

Empire State Development
Division of Science, Technology & Innovation
(NYSTAR)



A Division of Empire State Development

2023 Program Report
Centers for Advanced Technology
Academic Year July 2021 through June 2022

Contents

INTRODUCTION.....4

REQUESTS FOR PROPOSALS5

INDIVIDUAL CAT REPORTS5

**CENTER FOR ADVANCED CERAMIC TECHNOLOGY (CACT)
ALFRED UNIVERSITY6**

**CENTER FOR FLEXIBLE HYBRID MEDICAL DEVICE MANUFACTURING (FLEXMED)
BINGHAMTON UNIVERSITY10**

**INTEGRATED ELECTRONIC ENGINEERING CENTER
BINGHAMTON UNIVERSITY15**

**CENTER FOR ADVANCED MATERIALS PROCESSING
CLARKSON UNIVERSITY19**

**CENTER FOR ADVANCED TECHNOLOGY CENTER FOR LIFE SCIENCE ENTERPRISE
CORNELL UNIVERSITY28**

**ADVANCED SCIENCE RESEARCH CENTER SENSOR CAT
CITY UNIVERSITY OF NEW YORK31**

**CENTER FOR ADVANCED TECHNOLOGY IN TELECOMMUNICATIONS
NEW YORK UNIVERSITY, POLYTECHNIC UNIVERSITY35**

**CENTER FOR ADVANCED TECHNOLOGY FUTURE ENERGY SYSTEMS (CFES)
RENSSELAER POLYTECHNIC INSTITUTE43**

**ADDITIVE MANUFACTURING AND MULTIFUNCTIONAL PRINTING CENTER FOR ADVANCED TECHNOLOGY
ROCHESTER INSTITUTE OF TECHNOLOGY46**

**CENTER FOR BIOTECHNOLOGY
STONY BROOK UNIVERSITY49**

**CENTER FOR INTEGRATED ELECTRIC ENERGY SYSTEMS (CIEES)
STONY BROOK UNIVERSITY53**

**CENTER FOR ADVANCED TECHNOLOGY IN NANOMATERIALS AND NANOELECTRONICS
STATE UNIVERSITY OF NEW YORK POLYTECHNIC INSTITUTE (SUNY POLY)58**

**CENTER FOR ADVANCED TECHNOLOGY IN COMPUTER APPLICATIONS AND SYSTEMS ENGINEERING SYRACUSE
UNIVERSITY65**

**CENTER FOR ADVANCED TECHNOLOGY IN BIG DATA AND HEALTH SCIENCES
UNIVERSITY AT BUFFALO70**

**CENTER FOR ADVANCED TECHNOLOGY IN EMERGING AND INNOVATIVE SCIENCES
UNIVERSITY OF ROCHESTER75**

Introduction

Empire State Development (ESD) is New York's chief economic development agency. The mission of ESD is to promote a vigorous and growing state economy, encourage business investment and job creation, and support diverse, prosperous local economies across New York State through the efficient use of loans, grants, tax credits, real estate development, marketing and other forms of assistance.

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

SBTD's Division of Science, Technology & Innovation (NYSTAR) manages the Centers for Advanced Technology (CAT) Program. The CAT program, created in 1983, supports applied research, development, and technology transfer in multiple technological areas in collaboration with private industry. CATs play a critical role in spurring technology-based applied research and economic development in the State, promoting national and international research collaboration and innovation, and leveraging New York's research expertise and funding with investments from the federal government, foundations, businesses, venture capital firms and other entities.

Through a competitive process, NYSTAR awards 10-year designations in technology fields of strategic importance to New York's economic competitiveness. Eligible applicants are New York universities and affiliated research institutes.

Below are individual summaries for each of the 15 CATs covering the July 1, 2021 through June 30, 2022 reporting period with information as reported by each CAT that includes:

- Importance to NYS
- Impacts
- Federal or Other Grants Awarded
- Education and Technology Commercialization Activities
 - Commercialization
 - Start-up Companies Formed
 - Licensing Agreements
- Level of Matching Funds Provided

2021-2022 CENTERS FOR ADVANCED TECHNOLOGY (CAT) PROGRAM IMPACTS



NEW JOBS

249



RETAINED JOBS

89



ECONOMIC IMPACT

\$464,281,646

Generated impacts for the program are broken down by CAT below and included in the summary section for each CAT.

| Center | New Jobs | Retained Jobs | Total jobs | Economic Impact |
|--|------------|---------------|------------|----------------------|
| Center for Advanced Ceramic Technology at Alfred University | 3 | 0 | 3 | \$4,713,863 |
| Center for Flexible Hybrid Medical Device Manufacturing at Binghamton University | 9 | 18 | 27 | \$9,772,314 |
| Integrated Electronic Engineering Center at Binghamton University | 3 | 6 | 9 | \$95,909,250 |
| Center for Advanced Materials Processing at Clarkson University | 11 | 2 | 13 | \$3,811,355 |
| Center for Life Science Enterprise at Cornell University | 10 | 0 | 10 | \$8,793,993 |
| Advanced Science Research Center Sensor CAT at City University of New York** | 0 | 0 | 0 | \$1,937,079 |
| CAT in Telecommunications at New York University Polytechnic University | 27 | 0 | 27 | \$128,563,120 |
| CAT in Future Energy Systems at Rensselaer Polytechnic Institute | 4 | 4 | 8 | \$4,202,291 |
| Additive Manufacturing and Multifunctional Printing CAT at Rochester Institute of Technology | 16 | 4 | 20 | \$3,483,143 |
| Center for Biotechnology at Stony Brook University | 43 | 19 | 62 | \$39,916,528 |
| Center for Integrated Electric Energy Systems at Stony Brook University | 28 | 31 | 59 | \$3,173,673 |
| CAT in Nanomaterials and Nanoelectronics at SUNY Polytechnic Institute | 30 | 2 | 32 | \$74,720,402 |
| CAT in Computer Applications and Systems Engineering at Syracuse University | 13 | 0 | 13 | \$35,816,147 |
| CAT in Big Data and Health Sciences at University of Buffalo | 41 | 2 | 43 | \$20,475,889 |
| CAT in Emerging and Innovative Sciences at University of Rochester | 11 | 1 | 12 | \$28,992,599 |
| Totals | 249 | 89 | 338 | \$464,281,646 |

**The ASRC CAT at City University is a new CAT as of 2019. There is a ramp up period of one to two years for a new center, and coupled with COVID closures and restrictions, the ASRC got a slow start. However, they did report one new start-up, but as is normal with start-ups there are no employees yet.

Requests for Proposals

There were no Center for Advanced Technology Requests for Proposals released during this period. The next CAT competition is expected to be held in mid-2024 as 10 current CAT designations are set to expire on June 30, 2025.

Individual CAT Reports

Individual CAT reports continue for the remainder of this document.

Center for Advanced Ceramic Technology (CACT)
Alfred University
Dr. John Simmins, Director

Technology Focus Ceramics

Importance to NYS

Alfred University is the only institution in the country offering a glass science PhD and one of only two with accredited ceramic engineering programs. CACT links NYS firms to unique expertise aimed at solving a wide range of analytical and applied research needs for technical ceramics and glass materials science.

Description of Achievements

For the 2021-22 year, CACT supported analytical projects with the following NYS companies: **Belvac, Boston Valley Terra Cotta, Carty Consulting, Foster-Rush, Himed, KAPL Ceria Ceramics, Lockheed Martin, Monofrax, Moog, Pall Corp., Praxair, and Xerox Corporation.** CACT worked with the following non-NYS companies on analytical service projects: Armstrong (PA), Conox (TX), Flawless Photonics (CA), Lifeport, Inc. (WA), Medronic (MN), MTI (UT), and Pulpdent (MA).

CACT supported long-term service agreements/sponsored research agreements with the following NYS firms: **ASK Chemical, Correlle (Instant Brands), Corning, Knowles Precision Devices, Momentive, Optimax, Refraction, Saxon Glass, STM Properties, LLC, and Xylon Technical Ceramics.** Additional firms CACT worked with from outside NYS included **II-VI (CT), GBC Materials (PA), Glass WRX (SC), NextStep Arthropedix (OH), Pratt & Whitney (CT), Richland Glass (NJ), Saint-Gobain (MA), and WSP (FL).**

CACT supported student-led entrepreneurship through the second Startup Allegany Collegiate Competition held in April 2022. Winning teams received mentorship support from IncubatorWorks and pre-seed funding from CACT and other private sector sponsors. Last year’s second place team successfully installed glass processing equipment at IncubatorWorks and has started small-scale production.

Finally, CACT sponsored Alfred University students for internships at the following companies: **ASK Chemicals, Calix Ceramic Solutions, GBC Materials, Filtros, Ljungstrom, Sigma Advanced Materials, and R-Care** in addition to students working at Alfred University in support of ongoing research with the NYS Department of Environmental Conservation investigating technologies for improved glass recycling outcomes.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 3 | 0 | \$2,181,729 | \$317,737 | \$2,114,397 | \$100,000 | \$0 | \$4,713,863 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|------------------|-----------------------|------------------------|-------------------------|--------------------------------------|
| 7/1/21 – 6/30/22 | 37 | 9 | 28 | 19 |

Designations and Recognitions

None

Federal or Not-for-Profit Grants Awarded

| Project | Principle Investigator | Co-Investigator | Source | Amount | Duration (yrs.) | Summary |
|---------|------------------------|-------------------------------------|----------|-----------|-----------------|---|
| 235741 | Dr. Scott Misture | | NSF-DMR | 1,228,000 | 2016-2023 | Modeling approaches for fitting synchrotron x-ray scattering data to describe nanoscale-disordered bimetallic nanoparticles for nuclear waste immobilization. |
| 244529 | Dr. Scott Misture | Dr. Gabrielle Gaustad; Dr. Kun Wang | NSF MRI | 489,909 | 2020-2021 | For purchase of Focused Ion Beam Scanning Electron Microscope. |
| 235742 | Dr. Scott Misture | | U. of CT | 50,294 | 2018-2021 | Capture of airborne Cr, Si, S and B gaseous species for the mitigation of SOFC cathode poisoning: low cost alkaline-transition metal oxide getters and validation in SOFC system. |

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

CACT sponsored internships at **ASK Chemicals, Calix Ceramic Solutions, GBC Materials, Filtros, Ljungstrom, Sigma Advanced Materials, and R-Care**. Mechanical engineering students worked on a NYS DEC project investigating technologies for improved glass recycling. CACT employed three marketing interns to assist in developing new CACT marketing materials. CACT collaborated with IncubatorWorks, Houghton University and Alfred State College on 2nd annual Startup Allegany Collegiate Competition. This focused on student-led teams developing business concepts/business planning canvas, culminating with presentations and awards ceremony hosted at Alfred University. CACT provided support and briefed attendees of a Fractography industrial short course held on campus June 13-17, 2022.

Commercialization

Industrial outreach at international industrial conferences included Ceramics Expo in Cleveland, Ohio from August 30th through September 1st, 2021, and the Materials Science & Technology Conference in Columbus, OH from October 18th through 20th. CACT collaborated on the following federal applications: University of Rochester-led Build Back Better application on optical technologies and materials; University at Buffalo with LIFT on materials modeling and mechanical testing of 3D printed ceramics for hypersonics resulting in two awards; IncubatorWorks on USDA RISE application in April and May 2022. CACT and Binghamton University met on December 8, 2021, to discuss research in ceramics, glass, materials science, and industrial and federal programming.

Invention Disclosures /Patents

None

Start-up Companies Formed

| Company Name | City | Product/Service | Sector |
|--------------|------------|---------------------------|-------------------|
| GlassLab | Alfred, NY | Strengthened Glass Straws | Materials science |

Licensing Agreements

None

Royalties

None

Small Business Assistance Provided

CACT supported analytical projects with the following small NYS companies: **Belvac, Boston Valley Terra Cotta, Carty Consulting, Foster-Rush, Himed, KAPL Ceria Ceramics,** and **Monofrax**. CACT supported long-term service agreements/sponsored research agreements with the following small NYS firms: **Saxon Glass, STM Properties, LLC,** and **Xylon Technical Ceramics**. CACT sponsored Alfred University student internships at the following small NYS companies: **Calix Ceramic Solutions, GBC Materials, Filtros, Sigma Advanced Materials,** and **R-Care**. CACT also supported the creation of one new student-led startup company, **GlassLab**, which is based out of their partner NYS incubator, IncubatorWorks.

**Level of Matching Funds Provided and uses
Expenses (include Federal State, local funds & in-kind)**

| Operating Expenses | NYSTAR Funding | Matching Funds | | Total |
|----------------------|--------------------|--------------------|------------------|--------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$684,402 | \$98,802 | \$179,224 | \$962,428 |
| Indirect Costs | \$102,660 | \$24,700 | \$44,806 | \$172,166 |
| Equipment | \$92,435 | \$11,552 | \$95,209 | \$199,196 |
| Materials & Supplies | \$62,199 | \$18,159 | \$23,189 | \$103,547 |
| Tuition | \$0 | \$0 | \$0 | \$0 |
| Travel | \$15,490 | \$2,570 | \$6,087 | \$24,147 |
| Subcontractors | \$16,775 | \$4,200 | \$3,250 | \$24,225 |
| Other | \$161,023 | \$18,482 | \$1,098 | \$180,603 |
| Total | \$1,134,984 | \$178,465 | \$352,863 | \$1,666,312 |

** Additional Small NYS Company Match \$100,330

Total Federal: 0

Total In-kind: 0

Center for Flexible Hybrid Medical Device Manufacturing (FlexMed)
Binghamton University
Mark Poliks, Director

Technology Focus Medical Manufacturing/Biomedical & Devices

Importance to NYS

The FlexMed CAT provides economic growth for New York State by serving as a “synergy center” focusing on cost-effective product development and pilot manufacturing activities. FlexMed works with industry partners of all sizes – from large integrators and manufacturers to small start-ups – across New York State to design, develop and manufacture tools, processes, materials, and products in the health device space, based on flexible-hybrid electronics technologies.

Description of Achievements

During the 2021-2022 program year, FlexMed continued to work on a number of project and contract activities. Work was conducted on 20 flexible hybrid electronics projects with value in excess of \$13.1M, comprised of a combination of federal funding, NYS matching contributions, and industrial partner funding. Also, during the program year, the CAT:

- Worked on several COVID-related initiatives, including a collaborative project with collaborators from the University of Rochester School of Medicine to develop methods to test for the SARSCoV-2 and other biological agents.
- Undertook several workforce development initiatives, including a workforce training workshop co-sponsored with Cornell NanoScale Facility and RIT which brought together NYS industry, government, and universities to discuss needs to workforce training and how academic institutions can help.
- Continued to work with NextFlex to expand its FlexPro Workshops in New York State, which is hands-on technical training designed to immerse professionals into the design and manufacturing processes associated with flexible hybrid electronics (FHE).
- Participated in several synergistic efforts, including a joint CAT meeting with representatives from FlexMed, IEEC, and Clarkson University’s Center for Advanced Materials Processing (CAMP) to explore collaboration opportunities.
- Hosted representatives from CUNY Advanced Science Research Center (New York City) to discuss possible collaboration opportunities between research centers. These discussions led to the formation of a joint FlexMed/CUNY project team focused on the development of a coalition of academic institutions, nonprofits, industry, government entities and others to create a regional “innovation ecosystem” for the purpose of spurring research, technology translation and workforce development.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 9 | 18 | \$5,377,000 | \$1,025,438 | \$2,304,876 | \$65,000 | \$1,000,000 | \$9,772,314 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|---------------|-----------------------|------------------------|-------------------------|--------------------------------------|
| 2021-2022 | 18 | 12 | 8 | 15 |

Designations and Recognitions

| Award/Recognition | Date Received | Recognizing Organization | Link |
|--|-----------------------|--|---|
| FlexMed CAT Director Mark Poliks was appointed the rank of Distinguished Professor. | April 2021 | SUNY Board of Trustees. Appointment. | https://www.suny.edu/about/leadership/board-of-trustees/meetings/webcastdocs/Tab%205%20-Reso_AA_%20DP%202020.pdf |
| FlexMed/CAMM graduate student Emuobosan Enakerakpo won an Outstanding Poster award. The title of his poster was “Yield Optimization for Aerosol Jet Printing Manufacturing of Passive Electronics Elements.” | September 2021 | 2021 Electronics Packaging Symposium at Binghamton University. | No link available. |
| FlexMed/CAMM graduate student Firas Alshatnawi won a \$1,500 travel award for his paper titled “High Temperature Die Interconnect Approaches.” | May 30 – June 3, 2022 | Awardees are selected by the Electronic Components and Technology Conference (ECTC) technical committee in recognition of students with superior research papers. This award helped Firas offset his expenses related to attending the ECTC Conference in San Diego. | https://eps.ieee.org/images/files/education/ECTC_Student_Travel_Grant_Award_Winners_2014-2022docx.pdf |

Federal or Not-for-Profit Grants Awarded

| Project | Principle Investigator | Co-Investigator | Source | Amount | Duration (yrs.) | Summary |
|--|------------------------|--------------------|-----------------------|--------|-----------------|---|
| NextFlex CII FHE Ecosystem Enhancement | Mark Poliks (BU) | N/A | NextFlex (AFRL) | \$500K | 2 | Support to further the activities of the NYS NextFlex Node. Funding will support to NYS companies interested in FHE methodologies. |
| Wireless Interstitial Fluid Monitoring Devices | Mark Poliks (BU) | Azar Alizadeh (GE) | SEMI/ FlexTech (AFRL) | \$1.7M | 2 | Development of wearable biomarker sensing devices to (1) discover the most relevant biomarkers of anticipatory stress and (2) assess the dynamic variations |

| | | | | | | |
|--|------------------|--------------------------------------|--|--------|-----|--|
| | | | | | | of these markers as a function of daily activities and stress. |
| Advanced Power Device Integration Using Direct Write Technology | Mark Poliks (BU) | Arun Gowda (GE) | SEMI/ FlexTech (AFRL) | \$610K | 1.5 | Advance the use of direct write technology materials and manufacturing processes in high performance power electronics modules. |
| Soft, Electronic Skininnervated Robotic Worm for Rapid Maintenance of Strategic Assets (Sensiworm) | Mark Poliks (BU) | Deepak Trivedi (GE) | SEMI/ FlexTech (AFRL) | \$900K | 1.5 | Develop and demonstrate a bio- inspired soft robot for assisting a human operator in performing inspection, maintenance, and repair (IMR) in highly confined spaces inside industrial and defense assets. |
| Scalable Manufacturing of Microelectronic Biosensors using Conductive Inks | Mark Poliks (BU) | Lorenzo D'Amico (Triton Bio Devices) | FuzeHub Jeff Lawrence Innovation Fund (Non-Profit) | \$50K | 1 | Develop a prototype device capable of detecting bacterial pathogens in less than one hour. The resulting device will reduce the cost of rapid lab testing by 10x or more and enable the commercialization of a life-saving technology. |
| PC6.1: AM High Temperature RF Components for Hypersonics | Mark Poliks (BU) | David Shaddock (GE) | NextFlex (AFRL) | \$300K | 1 | Develop high temperature RF components and circuits suitable for hypersonic aviation, power generation, space exploration, and geothermal applications. |
| PC6.1: Evaluating System-on-foil™ Interposer for High-Performance FHE | Mark Poliks (BU) | Graeme Housser (Lux Semiconductors) | NextFlex (AFRL) | \$400K | 1 | Enable high performance FHE without sacrificing the attributes of flexible and printed electronics. |
| PC6.6: Models and Tools to Predict Reliability and Life of FHE Components & Systems | Mark Poliks (BU) | Suresh Sitaraman (Georgia Tech) | NextFlex (AFRL) | \$400K | 1 | Develop both empirical and physics-based reliability prediction models and tools for printed elements on flexible substrates. |
| PC6.7: Mid-Band Phased Array Demonstrator using Printed & Flexible Hybrid Electronics | Mark Poliks (BU) | Tom Rovere (LMCO) | NextFlex (AFRL) | \$575K | 1 | Create a fully functional beam steering, single polarization, phased array that will utilize aspects of both printed electronics and |

| | | | | | | |
|--|------------------|-----------------------|-----------------------|--------|-----|--|
| | | | | | | flexible substrates. |
| PC6.10: Small-Scale mm-Wave SATCOM System & 5G Systems for UAS Attributable Platform | Mark Poliks (BU) | Tom Rovere (LMCO) | NextFlex (AFRL) | \$850K | 1.5 | Utilize FHE technologies on a Lockheed Martin CONDOR small, unmanned aircraft system demonstrator vehicle and add new multi-functional capability to the aircraft. |
| 3D Printed Electronics with Multi Jet Fusion for Flexible Hybrid Electronics | Mark Poliks (BU) | Jarrid Alexander (HP) | NBMC/ FlexTech (AFRL) | \$1M | 1.5 | Develop a new paradigm for Flexible Hybrid Electronics enabled by utilizing HP, Inc.'s Multi Jet Fusion technology. The new paradigm promises to open the applicability of FHE to a much broader range of final applications |

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

FlexMed has partnered with NextFlex to expand their FlexPro Workshop offerings in New York State. The FlexPro program is hands-on technical training designed to immerse professionals into the design and manufacturing processes associated with flexible hybrid electronics (FHE), as well as familiarize participants with applications and benefits of FHE technology. In addition, FlexMed co-sponsored the 2022 NYS Nanotechnology Network Symposium at Cornell University in May 2022. The purpose of this symposium was to connect undergraduate and graduate students with NYS industry partners for the purpose of "Bridging the Workforce Gap." The day's events included an afternoon Poster Session & Career Fair for students.

Commercialization

During the 2021-2022 program year, FlexMed worked with several NYS companies to help advance their FHE-related R&D efforts to the manufacturing and commercialization stages. Companies include: GE Global Research, Corning, Inc., Lockheed Martin Owego, Universal Instruments, 2M Technology, TTM Technologies, Tapecon, Lux Semiconductors, Aincobio Biodevices, and CathBuddy. In addition, FlexMed staff actively participated in both MedTech and FuzeHub meetings and events in an effort to identify and understand the needs of, and connect with, NYS product developers. Finally, FlexMed worked closely with Binghamton's S3IP and IEEC to develop new opportunities for interested companies.

Invention Disclosures /Patents

| Disclosure /Patent Name | Inventor | Co-inventor | Licensing Partner | Research Sponsor | Description |
|---|-----------------------|--|--------------------------|-------------------------|---|
| US Patent 11,331,019 "Nanoparticle sensor having a nanofibrous membrane scaffold" | Chuan-Jian Zhong (BU) | Mark Poliks (BU), Benjamin Hsaio (Stony Brook), Ning Kang (BU), Shan Yan (BU), Jing Li (BU), | TBD | NSF | The invention covers nanocomposite scaffolds consisting of functionalized gold nanoparticles and nanofibrous membranes. The nanocomposites function as sensitive, tunable materials on a flexible platform suited for |

| | | | | | |
|--|--|--------------------------------|--|--|--|
| | | Shiyao Shan (BU), Jin Luo (BU) | | | (bio)sensing applications. The printable nanocomposite scaffolds facilitate integration into wearable medical devices. |
|--|--|--------------------------------|--|--|--|

Start-up Companies Formed

None

Licensing Agreements

None

Royalties

None

Small Business Assistance Provided

During the 2021-2022 program year, FlexMed worked with several small businesses and start-up companies to help them address product design concerns and evaluate new product manufacturing processes. R&D support, evaluation, and testing services were provided to **CathBuddy, Inc.**, (Woodbury, NY) and **Lux Semiconductors** (Albany, NY). Fabrication and pilot manufacturing services were provided to **Tapecon, Inc.** (Buffalo, NY), **Heat Inverse** (Ithaca, NY), and **SunDensity** (Rochester, NY). Finally, FlexMed staff provided funding proposal development assistance to **Organic Robotics Corporation** (Rochester, NY), **Assistance in Motion** (Ithaca, NY), **Advanced Fetal Monitoring, LLC** (Manlius, NY), and **Aincobio/Triton Biodevices** (Syracuse, NY).

Level of Matching Funds Provided and uses

Expenses (include Federal State, local funds & in-kind)

| Operating Expenses | NYSTAR Funding | Matching Funds | | Total |
|----------------------|------------------|--------------------|------------------|--------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$340,949 | \$219,287 | \$214,352 | \$774,588 |
| Indirect Costs | \$51,142 | \$54,821 | \$39,781 | \$145,744 |
| Equipment | \$0 | \$0 | \$0 | \$0 |
| Materials & Supplies | \$15,182 | \$28,672 | \$0 | \$43,854 |
| Tuition | \$0 | \$15,143 | \$0 | \$15,143 |
| Travel | \$1,631 | \$1,735 | \$0 | \$3,366 |
| Subcontractors | \$0 | \$0 | \$0 | \$0 |
| Other | \$213,527 | \$411,371 | \$0 | \$624,898 |
| Total | \$622,431 | \$731,029 | \$254,133 | \$1,607,593 |

** Additional 2:1 Small NYS Company Match \$118,730

Total Federal: 0

Total In-kind: 0

Integrated Electronic Engineering Center (IEEC)
Binghamton University
S.B. Park, Director

Technology Focus Electronics reliability, testing and smart manufacturing.

Importance to NYS

The IEEC assists New York State companies in improving their electronics designs by understanding failure modes and increasing efficiencies. This enhances manufacturability and reliability. Better electronics helps with lower cost of assemblies and lower warranty costs, which makes their products more competitive and profitable in the marketplace.

Description of Achievements

During this program year, the IEEC brought in Indium Corporation as a full member. IEEC research in understanding electro-migration of various solders, as well as atomic modeling of solder composites, was instrumental in Indium joining. Indium has been a sponsor of Binghamton’s Smart Electronics Manufacturing Lab (SEML) by providing solder pastes for their research and now Indium can benefit from CAT research on interconnects and thermal needs. The IEEC has also welcomed **Global Foundries** as a member of the center. IEEC will bring experience with stress testing and test vehicle design to assist Global Foundries with some of their on-going projects. The IEEC has continued their partnership with **Prismark Partners**, two major teardowns led to better understanding of advance packaging. The Apple Studio Ultra showed what is possible in high volume manufacturing using a silicon bridge using 25um interconnect pitch using copper tin interconnects. The AMD Ryzen 7000 3D package using copper to copper hybrid interconnect at 15 um pitch is the most advance high-volume device on the market.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 3 | 6 | \$43,926,650 | \$1,514,500 | \$0 | \$50,015,600 | \$452,500 | \$95,909,250 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|----------------------|------------------------------|-------------------------------|--------------------------------|---|
| 7/1/2021-6/30/2022 | 29 | 46 | 27 | 76 |

Designations and Recognitions

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

| | | | |
|---|--------------|------|---|
| Mechanical Engineers) Fellow | | | |
| Benson Chan, Elected to IEEE EPS Board of Governors | January 2022 | IEEE | https://eps.ieee.org/about/board-of-governors.html |

Federal or Not-for-Profit Grants Awarded

None

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

In September 2021, the IEEC, along with GE and IBM AI Hardware Center, co-hosted the IEEC’s annual Electronics Packaging Symposium (EPS). The event was in virtual format. There were 762 registered attendees, 2 keynote speakers, 24 invited speakers, and 41 student posters. The IEEC also organized 5 webinars on electronics packaging for the local chapter of the Electronics Packaging Society.

Commercialization

The IEEC has assisted in the development of key packages for their member companies and have been actively working with FuzeHub and the CNY Biotech Accelerator to let them know of the CATs capability to assist their startups with their needs to build electronics prototypes in the IEEC Smart Electronics Manufacturing Line (SEML).

Invention Disclosures /Patents

| Disclosure /Patent Name | Inventor | Co-inventor | Licensing Partner | Research Sponsor | Description |
|---|--------------|------------------|-------------------|--|--|
| Laser Markable Translucent Polyurethane-Based Coatings Filled with Silicon Rubber Particles, Disclosure RB-679 | Junghyun Cho | Preeth Sivakumar | | Honeywell | This invention makes conformal coatings on circuit boards tougher, more reliable, and able to be labeled using a laser marker. |
| Magnetic Device to Integrate Multiple Series Primary Parallel Secondary Connected Transformers with Precise Leakage Inductance on One Core, disclosure RB-684 | Pritam Das | | | Not attributable to a specific project, developed from several projects over the years | Integrates a specific type of transformer to feed multiple loads and provide precise leakage inductance without increasing leakage flux. |

| | | | | | |
|--|------------|--|--|--|---|
| Control of POL (Point of Load) Converter, RB-685 | Pritam Das | | | Not attributable to a specific project, developed from several projects over the years | Circuit design for cycle-by-cycle control of specific types of converters with capacitive output filters operating in boundary conduction mode. |
|--|------------|--|--|--|---|

Start-up Companies Formed

None

Licensing Agreements

None

Royalties

None

Small Business Assistance Provided

The IEEC provided resources and equipment to help small business improve the functionality, manufacturability, and reliability of their electronic products. Many of the tools in the IEEC and the Advanced Diagnostics Lab (ADL) are expensive and require specially trained personnel to operate. The CAT provides these tools to small companies at a fraction of the cost. In addition, the Smart Electronics Manufacturing Lab (SEML) is being offered to small and startup companies with their electronic prototyping needs

Level of Matching Funds Provided and uses

Expenses (include Federal State, local funds & in-kind)

| Operating Expenses | NYSTAR Funding | Matching Funds | | Total |
|----------------------|------------------|--------------------|--------------------|--------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$626,653 | \$325,568 | \$793,095 | \$1,745,317 |
| Indirect Costs | \$93,998 | \$73,121 | \$195,513 | \$362,632 |
| Equipment | \$0 | \$2,363 | \$7,000 | \$9,363 |
| Materials & Supplies | \$4,602 | \$30,934 | \$27,302 | \$62,838 |
| Tuition | \$16,815 | \$92,529 | \$72,842 | \$182,186 |
| Travel | \$302 | \$5,570 | \$34,581 | \$40,453 |
| Subcontractors | \$0 | \$0 | \$0 | \$0 |
| Other | \$35,785 | \$57,997 | \$57,948 | \$151,730 |
| Total | \$778,155 | \$588,083 | \$1,188,281 | \$2,554,519 |

**Additional Small NYS Company Match \$22,605

Total Federal: \$58,516

Total In-kind: 0

Center for Advanced Materials Processing
Clarkson University
Devon Shipp, Director

Technology Focus Advanced Material & Materials Processing

Importance to NYS

The mission of the Center at Clarkson University (CAMP) is to excel in applied research and development in advanced materials through collaborations with companies, industries, and entrepreneurs. Such alliances will advance innovation, assist in developing new products, and solve manufacturing challenges, and thus promote economic development in New York State.

Description of Achievements

Notable projects include environmental applications and sustainability (e.g., how polyfluoroalkyl substances (PFAS) can be removed from the environment and destroyed safely), and manufacturing and advanced structures analysis (e.g., analysis of viscoelastic materials used in bonding). The project funding supported innovative and creative research which translated into the products and applications of NY companies such as **L3Harris, GlobalFoundries, Estée Lauder, and DMAX Plasma**, in order to improve their competitiveness.

The center hosted the 24th Annual International Symposium on Chemical Mechanical Planarization (CMP) between August 16 – 19, 2021. CMP plays a central role in the semiconductor industry and CAMP has been leading CMP-related research globally for over three decades. For example, GlobalFoundries, one of NY State’s major chip producers has had years of collaborations with CAMP and the technological developments have yielded significant results and progress.

In addition, CAMP collaborated closely with several small start-up companies; these successes include receiving federal grants (e.g., SBIR and STTR) that allowed them to develop knowledge and products that will allow them to progress from “start up” to “established” companies. One example is **Pharmacoustics Technologies, LLC**, based in Potsdam NY, which received an NSF SBIR grant to develop ultrasonic technologies that would provide real-time preventative quality-monitoring devices for Continuous Manufacturing (CM) production line and stand-alone laboratory equipment for characterizing tablet physical properties. A second small company is **Ducted Wind Turbines**, which filled orders for their unique small wind turbines and has begun small-scale manufacturing in Potsdam NY.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 11 | 2 | \$260,000 | \$1,415,205 | \$1,648,050 | \$445,600 | \$42,500 | \$3,811,355 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|--------------------|-----------------------|------------------------|-------------------------|--------------------------------------|
| 7/1/2021-6/30/2022 | 14 | 17 | 20 | 37 |

Designations and Recognitions

| Awards / Recognition | Date Received | Recognizing Organization | Link |
|---|---------------|--|---|
| Clarkson Biology Student awarded a research grant from the Conchologists of America | 06/21/2022 | Conchologists of America | https://www.clarkson.edu/news/clarkson-biology-graduate-student-wins-research-grant |
| Clarkson student, Andrew Tota, won second place in the 2022 Environmental & Water Resources Institute (EWRI) Congress for his paper | 06/14/2022 | Environmental & Water Resources Institute (EWRI) | https://www.clarkson.edu/news/clarkson-undergraduate-student-awarded-prize-technical-paper |
| Clarkson Professor Selected Fellow of The Electrochemical Society, Class of 2022 | 06/08/2022 | The Electrochemical Society | https://www.clarkson.edu/news/clarkson-professor-selected-fellow-electrochemical-society-class-2022 |
| Clarkson Professor Emeritus Named North American Membrane Society Fellow | 06/01/2022 | North American Membrane Society (NAMS) | https://www.clarkson.edu/news/clarkson-professor-emeritus-named-north-american-membrane-society-fellow |
| Clarkson Mechanical Engineering Professor, Graduate Alumna Win American Welding Society Award | 05/04/2022 | American Welding Society | https://www.clarkson.edu/news/clarkson-mechanical-engineering-professor-graduate-alumna-win-american-welding-society-award |
| Clarkson Receive NSA Grant to Hold Summer REU Program in Math | 05/02/2022 | National Security Agency | https://www.clarkson.edu/news/clarkson-and-suny-potsdam-receive-nsa-grant-hold-summer-reu-program-math |

| | | | |
|---|------------|---|---|
| Clarkson Honors Engineering Student Wins American Concrete Institute Fellowship | 04/19/2022 | American Concrete Institute | https://www.clarkson.edu/news/clarkson-honors-engineering-student-wins-american-concrete-institute-fellowship |
| Clarkson Professor Receives Outstanding Service Award from NNY Section of the American Chemical Society | 04/04/2022 | American Chemical Society | https://www.clarkson.edu/news/clarkson-professor-receives-outstanding-service-award-ny-section-american-chemical-society |
| Clarkson University Chemical and Biomolecular Engineering Professor Awarded NSF CAREER Grant | 03/29/2022 | National Science Foundation | https://www.clarkson.edu/news/clarkson-university-chemical-and-biomolecular-engineering-professor-awarded-nsf-career-grant |
| Clarkson University Professor of Mechanical and Aerospace Engineering elected a Fellow of the American Society of Mechanical Engineers (ASME) | 02/16/2022 | American Society of Mechanical Engineers (ASME) | https://www.clarkson.edu/news/clarkson-university-professor-chunlei-liang-elected-fellowship-american-society-mechanical |
| Clarkson University Prof Awarded \$200K NSF Grant to Mitigate Wind Damage on Buildings | 01/05/2022 | National Science Foundation | https://www.clarkson.edu/news/clarkson-university-prof-awarded-200k-nsf-grant-mitigate-wind-damage-buildings |
| Clarkson Chemistry Professor Receives \$443K NIH Grant for Breast Cancer Research | 01/05/2022 | National Institute of Health | https://www.clarkson.edu/news/clarkson-chemistry-professor-receives-443k-nih-grant-breast-cancer-research |
| Clarkson Graduate Named National Engineering Association's Young Professional of the Year | 12/14/2021 | National Engineering Association | https://www.clarkson.edu/news/freak-nature-clarkson-graduate-named-national-engineering-associations-young-professional-year |

| | | | |
|---|------------|-----------------------------|---|
| Clarkson University Professors Awarded NSF Grant to Develop Inexpensive Sensors for Large-scale Detection of PFAS | 12/14/2021 | National Science Foundation | https://www.clarkson.edu/news/clarkson-university-professors-awarded-nsf-grant-develop-inexpensive-sensors-large-scale |
| Clarkson Professor's Start-up Wins \$50k in FuzeHub's Commercialization Competition | 11/23/2021 | FuzeHub | https://www.clarkson.edu/news/clarkson-professors-start-wins-50k-fuzehubs-commercialization-competition |
| Clarkson Professor Named to NYS Collaborative Climate Research Effort | 11/09/2021 | NYSERDA | https://www.clarkson.edu/news/clarkson-professor-named-nys-collaborative-climate-research-effort |
| Clarkson University Awarded \$2.5 Million Department of Education Grant | 10/06/2021 | US Department of Education | https://www.clarkson.edu/news/clarkson-university-awarded-25-million-department-education-grant |
| Clarkson University Ranked Among the Nation's Best by U.S. News & World Report and by College Factual | 09/20/2021 | U.S. News and World Report | https://www.clarkson.edu/news/clarkson-university-ranked-among-nations-best-us-news-world-report-and-college-factual |
| Clarkson University Awarded National Science Foundation Research Grant for Research Workforce Development in Advanced Algorithms and High-Performance Computing | 09/02/2021 | National Science Foundation | https://www.clarkson.edu/news/clarkson-university-awarded-national-science-foundation-research-grant-research-workforce |
| Interdisciplinary Clarkson University Team Receives One of NSF's 10 Big Ideas Grants to Create | 08/27/2021 | National Science Foundation | https://www.clarkson.edu/news/interdisciplinary-clarkson-university-team-receives-one-nsfs-10-big-ideas-grants-create-new |

| | | | |
|---|------------|-----------------------------|---|
| New Intelligent and Adaptive Firefighting Exoskeleton Suits | | | |
| Clarkson Honors Student Receives Atkins Foundation STEM Scholarship | 08/16/2021 | Atkins Foundation | https://www.clarkson.edu/news/clarkson-honors-student-receives-atkins-foundation-stem-scholarship |
| Clarkson Students Win NSF Fellowships for Mechanistic Machine Learning Research | 08/09/2021 | National Science Foundation | https://www.clarkson.edu/news/clarkson-students-win-nsf-fellowships-mechanistic-machine-learning-research |
| NSF Awards \$250,000 to Three Clarkson University Professors for Biometrics-based Authentication Research | 08/03/2021 | National Science Foundation | https://www.clarkson.edu/news-events/all-news?page=22 |
| Clarkson University Physics Undergrad Honored by American Chemical Society | 07/06/2021 | American Chemical Society | https://www.clarkson.edu/news/clarkson-university-physics-undergrad-honored-american-chemical-society |

Federal or Not-for-Profit Grants Awarded

| Project | Principle Investigator | Co-Investigator | Source | Amount | Duration (yrs.) | Summary |
|---------|------------------------|---|--------------------------|--|-----------------|--|
| 102187 | Marcias Martinez | Sumona Mondal, Craig Merrett | Office of Naval Research | \$40,000.00 (Portion of \$803,272 award total) | 6 | Develop a static strength prediction model that combines in-situ NDI and SHM techniques with computational and analytical modelling. |
| 102325 | Michael Bazzocchi | Marcias Martinez, Kevin Fite, Sean Banerjee, Natasha Banerjee | NSF | \$149,707.00 | 1 year | Investigate the adoption and perception of automated, adaptive, and intelligent firefighter |

| | | | | | | |
|--|-----------------|---------------|--|--------------|----------|---|
| | | | | | | exoskeleton suits by firefighters improve safety |
| | Selma Mededovic | Thomas Holsen | Strategic Environmental Research and Development (Department of Defense) | \$265,271.00 | 4 years | Demonstrate the technical feasibility of using a novel plasma spinning disc reactor for the complete destruction of PFAS. |
| | Robert Thomas | N/A | NASA | \$87,252.00 | 1 year | The Moon to Mars Planetary Autonomous Construction Technology project (MMPACT) focuses on using in-situ lunar resources to manufacture full-scale infrastructure. |
| | Mario Wriedt | N/A | \$7,200 | | 9 months | Wriedt's CAREER project is focused on the design and characterization of novel zwitterionic metal-organic frameworks (ZW-MOFs) with multi-stimulus-responsive properties. |

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

During this reporting period, CAMP Research Professor Richard Partch continued his longtime contact with SLC CITEC Director Steve Lockwood and staff at their Potsdam office, as well as with SCL IDA leaders John Pinkerton and Brian Norton. Discussions reviewed examples of how previous CAMP technical expertise has advanced NNY industry business as well as how to improve future relevant technical interaction with industry managers and personnel. CAMP also sponsored a 5-day X-Ray Crystallography Workshop hosted by Clarkson's Dr. Mario Wriedt and Dr. Peter Mueller from MIT.

Commercialization

CAMP has worked with several NYS companies on projects that have assisted them in the commercialization of their products. Companies include, but are not limited to, DMAX Plasma, Ames Goldsmith, Pharmacoustics, and Ducted Wind Turbines (DTW). As an example of CAMP's continued assistance, DWT made solid progress in the last year, accomplishing a fully commercialized transition from the Gen 2 to the Gen 3 fully commercialized turbine. They added a full-time Sales Manager and planned to ramp up sales in January 2022

Invention Disclosures /Patents

| Disclosure /Patent Name | Inventor | Co-inventor | Licensing Partner | Research Sponsor | Description |
|---|----------------------------|---------------------------------|--------------------------|--------------------------|---|
| Cooling Jet Mechanisms for Stable Growth of a Sheet on the Surface of a Molten Pool | Brian Helenbrook | Alireza Pirnia | N/A | N/A | New mechanisms for cooling the free surface in the horizontal ribbon growth (HRG) crystallization technique are proposed. |
| Portable Apparatus, Materials and Sensors For Rapid Detection Of Per And Poly-Fluoroalkyl Substances (PFAS) | Emanuela Silvana Andreescu | Abd Ur Rehman, Daniel Andreescu | N/A | N/A | A method and sensing system for the determination per and poly-fluoroalkyl substances (PFASs) is disclosed. |
| Materials And Sensors For Rapid Detection Of Per And Poly-Fluoroalkyl Substances (PFAS) | Emanuela Silvana Andreescu | Abd Ur Rehman, Daniel Andreescu | N/A | N/A | A method and sensing system for the determination per and poly-fluoroalkyl substances (PFASs) is disclosed. |
| Compositions and Methods for Producing Electrically Conductive Coordination Polymers and Uses Thereof | Mohamed H. Hassan | Emanuela Silvana Andreescu | N/A | N/A | Compositions, methods, and processes for producing an electrically conductive metalorganic material is disclosed. |
| Parallel Line Lidar Rangefinder | Austin Jantzi | William Jemison | TBD | Office of Naval Research | The parallel line lidar rangefinder exploits the frequency domain image processing to improve on conventional camera rangefinder. |
| Axicon Scatter Filter | Austin Jantzi | William Jemison | TBD | Office of Naval Research | Effect of axicon on the image and methods used to reconstruct the original |

| | | | | | |
|---|-----------------------------|---|--|-----------------------------|---|
| | | | | | image plate from the axicon distorted image. |
| Methods and apparatus for a mechanical testing system to characterize the heterogeneous deformation at microscale | Ajit Achuthan | Natasha Banerjee, Sean Banerjee, Janith Wann, Kavindu Wijesinghe | 522systems, Additive Manufacturing Innovations | National Science Foundation | Some innovative methods and apparatus are used to develop a mechanical testing system to characterize the heterogeneous deformation at microscale. |
| Acid Neutralizing Polymer Material and Method of Making Same | Matthew James Borowiak, Jr. | Richard Earl Partch | Patent Number: 11,078,331 | | A method of preparing an acid reactive functionalized polyamide. |
| Toner Surface Additive | Elizabeth K. Priebe | Christopher Michael Wolfe, Chieh-Min Cheng, Jordan A. Frank, Richard Partch | Patent Number: 11,169,461 | Xerox | There is provided a toner composition and a developer. Surface additives: strontium titanate (SrTiO.sub.3), silica (SiO.sub.2), silicon tetrachloride (SiCl.sub.4). |

Start-up Companies Formed

| Company Name | City | Product/Service | Sector |
|--------------|-------------------|-----------------------|------------|
| HadshaNY LLC | Morrisonville, NY | Suture Removal Device | Healthcare |

Licensing Agreements

None

Royalties

None

Small Business Assistance Provided

CAMP offered the Graduate Fellowship Grant Program to help small businesses and faculties conduct a robust, industry-relevant, applied research and technology transfer program built on Clarkson's expertise in materials science and engineering.

The Grants were to support the preliminary proof-of-concept work necessary to initiate new collaborations with small businesses, develop competitive proposals for industry projects, or externally funded research, such as GOALI and SBIR/STTR applications. Specifically, grant funds supported the stipend for a graduate student. A tuition waiver is in place for these fellowships.

One grant was offered to **Virtus Solis**, a company with expertise in power systems engineering. It was developing a low-cost space solar power system that is five times more cost-effective than existing renewable energy sources. The grant enabled the company to perform the orbital design and analysis for a new renewable space solar power system that will generate and transmit energy to Earth. This system is a low-cost transformative technology that will provide clean, distributed, and sustainable energy globally via a safe low-intensity microwave beam.

Another grant was offered to **KLAW Industries**, a New York State-based startup aiming to market Pantheon to concrete producers in New York State. The grant enabled the research which demonstrated the performance benefits of Pantheon, ensuring its acceptance in construction practice. That further created the opportunity to create a significant economic boon to the Broome County region where KLAW Industries intends to build its pilot plant.

Level of Matching Funds Provided and uses

Expenses (include Federal State, local funds & in-kind)

| Operating Expenses | NYSTAR Funding | Matching Funds | | Total |
|----------------------|------------------|--------------------|------------------|--------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$539,497 | \$454,595 | \$306,957 | \$1,301,049 |
| Indirect Costs | \$80,925 | \$68,189 | \$46,044 | \$195,158 |
| Equipment | \$97,738 | \$29,420 | \$43,473 | \$170,631 |
| Materials & Supplies | \$60,698 | \$100,971 | \$48,158 | \$209,827 |
| Tuition | \$1,488 | \$63,623 | \$38,688 | \$103,799 |
| Travel | \$11,129 | \$8,860 | \$3,297 | \$23,286 |
| Subcontractors | \$0 | \$0 | \$0 | \$0 |
| Other | \$8,546 | \$57,192 | \$122,239 | \$187,977 |
| Total | \$800,021 | \$782,850 | \$608,856 | \$2,191,727 |

**Additional 2:1 Small NYS Company Match \$355,120

Total Federal: 0

Total In-kind: 0

Center for Life Science Enterprise
Cornell University
Matt DeLisa, Director

Technology Focus Life Sciences

Importance to NYS

The Center for Life Sciences Enterprise (CLSE) provides transformative opportunities in New York’s agricultural, veterinary, medical, and engineering sectors. The CLSE offers business services for all stages of the company start up life cycle, from initial concept to securing venture capital funding.

Description of Achievements

The CLSE supported development of promising biotechnologies through matching grants to Cornell researchers who partnered with life sciences companies in human medicine and agriculture, in the areas of human and animal health, agriculture, and nutrition. Seven CAT project grants were awarded during this period, supporting further development and commercialization for six NYS companies.

The CLSE also provided industry education and support through the Entrepreneurship@Cornell summer internship program, which connects Cornell students with NYS life sciences companies for hands-on internships in all areas of product and business development. Eight interns worked with four biotechnology companies, receiving matching funds from the CAT program and the companies for their internship support.

The Center for Life Science Ventures (CLSV), partially funded through the CAT, provided intensive business incubation for 14 NYS life sciences companies, including **Ascribe Biosciences, Dimensional Energy, Ecolectro, Esper Biosciences, Inso Biosciences, Ionica, Kanvas Biosciences, Meiogenix, ORLink, Renerva, Repairogen, Sonder, VitaScan, and Zymtronix**. The companies were awarded over \$10.3 million in grant and employed 96 people in professional and technical positions.

The Biotechnology Resource Center (BRC), in partnership with the CLSE as part of the Cornell Institute of Biotechnology, provided scientific services and expertise to eight NYS companies through the BRC Bioinformatics, Epigenomics, Genomics, Imaging, and Proteomics core facilities.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 10 | 0 | \$275,999 | \$5,000 | \$3,669,998 | \$4,842,996 | \$0 | \$8,793,993 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|----------------------|------------------------------|-------------------------------|--------------------------------|---|
| | 23 | 7 | 4 | 8 |

Designations and Recognitions

None

Federal or Not-for-Profit Grants Awarded

| Project | Principle Investigator | Co-Investigator | Source | Amount | Duration (yrs) | Summary |
|--|------------------------|-----------------|-----------------------------------|-----------|----------------|--|
| Microscope acquisition – BRC Imaging facility | Rebecca Williams | | NIH | \$228,035 | 1 | Acquisition of an automated phase and fluorescence microscope for Imaging research. |
| High through-put label-free detection system - biomolecular interaction analysis | Matthew DeLisa | | NIH | \$349,701 | 1 | Acquisition of an Octet system for use in new biomolecular interaction core facility services. |
| Cassava pangenome | Cinta Romay | | Bill and Melinda Gates Foundation | \$368,113 | 2 | Cassava pangenome research for advanced breeding in a vegetatively propagated species. |
| Mining alleles for climate change adaptation | Cinta Romay | | Bill and Melinda Gates Foundation | \$705,000 | 3 | Mining useful alleles for climate change adaptation, using CGIAR gene banks. |

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

In partnership with the Entrepreneurship@Cornell program, the CAT conducted a summer internship program with NYS startup companies in the life sciences fields, including agriculture and biofuels, industrial safety, and laboratory product and service technology development. The interns gain invaluable industry experience and training, while the small company gains Cornell students' expertise and staffing support they could not otherwise receive. The following companies participated in 2022: **Apricity Solutions, Capro-X, Harrick Plasma, and Esper Biosciences.**

Commercialization

Cornell researchers partnered with NYS companies in medicine and agriculture. Larry Bonassar/3DBio Therapeutics evaluated injectable collagen patches for disc herniation repair. Roy Cohen/TET Medical scaled production of a rapid POC diagnostic for concussion and stroke. Iwijn De Vlaminck/Rheonix developed a same-day, cell-free RNA liquid biopsy assay. Marc Fuchs/Ascribe Biosciences evaluated efficacy of a nematode signaling molecule in suppressing viral diseases in grapevines. David Putnam/Bausch & Lomb developed an artificial lipid next-generation dry eye treatment. Jason Spector/NovaSterilis streamlined production of medical-grade acellular cartilage grafts for reconstruction. Joyce Van Eck/Ascribe Biosciences developed transgenic cell lines to enable efficient identification of novel molecules.

Invention Disclosures /Patents

None

Start-up Companies Formed

None

Licensing Agreements

None

Royalties

\$515,405 reported in aggregate for confidentiality.

Small Business Assistance Provided

The Center for Life Science Ventures (CLSV), Cornell’s business incubator for life sciences companies, is funded in part by the CAT. It focuses on accelerating R&D of client companies’ technology products, by assisting companies with developing business plans, securing investment, and strengthening management. The following businesses participated in the incubation program: **Ascribe Biosciences, Dimensional Energy, Ecoelectro, Esper BioSciences, Inc., Inso BioSciences, Inc., Ionica Sciences, Kanvas Biosciences, MeioGenix, ORLink, Renerva, Repairogen, Sonder Research X, VitaScan Technologies** and **Zymtronix**. The Biotechnology Resource Center (BRC) provided CAT-subsidized core facility services to eight NYS businesses.

Level of Matching Funds Provided and Uses**Expenses (include Federal State, local funds & in-kind)**

| Operating Expenses | NYSTAR Funding | Matching Funds | | Total |
|----------------------|------------------|--------------------|---------------|------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$222,730 | \$0 | \$0 | \$222,730 |
| Indirect Costs | \$33,410 | \$0 | \$0 | \$33,410 |
| Equipment | \$0 | \$0 | \$0 | \$0 |
| Materials & Supplies | \$28 | \$0 | \$0 | \$28 |
| Tuition | \$0 | \$0 | \$0 | \$0 |
| Travel | \$0 | \$0 | \$0 | \$0 |
| Subcontractors | \$110,000 | \$0 | \$0 | \$110,000 |
| Other | \$43,855 | \$20,426 | \$0 | \$64,281 |
| Total | \$410,023 | \$20,426 | \$0 | \$430,449 |

** Additional 2:1 Small NYS Company Match \$20,426

Total Federal: 0**Total In-kind: 0**

Advanced Science Research Center Sensor CAT
City University of New York
Dr. Rein Ulijn, Director

Technology Focus Sensor Technology

Importance to NYS:

The Advanced Science Research Center (ASRC) Sensor CAT (Center) continues to expand its role in building awareness of CUNY resources within a growing early-stage frontier technology; supporting areas of technology development ranging from Health and Human Sciences to new areas of city interest in Sustainable Fashion, Food, and Biomaterial Technology. Sensors and Sensing technology will continue to expand their many roles in the “smart” technology that is integrated into products governing everything from biomedical devices to advanced manufacturing, to flash flood awareness. The importance the program plays can further be seen with the increasing interest of local government (NYCEDC) to seek its support and collaboration on economic development projects in the city, and West Harlem specifically.

Description of Achievements

Efforts in outreach have led to a notable example of a new contracted CAT project at Medgar Evers College (MEC) where the CAT was successful in bringing in the college’s first major industry sponsored research contract, a multi-year agreement between the NYS-company Natrion and the MEC lab.

The ASRC Sensor CAT is a key partner in the successfully awarded NYCEDC Incubator Infrastructure project proposed by City College (CCNY) and funded through the LifeSci NYC division of economic development. This will offer both CCNY and ASRC (as well as CUNY) an incubator with the necessary lab instrumentation to cater to early-stage technology startups being supported by the CAT program and looking to locate within proximity to the center’s additional resources.

Finally, the CAT was able to organize and host a successful ribbon-cutting event for the program which was attended by supporters including the US Representative Adriano Espaillat (13th District – Harlem), Dr. Ted Latvic, SVP Global Foundries, Sir Jim McDonald, President UK Royal Academy of Engineers, among many CUNY innovation and career development organizations. The Sensor CAT is looking forward to making this an annual event to be held each Earth Week, as it ties into multiple events during the week hosted by the CAT and ASRC’s Nanoscience Initiative.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 0 | 0 | \$0 | \$10,463 | \$1,826,616 | \$0 | \$0 | \$1,837,079 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|---------------|-----------------------|------------------------|-------------------------|--------------------------------------|
| 2021-2022 | 11 | 6 | 2 | 34 |

Designations and Recognitions

None

Federal or Not-for-Profit Grants Awarded

None

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

CUNY Master's Program in Nanoscience graduated its first student, who was successful in landing a full-time job at the world's leading semiconductor lithography company, ASML (Wilson, CT). The CAT partnered the student with the startup company, VYIR, where he was able to work with the founder in the ASRC's Nanofabrication Facility training on instrumentation similar in principle to microelectronics industry tools and environment where he is now working.

The CAT successfully piloted CUNY's first STEM-focused entrepreneurship course for Grad Students. Five graduate students participated in the course with ranging research applications from quantum technology to bioinspired polymer membranes to turmeric-based wound care. The CAT's Business Development Director led four separate class panels, offering students the opportunity to engage with deep tech startup founders, Venture Capitalists, IP Legal Experts, and Industry scientist innovators. Sensor CAT continued its partnership with NYCEDC program LifeSciNYC to subsidize and co-fund a total of 17 CUNY student internships beginning June 2022.

Commercialization

The CAT has been engaging with Binghamton Universities' CAT (CAMM) and specifically their CAT focused on Flexible Hybrid Electronics (FlexMed) with the goal of connecting the Sensor-themed focus of the Center and associated developing projects in sensor-based device tech to the resources at Binghamton's CAT. ASRC Sensor CAT was invited to attend Binghamton's annual CAMM-led event Oct. 22. Sensor CAT also worked on the submission of an NSF Engine Phase I proposal in the Fall '22 with support from CATs at Binghamton University, Clarkson University, RPI, and Syracuse University. The goal of this Phase I will be creating an Engine connecting upstate – downstate NYS resources (heavily leveraging CAT/COE programs) focused on the theme of complex, novel biosensing products commercialization.

Invention Disclosures /Patents

| Disclosure Patent Name | Inventor | Co-inventor | Licensing Partner | Research Sponsor | Description |
|---|-----------------|----------------------|-----------------------------|-------------------|--|
| Apparatus and method to detect airborne objects using waveform analysis of reflected and scattered electromagnetic radiations | Dr. Moran Dagan | F.Moshary/A. Golovin | City University of New York | Atolla Technology | Electromagnetic radiation, emitted from a transistor, interacts with moving airfoils on an airborne object to produce reflected and scattered electromagnetic radiation, that in turn is analyzed to detect, classify and/or determine the orientation of the airborne object. |

Start-up Companies Formed

| Company Name | City | Product/Service | Sector |
|----------------|---------------|-----------------|--|
| Nomi Materials | New York City | biomaterial | Sustainable Personal Healthcare Products |

Licensing Agreements

None

Royalties

None

Small Business Assistance Provided

The CAT funded the attendance of two promising startups, VYIR, Inc. and Next-Generation Quantum Corp. (NGQ) to attend the NYSTAR Innovation Summit October 2021. The CAT Director of Business Development (BD) organized a meeting at the Summit with AFRL’s Deputy Director to introduce him to NGQ’s founders to discuss their Quantum computing device which they are beginning to work on in the ASRC Nanofabrication facility. This meeting with AFRL has been part of a larger effort by the BD Director to introduce key DoD stakeholders to CAT ASRC resources, with a focus on building ties for the first time with AFRL-site in Rome, NY.

**Level of Matching Funds Provided and uses
Expenses (include Federal State, local funds & in-kind)**

| Operating Expenses | NYSTAR Funding | Matching Funds | | Total |
|----------------------|------------------|--------------------|------------------|--------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$281,688 | \$341,227 | \$182,197 | \$805,112 |
| Indirect Costs | \$43,321 | \$68,245 | \$45,549 | \$156,115 |
| Equipment | \$0 | \$0 | \$0 | \$0 |
| Materials & Supplies | \$2,594 | \$23,462 | \$0 | \$26,056 |
| Tuition | \$0 | \$0 | \$0 | \$0 |
| Travel | \$1,670 | \$4,000 | \$0 | \$5,670 |
| Subcontractors | \$0 | \$0 | \$0 | \$0 |
| Other | \$6,262 | \$0 | \$0 | \$6,262 |
| Total | \$335,535 | \$436,934 | \$227,746 | \$1,000,215 |

** Additional 2:1 Small NYS Company match \$249,342

Total Federal: 0

Total In-kind: 0

Center for Advanced Technology in Telecommunications
New York University, Polytechnic University
Shivendra Panwar, Director

Technology Focus Wireless/Networking, Cyber Security, and Data Science/Applications

Importance to NYS

The Center for Advanced Technology in Telecommunications (CATT) at New York University (NYU); with support from Columbia University, focuses on information technology and telecommunications. The CATT conducts applied research with industry as well as industry-oriented education and training, in three main areas: Wireless networks, Network Security and Network Applications.

Description of Achievements

The New York Tech economy continues to grow with Google, Facebook, and Amazon, along with smaller tech companies, continue to expand their footprint in NY City. The availability of deep pools of potential employees, convenient public transport and last, but not the least, the research and training available at area universities like NYU, Columbia, and CUNY, have facilitated this trend.

NYU Wireless has established itself as the leading center for fifth generation (5G) cellular wireless research in the US. There is no US company in this area: Nokia and Ericsson, the two major players in the US, are headquartered in Finland and Sweden, respectively. CATT is well placed to lead this effort when funding is in place for a national effort. Investing in the continued success of CATT and NYU Wireless, NYU Tandon will be hiring a new tenure track faculty member in this area during the next academic year. CATT sees a renewed effort at the national level to reestablish US leadership in this area, as well as related areas, with the passage of the Chips and Science Act, and other universities are investing in this area after a long period of under-investment. A Wireless Industry-NSF joint program related to this effort, called RINGS, led to the funding of three NYU faculty, the largest for any university.

CATT’s cybersecurity faculty have pioneered a graduate-level online cybersecurity program. The NYU Cyber Fellows program offers scholarships that result in one of the lowest-cost online master’s degrees in the country, at \$18,000, and develops highly skilled technical graduates ready to step into the growing cybersecurity gap. The starting salary of graduates is expected to be about \$120,000. CATT is working to enroll Federal government employees from a national security agency into this program.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 27 | 0 | \$3,591,627 | \$2,305,000 | \$3,505,900 | \$76,127,014 | \$43,033,579 | \$128,563,120 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|----------------------|------------------------------|-------------------------------|--------------------------------|---|
| 07/2021-06/2022 | 25 | 22 | 7 | 30 |

Designations and Recognitions

None

Federal or Not-for-Profit Grants Awarded

| Project | Principle Investigator | Co-Investigator | Source | Amount | Duration (yrs.) | Summary |
|---|------------------------|-----------------|-----------------------------------|-------------|---|--|
| SaTC: TTP: Medium: Securing Python's Software Supply Chain | Justin Cappos | | National Science Foundation (NSF) | \$800,000 | July 1, 2021– June 30, 2023 (Estimated) | Capture metadata about the steps of the Python software supply chain systematically. Millions of users will be more protected against a variety of attacks. |
| SII-Center: SpectrumX - An NSF Spectrum Innovation Center | Thomas Marzetta | | University of Notre Dame | \$40,000 | September 15, 2021– August 31, 2022 (Estimated) | SII-Center will educate and develop a workforce needed to support industries which rely heavily on wireless technologies. SpectrumX will pursue its research strategy in scientific receiver hardware with interference measurement and mitigation capabilities. |
| Development and Delivery of Responsible AI (RAI) Curriculum at Facebook | Julia Stipanovich | | Facebook, Inc | \$1,000,000 | October 1, 2021 - December 31, 2022 (Estimated) | This project tackles the issues of ethics in AI, legal compliance, data quality, algorithmic fairness and diversity, transparency of data and algorithms, privacy, and data protection. |
| Nutritional Labels for Credit Decisions: Strengthening Accountability Through Public Disclosure | Julia Stipanovich | | JPMorgan Chase Bank | \$100,000 | October 8, 2021– September 30, 2022 (Estimated) | Ranking Facts, a Web-based application that generates a "nutritional label" for rankings is being presented. Ranking Facts on real datasets from different domains will be showcased. |
| Multimodal Transparent And | Claudio Silva | | Defense Advanced Research | \$1,195,483 | November 23, 2021 - | The NYU group aims to develop AI technologies to help people perform |

| | | | | | | |
|--|------------------|--|-----------------------------------|-------------|---|--|
| Interpretable Personal Assistant | | | Projects Agency | | November 22, 2022 | complex tasks while making these users more versatile by expanding their skillset – and more proficient by reducing their errors. |
| DSP And High-Resolution Angle Estimation Algorithms | Ivan Selesnick | | NXP USA, Inc | \$206,665 | February 1, 2022 – December 31, 2023 | NYU will perform additional research to refine and improve upon the research outcome of the last activities in the areas of interference mitigation DSP and high-resolution angle estimation algorithms. |
| Demonstrating Attacks and Defenses on Autonomous Platforms Driven by Deep Networks | Farshad Khorrami | | Army Research Office (ARO) | \$255,240 | February 1, 2022 – January 31, 2023 (Estimated) | The PIs are developing methodologies to defend against vulnerabilities of deep neural networks, the state-of-the-art machine learning approach, to both test/inference and training time attacks |
| Offshore Wind Innovation Accelerator | Kurt Becker | | Equinor Wind Services, LLC | \$2,341,602 | April 26, 2022 – April 25, 2025 (Estimated) | Establish and operate an incubator/accelerator for start-ups that develop and implement technologies that support the NY offshore wind industry. |
| Collaborative Research: SaTC: CORE: Medium: Methods and Tools for Effective, Auditable, and Interpretable Online Ad Transparency | Damon McCoy | | National Science Foundation (NSF) | \$383,708 | May 1, 2022 – April 30, 2026 (Estimated) | This project seeks to better understand current transparency mechanisms, develop new methods for collecting transparency data, and design new mechanisms that make transparency more useful; ultimately increasing end users' trust in targeted advertising. |
| RINGS: Building Next Generation Resilient | Sundeep Rangan | Farshad Khorrami, Ramesh Karri, Elza Erkip | National Science Foundation (NSF) | \$322,741 | May 1, 2022 - April 30, 2025 (Estimated) | The broad goal of this project is to develop methods to build resilient and secure NextG wireless systems from potentially |

| | | | | | | |
|--|-----------------|--|-----------------------------------|-----------|--|--|
| Wireless Systems from Unsecure Hardware | | Siddharth Garg | | | | unsecure hardware components. |
| RINGS: Resilient Delivery of Real-Time Interactive Services Over NextG Compute-Dense Mobile Networks | Andreas Molisch | Elza Erkip | University of Southern California | \$299,355 | May 1, 2022 - April 30, 2025 (Estimated) | The goal of this project is to develop a general mathematical framework as well as concrete algorithms to provide such RTI services with guaranteed latencies. |
| RINGS: Deployable End-to-End Resilience for Critical Internet Applications via Modular Redundancy | Dan Rubenstein | Todd Arnold, Ethan Katz-Bassett, Henning Schulzrinne | National Science Foundation (NSF) | \$311,075 | May 1, 2022 - April 30, 2025 (Estimated) | This research project prepares applications for the inevitable component failures by providing a shadow network: pre-planned alternatives ready to deliver critical services should the primary services, networks, or paths fail. |
| Collaborative Research: SaTC: CORE: Medium: An Incident-Response Approach for Empowering Fact-Checkers | Nasir Memon | | National Science Foundation | \$396,000 | May 1, 2022 - April 30, 2026 (Estimated) | This project combines the complementary information processing strengths of humans and computation to transform the efficiency, effectiveness, and scale of fact checking. |
| RINGS: Resilient Edge Networks with Data-driven Model-based Learning | Yong Liu | Shivendra Panwar, Pei Liu, Zhong-Ping Jiang | National Science Foundation (NSF) | \$334,277 | May 1, 2022 - April 30, 2025 (Estimated) | The project is developing novel hybrid learning solutions for autonomous and resilient wireless edge networks from the angle of joint provisioning, allocation, and scheduling of communication and computation resources. |

| | | | | | | |
|--|------------------|--|--|-------------|---|--|
| CPS: Medium: Aerial Co- Workers: Augmenting Physical and Cognitive Human Capabilities | Giuseppe Loianno | ChenFeng,S Farok Atashzar | National Science Foundation (NSF) | \$874,936 | January 1, 2022 - December 31, 2024 (Estimated) | This project studies the algorithmic foundations and methodological frameworks to augment human capabilities via a novel form of physical and cognitive collaboration between human and multi-agent robotic systems. |
| Dataset Search and Ranking for Data Augmentation and Explanation | Juliana Freire | Christopher Musco | National Science Foundation | \$1,093,195 | September 1, 2021 - August 31, 2024 (Estimated) | This project will develop novel algorithms for rapidly computing and searching for dataset relationships. |
| SaTC: TTP: Small: TRACE: Tracking Run-time Anomalies in Code Execution | Farshad Khorrami | Ramesh Karri | National Science Foundation | \$499,748 | July 15, 2021 - June 30, 2023 (Estimated) | For on-demand and continuous run-time integrity verification of fielded devices and detection of firmware/software anomalies, TRACE deploys lightweight measurer components to target devices to collect multi-modal on-device, time-series measurements. |
| Co- Development of Telehealth, Remote Patient Monitoring, and AI- based Tools for Inclusive Technology- Facilitated Healthcare Work of the Future | Oded Nov | Rumi Chunara, Batia Weisenfeld , Devin Mann, Olugbenga Ogedegbe | National Science Foundation | \$2,515,999 | October 15, 2021 - September 30, 2026 (Estimated) | The project focuses on the growth of Data-Intensive Technologies (DIT), which include telehealth and AI-based tools. The project's approach to transition to scale centers on alleviating existing misalignment between current healthcare work and data-intensive technologies. |
| NSF-AoF: CNS Core: Small: | Marco Mezzavilla | Sundeep Rangan | National Science | \$464,000 | October 1, 2021- September | The goal of this project is to advance the understanding of UAV mmWave channel |

| | | | | | | |
|--|----------------|----------|-----------------------------|-----------|--------------------------------|--|
| AERIAL: Air-to-Ground Channel Modeling and Tracking at Millimeter-Wave | | | Foundation-on | | 30, 2024 (Estimated) | propagation and, accordingly, design novel directional channel tracking algorithms to improve UAV mmWave connectivity. |
| EAGER: SUPER: Optically enhanced superconductivity in hydrogen-based materials | Matteo Mitrano | Yao Wang | National Science Foundation | \$299,999 | August 1, 2021 - July 31, 2023 | This project aims to gradually lower the pressure requirements in hydrogen-rich materials by modifying their microscopic properties with ultrafast laser pulses. |

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

CATT’s cybersecurity faculty has pioneered online certificate and graduate-level cybersecurity programs, offering a certificate and master’s degree scholarships. CATT continues to work with NYU Tandon’s enterprise learning team to develop tailored programs and course offerings for the top 10 leading industry partners, with more than 12,000 eligible employees, contributing to the economic development of New York State. Certificates and Masters level programs in mobility, network security, offensive security, and power engineering, have been developed for working professionals. CATT researchers have design and implement an education platform that allows K12 students to learn STEM concepts through running experiments on a city scale advanced wireless testbed deployed in NYC, called COSMOS. CATT works with Verizon on developing Virtual Reality (VR) and Augmented reality (AR) K12 STEM labs. Using VR and AR technologies seems to be a significant enabler of students’ engagement with the educational process.

Commercialization

CATT works closely with companies to translate research into know-how for the companies. A typical project involves faculty and students working with companies to identify engineering problems and their solution. These solutions often tap into the cumulative know-how and experience of CATT, which is an immense help to corporate clients. NYU also helps in the patent and commercialization process. There is an active effort to market and license patents. Additionally, through the Future Labs incubators, and [NYU Tech Venture Workshop](#) (TVW) entrepreneurs are encouraged to turn intellectual property into startup companies. TVW is based on the [NSF I-Corps](#) curriculum.

Invention Disclosures /Patents

| Disclosure /Patent Number | Inventor | Co-inventor | Licensing Partner | Research Sponsor | Description |
|---------------------------|--|-------------|-------------------|--------------------------------------|--|
| US11063879B2 | Menglei Zhang, Marco Mezzavilla, Sundeep Rangan, Shivendra S. Panwar | N/A | N/A | New York University | Determining A Receive Window Of A Receiving Device That Reduces Bufferbloat In A Wireless Communications System, Such As That Caused By TCP Dynamics Over Millimeter Wave Links. |
| US20210251511A1 | Kalle Levon, Hao-Chun Chiang, Nikita Grigoryev, Freya Schnabl, Ivan Selesnick | N/A | N/A | New York University | Analysis Of Gas Samples For Determination Of Physiological States And Disease States |
| US11103168B2 | Roozbeh Kiani, Davood Shahrjerdi, Bayan Nasri | N/A | N/A | New York University | Systems And Methods For In Vivo Detection Of Electrophysiological And Electrochemical Signals |
| US11094842B2 | Stephen W. Bedell, Keith E. Fogel, Bahman Hekmatshoar-Tabari, Devendra K. Sadana, Ghavam G. Shahidi, Davood Shahrjerdi | N/A | N/A | International Business Machines Corp | Heterojunction Photovoltaic Device And Fabrication Method |
| US20200177312A1 | Robert Lind Olesen, Eldad M. Zeira, Peter J. Voltz, Yongwen E. Yang, Qingyuan Dai, Chang-Soo Koo, I-Tai Lu, KunJu Tsai | N/A | N/A | InterDigital Technology Corp | Method and apparatus for implementing space time processing with unequal modulation and coding schemes |
| US20200383158A1 | Vishal Misra, Daniel S. Rubenstein | N/A | N/A | Columbia University of New York | Systems, methods, and media for providing multi-homing |
| US20210289519A1 | Yudong Yang, Vishal Misra, Daniel | N/A | N/A | Columbia University of New York | Systems, methods, and media for scheduling traffic of a communication session between an application on a |

| | | | | | |
|--|-----------------------------|--|--|--|----------------------------------|
| | Rubenstein, Yuming Jiang | | | | Wi-Fi network and another device |
|--|-----------------------------|--|--|--|----------------------------------|

Start-up Companies Formed

None

Licensing Agreements

None

Royalties

None

Small Business Assistance Provided

N/A

Level of Matching Funds Provided and uses

Expenses (include Federal State, local funds & in-kind)

| Operating Expenses | Matching Funds | | | Total |
|----------------------|------------------|--------------------|--------------------|--------------------|
| | NYSTAR Funding | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$496,630 | \$1,162,822 | \$1,219,094 | \$2,878,546 |
| Indirect Costs | \$74,494 | \$235,568 | \$242,085 | \$552,147 |
| Equipment | \$3,179 | \$17,362 | \$35,972 | \$56,513 |
| Materials & Supplies | \$4,723 | \$252,565 | \$221,522 | \$478,810 |
| Tuition | \$64,792 | \$15,320 | \$37,881 | \$117,993 |
| Travel | \$2,658 | \$6,638 | \$9,082 | \$18,378 |
| Subcontractors | \$112,997 | \$0 | \$0 | \$112,997 |
| Other | \$0 | \$0 | \$0 | \$0 |
| Total | \$759,473 | \$1,690,275 | \$1,765,636 | \$4,215,384 |

**Additional 2:1 Small NYS Company Match \$10,495

Total Federal: 0

Total In-kind: 0

Center for Advanced Technology Future Energy Systems (CFES)
Rensselaer Polytechnic Institute
Dr. Jian Sun, Director

Technology Focus Energy

Importance to NYS First designated as a CAT in 2004, the Center for Advanced Technology Future Energy Systems (CFES) supports NYS energy initiatives and the energy industry through applied research, technology transfer, education, and outreach. CFES research focuses on renewable energy, energy storage, energy efficiency, green hydrogen, and smart-grid technologies to enable a sustainable, resilient, and economical future energy system.

Description of Achievements

During this reporting period, CFES had 11 faculty members engaged in collaborative research with NYS companies on 17 projects. The companies included **IBM, SelfArray, StoreEn Technologies, Orion Polymer, General Electric, NYPA, Smarter Grid Solutions, BioChemInsights, WSP Wind Energy, Corning, Green Power Tower, Eaton CH, and MIMiC**. Research focus areas included energy storage, hydrogen generation, solid-state super-capacitors, wind turbines, distributed energy resources management, electrochemical cofactor regeneration, neural network models, glass composites, high voltage SiC power devices, additive manufacturing, and micro-climate solid-state HVAC.

CFES faculty were very active in pursuing new funding opportunities. Twelve new proposals were submitted. These include Radiative Heat Transfer (DARPA); Sample Reinforcement Learning (IBM); Testing and Validation of Heat Pump Prototype (Energant); High Performance Solid State Heat Pumps (NSF with MIMiC Systems); SiC and GaN Power Devices (Power America Institute); Building Thermal Loads (NSF); Interlinked Clean Energy Communities (University of Vermont); Simulations and Characterization of Radiation-Tolerant Diamond Power Devices (Euclid Beamlabs); Electrochemical Green Hydrogen (DOE and Carnegie Mellon); Materials and Chemistry for Redox Flow Battery (DOE); Enhanced Power System Resiliency (NSF); and Alternative Proton Exchange Membranes for Hydrogen Technologies (NYSP2i).

In the spring of 2022, the Center resumed in-person business development. This included in-person company meetings and NY-BEST's Capture the Energy Conference. Additionally, the Center collaborated with FuzeHub and the CEG to host the Green Energy Forum in April, with the Center Director delivering a keynote at the Forum.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 4 | 4 | \$864,000 | \$136,300 | \$1,053,119 | \$2,148,872 | \$0 | \$4,202,291 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|---------------|-----------------------|------------------------|-------------------------|--------------------------------------|
| 21-22 | 13 | 13 | 4 | 10 |

Designations and Recognitions

None

Federal or Not-for-Profit Grants Awarded

| Project | Principle Investigator | Co-Investigator | Source | Amount | Duration (yrs) | Summary |
|--|------------------------|-----------------|--------|-----------|----------------|---|
| Stable diacid coordinated quaternary ammonium polymers for 80-150 C fuel cells | Chulsung Bae | | DOE | \$178,015 | 2.5 | By increasing the operational flexibility, this class of fuel cell can simplify the requirements for heat and water management. |

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

During fiscal 21-22, CFES supported 2 postdocs (\$49,635.32), 9 graduate students (\$53,796.25 in stipends and \$55,672.50 in tuition) and 1 undergrad (\$838.20 in stipend).

Commercialization

Of the 13 New York State companies served, four are start-ups and three are small businesses. Working with CFES is an integral part of the development of their technology and commercialization strategies. **MIMiC** used part of their \$330K NYSERDA award to work with CFES to validate and characterize their prototype. This contributed to their raising \$210K in capital funding. **SelfArray**, another start-up, was awarded \$195,000 in federal funding. **Orion Polymer**, a small company born out of CFES research, generated \$234K in revenue in fiscal 2022. **BioChemInsights**, another small company that worked with CFES, was awarded \$95,000 in federal funding.

Invention Disclosures /Patents

None

Start-up Companies Formed

None

Licensing Agreements

None

Royalties

None

Small Business Assistance Provided

An integral part of the Center’s relationship with start-ups and small businesses is to bring awareness of third-party funding opportunities from relevant federal funding agencies such as DOE, NYSERDA, National Offshore Wind R&D Consortium (NOWRDC), and NASA. In addition, CFES regularly introduces start-ups and small businesses to other resources available to them through the NYS small business ecosystem. The organizations include ESD, CEG, FuzeHub, NextCorps, and WDI.

CFES encouraged and assisted many small-business partners to apply and compete in FuzeHub’s annual Commercialization Competition. Microrganic, a CFES industry collaborator who has developed innovative energy-efficient wastewater technology, competed, and became a finalist. CFES promoted the New York State Innovation Summit at Turning Stone in Verona, NY to small business partners. Aestus Inc., Brash Power, Combined Energies, and Microrganic all attended and exhibited their technologies.

CFES highlighted industry partner Actasys in a story-pitch led by NYSTAR. Actasys, whose technology was born out of RPI labs, is a Brooklyn-based manufacturer of air jet actuators sold to the automotive industry. The pitch led to a feature on Actasys in the Brooklyn Eagle, a “NYSTAR Asset Highlight” FuzeHub Blog, and participation with CFES as panelists in a NYSTAR webinar.

Level of Matching Funds Provided and uses

Expenses (include Federal State, local funds & in-kind)

| Operating Expenses | Matching Funds | | | Total |
|----------------------|------------------|--------------------|--------------------|--------------------|
| | NYSTAR Funding | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$562,555 | \$402,102 | \$963,608 | \$1,928,265 |
| Indirect Costs | \$ 84,382 | \$39,971 | \$136,148 | \$260,501 |
| Equipment | \$120,271 | \$61,629 | \$42,398 | \$224,298 |
| Materials & Supplies | \$76,335 | \$36,341 | \$159,887 | \$ 272,563 |
| Tuition | \$55,673 | \$155,883 | \$462,917 | \$674,473 |
| Travel | \$8,363 | \$4,795 | \$25,675 | \$38,833 |
| Subcontractors | \$30,000 | \$0 | \$373,581 | \$403,581 |
| Other | \$17,622 | \$7,249 | \$14,336 | \$39,207 |
| Total | \$955,201 | \$707,970 | \$2,178,550 | \$3,841,721 |

** Additional 2:1 Small NYS Company Match \$147,181

Total Federal: \$1,169,197

Total In-kind: \$0

Additive Manufacturing and Multifunctional Printing (AMPrint) Center for Advanced Technology
Rochester Institute of Technology
Denis Cormier, Director

Technology Focus Additive Manufacturing and 3D Printing

Importance to NYS

NY document printing companies have shed tens of thousands of jobs in recent years. 3D printing is closely related to document printing though, and this represents a unique opportunity for NYS. The AMPrint Center is helping OEM's, material providers, and end users tap into the rapidly growing 3DP market.

Description of Achievements

When the AMPrint CAT was founded in 2015, a fundamental premise of the Center's proposal was built around the notion that New York State's ailing printing industry could be revitalized by refocusing it on the rapidly growing 3D printing market sector. The current reporting period provided considerable evidence that the AMPrint Center's early vision is bearing fruit. **Xerox** and **Kodak** are both directly and indirectly involved in numerous additive manufacturing initiatives. The AMPrint Center has also been instrumental in attracting several out of state 3D printing companies, such as **Impossible Objects**, **Layer Metrics**, and others that cannot yet be named due to non-disclosure agreements, to establish business operations in New York within the reporting period. One of the AMPrint Center's two startup companies received an NSF Phase I SBIR award with assistance from the AMPrint Center. The AMPrint Center has also added several new pieces of equipment to support industry partnerships. Of particular note is Xerox's ElemX molten metal 3D printer whose development has been greatly accelerated via collaboration with the AMPrint Center. The AMPrint Center also installed a Nachi robot that is supporting startup companies working on 3D printing of very large structures.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 16 | 4 | \$517,000 | \$2,738,000 | \$148,143 | \$80,000 | \$0 | \$3,483,143 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|----------------------|------------------------------|-------------------------------|--------------------------------|---|
| 2021 - 2022 | 12 | 12 | 3 | 14 |

Designations and Recognitions

| Awards / Recognition | Date Received | Recognizing Organization | Link |
|--|----------------------|---------------------------------|---|
| AMPrint Center Director Denis Cormier –Fulbright Scholar | Feb. 2022 | Fulbright Program | https://www.wit.ie/news/news/wit-and-seam-welcome-fulbright-scholar-prof-denis-cormier |

Federal or Not-for-Profit Grants Awarded

| Project | Principle Investigator | Co-Investigator | Source | Amount | Duration (yrs) | Summary |
|--|------------------------|----------------------------|--------------------------------|-----------|----------------|--|
| Development of Advanced Manufacturing Technologies and Testing Methods | Christophe Lewis | Denis Cormier, Brian Landi | DOD U.S. Army Materiel Command | \$171,568 | 1.5 | This project is looking at development of novel materials for 3D printing that allow local control of mechanical properties. |

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

AMPrint Center faculty and staff reached industry via workshops and webinars. Workshops touched on how 3D printing can lead to more efficient products. Webinars and other talks addressed topics such as 3D printing with strong light weight carbon fiber composites, 3D printing metal components, 3D printed electronics, and the power of industry-academia R&D partnerships.

Commercialization

The AMPrint Center has seven joint patent applications with **Xerox** based upon research originating within the AMPrint Center for 3D printing via metal droplet jetting. Startup company **PrisAM** was assigned rights to IP developed with AMPrint Center faculty and resources. **PrisAM** has received two funded R&D awards this year based on that assigned IP. Lastly, it worked with **Myerson** to develop a 3D printer to produce custom dental appliances, and the 3D printer is to be built in Rochester, NY.

Invention Disclosures /Patents

| Disclosure /Patent Name | Inventor | Co-inventor | Licensing Partner | Research Sponsor | Description |
|---|-------------------|--|-------------------|------------------|---|
| Magnetic Field Patterning of Electrically Anisotropic Nickel Nanofibers Using Precursor Ink | Chaitanya Mahajan | Denis Cormier, Mark Irving, Scott Williams, David Borkholder, Ahmed Alfadhel | None to date | | The patent describes a new method for making composite materials with oriented metallic nanofibers. |

Start-up Companies Formed

None

Licensing Agreements

None

Royalties

| Project | Principle Investigator | Co-Investigator | Company Partner | Royalty Income |
|---|------------------------|-----------------|-----------------|----------------|
| Printed Conductors | Denis Cormier | Scott Williams | Corning | \$6,251 |
| Additive Manufacturing Research and Testing - 3D Liquid Metal Jetting | Denis Cormier | | Xerox | \$19,687 |

Small Business Assistance Provided

The AMPrint Center has a strong focus on helping small businesses identify and then pursue federal funding opportunities. It worked with Roccera on a successful U.S. Department of Energy grant proposal to 3D print ceramic materials for solid oxide electrolyzers. Layer Metrics is a startup company that the AMPrint Center helped bring to New York State from another state, and it then helped them write an NSF SBIR proposal and to seek out venture funding. Myerson is a Chicago-based small business that makes dentures. When Myerson wanted to develop a new 3D printer to produce custom dental appliances, the AMPrint Center built a custom prototype 3D printer to demonstrate feasibility of the process. It introduced Myerson to a Rochester NY based company to start work designing the commercial version of the 3D printer. The AMPrint Center then worked with that small business (name withheld for confidentiality reasons) to help develop the printer as well as the printer software. Lastly, the AMPrint Center routinely gives 3-5 lab tours per week to visiting companies, many of whom are small businesses. Faculty and staff provide informal advice to these companies to help them identify suitable 3D printers for their operations, select the most appropriate materials, troubleshoot 3D printer operations, etc.

Level of Matching Funds Provided and uses Expenses (include Federal State, local funds & in-kind)

| Operating Expenses | NYSTAR Funding | Matching Funds | | Total |
|----------------------|------------------|--------------------|------------------|--------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$305,668 | \$551,997 | \$289,393 | \$1,147,058 |
| Indirect Costs | \$45,851 | \$134,715 | \$75,032 | \$255,598 |
| Equipment | \$358,455 | \$39,907 | \$234,286 | \$632,648 |
| Materials & Supplies | \$14,798 | \$20,825 | \$34,541 | \$70,164 |
| Tuition | \$0 | \$0 | \$818 | \$818 |
| Travel | \$4,116 | \$10,966 | \$19,605 | \$34,687 |
| Subcontractors | \$0 | \$0 | \$6,360 | \$6,360 |
| Other | \$67,796 | \$38,796 | \$9,921 | \$116,513 |
| Total | \$796,684 | \$797,206 | \$669,956 | \$2,263,846 |

**Additional 2:1 Small NYS Company Match \$148,790

Total Federal: \$419,175

Total In-kind: 0

Center for Biotechnology
Stony Brook University
Dr. Clinton Rubin, Director

Technology Focus Life Sciences, enabling sciences & agricultural sciences

Importance to NYS

The Center for Advanced Technology in Biotechnology at Stony Brook University will capitalize upon the intellectual and physical resources of Stony Brook University to catalyze, accelerate, and enhance commercial opportunities to fuel the growth and economic impact of New York’s life sciences industry.

Description of Achievements

During the reporting period July 1, 2021 - June 30, 2022, the Center for Biotechnology’s (Center or CfB) programs contributed to the generation of total economic impact of \$39.3M. Forty-three new jobs were created and nineteen were retained. Total sponsored research expenditures were \$2.66M with corporate sponsored research expenditures of \$146K.

The Center played significant role in the Downstate New York SBIR/STTR Hub. During the 2021/2022 fiscal year more than 725 New York companies were contacted regarding the DNY SBIR/STTR Program. Seven federal agency specific SBIR/STTR workshops were hosted during the contract period and were attended by 200 companies. A total of seventy-three companies applied for 1:1 iterative proposal development support and fifty-six companies were ultimately accepted resulting in 25 proposals submitted for the April 2022 deadline. Fifteen projects were deferred to the September 2022 deadline.

The Center re-launched its Applied Research and Development (ARaD) Program that had been paused during the COVID pandemic. The ARAD program supports technology development collaborations between Stony Brook University faculty and NYS companies. Four new collaborative projects were selected for funding by the CfB’s External Review Board for the 2022-2023 fiscal year. In addition, 89 NYS emerging life sciences companies have been supported via the CfB’s Business Development programs which include BioStrategy Sessions, the Long Island Biomentor Initiative, and the Life Sciences.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 43 | 19 | \$16,578,573 | \$423,062 | \$8,710,747 | \$12,016,920 | \$2,187,226 | \$39,916,528 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|----------------------|------------------------------|-------------------------------|--------------------------------|---|
| 7/1/2021-6/30/2022 | 89 | 57 | 32 | 16 |

Designations and Recognitions

| Awards / Recognition | Date Received | Recognizing Organization | Link |
|-------------------------|---------------|--------------------------|---|
| Platinum Sustainability | 8/17/2021 | EcoVadis | https://www.gcimagazine.com/brands-products/news/news/21862997/biocogent-awarded-ecovadis-platinum-medal |

Federal or Not-for-Profit Grants Awarded

| Project | Principle Investigator | Co-Investigator | Source | Amount | Duration (yrs) | Summary |
|---|------------------------|-----------------|--------|-------------|----------------|--|
| Solvation modeling for next-gen biomolecule simulations | DILL, KEN | | NIGMS | \$1,335,473 | 1 | Improve computational biophysics and drug discovery, in some cases completely reformulated physical modeling of protein solvation and of protein-protein interactions. |
| Biomechanical approaches and technologies for enhancing TAVR outcomes | BLUESTEIN, DANNY | | NIBIB | \$763,857 | 1 | To develop next generation TAVR technology. |
| Prism-pet: a tof-doi-compton pet detector technology for total-body pet imaging | GOLDAN, AMIRHOSSEIN | | NIBIB | \$616,304 | 1 | To improve geometric coverage using large axial FOV for total-body imaging. |
| New antifungals targeting the synthesis of fungal sphingolipids | DEL POETA, MAURIZIO | | NIAID | \$768,609 | 1 | Optimize pharmacokinetics, toxicology properties without losing antifungal activity. |
| Sphingosine-1-phosphate and cryptococcosis | Del poeta, maurizio | | NIAID | \$498,277 | 1 | To study the role of the host SK1-S1P pathway in controlling the infection by Cryptococcus neoformans (Cn). |

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

The Fundamentals of the Bioscience Industry is an 84 hour seminars and workshops program, led by industry executives. Eight students participated in the 19th offering of the program; 1 graduate student pursuing an MS and seven graduate students pursuing a PhD.

CfB hosted four virtual SBIR/STTR general workshops (DOE Proposal Development, NIH Proposal Development, NSF Proposal Development and NSF Commercialization for Phases I & II under the Downstate New York

SBIR/STTR Program, which attracted sixty-nine participants, followed by one-on-one proposal development assistance for the federal agencies corresponding SBIR/STTR program deadlines.

Commercialization

The Long Island BioMentor Initiative provides intensive team mentoring to first-time entrepreneurs. Four new mentees and three new mentors were added to the program. One Quarterly Mentor Meetings, nine Mentor Team Meetings, and four BioStrategy Sessions were held. Mentee consideration is based upon stage of development, identified needs of the entrepreneur, and the intake assessment conducted by the program’s Entrepreneur Liaison.

Commercialization Fellows work directly with clients to conduct market assessments and IP due diligence, analyze regulatory pathways, develop financial models, connect entrepreneurs to the CFB network of industry professionals, they help hone the client’s investor presentation.

Invention Disclosures /Patents

| Disclosure /Patent Name | Inventor | Co-inventor | Licensing Partner | Research Sponsor | Description |
|--|--------------------|---------------------|-------------------|------------------|---|
| System, Method, and Computer-Accessible Medium for Virtual Pancreatography | Arie Kaufman | Konstantin Dmitriev | | | A system, method, and computer-accessible medium for using medical imaging data to screen for a cystic lesion(s.) |
| Methods and Compounds to Inhibit Enveloped Virus Release | Carol Carter | Susan Watanabe | | | A compound having an antiviral activity for inhibiting release of an enveloped virus from a cell is disclosed, including methods of inhibiting release of an enveloped virus from a cell. |
| Multi-Well Selenium Device and Method for Fabrication Thereof | Amirhossein Goldan | Wei Zhao | | | Provided is a field shaping multi-well detector and method of fabrication thereof. Patent Number: 2017205207 |
| Selenium Photomultiplier and Method for Fabrication Thereof (Selenium photomultiplier) | Amirhossein Goldan | Wei Zhao | | | The photomultiplier includes a field-shaping multi-well avalanche detector, including a lower insulator, an a-Se photoconductive layer and an upper insulator. |
| Multi-Well Selenium Device and Method for Fabrication Thereof | Amirhossein Goldan | Wei Zhao | | | Provided is a field shaping multi-well detector and method of fabrication thereof. Patent Number: CN 108780823 B |
| Multi-Well Selenium Device | Amirhossein Goldan | Wei Zhao | | | Provided is a field shaping multi-well detector and method of fabrication thereof. |

| | | | | | |
|------------------------------------|--|--|--|--|------------------------------------|
| and Method for Fabrication Thereof | | | | | Patent Number: ZL 2017 8 0015816.3 |
|------------------------------------|--|--|--|--|------------------------------------|

Start-up Companies Formed

None

Licensing Agreements

Terms and payments to the institution are inter-agency material agreements through The Research Foundation of SUNY's Office of Technology Licensing and Industry Relations (OTLIR).

Royalties

| Project | Principle Investigator | Co-Investigator | Company Partner | Royalty Income** |
|---------|------------------------|-----------------|-----------------|------------------|
| | | | | \$196,581 |

**Royalty income associated with the CAT is distributed under proprietary conditions through OTLIR; therefore, an aggregate figure is provided.

Small Business Assistance Provided

None

Level of Matching Funds Provided and uses

Expenses (include Federal State, local funds & in-kind)

| Operating Expenses | NYSTAR Funding | Matching Funds | | Total |
|----------------------|------------------|--------------------|--------------------|--------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$276,105 | \$96,516 | \$1,251,378 | \$1,623,999 |
| Indirect Costs | \$41,416 | \$24,129 | \$312,844 | \$378,389 |
| Equipment | \$0 | \$0 | \$93,983 | \$93,983 |
| Materials & Supplies | \$1,942 | \$12,797 | \$347,422 | \$362,161 |
| Tuition | \$0 | \$6,930 | \$22,400 | \$29,330 |
| Travel | \$0 | \$4,054 | \$16,159 | \$20,213 |
| Subcontractors | \$0 | \$0 | \$517,617 | \$517,617 |
| Other | \$7,517 | \$1,743 | \$94,733 | \$103,993 |
| Total | \$326,980 | \$146,169 | \$2,656,536 | \$3,129,685 |

** Additional 2:1 Small Business NYS Company Match \$145,744

Total Federal: \$1,768,991

Total In-kind: 0

Center for Integrated Electric Energy Systems (CIEES)
Stony Brook University
Prof. Benjamin Hsiao, Director

Technology Focus Energy storage and integration of renewable energy sources into the NYS electric grid

Importance to NYS

CIEES’ mission is to support the NYS Climate Leadership and Community Protection Act, which envisions a transformation of the State’s electricity grid to 70%, renewable generation by 2030 and zero-emission electricity by 2040. CIEES’ location on Long Island is strategic in utilizing 9 GW of offshore wind power for the NYS economy.

Description of Achievements

During the specified period, CIEES focused on facilitating the transition to green hydrogen as an energy storage and transmission medium in collaboration with **ConEdison**. Here, solid-state hydrate hydrogen storage was evaluated, utilizing six hydrogen storage tanks. The system proved to have reversible energy storage capabilities and high reliability.

CIEES also worked with **Gilman Industries** (Stony Brook, NY) to evaluate a hydrogen electrolyzer, which resulted in Gilman Industries winning the U.S. Department of Energy First Phase of the Hydrogen Shot Incubator Prize. They received \$60,000 to validate a novel electrolyzer system design that can utilize seawater as a feedstock without requiring precious metal materials. CIEES plans to assist Gilman Industries in the subsequent “Prove! Phase” application.

Furthermore, CIEES focused on enhancing a test microgrid for the Office of Naval Research for use in the second half of 2022. A \$260,000 Phase II award that involved energy storage units developed by **IOUXUS** (Oneonta, NY). The team installed six supercapacitor units and five Li-ion battery units. The upcoming project aims to showcase a rapidly deployable microgrid with reduced recovery time through optimized dispatching of a well-designed mix of energy storage resources. This approach will minimize redundancy and cost while integrating experimental design methods and advanced resilient control algorithms developed in previous phases to demonstrate improved performance.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 28 | 31 | \$852,000 | \$645,999 | \$369,972 | \$780,702 | \$525,000 | \$3,173,673 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|----------------------|------------------------------|-------------------------------|--------------------------------|---|
| 7/1/2021-6/30/2022 | 11 | 26 | 16 | 65 |

Designations and Recognitions

| Awards / Recognition | Date Received | Recognizing Organization | Link |
|--|---------------|---------------------------------------|---|
| Esther S. Takeuchi Elected to American Academy of Arts and Sciences. | Oct. 2021 | American Academy of Arts and Sciences | https://www.amacad.org/news/members-elected-2021-class-section |

Federal or Not-for-Profit Grants Awarded

| Project | Principal Investigator | Co-Investigator | Source | Amount | Duration (Yrs.) | Summary |
|---|--|--|--|-----------|-----------------|--|
| Management system for microgrid-tied kV-class supercapacitor units | Vyacheslav Solovyov (Stony Brook University) | Dr. Fang Luo (co-PI, SBU), Mr. Chad Hall (Ioxus Inc.) and Mr. Michael Kuhl (Unique Technical Services LLC) | US Navy Office of Naval Research | \$230,108 | 3 | The project addresses the need for effective management of high-voltage super capacitive energy storage. |
| Distributed and Asynchronous Active Fault Management (DA-AFM) for DERs and Microgrids | Dr. Peng Zhang (Stony Brook University) | N/A | US Navy Office of Naval Research | \$165,280 | 3 | The project goal is developing a software tool for efficient fault management in connected microgrids. |
| Practical Quantum Analytics for Ultra-Efficient and Resilient Bulk Power Systems Operations | Dr. Peng Zhang (Stony Brook University) | N/A | US Department of Energy, Brookhaven Science Associates LLC | \$11,834 | 2.4 | This project aims to develop practical and scalable quantum grid analytics (QGrid Analytics) to enable ultra-resilient bulk power system operations. |
| Semiconductor-Based EMI Mitigation Architecture for Future Power Electronics Systems | Dr. Fang Luo (Stony Brook University) | N/A | National Science Foundation | \$82,663 | 3 | The project provides a disruptive semiconductor-based active filtering method. |
| University and Navy Collaboration on Robust Energy | Imin Kao | Benjamin Hsiao | US Navy Office of Naval Research | \$264,999 | 3 | Developing an integrated system with PV-MD components |

| | | | | | | |
|--|------------|--|---------------------------|-------------|---|--|
| Infrastructure and Resiliency | | | | | | aims to boost solar panel efficiency by 10-25% and produce clean water. |
| Solar PLUS: Solar Integration through Physics-Aware Learning Based Ultra-Scalable Modeling and Analytics | Peng Zhang | Barry Mather, Xiangqi Zhu, Yuzhang Lin, Yue Zhao, Xin Wang, and Yifan Zhou | U.S. Department of Energy | \$1,500,000 | 2 | This project aims to develop ultra-scalable modeling and analytics of both transient and dynamic behaviors of power grids with solar PVs at all grid levels. |
| Practical Quantum Analytics for Ultra-Efficient and Resilient Bulk Power Systems Operations | Peng Zhang | N/A | U.S. Department of Energy | \$1,200,000 | 2 | This project aims to develop practical and scalable quantum grid analytics (Q Grid Analytics). |
| Neural Dynamic Equivalencing of Power Systems | Peng Zhang | N/A | ISO New England | \$60,000 | 2 | The project tests the hypothesis of reducing the system (grid) of original component models. |
| Integration Methods for High-Density Electric Drives | Fang Luo | N/A | U.S. Department of Energy | \$400,000 | 2 | The project's goal is to research and develop a heterogeneously integrated power module platform. |

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

CIEES continued building a test microgrid as an educational platform for Electrical Engineering students. The student project has been featured in the “NAVY magazine”.

During this period, the CIEES team created "Research NY," an on-campus internship known for its R&D focus. The program aims to foster R&D endeavors involving products and services from NYS companies. To achieve this, a workforce development initiative on microgrid implementation was devised. It encompasses energy storage, power electronics, and load management essentials for grids with abundant renewable energy sources.

Commercialization

The CIEES team secured a \$230k Phase II award “Management system for microgrid-tied kV-class supercapacitor units” that utilizes energy storage units developed and manufactured by **IOXUS** (Oneonta, NY). The project will apply advanced energy storage control algorithms developed by the Electrical Engineering and Computer Science teams on microgrid platforms. The successful demonstration will result in licensing of the energy control technology to the industrial partners.

Invention Disclosures / Patents

| Disclosure /Patent Name | Inventor | Co-inventor | Licensing Partner | Research Sponsor | Description |
|--|-----------------|--|------------------------|--|--|
| 050-9291: Method for Electrochemical Ocean Alkalinity Enhancement | Matthew Eisaman | N/A | Pending / Confidential | Grantham Foundation | The technology pertains to a system for alkalinity enhancement of a fluid to be utilized for negative emission carbon removal. |
| 63/292,627 System and Method for Electrochemical Ocean Alkalinity Enhancement | Matthew Eisaman | N/A | Pending / Confidential | Grantham Foundation | Method/system enhances alkalinity of brine for negative emission carbon removal. |
| 63/321,424 Gaseous Nitro-Oxidation Process for Upcycling the Biomass Waste Using the NO _x Gases | Benjamin Hsiao | Priyanka Sharma | Pending / Confidential | National Science Foundation | This application applies NO _x gas pollutant to upcycle biomass waste feedstocks. |
| 63/339,583 System and Method for Real-Time Mood Identification by Quantitative Facial Motion Analysis | Matthew Jacobs | Charles Mikell, Sima Mofakham, Selma Mohammad, Miriam Rafailovich, Jordan Saadon, Fan Yang | N/A | National Science Foundation and Stony Brook University | This technology assesses occupant comfort, adjusts environment, and saves AC electricity in buildings. |

Start-up Companies Formed

None

Licensing Agreements

None

Royalties

None

Small Business Assistance Provided

The CIEES team assisted small-business clients in developing SBIR and STTR proposals that helped businesses secure undiluted federal funding. For example, CIEES support has been critical in the development of the Phase II SBIR proposal by **SuperClean Glass** (Stony Brook, NY). The project aims to develop a novel cleaning system for solar panels. Similarly, CIEES support of Brookhaven Technology Group (Stony Brook, NY) resulted in a Phase II DoE award (\$1.099MM). The project develops a new type of superconducting cable that enables a new generation of fusion reactors. CIEES also supported a new startup **Magnet Launch** (Smithtown, NY) in securing a FuzeHub grant and developing a Phase I NSF STTR proposal. The Magnet Launch project performs a Vacuum/Structures design study to create a baseline design of the vacuum systems and structure for a maglev space rocket launcher. The rationale for this project is to have realistic inputs for the analysis of the power management and other systems that may be completed before the Vacuum and structural systems are fully addressed.

Level of Matching Funds Provided and uses

Expenses (include Federal State, local funds & in-kind)

| Operating Expenses | NYSTAR Funding | Matching Funds | | Total |
|----------------------|-----------------|--------------------|--------------------|--------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$83,859 | \$221,205 | \$670,729 | \$975,793 |
| Indirect Costs | \$12,579 | \$55,301 | \$167,682 | \$235,562 |
| Equipment | \$0 | \$115,871 | \$252,780 | \$368,651 |
| Materials & Supplies | \$0 | \$22,804 | \$44,081 | \$66,885 |
| Tuition | \$0 | \$6,607 | \$42,390 | \$48,997 |
| Travel | \$0 | \$12,003 | \$3,658 | \$15,661 |
| Subcontractors | \$0 | \$43,117 | \$82,886 | \$126,003 |
| Other | \$2,202 | \$12,250 | \$14,285 | \$28,737 |
| Total | \$98,640 | \$489,158 | \$1,278,491 | \$1,866,289 |

**Additional 2:1 Small NYS Company Match \$61,863

Total Federal: \$1,282,889

Total In-kind: 0

Center for Advanced Technology in Nanomaterials and Nanoelectronics
State University of New York Polytechnic Institute (SUNY Poly)
Michael Fancher, Director

Technology Focus Nanomaterials and nanoelectronics

Importance to NYS

As NYS has made significant investments to become a leader in high tech fields and attract companies to the State, CATN2 has supported many advancements in the semiconductor and related fields driving and supporting NYS’s leadership position. Several current efforts are focused on attracting significant funding to New York from the CHIPS Act.

Description of Achievements

The CATN2 successfully issued and funded the fourth and fifth rounds of competitive funding under the Center’s Matching Investment Program (MIP). The MIP was developed to address the research, development, and deployment needs of NY based companies to work with the CATN2 and collaborate with SUNY Poly faculty and to successfully leverage and build upon the capabilities available at SUNY Poly. The fourth round focused entirely on Covid-19 response and research. These two rounds leveraged \$403K of ESD/NYSTAR funding to enable \$1.05M in Matching Commitments from and in support of eight NY industry partners in Covid-19 response and research, MEMS, biopharmaceutical and tissue engineering, and semiconductor manufacturing.

Other highlights during this reporting period included: continuing the expansion of the silicon carbide power electronics ecosystem in the Mohawk Valley with the construction of **Cree’s (Wolfspeed’s)** \$1 billion chip fab; deepening the relationship with SUNY Poly housed start-up **Menlo Micro** to further develop their groundbreaking MEMS switch technology with facility access, intern support, and an MIP funded project; continued support of AIM Photonics and their workforce development programs; and growth of the Advanced Manufacturing Performance Center (AMP Center) with continued development of the Career Alignment Platform for advanced manufacturing focused exploration and training as well as an expansion of component/system test-beds for training of Pumps/Vacuum Systems, Sensors/Toxic Gas Monitoring Systems (TGMS), Valves & Seals/Multiple Systems, RF Products/Plasma Systems, and several others.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 30 | 2 | \$3,993,276 | \$1,922,148 | \$21,070,978 | \$45,025,000 | \$2,709,000 | \$74,720,402 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|----------------------|------------------------------|-------------------------------|--------------------------------|---|
| 2020-21 | 32 | 44 | 9 | 36 |

Designations and Recognitions

None

Federal or Not-for-Profit Grants Awarded

| Project | Principle Investigator | Co-Investigator | Source | Amount | Duration (Yrs.) | Summary |
|---|-------------------------------|-----------------|--|-----------|-----------------|---------|
| ENVision | Shadi Shahedipour -Sandvik | | SRI International | \$259,094 | 2 | |
| MITE-ARG (Massachusetts Integrated Photonics Technology Engagement – Alternate reality Game | David Haramé | | Flex Tech Alliance | \$124,889 | 1 | |
| Integrated Photonics Devices for Application-Specific Design | David Haramé | | Flex Tech Alliance | \$150,000 | .75 | |
| High-Performance, Low-Cost Anode-Free Lithium-Ion Batteries for EV and Consumer Electronics | Harry Efstathiadis | | Eonix (federal flow through) | \$35,000 | .5 | |
| ZEN Smart Building Partner Aligned Training Hub “ZEN Smart PATH” | Michael Fancher | | NYSERDA | \$397,637 | 3 | |
| Design and Evaluation of InAs/GaAs Quantum Dot integration Scintillation Detectors for HEP | Serge Oktyabrsky | | Dept. of Energy | \$140,000 | 1.5 | |
| Quic-TAQS: Multifunctional Integrated quantum | Spyros Galis | | University of Rochester (federal flow through) | \$110,000 | 1 | |

| | | | | | | |
|---|---------------------|--|--|-------------|----|--|
| photonic processor for quantum interconnect | | | | | | |
| SBIR Phase I: Novel Structure for Efficient and Reliable Medium Voltage Silicon Carbide (SiC) Power Devices | Juan Andre Melendez | | NoMIS Power Group (federal flow through) | \$66,544 | 1 | |
| Novel Wicking bioreactor for T Cell Expansion | Susan Sharfstein | | University of Delaware (federal flow through) | \$50,000 | .5 | |
| NNL Capstone Project of Nickel Ferrite | Kathleen Dunn | | Fluor Marine Propulsion (federal flow through) | \$85,342 | 1 | |
| Area Selective Deposition on ultra-thin EUV resists-toward enabling High NA EUV Resists | Christophe Vallee | | Semiconductor Research Corporation | \$90,000 | 1 | |
| Physical and Chemical characterization of advanced dielectric thin films for high fluence last applications | Mengbing Huang | | Lawrence Livermore National Laboratory | \$39,997 | .6 | |
| Ion Beam Characterization | Mengbing Huang | | Lawrence Livermore National Laboratory | \$19,995 | .5 | |
| AIM Photonics Point of Care Sensors for Corona Virus Response | David Haramé | | NIST | \$4,974,630 | 2 | |
| Photonic Multianalyte Biosensor for Rapid Point of | David Haramé | | NIST | \$299,149 | 1 | |

| | | | | | | |
|-------------------------|--|--|--|--|--|--|
| Care SARS CoV-2 Testing | | | | | | |
|-------------------------|--|--|--|--|--|--|

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

CATN2 has successfully implemented a comprehensive Engage, Enrich, and Educate approach to preparing the high-tech workforce focusing on 1) Engagement, to attract potential workers; 2) Enrichment, to build a workforce pipeline; and 3) Education and training that is industry oriented. Engagement efforts have emphasized exposure to nanotechnology careers. Enrichment efforts have targeted HS students through internships and HS classwork. Education and training efforts have focused on degree and certificate granting programs; certificates and badges under the NSF NEATEC program; and collaborative programs with all levels of local, state, and national universities under the federally funded AIM Photonics.

Commercialization

To generate broad commercialization impacts the CATN2 established and supports ongoing outreach and networking through referral networks in 1) RD&D Industry Alignment Frameworks (American Institute for Manufacturing Integrated Photonics (AIM Photonics), Statewide Silicon Carbide Power Electronics RD&D Initiative, and Advanced Manufacturing Performance (AMP) Center; 2) RD&D Shared-Use Facilities (SUNY Poly’s 200 and 300mm pilot lines and Zero Energy Net Facility Test-bed); 3) Strategic Economic Development Initiative Partnerships (Advanced Regenerative Manufacturing Institute (ARMI), The National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL), and Albany College of Pharmacy and Health Sciences Center for Biopharmaceutical Education and Training (CBET); and 4) Entrepreneurial Programs (iClean/Tech Valley Business Incubator and Corporate Venture Exchange).

Invention Disclosures /Patents

| Patent Application Name | Inventor | Co-inventor | Licensing Partner | Research Sponsor | Description |
|--|-----------------|--------------------------|-------------------|------------------|---|
| Methods for qualitative and quantitative analysis of a plurality of biomarkers | Nathaniel Cady | | N/A | SUNY RF | A protein microarray, in the form of a compact biochip, that can be analyzed with high sensitivity using GC-FP technology. |
| Semiconducting devices, back end of line portions for semiconducting devices, and dielectric materials incorporating deuterium | Patrick Lenahan | James Lloyd, Niaz Mahmud | N/A | N/a | Simple, scalable and inexpensive process to replace the hydrogen in low-k dielectrics with deuterium to improve semiconductor performance |

| | | | | | |
|--|------------------------|--|-----------------------|--|--|
| Methods for resistive ram (reram) performance stabilization via dry etch clean treatment | Karsten Beckmann | Nathaniel Cady, Martin Rodgers, Shyam Sridhar, Sergey Voronin, Qi Wang | N/A | N/A | An energy harvesting device made possible by the oscillatory behavior of suspending graphene. |
| Solid-state field-effect air filtration systems, masks including same, and methods of forming same | Haralabos Efstathiadis | Michael Fasullo, Iulian Gherasoiu | N/a | N/A | Battery-operated air filtration system for face masks that kills viruses on contact |
| Polishing slurries including ceria nanoparticles and methods for polishing materials using same | Kathleen Dunn | Christopher Netzband | N/A | N/A | Reducing manufacturing time, cost, and labor by employing chemistry to transform a two-step process into an easily controlled single-step. |
| Metal oxide semiconductor field effect transistors (mosfet) and methods of forming same | Woongje Sung | | NoMIS Power Group LLC | U.S. Dept. of Energy | Utilization of deep dopant implantation in 4H-SiC via an angled implant approach that enables dopant ions to tunnel deeper into the 4H-SiC atomic lattice allows for the innovation of power SiC MOSFET device design; |
| Additive manufacturing systems and methods of forming components using same | Bridget Boland | Gregory Denbeaux | N/A | N/A | An efficient, high purity material additive manufacturing technique designed to reduce material waste and energy consumption. |
| Compositions, apparatuses and methods for making and using bioscaffolds | James Castracane | Melinda Larsen, Pujhitha Ramesh, Susan Sharfstein, Yubing Xie | N/A | National Institute of Dental and Craniofacial Research | Methods to produce 3D nanofibrous scaffolds that closely mimic soft-tissue stromal ECM using a unique |

| | | | | | |
|--|------------------|---|-----------------------|--|--|
| | | | | | cryoelectrospinning process |
| Novel cryoelectrospun scaffolds for tissue engineering and methods for manufacturing | James Castracane | Melinda Larsen, Pujhitha Ramesh, Susan Sharfstein, Yubing Xie | N/A | National Institute of Dental and Craniofacial Research | Methods to produce 3D nanofibrous scaffolds that closely mimic soft-tissue stromal ECM using a unique cryoelectrospinning process |
| Chip-scale Photonic Processing Neuroprosthetic Emitter | Olivya Caballero | John Carter, Spyridon Galis, Stephen Macknik, Susana Martinez-Conde, Satyavolu Papa Rao, Edward White | N/A | N/A | A novel technology for optimizing visual prosthetics for individuals with foveal blindness. |
| Chip-scale Photonic Processing Neuroprosthetic Detector | Olivya Caballero | John Carter, Spyridon Galis, Stephen Macknik, Susana Martinez-Conde, Satyavolu Papa Rao, Edward White | N/A | N/A | A novel technology for optimizing visual prosthetics for individuals with foveal blindness |
| Extended P-well with a gradient doping profile for SiC MOSFETs | Dongyoung Kim | Adam Morgan, Woongje Sung | NoMIS Power Group LLC | U.S. Dept. of Energy | Utilization of deep dopant implantation in 4H-SiC via an angled implant approach that enables dopant ions to tunnel deeper into the 4H-SiC atomic lattice allows for the innovation of power SiC MOSFET device design; |
| Defect Density Manipulation in HfO2 for ReRAM Application via Angular Velocity Adjustments in a Semi-batch ALD Chamber | Karsten Beckmann | Nathaniel Cady, Jubin Hazra | N/A | U.S. Air Force Research Laboratory | This invention adjusts the ReRAM switching performance via angular velocity adjustments of the |

| | | | | | |
|--|-------------------|-------------------------------------|-----|-----|--|
| | | | | | semi-batch atomic layer deposition (ALD) tool NT333 from Tokio Electron |
| Humanized yeast deletion collection expressing cytochrome p450 1A2 | Michael Fasullo | | N/A | N/A | The yeast deletion collection has been valuable in profiling resistance to numerous pharmaceuticals and carcinogens (xenobiotics). |
| Suspended Graphene Energy Harvesting Solid State Structure | Christopher Hobbs | Vincent LaBella, Nicholas Pieniazek | N/A | N/A | An energy harvesting device made possible by the oscillatory behavior of suspending graphene. |

Start-up Companies Formed

| Company Name | City | Product/Service | Sector |
|-------------------|------------|--|------------------------------|
| NoMIS Power Group | Albany, NY | Custom design & fabrication of power semiconductor devices made at a low-cost, pure-play U.S. foundry. Discrete and module power packaging from qualified U.S. providers for device characterization and converter applications. | Semiconductor / clean energy |

Licensing Agreements

None

Royalties

None

Small Business Assistance Provided

Throughout this reporting period the CATN2 provided various services and assistance to NY based small businesses including the following: Access to state-of-the-art process and metrology equipment and expertise; Proof-of-concept support; Pilot-prototyping services; Manufacturing Scale-up; Technology demonstration and test including metrology, characterization, and reliability; Business development support, including making introductions and identifying grant, partnership, and sales opportunities; Access to industry compliant test-bed facilities; Federal and state outreach support including grant proposal drafting; Funding for collaborative research projects; Identify and assist in securing SUNY Poly students to serve as interns, research assistants, FTE, etc.; Access to expertise and subject matter experts through faculty, students, and other partners Create and maintain a pipeline of new employees; Develop and provide a wide range of specifically tailored workforce development programs; Entrepreneurship support – including business plan drafting, company introductions, guidance, pitch preparation, supporting business plan competitions and corporate venture exchange, etc.;

Some of the NY based small business that were provided these services during this reporting period included: **BESS Tech; Cytocybernetics; Eonix Energy; Free Form Fibers; Glauconix Biosciences; Hocus Locus; Lux Semiconductors; Magnolia Optical Technologies; Marktech Optoelectronics; Menlo Microsystems; Midux Technologies; NoMIS Power Group; NY Wired for Education; SeeQC; sxRNA Technologies; Xallent, Inc.**

Level of Matching Funds Provided and uses
Expenses (include Federal State, local funds & in-kind)

| Operating Expenses | NYSTAR Funding | Matching Funds | | Total |
|----------------------|------------------|--------------------|-----------------|--------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$154,584 | \$557,622 | \$54,258 | \$766,464 |
| Indirect Costs | \$23,436 | \$79,050 | \$12,317 | \$114,803 |
| Equipment | \$575,824 | \$22,226 | \$8,691 | \$606,741 |
| Materials & Supplies | \$15,214 | \$50,015 | \$16,585 | \$81,814 |
| Tuition | \$4,815 | \$26,589 | \$1,967 | \$33,371 |
| Travel | \$3,947 | \$8,938 | \$450 | \$13,335 |
| Subcontractors | \$0 | \$0 | \$0 | \$0 |
| Other | \$9,433 | \$14,477 | \$1,437 | \$25,347 |
| Total | \$787,253 | \$758,917 | \$95,705 | \$1,641,875 |

**Additional 2:1 Small NYS Company Match \$286,010

Total Federal: 0

Total In-kind: 0

Center for Advanced Technology in Computer Applications and Systems Engineering
Syracuse University
Pramod Varshney, Director

Technology Focus Information technology and telecommunications

Importance to NYS

CASE conducts research in progressive technology areas that involve large quantities of information about the environment or human behavior for improved situational awareness and to determine an appropriate action. Application domains include unmanned systems, health, defense, and security, that will lead to significant job creation and economic growth in NYS.

Description of Achievements

CASE continued to realize outlined goals and objectives, focusing activities to increase measurable economic impact and position CASE for continued success. CASE continued to be instrumental in delivering on the commitments of the URI, providing support to Genius NY finalist companies, access to UAVs and FAA licensed pilot for faculty and industry partners, technical support for UAVs and data security activities, assisting CenterState CEO with attraction activities, and working with key industry partners from start-ups to multinationals on related projects. Center leadership and staff continue to engage the Industry Advisory Board, faculty researchers, industry partners, and key university and community constituents in serving the New York State industry and scientific communities. CASE remains an active member of NUAIR, facilitating faculty and industry use of the FAA-designated UAS Test Bed. In addition, CASE continues to play a key role in the CNY Defense Alliance and support of the Cyber Research Institute. During the ongoing Covid19 pandemic, nearly all business development activities continued, yet via video conference.

CASE’s incubator is currently at 80% capacity, with 11 occupants. Several new companies continue to express interest in space and negotiations are ongoing. CASE works closely with the CenterState Corporation for Economic Opportunity (CEO)/Syracuse Technology Garden, StartFast, Launch NY and other partners in the Innovation Hotspot to provide supportive services and information for incubator companies.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 13 | 0 | \$9,395,850 | \$1,200,297 | \$22,520,000 | \$2,590,000 | \$110,000 | \$35,816,147 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|----------------------|------------------------------|-------------------------------|--------------------------------|---|
| 2021-2022 | 61 | 8 | 0 | 83 |

Designations and Recognitions

| Awards / Recognition | Date Received | Recognizing Organization | Link |
|---|---------------|---|---|
| Pioneer Award to CASE Executive Director Pramod Varshney | March 2022 | IEEE Aerospace and Electronic Systems Society | https://news.syr.edu/blog/2022/03/09/professor-pramod-k-varshney-honored-with-2021-ieee-aerospace-and-electronic-systems-society-pioneer-award/ |
| Claude Shannon-Harry Nyquist Technical Achievement Award to CASE Executive Director Pramod Varshney | May 2022 | IEEE Signal Processing Society | https://ecs.syracuse.edu/about/news/distinguished-professor-pramod-k-varshney-selected-to-receive-2021-shannon-nyquist-technical-achievement-award-from-the-ieee-signal-processing-society?_ga=2.169025448.823128135.1687291621-176009157.1687291621&_gl=1*_1ozyh9v*_ga*MTc2MDA5MTU3LjE2ODcyOTE2MjE.*_ga_65S0N1FWNY*MTY4NzI5MTYyMC4xLjAuMTY4NzI5MTYyMC42MC4wLjA |

Federal or Not-for-Profit Grants Awarded

None

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

The CASE Industry Co-op program, their signature workforce development program continues to be successful, placing students in a variety of short- and long-term positions within local companies to gain direct work experience and provide opportunities and encouragement to remain in the region after graduation. CASE, in partnership with the Department of Electrical Engineering and Computer Science (EECS), continues to support an annual colloquium series on industry-relevant technical topics. CASE continues to work with the New York State Science and Technology Law Center to deliver commercialization and intellectual property training.

Commercialization

CASE helps to promote CEO's NY Genius and Grants for Growth Programs, working together with CEO, The Technology Garden, CNY TDO, other universities, and range of representatives from industry to refer companies seeking funding to enable university-industry collaboration with significant commercial potential. CASE is working with winners of the Genius awards to assist them in achieving their business goals and hiring students to assist with research and development. CASE facilitated meetings between local small businesses and potential partners on campus and within larger corporations for potential commercialization opportunities. CASE's other commercialization partners include **Central NY Defense Alliance**, **NYSSTLC** and **NUAIR**

Invention Disclosures /Patents

| Disclosure /Patent Name | Inventor | Co-inventor | Licensing Partner | Research Sponsor | Description |
|--|-----------------|-----------------------------|-------------------|------------------|--|
| Solid Oxide Fuel Cell Catalytic Converter | Jeongmin Ahn | Thomas Welles | NA | NA | This invention can be configured for installation by automobile manufacturers for new vehicles or adapted for use as an after-market kit to reduce emissions and avoid the need for a catalytic converter. |
| Compositions of Nanoparticles with Radial Gradients and Methods of Use Thereof | Mathew Maye | NA | NA | NA | This invention is a chemical synthesis of nanomaterials that can be used as coatings or additives to materials to improve corrosion resistance, wear, and strength. The materials are also magnetic, and may be used in medical imaging, data storage. |
| Motion Sensor Assisted Room Shape Reconstruction and Self-Localization Using First-Order Acoustic Echoes | Biao Chen | Fangrong Peng, Tiexing Wang | NA | NA | This invention may be used for inconspicuous reconstruction of the shape of a room. |
| Metamaterial-Boosted Quantum Electromechanical Transducer for Microwave-Optical Interfacing | Britton Plourde | Matthew LaHaye | NA | NA | This invention is a high-efficiency microwave-to-optical transducer for quantum computing systems and may be used to convert quantum state information between the microwave and optical domains. |

| | | | | | |
|---|------------------|----------------------------|----|----|--|
| Improved Piezoelectric Sensors and Quartz Crystal Monitors | Fritz Schlereth | James Spencer | NA | NA | This invention is a dew point detector that employs quartz crystal monitors for improved accuracy of dew point measurements and condensation points of other gases. |
| Peptide Drug Improvement Using Vitamin B12 and Haptocorrin Binding Substrate Conjugates | Robert Doyle | NA | NA | NA | This invention is a coupling of compounds, bound by Haptocorrin to avoid undesirable pharmaceutical side effects. |
| Hybrid Additive-subtractive Laser Fabrication Platform for Shaping Hydrogels | Pranav Soman | Puskal Kunwar, Zhang Xiong | NA | NA | This is a hybrid laser printing platform to create 3D hydrogel constructs. Can be used to fabricate ready-to-use functional chips for potential cellular communication and migration applications. |
| Hierarchical Optimized Detection of Relatives | Jonathan Adelman | Michael Marciano | NA | NA | This is a system for evaluating a DNA sample and determining whether the sample contains related individuals and/or unrelated individuals with high levels of alleles sharing. |

Start-up Companies Formed

None

Licensing Agreements

| Project | Licensing Partner |
|---------------|--|
| 203 | Sensgard LLC |
| 100726,100843 | Pelitex |
| 100814 | Western New York based small biotech company |
| 100851 | NicheVision |

Royalties

CONFIDENTIAL

Small Business Assistance Provided

From July 1, 2021, to December 31, 2021, CASE supported 1 small business with a total of \$5,014 in support. From January 1, 2022, to June 30, 2022, CASE was able to support 2 small businesses with a total of \$21,413 in support. The CASE team was able to provide small business partners with a cumulative total of \$26,427 in support during the 2021-2022 project year, allowing small businesses to continue production, growth, and employment.

Level of Matching Funds Provided and uses

Expenses (include Federal State, local funds & in-kind)

| Operating Expenses | NYSTAR Funding | Matching Funds | | Total |
|----------------------|--------------------|--------------------|-----------------|--------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$1,161,751 | \$1,297,737 | \$37,258 | \$2,496,746 |
| Indirect Costs | \$163,343 | \$112,078 | \$5,589 | \$281,010 |
| Equipment | \$0 | \$0 | \$0 | \$0 |
| Materials & Supplies | \$0 | \$3,448 | \$4,031 | \$7,479 |
| Tuition | \$0 | \$18,207 | \$0 | \$18,207 |
| Travel | \$139 | \$4,388 | \$0 | \$4,527 |
| Subcontractors | \$0 | \$0 | \$0 | \$0 |
| Other | \$3,959 | \$80,804 | \$20 | \$84,783 |
| Total | \$1,329,192 | \$1,516,662 | \$46,898 | \$2,892,752 |

** Additional 2:1 Small NYS Company Match \$157,820

Total Federal: 0

Total In-kind: 0

**Center for Advanced Technology in Big Data and Health Sciences
University at Buffalo**

Dr. Alan Rae & Mr. Jeffrey Dunbar, Co-Directors

Technology Focus Big Data and Health Sciences

Importance to NYS

The UB Center for Advanced Technology in Big Data and Health Sciences (UB CAT) engages NYS companies in collaborative projects with university experts and infrastructure to advance innovations in life sciences through funding research and development projects. These activities result in company growth through job creation, job retention, increased ability to raise investment funds, and increased revenues positively impacting the economy of NYS.

Description of Achievements

The UB Center for Advanced Technology in Big Data and Health Sciences (UBCAT) continues to advance emerging health science technologies in the areas of diagnostics, therapeutics, and medical devices. Sixteen (16) companies located across New York State were awarded matching project funds to collaborate with nineteen (19) faculty across fourteen (14) departments at UB. The award recipients were **CytoCybernetics, Efferent Labs, For-Robin, Garwood Medical, Immune Modulatory Therapies, Manhattan BioSolutions Inc., EVQLV Inc., KAPS Biotechnology, KSL Diagnostics, Neurovascular Diagnostics, QAS.AI, Concarlo Holdings, Garwood Medical, Rheonix, Truvai Biosciences, and POP Biotechnologies.**

Key highlights include collaboration between UBCAT, Buffalo based KSL Diagnostics and Dr. Amy Jacobs from UB which led to the development and launch of first-of-its-kind antibody test that measures degree of immunity from COVID-19 post infection or vaccination. The project with UB spin-off, Immune Modulatory Therapies LLC, resulted in a patent submission entitled “Phosphatidylserine binding molecules block immune suppression of tumor-associated exosomes”.

On the workforce development front, thirteen UB students from various departments in the Jacobs School of Medicine & Biomedical Sciences, School of Engineering & Applied Sciences, School of Pharmacy & Pharmaceutical Sciences, School of Public Health and Health Professions and the College of Arts and Sciences were actively involved in the CAT projects. UB CAT continues to cultivate a relationship with The Buffalo Public School District (BPS) to support quality science education and hands-on experiences for students from K-12.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 41 | 2 | \$6,300,004 | \$1,257,432 | \$2,831,495 | \$10,061,958 | \$25,000 | \$20,475,889 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|---------------|-----------------------|------------------------|-------------------------|--------------------------------------|
| 2021-22 | 16 | 19 | 19 | 13 |

Designations and Recognitions

| Awards / Recognition | Date Received | Recognizing Organization | Link |
|---|----------------|---|----------------------------------|
| Dr. Norma Nowak & Dr. Venu Govindaraju -The Life Sciences Power 50. The scientists, entrepreneurs and investors driving New York’s biotech boom. | August 1, 2021 | City & State’s first Life Sciences Power 50 | Publication link |
| Dr. Jun Qu - The SUNY Chancellor’s Award for Excellence in Scholarship and Creative Activities | June 2022 | SUNY Chancellor’s Office | News Release |

Federal or Not-for-Profit Grants Awarded

| Project | Principle Investigator | Co-Investigator | Source | Amount | Duration (yrs.) | Summary |
|--|------------------------|-----------------|---------------------------|-----------|-----------------------|---|
| Investigation of Myocardial Sympathetic Denervation as a Novel Mechanism of Ischemia-Induced Pulseless Electrical Activity in Cardiac Arrest | Brian Weil | | ZOLL Foundation | \$ 47,740 | 1/3/2021 – 12/31/2023 | This grant will investigate a novel mechanism and establish a much-needed large animal model of this condition to facilitate further translational investigation. |
| Blood-Based Biomarkers Associated with Aneurysm Vessel Wall Enhancement | Vincent Tutino | | Brain Aneurysm Foundation | \$ 30,000 | 10/1/2021 – 9/30/2022 | UB in collaboration with Neurovascular Diagnostics has developed an algorithm to stratify intracranial aneurysms (IAs) rupture risk to help provide immediate |

| | | | | | | |
|--|-----------------|--|--|-------------|--------------------|--|
| on Post-Contrast MRI | | | | | | attention to high-risk cases while monitoring the low-risk cases. |
| Immunomodulatory therapy after resuscitation from cardiac arrest | Brian Weil | | National Heart Lung and Blood Institute | \$2,278,145 | 1/1/2022-12/1/2025 | The proposed study aims to identify novel treatments that protect the heart, brain, and other organs by modulating the immune-mediated inflammatory response after cardiac arrest. |
| Developing a multivalent subunit particle vaccine against tuberculosis | Jonathan Lovell | | National Institute of Allergy & Infectious Disease | \$1,392,562 | 4/1/2022-3/31/2025 | Development of an effective multivalent Tuberculosis vaccine by leveraging nanoparticles as a delivery vehicle. |

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

UB CAT provides a wide range of workforce development opportunities for a variety of ages and education levels to build the workforce for meeting the demand of new and growing companies in life sciences. Highlights include an NIH Science Education Partnership Award (SEPA) that provides training for high school teachers and students in metagenomics, bioinformatics, and scientific laboratory techniques. The CAT provides various experiential learning opportunities to UB students by way of CAT funded projects, internships with their data analytics group and placement of UB student assistants in companies they support. During this reporting period, UB CAT through the Career Experience Program provided experiential learning opportunities to seven students. Six students were placed on CAT projects with **Manhattan BioSolutions, KSL, QAS.AI, and Truvai Biosciences.**

Commercialization

The UB CAT provides NYS companies business development outreach, both direct and through local referral networks to educate and connect NYS companies to the funding and UB faculty expertise available through the CAT. UB CAT actively seeks out new partners and opportunities utilizing direct marketing campaigns, as well as select sponsorships, conferences, and business development engagements. The CAT Industry Advisory Board is comprised of strategic advisors with expertise in FDA regulatory pathways, drug development, venture capital, biomanufacturing, vaccine development, medical devices, and life sciences business strategy. Members formally meet annually to review and provide constructive feedback to CAT companies on their commercialization plans and are on hand throughout the year to provide recommendations and guidance on how the CAT can best meet industry partner needs. The CAT team also makes and receives referrals to and from FuzeHub, MedTech, Upstate Capital, NY Ventures, 43North, Invest Buffalo Niagara and other NYSTAR Centers.

Invention Disclosures /Patents

| Disclosure /Patent Name | Inventor | Co-inventor | Licensing Partner | Research Sponsor | Description |
|---|--|-------------|-------------------|------------------|---|
| Humanized Anti-TF-Antigen Antibodies | Kate Rittenhouse-Olson, Julia Abdullah, Jing Ying Eng, Stephen T Koury | | N/A | N/A | The present disclosure comprises in various embodiments compositions and methods for therapy of TF+ cancers |
| Novel Pneumococcal Vaccine Formulations | Pfeifer, Blaine / Lovell, Jonathan | | N/A | N/A | Immunogenic compositions are provided comprising PnCo and / or Glpo polypeptides identified as being preferentially expressed during the virulent phase of an infection related to streptococcal bacteria. The compositions can be used for eliciting immune response against streptococcal infections |
| Phosphoserine Containing Compositions for Immune Tolerance Induction | Balu-Iyer, Sathy / Bankert, Richard | | N/A | N/A | This technology is part of a portfolio of related platform delivery technologies based on lipid-based compositions that, when complexed with therapeutic proteins such as Factor VIII (hemophilia replacement therapy), provide for long-acting, less-immunogenic formulations that retain their biological activity. |
| Nanostructures Comprising Cobalt Porphyrin-Phospholipid Conjugates and Polyhistidine-Tags | Lovell, Jonathan | | N/A | N/A | Created a porphyrin-phospholipid based liposome capable of binding any peptide or protein that has been modified to have a histidine tail. Because this liposome can easily bind any peptide of this kind, this platform has potential use as a new vaccine |

Start-up Companies Formed

| Company Name | City | Product/Service | Sector |
|--------------|---------|---|--------------------|
| QAS.AI, Inc. | Buffalo | AI tool designed to improve treatment of patients undergoing endovascular surgeries by accurately predicting outcomes to aid in surgical decision making. | AI, Medical device |

Licensing Agreements

CONFIDENTIAL

Royalties

CONFIDENTIAL

Small Business Assistance Provided

The primary type of assistance provided to young companies supported through the UB CAT was to enable no cost extensions on funded projects. The majority of company partners were impacted by supply chain issues as a result of the pandemic. The UB CAT facilitated sourcing of certain lab supplies needed for critical projects from other vendors or UB labs. UB CAT supported prototype and product development for start-ups by engaging with CROs and UB core facilities who helped with manufacturing, validation, proof of concept testing and animal testing. In some instances, UB CAT helped companies apply to SBIR/STTR and FuzeHub grants.

Level of Matching Funds Provided and uses

Expenses (include Federal State, local funds & in-kind)

| Operating Expenses | NYSTAR Funding | Matching Funds | | Total |
|----------------------|--------------------|--------------------|------------------|--------------------|
| | | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$561,355 | \$165,002 | \$418,448 | \$1,144,805 |
| Indirect Costs | \$84,203 | \$24,750 | \$60,060 | \$169,013 |
| Equipment | \$119,114 | \$0 | \$0 | \$119,114 |
| Materials & Supplies | \$185,452 | \$219,901 | \$83,742 | \$489,095 |
| Tuition | \$15,755 | \$9,015 | \$0 | \$24,770 |
| Travel | \$1,569 | \$0 | \$0 | \$1,569 |
| Subcontractors | \$0 | \$0 | \$0 | \$0 |
| Other | \$425,924 | \$476,554 | \$162,320 | \$1,064,798 |
| Total | \$1,393,372 | \$895,222 | \$724,570 | \$3,013,164 |

** Additional 2:1 Small NYS Company Match \$863,291

Total Federal: \$227,998

Total In-kind: 0

Center for Advanced Technology in Emerging and Innovative Sciences
University of Rochester
Dr. Mark Bocko, Director

Technology Focus Photonics and Imaging Science Systems

Importance to NYS

CEIS’s primary focus has been optics, photonics, and imaging (OPI). The OPI cluster in Rochester consists of 120 companies employing over 10,000 people and is vital to the regions and State’s economy. More recently CEIS has been leading an effort to extend the state’s semiconductor industry from Albany to Rochester.

Description of Achievements

The Center’s 2021-2022 economic impact reporting collected for 16 partner organizations was \$30,918,926 (adjusted for job value calculations) with 5 partners reporting a total of 11 new jobs and 9 retained jobs. There were notable success stories. For example, **Clerio Vision**, which is developing technology for using femtosecond lasers to improve vision, reported 8 new and retained jobs and \$2.9M in private capital raised. Other partner companies that benefited from CEIS-sponsored research include L3-Harris, VisualDX, and OptiPro. The CEIS annual University Technology Showcase was conducted in person for the first time in three years. The event was held in collaboration with the UR Center of Excellence for Data Science and included a parallel AR/VR themed mini conference. The opening panel session centered on the role of arts and innovation in revitalizing downtown Rochester. There were several other notable achievements in the 2021-2022 period. One important achievement is the leadership CEIS has been providing to make Rochester a hub of the semiconductor industry, extending the State’s semiconductor corridor from Albany to Rochester. Another achievement was the support that CEIS provided to their partner AIM Photonics, part of SUNY Poly, to receive a new seven-year cooperative agreement with the Air Force Research. CEIS is also collaborating on an initiative to bring a film and music festival to Rochester that would build off of the Center’s successful Light & Sound Interactive events in 2017 and 2019.

Impacts

| New Jobs | Retained Jobs | Increased Revenues | Cost Savings | Govt Funds | Non-Govt Funds | Capital Improvements | Total Impacts |
|-----------------|----------------------|---------------------------|---------------------|-------------------|-----------------------|-----------------------------|----------------------|
| 11 | 1 | \$3,680,963 | \$2,931,593 | \$19,585,043 | \$2,715,000 | \$80,000 | \$28,992,599 |

Companies Served and Projects

| Annual Period | # of Companies Served | # of projects on-going | # of projects completed | # of students engaged with companies |
|----------------------|------------------------------|-------------------------------|--------------------------------|---|
| 7/1/2021-6/30/2022 | 13 | 4 | 13 | 37 |

Designations and Recognitions

| Awards / Recognition | Date Received | Recognizing Organization | Link |
|--|----------------------|---------------------------------|---|
| Mark F. Bocko, Ph.D. 2021 Engineer of Distinction | May 2022 | Rochester Engineering Society | http://www.hajim.rochester.edu/news/2022/awards-engineering-2022.html |
| James McGrath Dean’s Professor | May 2022 | University of Rochester | https://www.rochester.edu/newsletters/hajim/hajim-highlights-0621-2/ |

Federal or Not-for-Profit Grants Awarded

| Project | Principle Investigator | Co-Investigator | Source | Amount | Duration (yrs.) | Summary |
|--|-------------------------------|---|---|---------------|------------------------|---|
| MRI: Acquisition of a Micro-Transfer Printer for Heterogeneous Integration of Electronic/Photonic Microsystems | Karl Hirschman | Stefan Preble, Seth Hubbard, Parsian Mohseni, Ke Du | NSF | \$199,500 | 1 | Acquisition of a micro-transfer print instrument for transfer of devices onto non-native substrates. Directly supports the Corning sponsored research activity. |
| Design of Low Size, Weight, Power, and Cost (SWaP-C) Free-Space Optical Communications System – Phase II | Hui Wu | | Subaward by Critical Frequency Design for ARO | \$100,00 | 1 | Develop a new integrated transceiver system for free-space optical communication in a wide range of DoD applications; potentially deployed in devices across multiple fields. |
| Development of solar-thermal wastewater treatment system to provide potable water to African countries | Chunlei Guo | Dr. Joby Boxall, University of Sheffield, UK, Dr. Kirsty Carden, University of Cape Town, South Africa, Dr. Ted Nii Yemoh | World University Network | \$11,700 | 1 | Advance the water purification technology for African continent, pave the way to provide clean water to millions of people around the world, and save lives for those who would |

| | | | | | | |
|--|----------|-----------------------------------|--|----------|----------|--|
| | | Annang, University of Ghana | | | | die from water- borne diseases. |
| The Extension (Phase IIE & III) to Integrated Mid- Infrared Sources Enabled by Waveguides Written with Femtosecond Lasers: Inscription of Waveguides in IG2 Glass | Jie Qiao | | NASA | \$25,285 | 9 months | Develop process to inscribe waveguides in mid-IR material IG2 glass, using femtosecond lasers. |
| Ultrafast-laser- based polishing/forming of glass materials | Jie Qiao | John Lambropoulos | NSF/IUCRC/Ce nter for Freeform Optics | \$49,430 | 1 | Develop the method, modeling and process to figure and polish optics. |

Education and Technology Commercialization Activities

Industry-Oriented Education and Training

PI Mike Heilemann continues to train a former student that is now employed at L3 Harris. The UR research team has biweekly project meetings with **Clerio Vision, Inc.** to share results and to strategize about scientific questions, technological issues, manufacturing, and commercialization goals of this project. These meetings include students at all levels of pre and post-doctoral training, as well as staff from the company and UR. Several Clerio employees have been trained in giving outreach presentations. NY Space Grant grad students have given presentations to several K-12 groups locally, including HS students from the Rochester area. PI Andreas Savakis presented “Adaptive Learning for Dynamic Data and Information Processing,” online with the USAF. PIs hosted two scientists from **Glaukos** to collaborate on Optical Coherence Elastography (OCE) resulting in a publication in a peer-review journal. Glaukos provided samples for the experiments with LighTopTech to assess the capability of GDOCM to do OCE and to guide the development of the OCE module.

Commercialization

Several companies have expressed interest in the capabilities of visual simulation of multifocal contact lenses and intraocular lenses developed with Clerio Vision: Alcon Research Labs, J&J Vision Care, CooperVision, BVI-PhysIOL, Essilor International and Reality Labs. Two companies overseas are interested in opening offices in the Rochester area as a result of interactions stimulated by the project: **Fyla**, Valencia, Spain (manufacturer of the supercontinuum laser source in the adaptive optics visual simulator); and **2EyesVision**, Madrid, Spain (co-founded by Susana Marcos, Luminate Finalist, and manufacturer of a wearable binocular simulator of Simultaneous Vision). The result of the **Aktiwave** project has led to collaborative discussions with **Coherent**, **Toptica Photonics**, NASA and AFRL. In addition to **L3Harris Space & Airborne Systems** and its customers, PI has reached out to Facebook and began work with **Critical Frequency Design** on a DoD funded project related to free-space optical communication.

Invention Disclosures /Patents

| Disclosure /Patent Name | Inventor | Co-inventor | Licensing Partner | Research Sponsor | Description |
|--|--------------------------------|--|-------------------|---|--|
| Control of Laser Frequency in an Optical Gyroscope with a Ring Resonator | Jaime Cardenas | Meiting Song | | AN Jordan Scientific, LLC and CEIS/NYSTAR | Provisional application 63/288,423, December 2021 |
| Pseudo-random sparse arrays for cost, area, and power savings in ultrasound imaging provisional application 63/260,091 | Zeljko Ignjatovic | Jovan Mitrovic, William J. Sehnert | | Carestream Health and CEIS/NYSTAR | Pulse-echo ultrasound imaging method of separating transducer elements of an ultrasound transducer array into two disjoint subsets to perform transmit operation only while the elements of the other subset perform the receive operation only. |
| Ophthalmic lens with depth-modulated optical structures and methods of forming world intellectual property Organization WO2021202247 dated 10/7/2021 | Wayne Knox | XU, Lisen J., SMITH, Brian T. GANDARA-MONTANO, Gustavo A | | Clerio Vision, Inc. and CEIS/NYSTAR | A new way of writing hydrogels structures by varying the depth of the laser focus. It results in better devices, especially in hydrophobic polymers. |
| Chipscale photonic gyroscope based on weak value amplification | Meiting Song | Jaime Cardenas, Andrew Jordan | | AN Jordan Scientific and CEIS NYSTAR | Using the bright port output light of the Weak Value Gyro cavity to stabilize the laser to the sensing cavity. It has commercial applications in inertial measurement units. |
| Multiphoton LIRIC: modeling, scaling, and material modification studies | Wayne Knox | | | Clerio Vision, Inc. and CEIS/NYSTAR | A new invention is disclosed. Provisional patents are being filed. A second new invention is disclosed. Provisional patents are being filed. |
| Scalable manufacturing with laser induced refractive index change | Knox; Wayne H.; Huang; Ruiting | | | Clerio Vision, Inc. and CEIS/NYSTAR | How to design manufacturing systems using high power femtosecond lasers in order to scale-up the volume of manufacturing, particularly for |

| | | | | | |
|---|-------------------|------------------------------------|--|-----------------------------------|---|
| US Patent Application 20220001495 date 1/6/2022 | | | | | the application of custom contact lenses. |
| Method and System of Pulse-Echo Ultrasound Imaging Using Pseudo-Random Sparse Array U.S. Application No. 17/817,211 | Zeljko Ignjatovic | Jovan Mitrovic, William J. Sehnert | | Carestream Health and CEIS/NYSTAR | Method of separating transducer elements of an ultrasound transducer array into two disjoint subsets such that the transducer elements in one subset perform transmit operation only while the elements of the other subset perform the echo receive operation only |

Start-up Companies Formed

None

Licensing Agreements

None

Royalties

| Project | Principle Investigator | Co-Investigator | Company Partner | Royalty Income |
|------------------------------|------------------------|--|---------------------|-----------------------------------|
| 1430C012, 1430C013, 1430C014 | Krystel Huxlin | Wayne Knox, Jonathan Ellis, Kaitlin Wozniak, Li Ding, Daniel Brooks among others | Clerio Vision, Inc. | 6 royalties totaling \$815,039.92 |

Small Business Assistance Provided

Longtime CEIS partners Jim McGrath and **SiMPore, Inc.**, helped pave the way for nanomembrane technology to detect diagnostic levels of biomarkers related to TBIs and bladder cancer immunotherapy. McGrath’s team along with faculty at the University of Ottawa received \$1.6M from the National Institute for Biomedical Imaging and Bioengineering to develop a device, which would be less expensive, faster, and portable for doctors’ offices and smaller hospitals. In addition, it would be able to produce results quickly when used in the field by emergency responders. RIT leveraged CEIS support to develop a femtosecond-laser-based direct laser writing (DLW) technique to fabricate three-dimensional waveguides inside of laser crystal materials. The research team and **Aktiwave** have performed the comparative study and achieved the optimized DLW parameters for both 515 and 1030nm laser sources. Another CEIS supported project team built a new high dynamic range autocorrelator and used it to study the quality of fiber-compressed pulses. They then took it to partner **Clerio Vision** to study their fiber pulse compressor and compared it to the pulse quality with a newly purchased commercial femtosecond laser. The team also did a lot of preliminary work in the measurement of Laser Induced Refractive Index Changes (LIRIC) in dehydrated hydrogels of various formulations. CEIS subsidized vendor/attendance fees at the 2021 NYS Innovation Summit for start-up partners – **LighTopTech, Mosaic Microsystems, and VeRacity VRcade**. CEIS supported Optics faculty assisted partner **SunDensity** with developing comprehensive computational scripts for the efficient use of commercial software, and unique

programming tools aimed on modeling optical properties for Photonic Smart Coatings (PSC™). Numerical calculations guided the manufacturing process by eliminating inefficient designs, which saved a considerable amount of the company’s resources.

Level of Matching Funds Provided and uses
Expenses (include Federal State, local funds & in-kind)

| Operating Expenses | Matching Funds | | | Total |
|----------------------|------------------|--------------------|---------------|--------------------|
| | NYSTAR Funding | Company Cost Share | Other Sources | |
| Salaries & Fringe | \$667,949 | \$442,429 | \$0 | \$1,110,378 |
| Indirect Costs | \$83,285 | \$74,315 | \$0 | \$157,600 |
| Equipment | \$20,314 | \$45,154 | \$0 | \$65,468 |
| Materials & Supplies | \$2,222 | \$46,958 | \$0 | \$49,180 |
| Tuition | \$6,149 | \$0 | \$0 | \$6,149 |
| Travel | \$1,774 | \$3,805 | \$0 | \$5,579 |
| Subcontractors | \$35,150 | \$0 | \$0 | \$35,150 |
| Other | \$18,066 | \$39,941 | \$0 | \$58,007 |
| Total | \$834,909 | \$652,602 | \$0 | \$1,487,511 |

** Additional 2:1 Small NYS Company Match \$401,027

Total Federal: 0
Total In-kind: 0