EGD Collective.
- Margaret Robertson - Interim Incubator Director, NYU Game Center & 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.

**Center of Excellence in Digital Game Development
Rochester Institute of Technology
Dr. David Long, Center Director**

Technology Focus: Digital media research, production, and publication, including games, live action film, animation, digital design VR/AR/XR and more.

Importance to NYS

The Rochester Institute of Technology’s (RIT) Center of Excellence in Digital Game Development (CoE) at the Center for Media, Arts, Games, Interaction & Creativity (MAGIC) fosters collaboration between the academic research community on campus and the business and technology sectors in the Rochester community. The CoE leverages their state-of-the-art facilities, professional and academic networks, faculty and student expertise in digital media research and production to develop and commercialize new media and technologies; promote investment in digital media production in New York State; help create and expand technology-related businesses and employment opportunities and retain a highly educated student workforce in the Rochester area and within the state.

Purpose

The CoE at 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 K-12 schools and programs; supporting students who are interested in publishing games through our MAGIC Maker program; supporting indie developers through our Community Incubator program; showcasing and playtesting games being developed in our community at the annual Rochester Game Festival; showcasing at conferences/festivals and events in around New York State.

Impacts

New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
0	0	0	\$89,709	\$0	\$4,000	\$0	\$93,709

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with companies
2021-2022	16	16	16	5	38

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 (includes support for 5 years of scholarships benefitting 10 students)
Princeton Review recognition as a top program in game development	3/22/22	Princeton Review	https://www.rit.edu/news/rit-game-design-programs-ranked-among-best-world-0#:~:text=RIT%27s%20game%20design%20and%20development,of%20Computing%20and%20Information%20Sciences.

2021 -2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$263,699	\$0	\$289,877	\$553,576
Indirect Costs	\$39,555	\$0	\$0	\$39,555
Equipment	\$0	\$0	\$0	\$0
Materials & Supplies	\$0	\$0	\$0	\$0
Tuition	\$0	\$0	\$0	\$0
Travel	\$2,355	\$0	\$0	\$2,355
Subcontractors	\$0	\$0	\$0	\$0
Other	\$47,289	\$0	\$109,359	\$156,648
Total	\$352,898	\$0	\$399,236	\$752,134

Total Federal: 0

Total In-kind: 0

Capital Expenditures: None

Commercialization Plan

The CoE focuses 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 our leadership of the Digital Games Industry Association, an organization founded to help grow and influence the economic growth of our 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 5th cohort) to become a vital community asset and support new projects on an annual basis. Finally, they 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	Inventor	Co-Inventor	Patent #	Description
Trent Garlipp	Walk with Yia	NA	NA	Video Game
Emma Schaale	Artificia	NA	NA	Video Game
Russ Kumro	Jamjam N’ Jelly	NA	NA	Video Game
Emory Graham	Super High Dunk	NA	NA	Video Game

Start-up Companies Formed: None

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Project**	PI	Partner
Digital Kormantin	David Long	MAGIC Spell Studios
Tracking eyes and ethics in the Metaverse	Shaun Foster	MAGIC Center
NextCorps	David Long	MAGIC Center
Affordable and Intelligent Augmented Reality Platform for Manufacturing Workforce and Education	Yunbo Zhang	MAGIC Center
Exploring Tacit Knowledge with Artificial Intelligence And Virtual/Augmented Reality	Yunbo Zhang	MAGIC Center
Resistance Mapping	Whitney Sperrazza	MAGIC Center
Improving And Modernizing Machinist Training and Education	Rui Liu	MAGIC Center
EPIC Games: Augmented Reality Theatre Production	Joe Geigel	MAGIC Center
EPIC Games: Multimodal Interactions for Photo Mgmt	Chao Peng	MAGIC Center
EPIC Games: 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 our own internal game project “*That Damn Goat*” that each have their own intellectual property ownership agreements. <https://www.rit.edu/magic/programs>

Description of any relationships with secondary schools and community colleges

The CoE at MAGIC continues to engage the K-12 population by raising awareness of career opportunities in the digital media fields and specifically the games industry. Our outreach efforts included multiple K-12 workshops as well as with several community organizations including The Strong Museum and ROC Game Dev and by hosting the annual Rochester Game Festival, now in its 5th year.

Strategic plan

MAGIC is a resource for the RIT and Rochester communities and beyond. MAGIC provides unique facilities that are available for film, games, and interactive media design. MAGIC was built in collaboration with RIT's nationally ranked academic programs from the School of Film and Animation, School of Interactive Games and Media, and School of Design for delivering hands-on curriculum in game design, 2D and 3D animation, filmmaking, and digital design. Faculty engages in research and production in the building, developing curriculum and engaging students at the undergraduate and graduate levels. RIT students learn using the same hardware and software platforms found in industry while honing their technical and creative skills.

MAGIC's strengths and strategic priorities are teaching, scholarship, exhibition, entrepreneurship, 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.

The CoE at 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. They support indie developers in the Rochester community through our Community Incubator Program, a program that was modeled after the successful student Maker program. A new program was created this year, the Traver Creative Technologists Founders program, which focuses on entrepreneurship and matching problems that creative industries face with software and technology solutions.

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, Chief of Staff | Director of Game Industry Relations
- Dennis McCorry, Digital Game Hub Coordinator

**Center of Excellence in Digital Game Development
Rensselaer Polytechnic Institute
Professor 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, combining the cutting edge of technological innovation with entertainment, creativity, and real-world problem-solving. New York State is a growing hub for the games industry, with \$2 billion in annual economic impact supporting over 11,000 jobs in a vibrant ecosystem of large companies, independent studios, and nationally ranked college programs.

Purpose

The Center of Excellence 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. The overall strategy includes (1) building 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.

Impacts

New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
8	0	\$0	\$244,594	\$0	\$0	\$1,000	\$245,594

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with companies
2021-2022	10	1	4	4	40

Designations and Recognitions: None

2021-2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$133,235	\$0	\$34,834	\$168,069
Indirect Costs	\$0	\$0	\$0	\$0
Equipment	\$0	\$0	\$40,753	\$40,753
Materials & Supplies	\$2,942	\$0	\$0	\$2,942
Tuition	\$19,045	\$0	\$10,225	\$29,270
Travel	\$2,603	\$0	\$0	\$2,603
Subcontractors	\$0	\$0	\$0	\$0
Other	\$65,133	\$0	\$148,023	\$213,156
Total	\$222,958	\$0	\$233,835	\$456,793

Total Federal: 0

Total In-kind: 0

Capital Expenditures (Includes Federal, State, Local Funds & In-Kind): None

Commercialization Plan

The Center of Excellence 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; interactive narrative; data visualization; analog and tabletop game design; 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. The Center gives 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. The Center provides workforce development, outreach, and expanding access to games careers. They promote the work of game studios in the Capital Region and support the games development community.

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 and augmented reality, game-based learning, and interactive simulation, both physical and digital, are areas where the Center provides consultation and expertise.

Actual or anticipated new products or processes with commercial application: None

Start-up Companies Formed

Company Name	City	Product/Service	Sector
MeDKit	Troy, NY and Seoul, ROK	<i>Emotion Adventure</i> , therapeutic mobile game	Digital Games
Headstone Interactive, LLC	Albany, NY	<i>The Camera that Bleeds</i> , PC mystery game	Digital Games
Nauticus Studio	Troy, NY	PC strategy games	Digital Games
Werewolf Moon Studios LLC	Albany, NY	PC action games	Digital Games

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

None

Description of any relationships with secondary schools and community

The Center works with local partners to foster student interest in not only the fun of playing games, but also the technical innovation, imagination, and teamwork involved in creating games. They 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. For example, the Center participated in the Chatham Middle School Career Day in Chatham, New York, and presented to four classrooms of 7th graders on jobs in the games industry, examples of local companies, and suggestions on how to prepare for career paths in games.

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. The Center continues 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 incorporates multiple approaches to different pieces of the challenge:

- Build and Refine the Talent Pipeline
 - Prepare students to work and innovate in the games industry through undergraduate and graduate education at RPI.
 - STEM, STEAM, teacher training, and other outreach programs.
 - Work with partner organizations to provide opportunity and alternate pathways.
- Assist New Studios and Companies
 - Publicize Level Upstate, the Center’s summer intensive program for early-stage games studios and independent developers.
 - Provide mentoring and networking opportunities.
 - Provide technical expertise.
 - Work with local partners to create and “scale up: accelerator programs.
- Established Companies
 - Identify and work to address workforce needs.
- Regional Profile
 - Publicize GameFest, the Center’s annual public exhibition and symposium of student and indie games. GameFest features student games from colleges and universities around the Northeast and has been hosted by RPI since 2004.
 - Promote the work of companies in the cluster, as well as opportunities in the region and the State, through attendance at conferences and trade shows. This includes major games industry events, such as the Game Developers Conference (GDC) in San Francisco, CA.
- Technology Innovation and Application
 - Pursue research in VR/AR, AI, and other areas relevant to games.
 - Apply game technologies to problems in other related industries.

Governance Structure

The Center of Excellence 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. GSAS offers B.S, M.S., and Ph.D. degrees with faculty from multiple Departments, including Arts, Cognitive Science, Computer Science, Communication and Media, and Science and Technology Studies. 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.

**Center of Excellence in Healthy Water Solutions
Clarkson University and SUNY ESF
Stefan Grimberg and Stephen Shaw, Co-Directors**

Technology Focus: Healthy water systems

Importance to NYS

Access to clean water is vital to NYS tourism, agricultural and manufacturing industries. The mission of the Center of Excellence in Healthy Water Solutions (HWS) 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 College of Environmental Science and Forestry (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 improving 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	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
0	0	\$0	\$25,000	\$0	\$0	\$0	\$25,000

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with companies
2021-2022	3	2	3	2	5

Designations and Recognitions: None

2021-2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$31,438	\$79,816	\$123,881	\$235,135
Indirect Costs	\$4,715	\$11,972	\$18,582	\$35,269
Equipment	\$0	\$10,000	\$0	\$10,000
Materials & Supplies	\$8,378	\$0	\$45,544	\$53,922
Tuition	\$0	\$0	\$26,784	\$26,784
Travel	\$3,647	\$0	\$3,797	\$7,444
Subcontractors	\$77,915	\$77,915	\$0	\$155,830
Other	\$1,050	\$0	\$3,504	\$4,554
Total	\$127,143	\$179,703	\$222,092	\$528,938

Total Federal: \$200,826

Total In-kind: 0

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 and identify solutions. 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 or PFAS treatment.

Actual or anticipated new products or processes with commercial application

Patent Name	Inventor	Co-Inventor	Patent #	Description
Electrochemical process to mitigate Harmful Algae Blooms (HAB)	Yang Yang	Stefan Grimberg, Shasha Yang		Invention has been disclosed and nonprovisional patent has been filed additional comments have been provided and they are awaiting patent issued Spring'24

Start-up Companies Formed: None

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Project	Inventor	Licensing Partner
Development of Sustainable and Renewable Photovoltaic System for Perfluorooctanoic Acids Removal in Aqueous Environment	Chang Geun Yoo (ESF), Gyu Leem (ESF), Yang Yang (Clarkson), Ian T. McCrum (Clarkson)	
Wetland and Sediment Plume Monitoring using Advanced Remote Sensing and Machine Learning Techniques	Bahram Salehi, ESF; Sean Banerjee, Clarkson	
Development of Energy-efficient Wastewater Treatment for Removal of Pharmaceutical contaminants.	Gyu Leem and Chang Geun Yoo, SUNY ESF; Yang Yang, Clarkson University	
Non-targeted screening of drinking water disinfection byproducts and their degradation and detoxification using a continuous flow photoelectrochemical cell	Leanne Powers (PI), SUNY ESF, Gyu Leem, SUNY ESF, Jingyun Ye, Clarkson University,	
Advanced Sequencing to Assess Risks Associated with Antibiotic Resistance as An Emerging Contaminant in Great Lakes Sediment and Fish	Yaqi You (SUNY ESF), Susan Bailey (Clarkson), Thomas Holsen (Clarkson)	
Assessing the ecotoxicity of mixtures of per- and polyfluoroalkyl substances	Roxanne Razavi and Christopher Whipps (SUNY ESF, EB), Sujana Fernando (Clarkson University), Philip Goodrum (GSI Environmental Inc.)	
High-Capacity Sorbents for Rapid and Efficient Removal of Phosphorous from Nonpoint Sources of Runoff	Douglas Daley (ESF) and Silvana Andreescu (Clarkson)	

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

The NYS Center of Excellence in Healthy Water Solutions has sponsored STARTScience@Clarkson, a high school outreach event designed to expose high school students to sciences and careers in STEM. The event, organized by the Department of Chemistry and Biomolecular Science in collaboration with the Institute for STEM Education aimed to motivate and inform the young generation about career paths in STEM, and opportunities in industry, healthcare, research, and teaching. It provided an

opportunity for students to engage with and learn from professionals in these fields, meet and discuss with students and visit state-of-the-art facilities and instrumentation. Over 150 participants attended of which about 125 were high school students and their science teachers from 14 high schools across the Northern NY. Students and faculty from Clarkson and guests from industry and NYS-DEC participated and shared personal stories with students related to their own educational and career path and encouraging them to stay curious and follow interests to meaningful careers.

Strategic plan

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. The Strategic Plan developed by the Center is focusing on increasing seed and commercial grant opportunities while providing educational programs to co-sponsor internships at industry and non-for-profit organizations.

Governance Structure

The Center is the only CoE that is administered by two academic institutions (Clarkson University and SUNY ESF) and is not associated with any significant capital investment. 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 biweekly 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 increased the Center hired one administrative staff increasing efficiency in financial accounting, industry – center outreach/interactions. Most importantly administrative staff helped us more efficiently coordinate stakeholders within the two institutions to assist industrial/municipal stakeholders within NYS.

Center of Excellence 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 of Excellence in Precision Medicine and Responses to Bioterrorism and Disasters (the Center) is a unique resource for New York State. No other facility possesses both the technological and research expertise, nor the simulation and training capabilities to address the needs of the audiences served and assure preparedness in NYS for public health emergencies, natural disasters, and mass violence including mass shootings and terrorism events.

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.

Impacts

New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
0	0	\$0	\$13,010	\$0	\$0	\$0	\$13,010

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with companies
2021-2022	50	0	5	10	35

Designations and Recognitions: None

2021-2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$504,110	\$0	\$792,375	\$1,296,485
Indirect Costs	\$75,616	\$0	\$0	\$75,616
Equipment	\$138,232	\$0	\$0	\$138,232
Materials & Supplies	\$0	\$0	\$0	\$0
Tuition	\$0	\$0	\$0	\$0
Travel	\$27,848	\$0	\$0	\$27,848
Subcontractors	\$28,760	\$0	\$0	\$28,760
Other	\$78,008	\$0	\$75,717	\$153,725
Total	\$852,574	\$0	\$868,092	\$1,720,666

Total Federal: 0

Total In-kind: 0

Capital Expenditures

Capital Equipment Purchases	NYSTAR Funding	Federal	Other Sources	In-kind	Total
Cenero LLC	\$60,017.40	\$0	\$0	\$0	\$0
TacMed Solutions	\$105,256.20	\$0	\$0	\$0	\$0
CDW Government Inc	\$3,513.82	\$0	\$0	\$0	\$0

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). The plans started during 2020-2021 but were delayed into 2021-2022 due to COVID.

Actual or anticipated new products or processes with commercial application: None

Start-up Companies Formed: None

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

None

Description of any relationships with secondary schools and community colleges

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 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 21-22 fiscal year included planning for a further expansion of our physical plan to allow an increased deliver of programs both in terms of numbers of students accommodated and types of programs offered that was delayed due to COVID. This plan 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.

Center of Excellence in Advanced and Sustainable Manufacturing
Rochester Institute of Technology
Dr. Michael Thurston, Director

Technology Focus: Advanced and Sustainable Manufacturing

Importance to NYS

The Center of Excellence in Advanced and Sustainable Manufacturing (CoE-ASM) provides technical assistance, technology development, and technology transfer to NYS companies, improving product and process sustainability and enabling advanced manufacturing technology adoption. CoE-ASM assists companies with advancing their technology and manufacturing readiness. CoE-ASM also increases company success, strengthens existing manufacturing operations, and helps grow value-added manufacturing jobs in NYS.

Purpose

CoE-ASM's purpose is to provide technical expertise to NYS companies to improve manufacturing sustainability and competitiveness and increase the number of value-added manufacturing jobs. CoE-ASM focuses on three primary activities: 1) technical assistance to NYS manufacturers and start-ups, 2) applied research and development to provide solutions to commonly faced technology challenges, and 3) technology awareness and training.

CoE-ASM assists NYS manufacturing companies with identification and adoption of existing technologies to improve the performance and efficiency of their products and processes. CoE-ASM research and development focus is three-fold: 1) improving overall manufacturing efficiency and effectiveness, 2) reducing product material and energy intensity over the life cycle, and 3) developing and supporting transition to advanced manufacturing processes. Activities include engagement with Manufacturing USA Institutes, development of metrics and assessment tools for advanced and sustainable manufacturing, technology proof-of-concept demonstration and evaluation, and technology deployment and commercialization support through manufacturing readiness assessment and advancement, and technology design troubleshooting. Deployment activities include but are not limited to licensing of technology resulting from research, technical and economic assessments for candidate technologies, manufacturing process assessments, and technical training (e.g., training in sustainable design, manufacturing readiness, digital manufacturing).

CoE-ASM developed an Industry 4.0 initiative under an ESD High Tech Matching Grant, linking NYS companies with the work and missions of Manufacturing USA Institutes, including MxD (digital), ARM (robotics), and CESMII (smart manufacturing), to advance integration of advanced manufacturing technologies, such as machine learning, business intelligence and robotics, in manufacturing operations – with a focus on supporting small and medium-sized NYS manufacturers.

Impacts

New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
72	27	\$2,979,291	\$262,352	\$3,150,000	\$3,536,906	\$224,723	\$10,153,272

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with companies
2021-2022	65	61	6	20	2

Designations and Recognitions: None

2021-2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$518,636	\$79,693	\$285,529	\$883,858
Indirect Costs	\$77,795	\$37,581	\$253,598	\$368,974
Equipment	\$0	\$0	\$0	\$0
Materials & Supplies	\$12,826	\$0	\$70,983	\$83,809
Tuition	\$0	\$0	\$0	\$0
Travel	\$5,224	\$0	\$8,538	\$13,762
Subcontractors	\$11,441	\$0	\$19,165	\$30,606
Other	\$9,426	\$1,127	\$133,582	\$144,135
Total	\$635,348	\$118,401	\$771,395	\$1,525,144

Total Federal: \$98,424

Total In-kind: 0

Capital Expenditures: None

Commercialization Plan

The CoE-ASM commercialization plan considers four primary commercialization pathways:

1. Identify and apply under-utilized technologies to resolve specific business challenges faced by NYS manufactures - this may include established and emerging technologies.
2. Work with specific NYS companies to design and develop product and process technologies that address a particular product, manufacturing opportunity or challenge, and facilitate adoption of

the technology within the company while considering other broader dissemination opportunities.

3. Research and develop new technologies that advance the state-of-the-art in Advanced and Sustainable Manufacturing, and license CoE-ASM developed technologies that have unique intellectual property (IP) and/or disseminate the findings more broadly. CoE-ASM puts a priority on licensing and dissemination within NYS.
4. Provide support to companies to get new technologies ready for commercialization – this includes working with start-ups and existing manufacturers to address technology and manufacturing readiness challenges impeding their growth within NYS.

Generally, CoE-ASM targets NY companies that have aggressive sustainability or growth goals, or companies that are particularly interested in implementing innovative product or manufacturing process technologies. A key target segment is small and medium enterprise companies across multiple industry sectors that design and manufacture their own product lines in NY.

Actual or anticipated new products or processes with commercial application

Patent Name	Inventor	Co-Inventor	Patent #	Description
Modular Weed Barrier Mat Using Upcycled Tires	Mark Walluk, Allen Luccitti, Ronald Holding Robert Lucas (Chautauqua Hydroseeding)		TBD – license agreement with the company is in discussion stage	Improvements to mat created from used tire treads that impedes weed growth around fences and signposts, minimizing herbicide use.
TBD	Brandon Baker, Mark Walluk, Ronald Holding		TBD – license agreement with BiRed in discussion stage	Mechanical Design Supporting an Infrared Mammography System
TBD	Scott Nichols		TBD – license agreement with BiRed in discussion stage	Electrical and Software Design Supporting an Infrared Mammography System
Copyright Material, no anticipated patent	Brian Hilton, Kevin Newton		NA – copyrightable material	Startup Manufacturing Readiness Assessment Tool incorporating sustainable design considerations
No anticipated patent	Mark Walluk			Energy harvester from vibrations caused by vortex shedding in fluids, for Enetics

Patent Name	Inventor	Co-Inventor	Patent #	Description
No anticipated patent	Brandon Baker			Enclosure design for temperature measurements and wireless communication for WeRadiate
No anticipated patent	Brandon Baker			Fabrication method for folding and pressing geotextile material for BioSand Bag Filter

Start-up Companies Formed: None

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

No new IP ownership or licensing agreements to report this period. Projects under a sponsored research agreement during the reporting period are listed below with the Principal Investigator in place of the “Inventor” and the partner and/or sponsoring company/organization in place of the “Licensing Partner.”

Project	Inventor	Licensing Partner
Manufacturing Readiness Program	Brian Hilton	U.S. Department of Commerce, NIST, MEP via subaward from NextCorps
Scale for ClimateTech Manufacturing Readiness Program	Brian Hilton	NYSERDA via subaward from SecondMuse
Scale for ClimateTech Program	Brian Hilton	NYSERDA via subaward from NextCorps
Integrating Risk Assessment for Pollutants into Energy-saving Strategies for Sustainable Environmental Management of Collection Storage Spaces	Martin Schooping	National Endowment of the Humanities

Project	Inventor	Licensing Partner
Integrating Smart Meter with Smart Inverter	Nenad Nenadic	NYSERDA
Evaluation of a Compact Fuel Cell System for High Altitude	Mark Walluk	Dept. of the Air Force SBIR via subaward from Falcon Fuel Cell
Validation of Geothermal Vertical Ground Loop Heat Pumps (ccGeoHP)	Brandon Baker	NYSERDA via subaward from Dandelion Energy
Alternative Alignment Clip Design	Allen Luccitti	Davies Office, Inc.
Manufacturing Specification Development	Brandon Baker	BioSand Bag Filter, LLC
Assessment of Machinery Reliability Issues	Scott Nichols	EchoStone Opco LLC
E12x and E15x Environmental and Shipping Testing	James Larrabee	Council Rock Enterprises LLC
Probe Assembly Revision Assistance	Brandon Baker	WeRadiate LLC
Manufacturing Engineering Support for Fold-up Windows	Allen Luccitti	Rochester Colonial Manufacturing Corp
Pressing Operation Design Assistance	Brandon Baker	Jeca Energy Bar Co. LLC
Infrared Mammography System Prototype	Mark Walluk	BiRed Imaging Inc.
SteriSpace EMC Review and Mitigation Plan Development	James Larrabee	You First Services, Inc.
Manufacturing Engineering Assessment of Glen	Gerry Hurley	Arc of Chemung-Schuylar Counties Chapter of NYSARC, Inc.

Project	Inventor	Licensing Partner
Copack Dry and Wet Kitchen Operations		
Ammonia PEM Fuel Cell Lab Capability Analysis	Kevin Newton	Amogy Inc.
3-D Printed Prototype Model	Kyle DePalma	Vance Metal Fabricators Inc.
Investigation of Requirements to Build Weed Mats at Volume	Allen Luccitti	Chautauqua Hydroseeding LLC
HALT Environmental Testing	Allen Luccitti	Poseidon Systems, LLC
Quality Technical Specifications Framework Development	Kevin Newton	NYSERDA Scale for ClimaTech program/Made of Air

Description of any relationships with secondary schools and community

CoE-ASM is collaborating with the RIT College of Engineering and Monroe Community College (MCC) on an NSF-funded program specifically targeted towards advanced manufacturing and sustainability training for manufacturing technicians in the Rochester area. CoE-ASM continued discussions with MCC on opportunities to support integration of Industry 4.0 concepts into the new Finger Lakes Workforce Development (“FWD”) Center at the Rochester Downtown Campus, as well as in other locations that support training of manufacturing technicians. The new FWD Center will support degree-based educational activities and executive and workforce training programs in advanced manufacturing. CoE-ASM also regularly provides tour of their facilities to middle and high school student groups to encourage STEM career paths.

Strategic plan

CoE-ASM focuses on activities that directly enhance the competitiveness of NYS companies resulting in economic growth in the State and that promote increased federal funding for Advanced and Sustainable Manufacturing in NYS. Specific strategies employed include: strengthening and building relationships with industrial partners; developing/maintaining a diverse and highly qualified advisory board; maintaining a qualified engineering and scientific team dedicated to company and grant funded projects; partnering/collaborating with existing programs to facilitate outreach and marketing; leveraging relationships with FuzeHub and the MEP network as well as with other NYS centers; supporting/advancing growth of existing NYS clusters including Energy Storage and Food Processing; engaging in Manufacturing USA Institutes in aligned technology areas; identifying opportunities for

new company creation or job creation at existing companies; 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 CoE-ASM's mission, CoE-ASM will continue to annually collect, analyze, and react to the ESD-required metrics from companies assisted. These metrics along with the general progress toward the above stated strategies will be periodically reviewed with the CoE-ASM advisory board in order to assess and revise the strategy to maintain pertinence to NYS needs in the Center's technology focus area.

Governance Structure

Please refer to the commercialization plan above for more detail. 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 who is engaged in development and outreach, program leadership, project review, and educational activities. He is responsible for developing relationships with CAT and CoE Centers in NYS, as well as national initiatives. CoE-ASM Program Manager, Mark Walluk, manages the day-to-day operations of the Center, dedicated technical staff, and engages prospective NYS clients.

CoE-ASM is advised by an industry advisory board led by Dr. Nabil 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.

Center of Excellence in Advanced Energy Research and Technology
Stony Brook University
David Hamilton, Interim Center Director

Technology Focus: The Center of Excellence in Advanced Energy Research and Technology (AERTC) focuses on technologies in five areas: energy production, grid modernization, energy storage, gas phase energy, and emerging decarbonization technologies.

Importance to NYS

AERTC's activities address technical challenges that support the achievements of NY State's (NYS) clean energy and climate targets. The applied research approach has a positive impact on the economy in NYS by increasing jobs through funded projects, private investment, and accelerated product commercialization that further the development of businesses and companies.

Purpose

AERTC drives innovation that leads to commercialization of products that address technical gaps required to meet economic and climate leadership goals for NYS and their industrial partners. Activities focus on applied research, development, demonstration and commercial deployment, and workforce development related to the energy sector. The Center leverages resources from Stony Brook University (SBU), Brookhaven National Laboratory (BNL), the AERTC Advisory Board, and a network of contacts as a key player in the regional sustainable energy ecosystem.

AERTC provides leadership, critical infrastructure, skilled personnel, and strategic partners to drive energy technologies towards commercialization. Team members support project identification, collaborations, proposals, and project execution. Private sector investment is promoted through relationships in energy utility and industrial markets. AERTC's 50,000 square foot building provides unique laboratory and office space for associated centers, SBU faculty, staff, students, and partner companies. The AERTC CoE program scope extends to collaborative projects that occur at other locations.

Resources are applied in multiple ways to advance collaborative projects that contribute to meeting New York State's clean energy and climate targets while accelerating economic activity resulting in a positive impact for NY. Outreach events for education, awareness and training support a sustainable energy ecosystem. This includes engagement with industry representatives, elected officials, K-12 schools and community colleges. Workforce development programs include a robust internship program that allows students to gain knowledge of the energy sector and valuable work experience. Industrial partners gain access to a pool of students to support current research projects and potential qualified future employees.

Impacts

New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
6	13	\$634,154	\$346,000	\$1,563,327	\$13,883,923	\$33,500	\$16,460,904

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with companies
2021-2022	15	3	19	7	33

Designations and Recognitions

Awards / Recognition	Date Received	Recognizing Organization	Link
Dean's Award Millionaires Club- Dr. Fang Luo	Nov-21	CEAS	https://www.stonybrook.edu/commcms/ceas/about/office-of-the-dean/state-of-the-college-address/2021
PEDG 2021 Best Paper Award- Dr. Fang Luo	Jun-21	IEEE	N/A
Student Distinguished Travel Award – Dr. Fang Luo	Jun-21	SBU GSO	N/A
ACM SIGMETRICS 2021 Rising Star Research Award – Dr. Zhenhua Liu	Jul-21	ACM SIGMETRICS	https://www.sigmetrics.org/awards.shtml#risingstar
2021 ACM SIGMETRICS Test of Time Award	Jul-21	ACM SIGMETRICS	https://www.sigmetrics.org/awards.shtml#testoftime

Awards / Recognition	Date Received	Recognizing Organization	Link
– Dr. Zhenhua Liu			
2022 National Academy of Inventors-Dr. Amy Marschilok	May 21	STONY BROOK UNIVERSITY CHAPTER OF THE NATIONAL ACADEMY OF INVENTORS	https://www.stonybrook.edu/commcms/na/index.php

2021-2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$721,213	\$0	\$84,527	\$805,740
Indirect Costs	\$108,182	\$0	\$12,679	\$120,861
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	\$770,053	\$770,053
Total	\$829,395	\$0	\$867,259	\$1,696,654

Total Federal: 0

Total In-Kind: 0

Capital Expenditures: None

Commercialization Plan

AERTC focuses on advancing a targeted range of sustainable energy technologies to support the achievement of NYS’s economic and climate leadership goals through collaborative projects with industry. Projects leverage the competencies of the AERTC staff, associated SBU faculty, researchers, students, advisory board members and business leaders along with the Center’s physical resources to foster impactful relationships between industry and academia.

Project deliverables include technical advancements, demonstration, and validation of commercially viable products in the areas of clean energy production, smart grid transmission, energy storage, low carbon gas phase technologies, and emerging decarbonization technologies. Research topics include

battery materials, large-scale energy storage, renewable natural gas, energy efficient processes and emerging decarbonization technologies. These projects include technical and commercial objectives, as identified by industry partners. A Project Coordinator is assigned for communication, coordination, and efficient execution against identified milestones and deliverables. Analysis of these projects include economic impact in NYS along with technical benefits including reduced emissions, energy efficiency and/or grid stability.

Industry partners establish product development plans that include projects with AERTC designed to accelerate the timeline, optimize performance, and maximize value. AERTC staff members provide consultation support, and interactive collaboration to support business development. Access to an extensive network of commercial contacts including the AERTC advisory board provides valuable exposure to new customers, applications, and markets. Continued expansion of the network across the energy ecosystem includes exploration of resources that can be accessed through collaboration with the other NYSTAR centers, programs, and assets.

Actual or anticipated new products or processes with commercial application

Patent Name	Inventor	Co-Inventor	Patent #	Description
Composition and Method for Rechargeable Battery	Amy Marschilok	Esther Takeuchi, Kenneth Takeuchi, David Bock.	17/766,501	A rechargeable material combined with a high-capacity primary battery material; lithium vanadium oxide was combined with carbon monofluoride.
Ceramic Matrix Composites Enable Through Metal Halide Assisted Sintering	Lance Snead	David Sprouster, Jason Trelewicz	17/790,086	This technology produces compact small modular reactors using advanced moderating materials.
Electrolyte Compositions for use in batteries and energy storage	Amy Marschilok	Esther Takeuchi, Kenneth Takeuchi, David Bock.	63/173,642	This invention consists of new classes of electrolytes for operation of Li-ion batteries and for electric vehicles and other portable power needs.
Thermal Treatment Methods for Formation and Recycling of	Amy Marschilok	Esther Takeuchi, Kenneth	63/211,057	This technology is co-developed with BNL and is directed to a regenerable battery for

Patent Name	Inventor	Co-Inventor	Patent #	Description
Regenerable Electrodes		Takeuchi, David Bock.		environmentally friendly battery technology.
Multi-Cell Multi-Layer High Voltage Supercapacitor Apparatus Including Graphene Electrodes	Zemfira Abutalibova	Vladimir Samuilov, Vyacheslav Solovyov	11/127538	This technology develops an apparatus that will maintain a high electrical voltage without EDLC's. The apparatus will provide a high energy, high voltage, and low loss supercapacitor.
Extended life energy storage systems and methods of manufacturing thereof	Amy Marschilok	Esther Takeuchi, Kenneth Takeuchi	11/108036	This technology is a new push-sum enabled microgrid control to achieve average consensus at every node even under a time-varying, directed communication network.

Start-up Companies Formed: None

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

None

Description of any relationships with secondary schools and community colleges

Relationships with schools and students below the university level have been built around participation in informative events, workshops, and seminars. An example is an invitation to participate in the AEC21 poster session, which was extended to community college students. Ongoing discussions with Suffolk Community College and SUNY Farmingdale involve the planning of future events including workforce development and upskilling of workforce participants. Outreach efforts to secondary schools will leverage established NYS programs such as BOCES and SUNY Master Teacher. These programs provide direct access to High School, and other grades, teachers who can have a positive influence over many students with identified interests in scientific studies, careers, and technical vocations. Relationships will start with the program leaders, then events with teachers resulting in a regular series of interactive events with students.

Strategic Plan

AERTC's core mission is to drive activities with positive economic impact by advancing sustainable energy technologies through research, development, demonstration, and commercialization. As a recognized leader within the regional energy ecosystem, activities expand the network of contacts with academic and industry leaders to strengthen the ecosystem, attract more partners and encourage collaborative projects.

Key to this strategy is leveraging the resources from Stony Brook University, Brookhaven National Laboratory and other leading research organizations including NYSTAR assets that complement those at AERTC. Participation in multi-organization proposals for funding is another mechanism for building relationships with other universities, research organizations and companies in the cleantech space.

AERTC's Advisory Board includes leaders from the energy segment. Increasing engagement with the Board members' organization will strengthen industry connections, improve knowledge of needs and establish collaborations. Outreach to smaller, technologically leveraged companies will continue to build a pipeline of opportunities with high growth potential.

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 roadmaps. Roadmaps are generated by utilities, industry, and other organizations. The most prominent roadmap aligns with the NYS's Climate Leadership (CLCPA) targets. A business development style approach to collaborations will look to align researchers, staff expertise, AERTC's resources, facilities, and network of contacts to gaps identified in the roadmaps. Teams will pursue federal, state, and industrial funded projects which focus on solutions with a clear pathway to commercialization.

Governance Structure

The AERTC is one of the programs that comprises Stony Brook University's (SBU) Economic Development (Econ Dev) enterprise, Econ Dev is part of Stony Brook University's Office of the Vice President of Research (OVPR). AERTC is led by a Center Director, who is responsible for operation of the program, and reports up to the Associate Vice President of Technology Partnerships, who leads Econ Dev. The Associate VP provides oversight of AERTC, the other centers and a shared services staff that supports the Center. Support staff for AERTC includes administrative, financial, marketing, HR, facilities management, and project management functions. An active Advisory Board is led by their chairman, Bob Cattell. The Board provides input regarding industry needs and guidance on beneficial activities.

Center of Excellence in Wireless and Information Technology
Stony Brook University
Dr. Rong Zhao, Director

Technology Focus: Wireless and information technology including AI, cybersecurity, IoT, and VR/AR/MR.

Importance to NYS

Working with industry partners, the Center of Excellence in Wireless and Information Technology (CEWIT) continues to pursue innovation, create high-quality jobs, maximize the commercial potential of university research, and develop next-generation workforce. A leader in applied research and technology development, CEWIT offers unparalleled resources for developing technical innovations for industries such as healthcare, defense, energy, digital manufacturing, and others.

Purpose

CEWIT provides unique and much-needed technical assistance to their 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 their entire 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 their 94 affiliated faculty members, over 200 student researchers, and external collaborators as well.

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 their industry partners, summer research programs for high school students, student hackathons, and on-site and virtual training programs for local companies and community members.

Impacts

New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
55	17	\$371,000	\$477,059	\$550,000	\$10,000	\$33,693	\$1,441,752

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with companies
2021-2022	21	19	31	27	85

Designations and Recognitions

Awards / Recognition	Date Received	Recognizing Organization	Department	Link
Dr. I.V. Ramakrishnan: National Academy of Inventors	2022	National Academy of Inventors	Computer Science	https://www.stonybrook.edu/commcms/ipp/Events/NAI_AnnualMeeting_2022.php
Dr. Dimitris Samaras: National Academy of Inventors	2022	National Academy of Inventors	Computer Science	https://www.stonybrook.edu/commcms/nai/index.php
Dr. Klaus Mueller: IEEE VGTC Visualization Academy	2022	IEEE Computer Society	Computer Science	https://tc.computer.org/vgtc/awards/visualization-academy/
Scott A. Smolka: ACM Fellow	2022	ACM Fellow	Computer Science	https://www.cs.stonybrook.edu/about-us/News/celebrating-professor-scott-smolka-named-2021-acm-fellow
Kevin McDonnell: SUNY Excellence in Teaching	2021	Chancellor's Award for Excellence in Teaching	Computer Science	https://www.cs.stonybrook.edu/about-us/News/computer-science-professor-wins-suny-chancellor%E2%80%99s-award-excellence-teaching
Anurag Purwar: ASEE Distinguished Teaching Award	2021	American Society of Engineering Education (ASEE) Mid-Atlantic Division	Mechanical Engineering	https://sites.asee.org/middleatlantic/awards/

Awards / Recognition	Date Received	Recognizing Organization	Department	Link
Anurag Purwar: National Academy of Inventors	2021	National Academy of Inventors	Mechanical Engineering	https://www.stonybrook.edu/commcms/nai/index.php
Danny Bluestein: National Academy of Inventors	2021	National Academy of Inventors	Biomedical Engineering	https://www.stonybrook.edu/commcms/nai/index.php
Erez Zadok: Elected as ACM Distinguished Member for “Outstanding Scientific Contributions to Computing.”	2021	ACM	Computer Science	https://www.acm.org/media-center/2021/december/distinguished-members-2021
Steven Skiena	2022	Fulbright Scholar	Computer Science	https://news.stonybrook.edu/university/steven-skiena-earns-fulbright-u-s-scholar-award/
Erez Zadok: Excellence in Scholarship & Creative Activities	2022	SUNY Chancellors Award	Computer Science	https://www.cs.stonybrook.edu/Award-Names/SUNY-Chancellors-Award-Excellence-Scholarship-Creative-Activities
Allen Tannenbaum: IFAC Fellow Award	2022	IFAC Fellow Award	Computer Science	https://www.cs.stonybrook.edu/2022-ifac-fellow-award-allen-tannenbaum
Anurag Purwar: Margaret Ashida STEM Leadership Award	2022	The New York State STEM Education Collaborative (NYSSEC)	Mechanical Engineering	http://www.nysstemeduction.org/institute/margaret-ashida-stem-leadership-award/
Anurag Purwar: Margaret Ashida	2022	The New York State STEM Education	Mechanical Engineering	http://www.nysstemeduction.org/institute/margaret-ashida-stem-leadership-award/

Awards / Recognition	Date Received	Recognizing Organization	Department	Link
STEM Leadership Award		Collaborative (NYSSEC)		tute/margaret-ashida-stem-leadership-award/
Danny Bluestein: SUNY Distinguished Professor	2022	State University of New York (SUNY)	Biomedical Engineering	https://www.stonybrook.edu/commcms/ceas/news/2023/march/danny_bluestein_named_suny_istiguated_professor.php

2021 -2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$793,702	\$0	\$0	\$793,702
Indirect Costs	\$119,055	\$0	\$0	\$119,055
Equipment	\$0	\$0	\$0	\$0
Materials & Supplies	\$0	\$0	\$96,181	\$96,181
Tuition	\$0	\$0	\$0	\$0
Travel	\$0	\$0	\$0	\$0
Subcontractors	\$0	\$0	\$0	\$0
Other	\$0	\$0	\$670,277	\$670,277
Total	\$912,757	\$0	\$766,458	\$1,679,215

Total Federal: 0

Total In-kind: 0

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 focuses 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 their region and the entire New York State. The Center is recognized for its work in computer vision, immersive visualization, machine learning and artificial intelligence and offers world-class facilities such as the Reality Deck, Silo, Immersive Cabin, and the SMART Cluster. 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: a) develop collaboration with >20 industry partners; b) engage in >25 research and development projects with industry partners; c) employ >75 student researchers/interns in these projects; d) generate >15 patent applications and/or issued patents; and e) assist their industry partners to create >50 new jobs. Please see the enclosed commercialization plan for details.

Actual or anticipated new products or processes with commercial application

Patent Name	Inventor	Co-Inventor	Patent #	Description
Compositions and methods for spinal disc repair and other surgical and non-surgical indications	Arie Kaufman	Qui Sun, Li-Yi Wei	3,023,488 (CA)	Method merges virtual and physical reality, enabling safe and natural user movement in a circumscribed physical environment.
System, Method, and Computer-Accessible Medium for Virtual Pancreatography	Arie Kaufman	Konstantin Dmitriev	11,348,228 (US)	This technology enhances early pancreatic cancer detection via virtual pancreatography, addressing limitations in diagnosing precursor stages.
System and Method to Quantify Tumor Infiltrating Lymphocytes (TILs) for Clinical Pathology Analysis Based on Prediction, Spatial Analysis, Molecular Correlation, and Reconstruction of TIL Information Identified in Digitized Tissue Image	Dimitros Samaras	Joel Saltz, Rebecca Batiste, Rajarsi Gupta, Le Hou, Tahsin Kurc, Alexander Lazar, Vu Nguyen, Arvind Rao, Ashish Sharma, Ilya Shmulevich, Pankaj Singh, Vestinn Thorsson, John Van Arnam, Tianhao Zhao	11,164,312 (US)	This technology introduces software for precise analysis of digitized pathology slides, improving TIL assessment for diagnosis, prognosis, and research.
Hybrid Active Matrix Flat Panel Detector System and Method	Wei Zhao	Adrian Howansky, Anthony	7,078,588 (JP)	This technology creates a layered hybrid detector, boosting x-ray performance and image

Patent Name	Inventor	Co-Inventor	Patent #	Description
		Lubinsky, James Scheuermann		quality without increasing patient radiation exposure.
System and Method Associated with Progressive Spatial Analysis of Prodigious 3D Data Including Complex Structures	Fusheng Wang	Yanhui Liang, Hoang Vo	11,188,738	This technology refines 3D spatial queries in digital pathology, allowing adjustable compression levels for accurate analysis of biological structures.
System and Method Associated with Determining Physician Attribution Related to In-Patient Care Using Prediction-Based Analysis	I.V. Ramakrishnan	Vikas Ganjigunte Ashok, Todd Griffin, Erin Healy	11,114,197	To address performance measurement challenges, this introduces Attribution Manager Software leveraging EHR data for precise physician performance assessment.
Attenuation Viruses Useful for Vaccines	Steven Skiena	Jeronimo Cello, John Coleman, Bruce Futcher, Steffen Mueller, Dimitris Papamichail, Steven Skiena, Eckard Wimmer	11,162,080	The invention involves creating an attenuated virus via modified nucleotide substitutions, utilizing a process optimizing codon pairs for efficacy.
System and Method for Toothbrush Monitoring Using Magneto-Inductive Coil Sensor	Shan lin		17/620,810	This sensor technology tracks, recognizes, and improves tooth brushing by analyzing activities, aiming to enhance oral hygiene based on recommendations.
System and Method for Real-Time Mood Identification by Quantitative Facial Motion Analysis	Fang Yang	Matthew Jacobs, Charles Mikell, Sima Mofakham, Selma Mohammad,	63/339,583 (US)	This enables real-time mood identification via facial motion analysis, aiding psychiatric diagnosis and offering

Patent Name	Inventor	Co-Inventor	Patent #	Description
		Miriam Rafailovich, Jordan Saadon		quantifiable data for classification.
Apparatus, Method and System for Person Detection and Identification Utilizing Wireless Signals and Images	Shan Lin	Hongkai Chen, Munir Sirajum	17/728,543 (US)	The RFcam system is used to monitor and analyze human actions and events which aids in new mobile apps and services.
Risk Adjusted Mortality Rate Using Automated Determination of Patient Co-Morbidities	IV Ramakrishnan	Mark Henry	20849115.9	Automates finding patient comorbidities from electronic health records, aiding hospital coding and informing the health team.
System and Method for Identifying Fractures in Digitized X-Rays	Imin Kao	Fzel Khan, Jafar Khan, Sajid Khan	17/619,085	Conversion of the digitized x-rays allow them to be analyzed by algorithms to detect fractures via pixel shares, reducing missed diagnoses risk and aiding doctors in review.
System and Method for Automatic Segmentation in Medical	Arie Kaufman	Konstantin Dmitriev	17/614,702	This technology provides precise multi-class segmentation from single-class biomedical image datasets, addressing diagnostic variability in clinical research.
System and Method for Tracking Human Behavior Real-Time with Single Magnetometer Sensor and Magnets	Shan Lin		17/605,068	This technology detects various unsafe driving behaviors by monitoring driver hands and head motions in real-time thus assisting in collision prevention.
System and Method to Quantify Tumor Infiltrating	Dimitros Samaras	Joel Saltz, Rebecca Batiste, Rajarsi	17/483,519	Digital pathology technology provides a robust and reproducible

Patent Name	Inventor	Co-Inventor	Patent #	Description
Lymphocytes (TILs) for Clinical Pathology Analysis Based on Prediction, Spatial Analysis, Molecular Correlation, and Reconstruction of TIL Information Identified in Digitized Tissue Image.		Gupta, Le Hou, Tahsin Kurc, Alexander Lazar, Vu Nguyen, Arvind Rao, Ashish Sharma, Ilya Shmulevich, Pankaj Singh, Vestinn Thorsson, John Van Arnam, Tianhao Zhao		TIL assessment tool, improving diagnostics, prognostics, and research in cancer via quantifiable measurements.
Ultra Low Power Core for Lightweight Encryption	Emre Salman	Yasha Karimi, Milutin Stanacevic, Tutu Wan, Huang Yuanfei	17/438,662	This technology generates encryption keys through the use of adiabatic registers and key generation data values.
System and Method for Virtual Pancreatography Pipeline	Arie Kaufman	Konstantin Dmitriev, Sheerai Jadhav	PCT/US21/48632	Early detection of pancreatic cancer precursors is enabled by this technology, offering improved virtual pancreatography for diagnosis

Start-up Companies Formed: None

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Project	Inventor	Licensing Partner
Automated Identification and Documentation of Co-Morbidities from Patient's Electronic Health Record	IV Ramakrishnan, Mark Henry	Retrieve Medical Inc.

Description of any relationships with secondary schools and community colleges

As a workforce development initiative associated with STEM disciplines, CEWIT developed a Robotics Camp in partnership with Mechanismic, Inc., to engage 7th-12th graders with a special consideration and scholarship to students in underrepresented districts. Additionally, CEWIT developed in collaboration with Softheon Inc., a year-long opportunity for interns to learn enterprise software development best practices and acquire hands-on experience through a collaborative project called

WikiLearn. Further expanding their industry collaborations resulted in an increase in their internship and training programs with Zebra Technologies, IPVideo, and ClearVision. In collaboration with CEWIT, faculty member Prof. Fusheng Wang established a four-week Computer Science and Informatics Research Experience (CSIRE) summer program focusing on research projects for high school students particularly on Deep Learning, including the use of specialized facilities located at CEWIT, including the RealityDeck and SMART cluster.

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; and 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, and to facilitate collaboration between industry and academic communities. CEWIT, along with their 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.

The impact of programs is measured by the number of joint projects with industry and outreach activities; research and training opportunities for students; jobs created by industry partners; and jobs retained by industry partners. CEWIT collects economic impact data from their industry partners annually, including increased revenues, increased expenditures, government, and non-government funding received, and cost savings. They track the productivity of their R&D teams by the numbers of partners attracted; invention disclosures; patent applications and issued patents; and licensing agreements executed with industry partners. They conduct surveys and seek feedback from participants of their 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, and Peter Donnelly, Associate Vice President for Technology Partnerships. Dr. Satya Sharma retired as Executive Director of CEWIT during this period and Dr. Rong Zhao was appointed Center Director. The Center management team also includes Dr. Arie Kaufman, Chief Scientist; Division Directors overseeing R&D programs in strategic areas; and the Associate Director of Computing Services. CEWIT's projects and programs are guided by their Industrial Advisory Board (IAB) and leadership of academic units across Stony Brook University campus. CEWIT's management team works diligently with SBU and Economic Development leadership and IAB members to assess their progress, evaluate areas for improvement, identify new opportunities, and set short-and long-term work plans.

Center of Excellence in Nanoelectronics and Nanotechnology
SUNY Polytechnic Institute
Fatemeh (Shadi) Shahedipour-Sandvik

Technology Focus: Nanoelectronics and nanotechnology

Importance to NYS

SUNY Polytechnic’s College of Nanoscale Science and Engineering (CNSE) is home to the Center of Excellence in 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 dual mission to enable a robust innovation pipeline by supporting applied research while operating manufacturing scale-up facilities to enable the commercial deployment of these innovations is key to catalyzing a nanotechnology eco-system that has resulted in significant job creation and private sector investment. The manufacturing scale-up facilities that are supported by the CENN at SUNY Poly’s CNSE 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 Center of Excellence Program statute.

Impacts

New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
49	2	\$6,821,000	\$207,298,405	\$1,299,611	\$45,000,000	\$185,000	\$260,604,016

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with companies
2021-2022	13	5	31	14	7

Designations and Recognitions: None

2021 -2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$272,653	\$0	\$696,527	\$969,180
Indirect Costs	\$40,975	\$0	\$104,479	\$145,454
Equipment	\$17,729	\$0	\$148,839	\$166,568
Materials & Supplies	\$25,736	\$0	\$0	\$25,736
Tuition	\$24,811	\$0	\$0	\$24,811
Travel	\$1,202	\$0	\$0	\$1,202
Subcontractors	\$0	\$0	\$0	\$0
Other	\$47,744	\$0	\$0	\$47,744
Total	\$430,850	\$0	\$949,845	\$1,380,695

Total Federal: 0

Total In-kind: 0

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 Center for Advanced Technology in Nanomaterials and Nanoelectronics (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 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.
- Clean energy technologies – Sic power electronics, energy creation, and energy storage.

Actual or anticipated new products or processes with commercial application

Patent Name	Inventor	Co-Inventor	Patent #	Description
Methods and Compositions for Use of Non-Coding RNA in Cell Culturing and Selection	Nicole Borth	Edward Eveleth, Scott Tenenbaum, Francis Doyle, Zachary Wurz	11,254,935	Using RNA to make positive and negative selection approaches to establishing high gene of interest producing cell lines, e.g., CHO lines.
Metallic Gratings and Measurement Methods Thereof	Alain Diebold	Nick Keller, Sam O'Mullane, Brennan Peterson	US20160069792A1	A method can include propagating input electromagnetic radiation onto a metallic grating having a two-dimensional periodic grating pattern and measuring a critical dimension of the metallic grating using output electromagnetic radiation from the metallic grating.

Start-up Companies Formed: None

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

None

Description of any relationships with secondary schools and community colleges

CENN Nano Education efforts have focused on the construction and operation of facilities that support the growth of an industry centric workforce pipeline that focuses on the following three areas of: 1) Engagement; 2) Enrichment; and 3) Education. The CENN Nano Education 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. Many of the regularly held activities were either modified or cancelled/postponed because of the COVID-19 Global Pandemic.

The following represents the activities that took place: Nano Career Days, Women in STEM, Teacher and Industry Representative Tours, Tech Valley High Microscopy Experience, Rensselaer Park Elementary pumpkin fest STEM for the fall festival, After school STEM club at Okte Elementary School in the Shenendahowa School District, and ONC BOCES New Visions STEM program provided students an exposure to emerging nanotechnology fields, Pi Day 2022, Family Science at Home, Black History Month African American STEM Innovators, Tech Valley High School – Camp Innov@tion, Albany High School Nanotechnology Class, Northeast Advanced Technology Education Center (NEATEC) K-12 Teacher Training, Northeast Advanced Technology Education Center (NEATEC) K-12 coding event on Raspberry Pie, and The 15-Love Program’s Summer Sessions , Northeast Advanced Technology Education Center (NEATEC), SUNY Poly Summer Internship Program, and AIM Photonics Academy.

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:

- *Adjacent Market Technology Solutions*
CENN to provide a technology commercialization “bridge” by focusing on the deployment-phase with manufacturing scale-up process support by 1) identifying potential technology solutions either deployed in adjacent markets or incubating in academic and government laboratories; 2) specifying manufacturing requirements; and 3) demonstrating potential solutions in relevant demonstration testbeds.
- *Scientists, Engineer, and Technician Education*
With access to industry-compliant infrastructure and unmatched characterization equipment, undergraduate, masters and doctoral study is supported by the CENN through SUNY Poly’s unique multi-disciplinary hands-on training curriculum.
- *Supply Chain Test Beds*
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. 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. Resulting in a seamless transition of innovation to commercialization as each phase in the RD&D continuum is operated under the SUNY Poly CNSE umbrella with overlapping personnel.

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.

Syracuse Center of Excellence in Environmental and Energy Systems
Syracuse University
Prof. Jianshun “Jensen” Zhang, Executive Director

Technology Focus: Energy and environmental systems

Importance to NYS

The Syracuse Center of Excellence 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 1) advanced building and community systems, 2) clean and renewable energy, and 3) water resources.

Purpose

Led by Syracuse University and in collaboration with academic and industrial partners, SyracuseCoE’s mission is to connect cutting-edge academic talent with industry to create commercializable innovations and to tackle the most challenging problems across multi-scales of the built environment and urban ecosystems. SyracuseCoE’s vision is to become the most engaging and impactful center for innovation in environmental control and energy technologies, regionally and internationally.

SyracuseCoE accomplishes its mission through active engagement of faculty, staff, students and industrial partners in the use-inspired research, development, testing and demonstration of innovative technologies for healthy and efficient buildings, clean energy, and resilient low-carbon communities and cities. SyracuseCoE serves both industries and academic researchers by connecting the two, supporting them with state-of-the-art testing and modeling facilities and expertise, providing seed funding, and supporting proposals to seek externally funded projects.

Impacts

New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
30	6	\$1,672,587	\$15,374	\$1,018,851	\$42,453,187	\$1,477,286	\$46,637,285

Companies Served and

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with companies
2021–2022	22	19	15	14	41

Designations and Recognitions: None

2021-2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$617,704	\$0	\$91,920	\$709,624
Indirect Costs	\$92,655	\$0	\$0	\$92,655
Equipment	\$0	\$0	\$0	\$0
Materials & Supplies	\$15,076	\$0	\$0	\$15,076
Tuition	\$0	\$0	\$0	\$0
Travel	\$4,793	\$0	\$0	\$4,793
Subcontractors	\$0	\$0	\$309,163	\$309,163
Other	\$21,702	\$0	\$771,975	\$793,677
Total	\$751,930	\$0	\$1,173,058	\$1,924,988

Total Federal: \$38,131

Total In-kind: 0

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. In the five-county Central New York region, firms in these four sectors employ more than 15,000 workers.

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 and 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, SUNY Upstate Medical University, and SUNY Oswego—to access additional resources including over 20 associated laboratories and personnel for collaborative projects.

SyracuseCoE develops industry-academic 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.

Actual or anticipated new products or processes with commercial application

Patent Name	Inventor	Co-Inventor	Patent #	Description
SCROLL-TYPE MACHINE	James W. Bush		EP 3568571	Scroll compressor for small-scale (less than 300 Watt) cooling applications.
Thermal Dissipative Uni-Body Structure	Chris Nolan	Joe Casper	Invention disclosure	Thermal Dissipative Uni-Body Structure
Torchiere With Air Flow Mechanism and Ultraviolet Disinfection	Brian D. Carter	Eric A. Schiff	63/244,470 (provisional)	Air cleaning device integrated with residential lighting
Systems and methods for optimizing building-to-grid integration	Bing Dong	Ahmad Taha, Nikolaos Gatsis, Zhaoxuan Li, Ankur Pipri	11177656	Optimization of building-to-grid integration.
PIEZOELECTRIC SENSORS AND QUARTZ CRYSTAL MONITORS	James T. Spencer	Fritz Schlereth	10,295,504	Preparation of New QCM-based broad range sensors

Start-up Companies Formed: None

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Project	Inventor/Researcher	Licensing/Research 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

Description of any relationships with secondary schools and community colleges

During this period, discussions related to the development of a new workforce training program advanced in collaboration with the Syracuse University Industrial Assessment Center, a U.S. Department of Energy-supported training program for students focused on energy improvements in industrial settings. This program is expected to provide training related to high performance building commissioning and optimization, in collaboration with industry partners. Partners in this effort included SUNY Community Colleges office, as well as Partners for Business & Education, a program administered by the Manufacturers Association of Central New York.

Strategic Plan

SyracuseCoE is a hub for innovation: 1) It researches, develops, and demonstrates commercializable innovations for healthy and efficient buildings, clean energy and resilient and low-carbon communities and cities; and 2) 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 is headquartered in an iconic 55,000-square-foot facility at the intersection of two interstate highways adjacent to downtown Syracuse. 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. 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, SUNY Upstate Medical University, and SUNY Oswego—to access additional resources including over 20 associated laboratories and personnel for collaborative projects, deepening research and development activities in environmental and energy systems in the region and state, as well as strengthening the capabilities available to companies engaging in product development and growth in these areas.

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. 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. SyracuseCoE was established in 2002 under New York State's Center of Excellence program, combining activities of the New York Indoor Environmental Quality (NYIEQ) Center, Inc. (a non-profit organization established in 2000) and the Environmental Quality Systems Strategically Targeted Academic Research Center (EQS STAR) Center (a multi-institutional research center competitively awarded to Syracuse University and 11 partners in 2001). Governance of SyracuseCoE activities is led by Syracuse University, with advice from CenterState Corporation for Economic Opportunity (CenterState CEO) and industry and academic partners, including SUNY College of Environmental Science and Forestry (ESF), SUNY Upstate Medical University and SUNY Oswego. Members of SyracuseCoE's Industry Partner Council meet twice annually and provide guidance on activities that are supported using funding provided by partner firms and institutions.

Center of Excellence in Weather & 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 Center of Excellence in Weather and Climate Analytics (CoE) is critical to the NYS economy. Weather has a profound impact on New York’s economy, with potential annual impact of \$58 billion (based on NYS economy’s estimate of weather sensitivity being 3.4% of the \$1.7-trillion NY economy). The CoE 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	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
0	4	\$2,162,000	\$532,000	\$432,000	\$2,250,000	\$150,000	\$5,526,000

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with companies
2021-2022	34	6	19	4	25

Designations and Recognitions: None

2021-2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$405,595	\$0	\$0	\$405,595
Indirect Costs	\$60,257	\$0	\$0	\$60,257
Equipment	\$12,400	\$0	\$0	\$12,400
Materials & Supplies	\$0	\$0	\$0	\$0
Tuition	\$0	\$0	\$0	\$0
Travel	\$10,102	\$0	\$0	\$10,102
Subcontractors	\$0	\$0	\$0	\$0
Other	\$805	\$516,907	\$0	\$517,712
Total	\$489,159	\$516,907	\$0	\$1,006,066

Total Federal: 0

Total In-kind: 0

Capital expenditures (Includes Federal, State, Local Funds & In-Kind): None

Commercialization Plan

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

Patent Name	Inventor	Co-Inventor	Patent #	Description
Enhancing Predictability of Weather-Caused Power Outages with NY Mesonet Observations	Dr. Jeff Freedman			This invention enhances prediction of weather-caused power outages and has been demonstrated in Avangrids NYS service territory.
xCITE Mobile Application Network	Dr. Kara Sulia	Arnold Kurbanovas		This invention allows NYS Mesonet information to be accessed through a mobile network.

Start-up Companies Formed: None

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

None

Description of any relationships with secondary schools and community colleges

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 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.

**Center of Excellence in Bioinformatics and Life Sciences
University at Buffalo
Dr. Norma Nowak, Director**

Technology Focus Bioinformatics and Life Sciences

Importance to NYS:

The NYS Center of Excellence in Bioinformatics and Life Sciences (CBLS) is a hub for innovation and technology-based economic development driving scientific discoveries and facilitating collaboration among academia, industry, and the public sector. Their mission is to actively support development of emerging technologies that have a positive impact of societal health and to strengthen the region’s and the state’s economies.

Purpose

The CBLS, one of the original four CoEs, connects University experts and New York State businesses to life sciences resources, incubator space, shared equipment, advanced computing solutions, funding, as well as provides programming aimed at supporting entrepreneurs to drive life sciences innovation and to commercialize new technologies. As NYS continued to battle the COVID-19 pandemic, the Governor’s office announced selection of the CBLS Genomics and Bioinformatics Core (GBC) as part of a \$20 million sequencing partnership between the state Department of Health’s Wadsworth Center and external laboratories to bolster state efforts in COVID-19 variant surveillance. The strategic decision made by CBLS leadership to invest in sequencing and bioinformatics experts and technologies a decade ago with support from NYSTAR enabled us to address this public health crisis quickly and effectively. This crisis has also shown the vital role that genetic sequencing and bioinformatics plays in the health sector.

Impacts

New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
43	6	\$3,303,000	\$1,290,757	\$1,171,000	\$4,892,323	\$281,713	\$10,938,793

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with companies
2021-2022	35	25	2	14	16

Designations and Recognitions

Awards / Recognition	Date Received	Recognizing Organization	Link
SUNY Chancellor’s Award in Scholarship and Creative Activities – awarded to Jun Qu, Ph.D.	June 2022	SUNY	https://pharmacy.buffalo.edu/news-events/news.host.html/content/shared/pharmacy/articles/academic_articles/2022/qu-receives-2022-suny-chancellor-s-award-in-scholarship-and-crea.detail.html
Power 200 WNY’s influential businesswomen - awarded to Norma Nowak, Ph.D.	September 2021	Business First	https://www.bizjournals.com/buffalo/news/2021/09/02/power-200-women-the-entire-list.html
The Life Sciences Power 50 - Norma Nowak, Ph.D.	August 2021	City and State NY	https://www.cityandstateny.com/power-lists/2021/08/life-sciences-power-50/184085/
Selection of CBLS Sequencing Core to Assist the State in the Identification of COVID-19 Variants	July 2022	NYS	https://www.governor.ny.gov/news/governor-cuomo-announces-selection-laboratories-assist-state-identification-covid-19-variants
\$10M federal award: Advanced Cyber Infrastructure Coordination Ecosystem: Monitoring and Measurement Services	May 2022	National Science Foundation	https://www.buffalo.edu/news/releases/2022/04/027.html

2021-2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$523,658	\$0	\$0	523,658
Indirect Costs	\$78,549	\$0	\$0	78,549
Equipment	\$0	\$0	\$0	\$0
Materials & Supplies	\$7,506	\$0	\$0	\$7,506
Tuition	\$0	\$0	\$0	\$0
Travel	\$1,338	\$0	\$0	\$1,338
Subcontractors	\$52,722	\$0	\$0	\$52,722
Other	\$3,844	\$0	\$2,912,186	\$2,916,030
Total	\$667,617	\$0	\$2,912,186	\$3,579,803

Total Federal: 0

Total In-kind: 0

Capital Expenditures: None

Commercialization Plan

The CBLS supports tenant companies and external partners with expertise, facilities and equipment that allow them to perform early-stage product development research in diagnostics, analytics, and therapeutics. Big pharma and biotech partners gain access to expertise and ‘omics facilities that help them test and develop therapeutics at both preclinical and clinical stages of development and develop processes and software to accelerate their in-house R&D efforts. The CBLS provides indispensable expertise, facilities, and technology to New York State life science startups that would otherwise be cost-prohibitive. This “bench to bedside” support is needed so state-of-the-art advances can come to fruition. The CBLS makes direct investments in the development of specific translational technologies invented at UB to help them reach the technology readiness levels required for industry partnering.

Among others, the Center is investing in ‘spatial omics’ technologies in demand by biotech and pharma for biomarker discovery and drug development, through equipment purchase and by supporting the development of a groundbreaking spatial proteomics technology invented in the Center’s Proteomics & Bioanalysis Core.

Actual or anticipated new products or processes with commercial application

Patent Name	Inventor	Co-Inventor	Patent #	Description
Photoacoustic Breast Imaging System and Method	Xia, Jun		17/600,085	Photoacoustic mammography uses fast-pulse lasers to heat tissue and images the resulting acoustic wave. The process eliminates radioactivity and the inconsistencies of ultrasounds.
Methods of Using Steroid Derivatives in the Treatment of Traumatic Brain Injury and Stroke	Poulsen, David		63/129,685	Steroid derivatives have been developed for the treatment of Traumatic Brain Injury (TBI) and stroke.
Differential PMOSISFET-Based pH Sensor	Titus, Albert		63/217,657	new low-cost CMOS-based pH sensor with potential to be self-calibrating and disposable.
Patent Name: Shear Thinning Hydrogels and Uses Thereof	Andreadis, Stelios		63/238,911	injectable hydrogel compositions with shear-thinning properties that enable delivery of drugs and cell therapies without damaging effects.

Patent Name	Inventor	Co-Inventor	Patent #	Description
Autonomous Self-Healing Elastomers and Applications Thereof	Andreadis, Stelios		63/255,012	self-healing elastomer compositions that are useful across a variety of applications, including but not limited to tissue engineering (e.g., vascular grafts).
GLP-1R/GIPR Dual Agonists and Methods of Making and Using Same	Lin, Qing	Yang, Yifang / Reddy, Rajasekhar	030-7495	series of stapled, dual agonist peptide compositions for the treatment of diabetes and obesity
Orthogonally Crosslinked Proteins, Methods of Making Same, and Uses Thereof	Lin, Qing		030-7494	A platform bioengineering approach, which combines orthogonal protein crosslinking with supercharging protein surfaces, to design and develop cell-penetrating monobodies.

Start-up Companies Formed

Company Name	City	Product/Service	Sector
QAS.AI, Inc.	Buffalo	AI tool designed to accurately predict outcomes to aid in endovascular surgical decision making.	Medical Device/AI

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Confidential – not for public release

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

UB CBLS offers a multitude of workforce development opportunities for a variety of ages and education levels which include science career education outreach, genomics, and bioinformatics education in formal and informal K-16 environments, Career Experience Program, and interfacing with new and growing companies to help fulfill their workforce needs.

Partnership with Buffalo Public Schools: UB CBLS continues to partner with the Buffalo Public School District (BPS) to support quality science education and hands-on experiences for students through the Research Laboratory High School in Bioinformatics and Life Sciences, a BPS approved UB after-school program, with a science and inquiry-based curriculum. To expand STEM Workforce Pipeline, BPS submitted a grant application with UB as a subcontractor to develop a STEM program for students in kindergarten through 8th Grade. This new program will encourage students to attend The Research Laboratory School.

Science Education Fellows: Drs. Small and Nowak were awarded funding from The Cullen Foundation to place UB students with Living Environment teachers in Buffalo Public Schools, as Science Ambassadors.

Career Experience Program (UB Student Experiential Learning): During the reporting period, local life sciences companies were recruited to host UB students working in a variety of positions during the Spring 2022 Semester, funded by UB's Center of Excellence in Bioinformatics and Life Sciences.

Partnership with UB's "Genome, Environment and Microbiome" Community of Excellence (GEM): CBLS worked on genome and microbiome education in the community and in K-12 schools.

Science Education Partnership Award (SEPA): This federal award is to develop a program to train teachers and high school students in metagenomics and bioinformatics.

Strategic plan

The CBLS serves life science companies across the state through access to their 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 their strategic goals. These include leveraging expert guidance from their 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 their marketing team does extensive internal and external outreach to attract new businesses and to deepen relationships with existing companies. 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, Center of Excellence 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, and Upstate Capital to name a few.

CBLS has 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. The UB SWIFT accelerated licensing terms have been commented on as very novel and reasonable by several partner companies.

Their key indicators for measuring success are in alignment with NYSTAR metrics: (1) Creating Economic Impact in New York State; (2) Supporting industry sponsored research; (3) Collaborate on SBIR/STTR with New York companies; (4) Federal grants enabled by industry collaboration; (5) Support the creation of new start-ups; (6) Provide experiential learning opportunities to students; and (7) generate positive media reports about their activities.

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.) Dr. Nowak is a recognized leader in the field of human genomics, having played a key role in the Human Genome Project. Dr. Nowak is the founder and Chief Scientific Officer of Empire Genomics LLC, a molecular diagnostics firm focused on enabling personalized medicine. In addition, she is a board member of 43North, guiding the one-of-a-kind business plan competition.

Dr. Nowak is supported by a comprehensive team of scientific, operations, business development and marketing experts. The CBLS Industry Advisory Board (IAB) comprised of industry experts in the fields of big data, drug development, diagnostic tools, healthcare IT and medical devices meet annually to review and advise on emerging technologies and review projects. The board is on hand informally throughout the year to provide recommendations and guidance on how the CBLS can best meet industry partner needs.

**Center of Excellence 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 Center of Excellence 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 Energy, 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 Center of Excellence 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	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
19	0	\$3,803,000	\$806,372	\$2,370,000	\$6,407,323	\$182,500	\$13,569,195

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with companies
2021-2022	77	55	7	9	79

Designations and Recognitions: None

2021-2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$585,248	\$0	\$781,993	\$1,367,241
Indirect Costs	\$87,787	\$0	\$0	\$87,787
Equipment	\$24,932	\$0	\$0	\$24,932
Materials & Supplies	\$57,277	\$0	\$0	\$57,277
Tuition	\$14,256	\$0	\$0	\$14,256
Travel	\$5,590	\$0	\$0	\$5,590
Subcontractors	\$0	\$0	\$0	\$0
Other	\$15,546	\$0	\$465,286	\$480,832
Total	\$790,636	\$0	\$1,247,279	\$2,037,915

Total Federal: 0

Total In-kind: 0

Capital Expenditures: None

Commercialization Plan

UB's New York State Center of Excellence 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, and catalysts.

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 the 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, 42 FIAR projects, totaling approximately \$1.55M 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 application

Patent Name	Inventor	Co-Inventor	Patent #	Description
Imaging Contrast Agents and Uses hereof	Janet Morrow	Pavel Tsitovich, Sarina Dorazio, Abiola Olatunde	14/116,270 16/615,024 16/973,349	The use of iron-based contrast agents to replace potentially toxic gadolinium compounds in medical imaging.
Devices and methods in photoacoustic tomography	Jun Xia	Tuehang Wang	15/781,329	Technology is being developed for more patient-friendly diagnosis of mammography.
Quantum Devices and Methods Using Entangled Photons and Phonons	Vasili Perebeinos	Jonathan Bird, Huamin Li	17/585,528	A quantum semiconductor design that opens up the possibility of realizing novel devices in which electron-phonon coupling is exploited to generate single phonons on-demand.
Methods and Systems for Assessing a Vasculature	Ionita, Ciprian N.		17/780,283	AI software that interprets X-ray angiogram images to diagnose and predict outcomes for aneurysm and ischemic stroke patients.
Hybrid Covalent-Van Der Waals System 2D Heterostructures by Dative Epitaxy	Zeng, Hao	Bian, Mengying	63/315,965	A distinct form of thin film epitaxy utilizing dative bonds used to grow semiconductor crystals with single unit cell thickness on a thin layer vdW template.
GLP-1R/GIPR Dual Agonists and Methods of Making and Using Same	Lin, Qing	Yang, Yifang Reddy, Rajasekhar R.	63/317,197	A series of stapled, dual agonist peptide compositions for the treatment of diabetes and obesity
Orthogonally Crosslinked Proteins,	Lin, Qing		63/319,576	Combines orthogonal protein crosslinking with

Patent Name	Inventor	Co-Inventor	Patent #	Description
Methods of Making Same, and Uses Thereof				supercharging protein surfaces, to design and develop cell-penetrating monobodies.
Manganese(III) Compounds, Methods of Making Same, and Uses Thereof	Lacy, David C.	Griffiths, Justin R. / Saju, Ananya	63/339,181	A method for preparing sources of MnCl ₃ that can be carried out open to air using reagent-grade solvents.

Start-up Companies Formed

Company Name	City	Product/Service	Sector
Copprum	Buffalo	Advanced printable electronic inks	Flexible printable electronics

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Project	Inventor	Licensing Partner
Green and Low-Cost Hydrogen Peroxide On-Site Production for Disinfection	Gang Wu	Bettergy Corp.
Converging Additive Manufacturing, Materials Informatics, and Nanotechnology for Innovative Water Treatment and Resource Recovery	Nirupam Aich Chi Zhou Olga Wodo	Bettergy Corp.
Ultrahigh Performance Supercapacitor Using Two-dimensional CN Crystals (Stage II)	Huamin Li Fei Yao	Custom Electronics Inc.
Computational Modeling of the Electrochemical Microenvironment Adjacent to Cathodically Stimulated Orthopedic Implants	Mark Ehrensberger	Garwood Medical Devices
Rational Design of Mixed Matrix Membranes for the Production of Blue and Green Hydrogen	Haiqing Lin Mark Swihart	Ludlow Electrochemical Hardware
Development of software tools to monitor and efficiently operate CBRS networks	Filippo Malandra	Integrated Systems
Evaluating Cloud-based Over-the-Air Technologies for Device Fleet Management: A Collaborative Project with CleanSlate UV	Jinjun Xiong Ethan Blanton	CleanSlate UV
Computational Modeling of Aerosol Transmission and UV-C Aerosol Pathogen Reduction Systems	Francine Battaglia	uvPhyzz LLC
Development of function prototypes as proof-of-concept devices of distributed UHF RFID tags for Direct to Packaging (DTP) Printing	Zhangyu Guan Filippo Malandra Nicholas Mastronarde	Armor-IIMAK

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

CMI offers a multitude of workforce development opportunities for a variety of ages and education levels. Sandra Small, Ph.D., the Science Education Manager, leads these initiatives. Her duties include science career education outreach, STEM education in formal and informal K-16 environments, directing the Career Experience Program, and interfacing with new and growing companies to help fulfill their workforce needs.

Dr. Small was awarded funding from The Cullen Foundation to pair UB students (Science Ambassadors) with science teachers in Buffalo Public Schools. Six ambassadors were placed with BPS teachers during the Fall 2021 Semester. Five of the ambassadors continued working in the classrooms during the Spring 2022 semester.

Dr. Small was awarded a contract with Buffalo Public Schools to support the development of a STEM-specific elementary school, which will serve as the beginning of a workforce development pipeline.

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 also 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.

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.

CMI Staff:

Dr. Alan Rae, Director

Dr. Quanxi Jia, Scientific Director (summer salary)

Christopher Janson, Senior Business Development Manager (100% effort)

Adrian Levesque, Computational and Data Visualization lead (25% effort)

Kathryn Helfer, Budget & Operations Manager (30% effort)

Thomas Matheny, CRM Development (15%)

Dr. Sandra Small, Science Education Manager (20% effort)

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.

Company

Buffalo Manufacturing Works

Harper International Corp

Linde

Moog

Copprium

S. Howes, Inc.

Tapecon, Inc.

Unifrax

Viant Medical

Washington Mills

IAB Representative

Alex Kitt, Product Manager

Prasad Apte, PhD, Director of Technology

Jonathan Lane, PhD, Senior Technology Expert

Lance Johnson, Manager, Manufacturing Engineer

Brian Bischoff, President

Fred Mertz, President

Steve Davis, President

Donghui Zhao, Manager, Materials Research

Ashish Shah, PhD, VP, R&D and Engineering

Matthew Creedon, PhD, Technical Development Manager

**Center of Excellence in Data Science
University of Rochester
Dr. Mujdat Cetin, Director**

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

Importance to NYS

The Center of Excellence in Data Science (CoE) 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 Center of Excellence in Data Science (CoE) 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 a variety of disciplines including computer science, medicine, brain and cognitive sciences, biomedical engineering, optics, electrical and computer engineering, mechanical engineering, physics, chemistry, biology, earth and environmental sciences, business, economics, political science, linguistics, and education. 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 (CIRC) 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	Government Funds	Non-Government Funds	Capital Improvements	Total Impacts
12	8	\$1,825,463	\$2,060,000	\$0	\$4,988,594	\$0	8,874,057

Companies Served and Projects

Annual Period	Companies Served	Small NYS Companies Served	Projects On-Going	Projects Completed	Students Engaged with companies
2021-2022	11	6	9	3	19

Designations and Recognitions

Awards/Recognition	Date Received	Recognizing Organization	Link
Mujdat Cetin (Next editor-in-chief of the journal IEEE Transactions on Computational Imaging)	Summer 2021	IEEE	https://signalprocessing.society.org/publications-resources/ieee-transactions-computational-imaging/technical-liaison-committeeditorial
Adam Frank (2021 Carl Sagan Medal)	2021	Division of Planetary Sciences (DPS) of the American Astronomical Society	https://dps.aas.org/
Gaurav Sharma (2021 Raymond C. Bowman Award)	2021	Society for Imaging Science and Technology (IS&T)	https://www.imaging.org/site/IST/
Jiebo Luo (ACM SIGMM Award for Outstanding Technical Contributions to Multimedia)	Fall 2021	Association for Computing Machinery (ACM) Special Interest Group on Multimedia (SIGMM)	http://sigmm.org/news/sigmm_technical_award_2021
Gonzalo Mateos (2021 IEEE Signal Processing Society (SPS) Pierre-Simon Laplace Early Career Technical Achievement Award)	Fall 2021	IEEE	https://signalprocessing.society.org/community-involvement/awards-submit-award-nomination#earlycareer
David Williams (Fellow, National Academy of Inventors)	Fall 2021	National Academy of Inventors	https://academyofinventors.org/

Awards/Recognition	Date Received	Recognizing Organization	Link
Chenliang Xu (James P. Wilmot Distinguished Assistant Professorship)	Fall 2021	University of Rochester	https://www.rochester.edu/communications/newsletters/researchconnections/research-connections-0625/
Elaine Hill (appointed to National Bureau of Economic Research's program on Health Economics and Children)	Spring 2022	National Bureau of Economic Research	https://www.nber.org/people/elaine_hill?page=1&perPage=50
Susana Marcos (Class of 2022 Gold Fellow)	Spring 2022	Association for Research in Vision and Ophthalmology (ARVO)	https://www.arvo.org/awards-grants-and-fellowships/arvo-fellows/2022-arvo-fellows/
Andrew White (2021 Young Engineer of the Year Award)	Spring 2022	Rochester Engineering Society	https://issuu.com/greggdowski/docs/2022_april_re
Mark Bocko (2021 Engineer of Distinction)	Spring 2022	Rochester Engineering Society	https://issuu.com/greggdowski/docs/2022_april_re
Jannick Rolland (elected member of Virtual Reality Academy)	Spring 2022	IEEE's Visualization and Graphics Technical Community	https://tc.computer.org/vgtc/
Michael Scott (Fellow of the American Association for the Advancement of Science (AAAS))	Spring 2022	American Association for the Advancement of Science (AAAS)	https://www.aaas.org/

2021 -2022 Operating Budget (Includes Federal, State, Local Funds & In-Kind)

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$513,558	\$0	\$590,137	\$1,103,695
Indirect Costs	\$77,034	\$0	\$88,521	\$165,555
Equipment	\$82,211	\$0	\$219,064	\$301,275
Materials & Supplies	\$1,846	\$0	\$1,227	\$3,073
Tuition	\$2,140	\$0	\$0	\$2,140
Travel	\$4,209	\$0	\$64	\$4,273
Subcontractors	\$0	\$0	\$0	\$0
Other	\$38,690	\$0	\$8,904	\$47,594
Total	\$719,688	\$0	\$907,917	\$1,627,605

Total Federal: 0

Total In-kind: 0

Capital expenditures (Includes Federal, State, Local Funds & In-Kind)

Capital Equipment Purchases	NYSTAR Funding	Federal	Other Sources	In-kind	Total
Vertiv – Equipment for high-speed computing	\$73,203	\$0	\$0	\$0	\$73,203
Computer start up package	\$7,528	\$0	\$0	\$0	\$7,528

Commercialization Plan (products or processes developed at facility – Summary of full 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 #	Description
A Deep Learning based Speech Anti-spoofing System for Synthetic Voice Attacks	Zhiyao Duan	You Zhang		This is a deep learning based anti-spoofing system able to classify synthetic voices from bona fide speech recordings. Can be used

Patent Name	Inventor	Co-Inventor	Patent #	Description
				in speaker verification, speaker recognition, deepfake detection and other applications in security and surveillance.
Energy-Based Learning with an Ising Machine Substrate	Michael Huang	Zeljko Ignjatovic, Richard Afoakwa, Uday Kumar Reddy Vengalam, Yiqiao Zhang	US Provisional Application 63/176,247	The present invention provides a new class of augmented Ising machine suitable for both training and inference in machine learning applications.
A Bistable Resistively Coupled Ising Machine with Spin-Fix Perturbations for Improved Solution Quality	Yiqiao Zhang	Zeljko Ignjatovic, Michael Huang	US Provisional Application	An Ising machine having a network of resistively coupled circuit nodes where at least one node comprises a capacitor whose voltage between its terminals represents a state variable of the node.
Increasing Ising Machine Capacity with Multi-Chip Architectures	Michael Huang	Richard Afoakwa, Anshujit Sharma, Zeljko Ignjatovic		An architecture for multiprocessor Ising machines. This design allows scalability of machine capabilities. If Ising machines become commercially available, this invention will be a major IP with extraordinarily high commercial potentials.

Start-up Companies Formed

Company Name	City	Product/Service	Sector
Phlotonics	Rochester, NY	Light powered chips to measure patient biology	Health Sciences
IngenID	Rochester, NY	Voice biometrics solutions	Audio & Speech Analytics

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Project	Inventor	Licensing Partner
2089A003 Speaker Verification System, and Deep Learning based Speech Anti-spoofing System for Synthetic Voice Attacks	Zhiyao Duan, Ge Zhu, You Zhang	Voice Biometrics Group (VBG)

Description of any relationships with secondary schools and community colleges

The Goergen Institute for Data Science (GIDS) at the University of Rochester, the academic unit that houses the CoE in Data Science, hosted 12 high-school students for a week-long data science summer camp. In this week-long program, students have a hands-on opportunity to experience the growing field of data science. After a brief introduction and appreciation on why data science is the most sought-after profession in the 21st century, the students immersed in analyzing and visualizing large data sets (derived from healthcare, sports, music, business) to discover insights using state-of-the-art data science tools. By means of a series of interactive examples in various domain/subject areas, they gain experience in data science techniques such as data preparation and exploration, data visualization, and an introduction to predictive modeling. Due to COVID restrictions, the program was offered online via Zoom.

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 includes 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, research and networking events, 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; audio and speech processing; optics; computer/human vision; life sciences and biomedicine; human-computer interaction; robotics; economics and business data analytics; and 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 as well as the GIDS External Advisory Committee provide 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 University’s Vice President for Research, Dean of the School of Arts and Sciences, Dean of the Hajim School of Engineering & Applied Sciences, and Dean for Research in Arts, Sciences and Engineering also provide guidance and oversight to the CoE Director regarding the Center’s activities. The CoE also receives advice and feedback from the GIDS

External Advisory Committee, whose membership currently includes recognized leaders from Bright House Networks, IBM, Origent Data Sciences, L3 Harris, Soleo Communications, Clark Atlanta University, Cornell University, Microsoft, Wegmans, University of Pittsburgh, Vnomics, QbDVision, Xerox, Evidation Health, and other leading companies and institutions.

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