ANNUAL REPORT
FY 2022—2023

Center for Manufacturing Research

College of Engineering

Tennessee Tech University

Center for Manufacturing Research
Moving Technology Forward

College of Engineering
TENNESSEE TECH

About the Cover

(Upper left photo)

Dr. Pingen Chen is the lead investigator of “Rural Reimagined: Building an EV Ecosystem and Green Economy for Transforming Lives in Economically Distressed Appalachia”, awarded by the U.S. Department of Energy. He is shown next to one of the electric vehicles used in demonstrations across the region to build the clean economy in rural areas.

(Lower right photo)

Dr. Rory Roberts is spearheading a team consisting of several universities and industry partners in the CarbonLess Electric AviatioN (CLEAN) as part of NASA’s University Leadership Initiative program. Pictured are the TTU faculty and student team members in the Propulsion, Power, and Thermal Systems Laboratory (left to right): Dr. Ahmad Vaselbehagh, Dr. Bruce Jo, Dr. Mingyang Gong, Aaron Bain, Alex Tharpe, David Schafer, Jeff Webster, Jimmy Meacham, Andrew Ellicott, Noah Simpson, Trevor Kramer, and Dr. Rory Roberts.

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Tennessee Technological University
Center for Manufacturing Research
Annual Report – FY 2022 – 2023

Mission Statement
(Unchanged since 2001)

"To advance and support scientific and engineering knowledge in areas related to manufacturing through fundamental research and technology transfer activities, and to impact the instructional program in those areas."

The Center for Manufacturing Research (CMR) at TTU was established in 1984 and named a THEC Established Center of Excellence in 1990.

Director

Ying Zhang, Ph.D.
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CMR External Advisory Board

Dr. Abhijeet Borole – Electro-Active Technologies, Knoxville, TN
Thomas Lawson – Nissan North America, Decherd, TN
Brad Long – Cummins Filtration, Cookeville, TN
Jonathan Miller – Aerojet Ordnance Tennessee, Jonesborough, TN
Dr. Richard Mu - TSU Interdisciplinary Graduate Engineering Research Institute, Tennessee State University, Nashville, TN
David Nesbitt – Applied Thermal Coatings, Chattanooga, TN
Robert Wiseman – Lochinvar LLC, Lebanon, TN

CMR Faculty and Staff

Brian Bates, Senior R&D Engineer
Michelle Davis, Programs Manager
Brandon England, Post-Doc Researcher
Dr. Mingyang Gong, Postdoctoral Research Associate
Dr. Nan (Terry) Guo, Assistant Research Professor
Karen Harris, Financial Analyst
E. Wayne Hawkins, Material Science Lab Manager
Suzanne Henry, Center Manager
Giovanni Mainardi Neto, R&D Engineer I
Tammy Martin, Financial Associate (part-time, temporary)
Darlene Wiegand, Financial Analyst (part-time, temporary)

CMR Faculty Associates*

Dr. Mohammad Albakri, ME
Dr. Ali Alouani, ECE
Dr. Steven Anton, ME
Dr. Pedro E. Arce, ChE
Dr. Andrea Arce-Trigatti, Curriculum & Instruction
Dr. Indranil Bhattacharya, ECE
Dr. J. W. Bruce, ECE
Dr. Stephen Canfield, ME
Dr. Pingen Chen, ME
Dr. George Chitiyo, Curriculum & Instruction
Dr. William Eberle, CS
Dr. Ismail Fidan, MET
Dr. Manaak Gupta, CS
Dr. Syed Rafay Hasan, ECE
Dr. Ada Haynes, Sociology & Political Science
Dr. Stephen Idem, ME
Dr. Bruce Jo, ME
Dr. Duckbong Kim, MET
Dr. Ethan Languri, ME
Dr. Allen MacKenzie, ECE
Dr. Mohamed Mahmoud, ECE
Dr. Joseph Ojo, ECE
Dr. Andy Pardue, ME
Dr. Avinash Paruchuri, MET
Dr. Darek Potter, STEM
Dr. Mohan Rao, ME
Dr. Rory Roberts, ME
Dr. Jonathan (Robby) Sanders, ChE
Dr. Susmit Shannigrahi, CS
Dr. Holly Stretz, ChE
Dr. Doug Talbert, CS
Dr. John Tester, GBE
Dr. Dennis Ulybyshev, CS
Dr. Ahmedreza Vaselbehagh, ME
Dr. L. (Fred) Vondra, MET
Dr. Chris Wilson, GBE, ME
Dr. Jiahong (John) Zhu, ME

* CMR Faculty Associates are TTU faculty members who work with the CMR by serving as principal investigators, co-principal investigators, or other senior personnel on externally-funded projects, as well as by submitting proposals to seek external funding.

EXECUTIVE SUMMARY

FY22-23 has witnessed unprecedented success as the CMR secured over $4.1M in external funding, a 98% increase over the previous year. This achievement marks the highest funding level since the Center's inception in 1984. The faculty's hard work and dedication have played a pivotal role in attaining such significant funding, enabling the Center to expand its research capabilities, forge valuable partnerships, and accelerate innovation in a range of research areas. This summary highlights two large grants, offering a glimpse into the accomplishments. The report also showcases several other competitive and exciting research projects, as detailed in the "Research Highlights" section.

The team led by Dr. Pingen Chen has been awarded over $8M ($4,012,930 sponsor share + $4,013,156 cost share) by the U.S. Department of Energy for their proposal titled "Rural Reimagined: Building an EV Ecosystem and Green Economy for Transforming Lives in Economically Distressed Appalachia." This project aims to provide clean and affordable mobility options to underserved communities by developing needed charging infrastructure and by adopting and demonstrating various cost-effective electric vehicles in diverse applications. Additionally, the project will facilitate collaborative opportunities among universities, automotive electric vehicle manufacturers, charging station suppliers, and other stakeholders for workforce training, catering to the rapidly growing electric vehicle industry and the clean energy economy.

Dr. Rory Roberts and his team have been selected by NASA to receive a grant of over $8M ($7,999,982 sponsor share + $670,032 cost share) for the development of an electric-powered commercial aircraft. The project, titled 'CarbonLess Electric AviatioN (CLEAN),' aims to create a preliminary design for a 150-passenger electrified aircraft that utilizes an ammonia-based integrated propulsion, power, and thermal management system. The CLEAN team is one of four teams nationwide chosen by NASA to address pivotal challenges in the future of air travel as part of the agency's University Leadership Initiative. With the anticipated growth of advanced air mobility and the increasing emphasis on sustainable aviation, involving today's students in addressing forthcoming challenges is crucial. The CLEAN team will directly engage nearly 100 undergraduate and graduate students as researchers across five universities, with over 50 opportunities available at Tennessee Tech alone.

During FY22-23, a total of $4,141,124 was activated for 25 research projects from various funding agencies. CMR Faculty Associates submitted 33 research proposals totaling over $30M. The quality of the faculty's research is further highlighted by their scholarly contributions, which include 52 journal papers, 69 conference papers, and 10 book chapters over the past year.

CMR Faculty Associates remain dedicated to teaching and training the next-generation manufacturing workforce. In FY22-23, CMR supported a total of 55 graduate students (18 M.S. and 37 Ph.D. students), including 2 M.S. and 7 Ph.D. students from underrepresented minorities. CMR also supported 18 undergraduate research assistants through both State Appropriations and externally-funded projects.

Center Research, Education and Outreach Areas

Smart Manufacturing, including (1) Additive Manufacturing, (2) Advanced Robotics and Smart Mobility, and (3) Cybersecurity in Manufacturing.

Sustainable Materials and Manufacturing, including (1) Materials Processing and Modeling and (2) Energy Conversion / Storage Materials and Systems.

Industry Support, including efforts to provide Tennessee manufacturers with technical expertise in problem-solving challenges faced in materials, design, testing, and processes.

Education and Outreach, including efforts to enhance the Tennessee workforce development and outreach in the CMR's research areas in addition to such other activities as energy efficiency, waste reduction, and productivity improvements.

Selected Highlights from FY 2022 – 2023

Twenty-five distinct research projects were funded for a total of $4,141,124 from various funding agencies (e.g., National Science Foundation, U.S. Department of Energy, NASA, Office of Naval Research).

CMR's new matching funds for the past FY were $3,397,128. This amount excludes $749,606 of indirect costs associated with this year's funded projects.

Thirty-three research proposals totaling $30,585,628 were submitted by CMR faculty and faculty associates.

CMR supported 55 graduate students during the past FY. A total of 18 M.S. students and 37 Ph.D. students were funded through both State appropriations and external funding received by faculty. Specifically, external grants funded 10 of the M.S. students and 19 of the Ph.D. students. Thus, 53% of CMR graduate students supported was from external funding. Among the graduate students funded by CMR, two M.S. and seven Ph.D. students were from underrepresented minorities.

Thirteen M.S. students and seven Ph.D. students supported by CMR received their degrees during FY22-23.

CMR supported a total of 18 undergraduate research assistants during this past fiscal year through both State Appropriations and externally-funded projects.

CMR Faculty Associates and R&D engineers have published 52 journal papers, 69 conference papers, 10 book chapters and three reports during the past year.

Table 1. Summary of CMR Accomplishments

	FY 17-18	FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23
Total External Activations	$2,242,209	$2,090,724	$2,411,429	$2,185,133	$2,085,716	$4,141,124
Number of Graduate Students Supported by External Funding and State Appropriations	46	33	36	41	53	55
Percentage of Graduate Students Supported by External Funding	67%	55%	53%	59%	38%	53%
Number of Undergraduate Students Supported by External Funding and State Appropriations	53	46	35	50	41	18

Table 1 summarizes CMR accomplishments in the past six years. A brief description of some of these funded projects can be found in the "Research Highlights" on pages 7-10.

The Center's annual external activations (FY12-13 to FY22-23) are presented in Figure 1. The proposals submitted by the CMR Faculty Associates (FY12-13 to FY22-23) are shown in Figure 2.

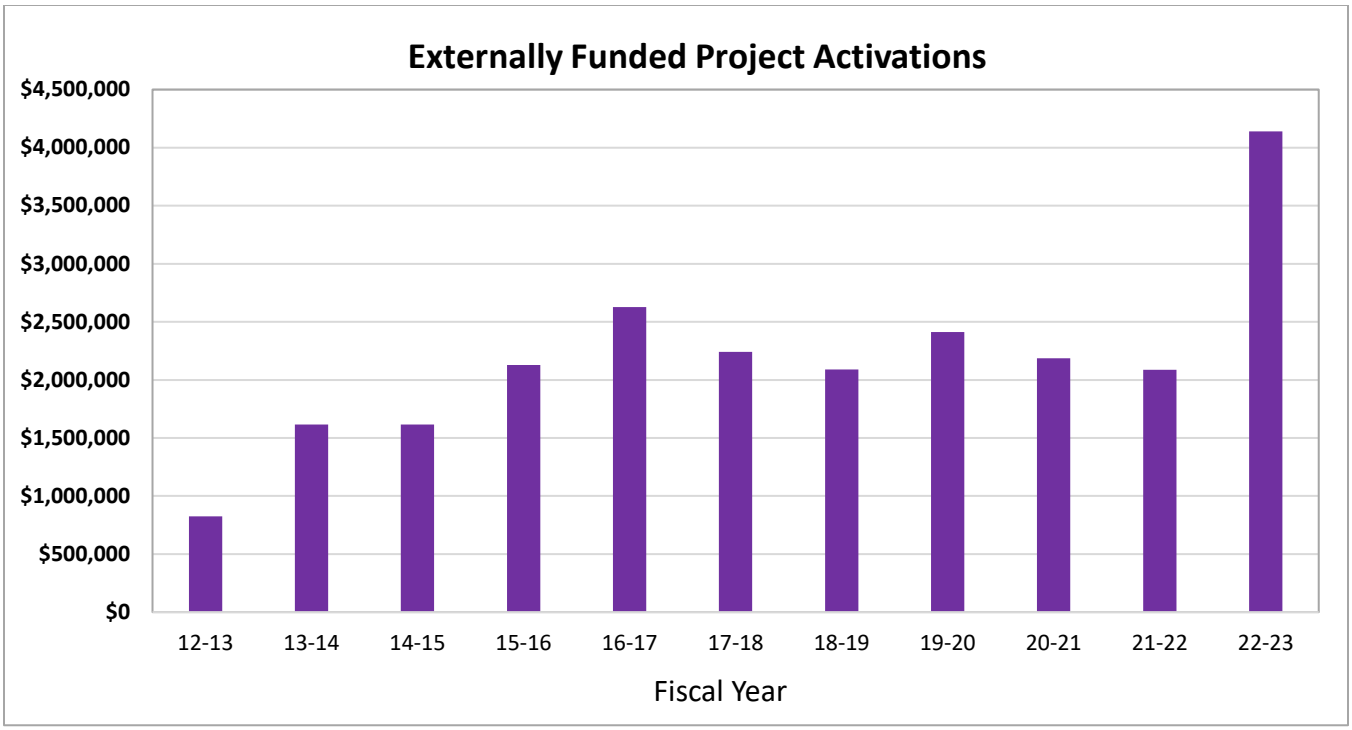


Figure 1 – Externally Funded Activations Since FY12-13

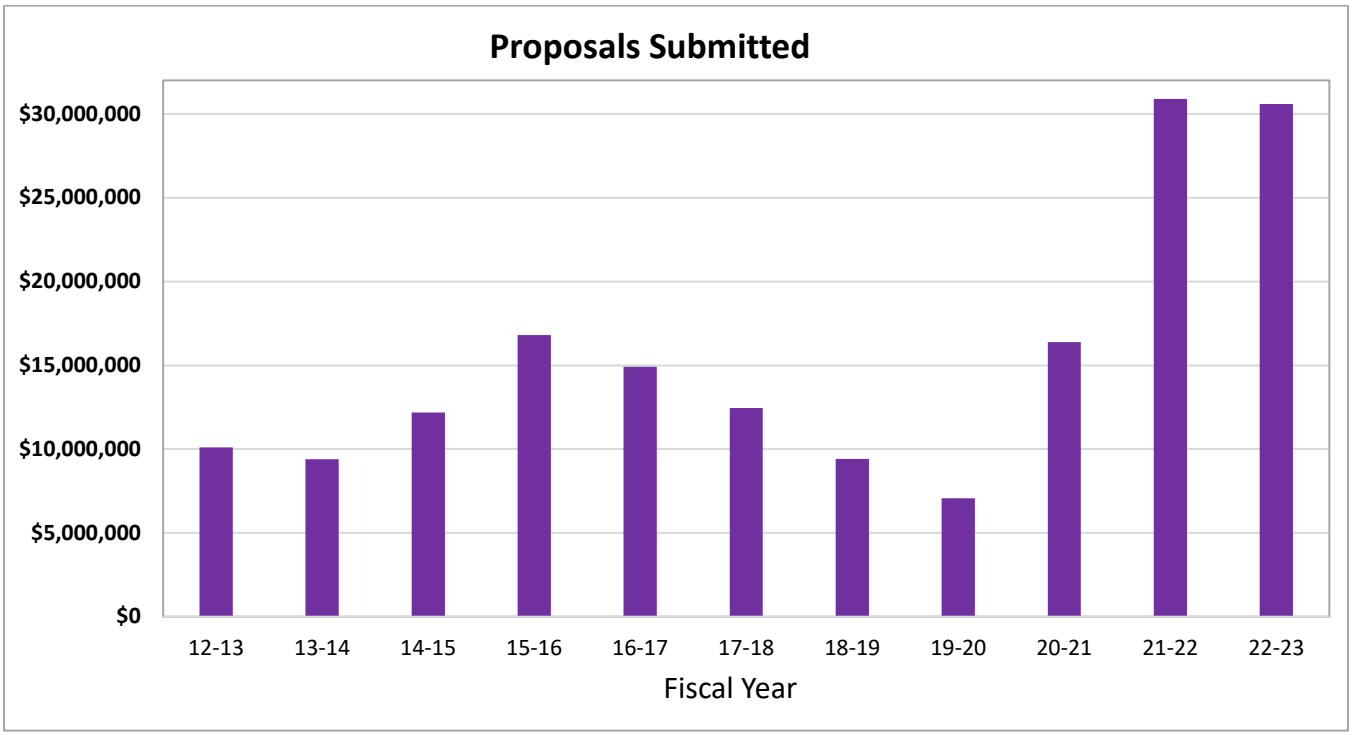


Figure 2 – Proposals Submitted Through CMR Since FY12-13

Table 2 shows various sources of external revenues for the past six years that were used to “release” or “free up” State appropriations for other strategic investment areas.

Table 2. Salary and Supplies Released by External Funding

Performance Metrics	FY 17-18	FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23
CMR faculty and staff release time	$101,464	$86,717	$129,844	$155,410	$80,066	$107,517
Graduate student stipend and fees from external sponsors	$428,579	$287,144	$157,179	$294,022	$431,500	$494,940
Total of income resources (F&A return, testing income, GRA support, equipment usage, and release	$614,388	$412,454	$304,220	$472,841	$542,281	$618,667

Research Highlights

Dr. Ali Alouani (Electrical and Computer Engineering) was awarded $185,792 from Tennessee Valley Authority for “Autonomous Intelligent Robot (AIRobot) for TVA Substation Inspection”. The research objective is the design and development of an intelligent robot to collect relevant data while autonomously traveling across a TVA substation. The AIRobot automatically communicates pertinent data to a maintenance team/control center/operator via a dashboard. Furthermore, the AIRobot has onboard intelligence and learning capabilities, utilizing sensors’ data fusion to detect abnormal patterns and alert the appropriate personnel in real-time. It also detects visible wear and tear of a piece of equipment in the substation by analyzing acquired images. The AIRobot can be utilized in different substations of different sizes and topologies.

Dr. Pingen Chen (Mechanical Engineering) was awarded more than $8 million ($4,012,930 Sponsor Share + $4,013,156 Cost Share; Year 1 Activation $2,047,532) by the Department of Energy for the project “Rural Reimagined: Building an EV Ecosystem and Green Economy for Transforming Lives in Economically Distressed Appalachia”. This research seeks to contribute to the building of the clean energy economy in rural areas and provide clean and affordable mobility options to underserved communities. This will be accomplished by developing needed electric vehicle charging infrastructure and adopting and demonstrating various cost-effective EVs in diverse applications. Five major components make up the project: 1) charging infrastructure development, 2) electric vehicle acquisition and demonstration, 3) data collection and analysis, 4) outreach and education, and 5) workforce training and economic development. Long term impacts on rural areas will include transition from a fossil fuel-based fuel economy to clean energy, improved environmental quality and public health as well as creating new job opportunities.

Dr. Ethan Languri (Mechanical Engineering) and **Dr. Stephen Idem** (Mechanical Engineering) received two awards from the Department of Energy totaling $366,341 ($2.3M total 5 year award = $1,750,000 sponsor share + $560,026 cost share) for the project “Public-Private Partnership to Promote Efficient, Resilient and Secure Manufacturing and Workforce Development”. This award continues the Industrial Assessment Center (IAC) which has been in existence at TN Tech since 2006. The goals of the IAC are: 1) assisting small and medium-sized manufacturers to become more energy efficient and reduce carbon emissions, and 2) training the next generation of energy engineers. TN Tech, together with its Satellite Center at the University of Memphis, has the only IAC in the state of Tennessee.

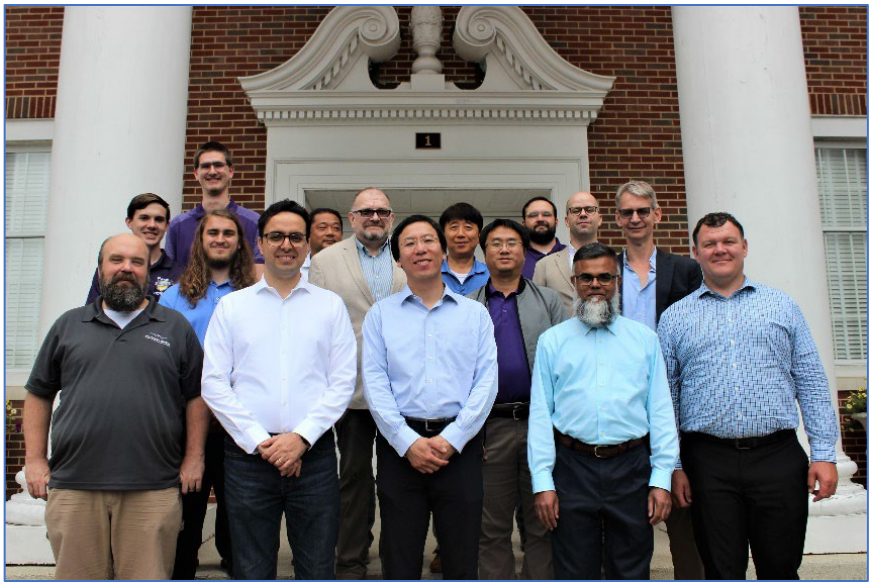
In FY 2022-2023, the IAC conducted energy assessments for 19 manufacturers and one municipal wastewater facility in Tennessee, Kentucky, and Mississippi. One of these clients was Astec Heatec, a manufacturer of asphalt heaters and liquid storage tanks in Chattanooga. Patrick Swiecichowski, Mechanical Engineering Ph.D. student, is shown on the previous page checking for costly compressed air leaks during the on-site assessment. The team identified projects that will save the plant over 7% of their annual utility costs and approximately 280,000 lbs. of carbon dioxide from being released into the atmosphere.

The IAC received the "2022 Excellence in Applied Energy Engineering Research" from the U.S. Department of Energy for work titled "Field Validation Study of an In-House Developed Cooling Tower Efficiency Model". This research provides validation to the "TTU Cool Tool" to help manufacturers operate in water-stressed areas that may not be able to use evaporative cooling for thermal management. Pictured to the right are Mechanical Engineering Ph.D. student Spencer Jones and IAC Director Ethan Languri, Ph.D. (Mechanical Engineering).

Dr. Olorunfemi Ojo (Electric and Computer Engineering) received $175,000 in activation (total funding $503,954) from the Office of Naval Research to investigate "Control of Modular Multi-Dual Active Bridge Converters for Integrated Ship-Board Power System". This research contributes toward the U.S. Navy's objectives of evolving a new architecture of the Navy shipboard distribution electric power system. It investigates the modular, multi-dual active bridge converter system with high-frequency transformers by interphasing the loads to the energy sources. The high-frequency operation, the multi-dual active bridge designs with separate transformers linking loads to sources, and the feasibility of the zero-voltage converter under all operating conditions make this topology desirable for the specified Navy application. To achieve high/fast dynamic performance control, especially for pulsed power and propulsion loads, an exact decoupling feedback linearization control strategy will be developed and implemented.

Dr. Rory Roberts, Dr. Bruce Jo, and Dr. Ahmad Vaselbehagh (Mechanical Engineering) received $300,000 as the first activation from NASA for the CarbonLess Electric AviatioN (CLEAN) project ($8,670,014 total award = $7,999,982 sponsor share + $670,032 cost share). Team members include Tennessee State University, The Ohio State University, University of Dayton, University of Washington – Bothell, Boeing Research & Technology, Raytheon Technologies Research Center, and Special Power

Sources. This project seeks to help solve one of aviation's key challenges for the future of commercial air travel: zero-emission aircraft by 2050. The team of researchers, led by Dr. Roberts, will explore a preliminary design for an electrified, 150-passenger aircraft that uses an ammonia-based integrated propulsion, power, and thermal management system. The research focuses on investigating, designing, and testing several components and subsystems that are required for a zero-emissions commercial passenger aircraft. The research team has unique one-of-a-kind testing capabilities for Solid Oxide Fuel Cell Combustor (SOFCC) with a turbogenerator (TG) power generation technologies under flight conditions including pressurized operation with rapid changes in load for emulated in-flight operation. SOFC-TG technology is a unique and transformative concept addressing many of the challenges faced in all-electric propulsion-based aviation. The power generation system has high part-load efficiency during cruise, high specific power density, load following capability, high-power capacity at high altitudes adapting to low temperatures and pressures, rapid startup time, and efficient thermal management. The SOFCC-TG concept achieves the performance targets necessary for electrifying zero emissions 150-passenger aircraft by reducing the complexity of traditional fuel cell-gas turbine hybrid systems.



Dr. Doug Talbert (Computer Science) was awarded $127,364 (Year 1; Total Award $373,481) for the project "Making Computerized Trauma Triage Decision Support Accurate, Fair and Trustworthy". The long-term aim of this research is to build an intelligent, learning computerized trauma triage decision support (CTDS) system that, aided by an information-rich environment, collects and processes prehospital data and effectively communicates accurate and understandable triage recommendations that improve patient outcomes. This step towards that goal will validate and extend preliminary results and assess the complexity of AI-generated explanations intended to improve the trustworthiness of such a CTDS system. First, the researchers will use a large demographically and geographically diverse data set to build and quantitatively assess the performance of multiple complex models, then assess the group fairness of these complex models and evaluate multiple bias mitigation strategies. Lastly, they will work with paramedics to both design algorithmically generated, EMS-oriented explanations and assess the trustworthiness of those explanations.

Center Activities

Materials Science Laboratory

The Materials Science Laboratory (MSL) conducts morphology and topographical characterization for a wide range of materials, including (but not limited to) polymers, ceramics, metals and their alloys, fibers, aggregates and composites. A centerpiece of the MSL is the ultra-high-resolution Field Emission Scanning Electron Microscope Hitachi FE_SEM SU7000. Tennessee Tech was the first university in North America to receive this equipment.

In FY 22-23, the MSL was cleaned and reorganized, making it more user friendly and efficient. Additionally, a new rough cut saw was added and the macro-hardness tester was relocated to the lab space, adding to the overall capability of the laboratory. The addition of a rough cut saw enables the lab users to process larger samples more quickly and free up the precision saw for other tasks. The relocation of the macro-hardness tester makes the instrument more accessible than before, allowing us to conduct tests more efficiently and with greater ease. Overall, the improvements made have increased the laboratory's ability to produce high-quality work and contribute to the advancement of the university.

Advanced Manufacturing Workforce Development

A group of educators and professors have unveiled a revolutionary new training platform that is set to transform the way technicians in advanced manufacturing are trained. This project is a collaboration between Somerset Community College in Somerset, Kentucky, Edmonds College in Lynnwood, Washington, and Tennessee Tech University, led by CMR Faculty Associate**, Dr. Ismail Fidan** (Manufacturing and Engineering Technology).

Traditionally, technicians and companies that employ them have relied on costly hardware and hands-on training to gain the skills needed to perform their tasks. However, the advent of virtual reality (VR) has opened up new possibilities for training, with the technology able to replicate real-world scenarios and provide immersive, effective learning experiences.

VR applications are expensive, however, making it difficult for community and technical colleges to adopt them as a training tool. This is where the Low-Cost Virtual Reality Platform project comes in. Led by a team of educators with related experience and expertise, the project has developed a low-cost platform for creating VR modules that can be customized and adopted by colleges with limited resources.

The platform has already been used to develop four VR modules on blueprint reading, basic work area safety, quality control, and geometric dimensioning and tolerancing, with promising results.

This innovative project is proving that effective training doesn't have to be expensive or out of reach. By providing a solution to a longstanding problem, the project is helping to create a training method that is accessible for students and affordable for schools, colleges, and companies. As the demand for skilled technicians in advanced manufacturing continues to grow, this low-cost virtual reality platform is poised to become a game-changer, helping to bridge the skills gap and equip the next generation of technicians with the knowledge and expertise they need to succeed.

The project team is confident that the low-cost virtual reality platform will have a lasting impact on technician training in advanced manufacturing. By providing an immersive and interactive learning experience, the platform is helping to engage students and keep them motivated, while also increasing retention and comprehension of complex concepts.

CMR Staff Recognition

Michelle Davis was awarded the 2023 Outstanding Staff Award for Excellence in Job Performance, Attitude, and Commitment by the TN Tech College of Engineering. Michelle has worked for the CMR since 2007, first as Outreach Coordinator, and currently as Programs Manager. Michelle manages CMR projects that have an aspect of community and industry outreach, including the Industrial Assessment Center.

Nan "Terry" Guo, Ph.D. has been with the CMR since 2004 as an R&D Engineer and was promoted to Assistant Research Professor, making his focus specifically on generating research results and acquiring external grants. Dr. Guo's research areas are: 1) Next-generation wireless communication and networking, 2) Data and information science (data science, information theory, detection and estimation theory, signal processing, sensing), and 3) Cyber-physical system security.

Karen Harris joined the CMR as a Financial Analyst in April 2023, expanding the Center's financial and reporting capabilities. Karen is a graduate of TN Tech (Accounting, 1992) and previously worked for the university's Financial Aid Office. She and her husband live on a working beef cattle farm and have 4 children and 2 grandchildren.

Earl “Wayne” Hawkins retired from the CMR after 33 years of service to Tennessee Tech. Wayne began his career at TN Tech in 1990 as a part-time Laboratory Assistant and over the years was promoted to Lab Manager of the Materials Science Lab (MSL), conducting microstructural characterization for a wide range of materials. In 2021, he was honored with the College of Engineering’s Outstanding Staff Award.

Faculty and Student Accomplishments and Awards

CMR Faculty Associate **Dr. Ethan Languri** (Mechanical Engineering) and Ph.D. student **Spencer Jones** (Mechanical Engineering) received the 2022 Excellence in Applied Energy Engineering Research Award from the U.S. Department of Energy for work titled “Field Validation Study of an In-House Developed Cooling Tower Efficiency Model”.

CMR Faculty Associate **Dr. Ahmad Vaselbehagh** (Mechanical Engineering) was awarded the 2022 – 2023 Brown-Henderson Outstanding Engineering Faculty Award which recognizes accomplishments which most closely reflect the mission of the College of Engineering, to prepare our graduates through a blend of education, research, and service.

The following faculty associates received the **Wings Up 100** award, recognizing faculty who bring in $100,000 or more in external funding for student research in the previous academic year: **Dr. Ali Alouani** (Electrical & Computer Engineering), **Dr. Pingen Chen** (Mechanical Engineering), **Dr. Ismail Fidan** (Manufacturing & Engineering Technology), **Dr. Maanak Gupta** (Computer Science), **Dr. Duckbong Kim** (Manufacturing & Engineering Technology), **Dr. Ethan Languri** (Mechanical Engineering), **Dr. Mohamed Mahmoud** (Electrical & Computer Engineering), **Dr. Rory Roberts** (Mechanical Engineering), **Dr. Susmit Shannigrahi** (Computer Science), **Dr. Ahmad Vaselbehagh** (Mechanical Engineering), and **Dr. Chris Wilson** (Mechanical Engineering).

CMR-supported student **Oluwaseyi Ayeni** received both a Kandy Thevar scholarship and an NSBE graduate student scholarship.

CMR-supported student **Emmanuel Aboah Boateng** won the Electrical and Computer Engineering Ph.D. division of the Tennessee Research and Creative Inquiry Day for his paper “Explainable ICS Anomaly Detection based on COPOD Algorithm”.

CMR-supported students **Joshua Lolonyo Korku Avornyo** and **Taiye Owu** tied for first place in the Electrical and Computer Engineering Master’s Division of the Tennessee Research and Creative Inquiry Day for their papers “A Simplified Approach to the Analysis of High Order Bi-Directional Inductive Power Transfer Systems” and “Minimization of Stray Field and Coupling Coefficient for a Double-D Pad Wireless Power Transfer Using an Analytical Approach”.

CMR-supported student **Mohammad Alshaikh Ali** won the Manufacturing and Engineering Technology Ph.D. division of the Tennessee Tech Research and Creative Inquiry Day for his paper “Using Regression Machine Learning to Predict Mechanical Properties of Additively Manufactured Specimens with Imbalanced Data”.

CMR-supported student **Jacob Hott** won the Mechanical Engineering Master’s division of the Tennessee Tech Research and Creative Inquiry Day for his paper “An Investigation of a Laboratory Scale Surrogate Model for the Design of Smart Buildings”.

Select 2022 - 2023 CMR Supported Alumni

Emmanuel Aboah Boateng, Ph.D., Electrical and Computer Engineering, 2023
Applied Scientist II
Microsoft
Atlanta, Georgia

Kaydn Brady, M.S., Electrical and Computer Engineering, 2023
GNC Engineer
Lockheed Martin
Texas

William Buida, M.S., Mechanical Engineering, 2022
Specialist, M&T Mechanical Design
Denso
Maryville, Tennessee

Tolulope Odetola, Ph.D., Electrical and Computer Engineering, 2022
Senior Machine Learning Engineer
Whirlpool Corporation
United States

Brandon Patel, M.S., Mechanical Engineering, 2023
Vehicle Stability Assist Test Engineer
Honda R&D Americas
Marysville, Ohio

Ibrahim Yilmaz, Ph.D., Computer Science 2022
Senior Machine Learning Research Scientist
Mayo Clinic
Jacksonville, Florida

Publications of CMR Faculty Associates & Staff
(January 2022 – December 2022)

Journal Publications

1. Abdelfattah, Sherif, Mohamed Baza, **Mohamed MEA Mahmoud**, Mostafa M. Fouda, Khalid A. Abualsaud, and Mohsen Guizani. "Multidata-owner searchable encryption scheme over medical cloud data with efficient access control." IEEE Systems Journal 16, no. 3 (2021): 5067-5078.
2. Abdel-Rahman, Mohammad J., Adel M. AlWaqfi, Jumanh K. Atoum, Maysa A. Yaseen, and **Allen B. MacKenzie**. "A Novel Multi-Objective Sequential Resource Allocation Optimization for UAV-Assisted VLC." IEEE Transactions on Vehicular Technology (2023).
3. Abdulaal, Mohammed J., Mohamed I. Ibrahem, **Mohamed MEA Mahmoud**, Junaid Khalid, Abdulah Jeza Aljohani, Ahmad H. Milyani, and Abdullah M. Abusorrah. "Real-time detection of false readings in smart grid AMI using deep and ensemble learning." IEEE Access 10 (2022): 47541-47556.
4. Adepoju, Webster, **Indranil Bhattacharya**, Mary Sanyaolu, Muhammad Enagi Bima, Trapa Banik, Ebrahim N. Esfahani, and Olatunji Abiodun. "Critical review of recent advancement in metamaterial design for wireless power transfer." IEEE Access 10 (2022): 42699-42726.
5. Adepoju, Webster, **Indranil Bhattacharya**, Mary Sanyaolu, and Ebrahim Nasr Esfahani. "Equivalent circuit modeling and experimental analysis of low frequency metamaterial for efficient wireless power transfer." IEEE Access 10 (2022): 87962-87973.
6. Aghili, Seyed Farhad, Mahdi Sedaghat, Dave Singelée, and **Maanak Gupta**. "MLS-ABAC: Efficient multi-level security attribute-based access control scheme." Future Generation Computer Systems 131 (2022): 75-90.
7. Alansari, Seham A., Mahmoud M. Badr, **Mohamed MEA Mahmoud**, Waleed Alasmary, Fawaz Alsolami, and Abdullah Marish Ali. "Efficient and privacy-preserving infection control system for COVID-19-like pandemics using blockchain." IEEE Internet of Things Journal 9, no. 4 (2021): 2744-2760.
8. Al-Maslamani, Noora Mohammed, Bekir Sait Ciftler, Mohamed Abdallah, and **Mohamed MEA Mahmoud**. "Toward Secure Federated Learning for IoT Using DRL-Enabled Reputation Mechanism." IEEE Internet of Things Journal 9, no. 21 (2022): 21971-21983.
9. **Alouani, Ali T.**, and Tarek Elfouly. "Traumatic brain injury (TBI) detection: past, present, and future." Biomedicines 10, no. 10 (2022): 2472.
10. **Arce, Pedro E., Andrea Arce-Trigatti,** Lacy Loggins, **J. Robby Sanders**, Juan S. Guerrero-Pérez, Gustavo E. Bolaños Barrera, and Mario A. Oyanader. "Universes of Learning (UoL) as creative educational experiences: Exploring the TSPACK and Renaissance Foundry Model as catalysts for learning transformations." New Directions for Teaching and Learning 2022, no. 169 (2022): 65-81.
11. **Arce-Trigatti, Andrea**, Steffano Oyanader, Luis Hevia, and **Pedro Arce**. "Exploring Students' Attitudes and Intentions in a Student-Staff Led Research Initiative." The Journal of Educational Innovation, Partnership and Change 8, no. 2 (2022).
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65. Staller, Joseph, Robert PM Craven, **Stephen Idem**, Sastry Munukutla, Keith Kirkpatrick, Dudley Benton, Susan Eisenstadt et al. "A Modified F-Factor Approach for Real-Time Performance Monitoring of Fossil Fuel Power Plants." In ASME Power Conference, vol. 85826, p. V001T01A001. American Society of Mechanical Engineers, 2022.
66. **Su, Zifei**, and **Pingen Chen**. "Cooperative Eco-driving Controller for Battery Electric Vehicle Platooning." IFAC-PapersOnLine 55, no. 37 (2022): 205-210.
67. **Su, Zifei**, and **Pingen Chen**. "Eco-driving for Battery Electric Vehicles Using Traffic-aware Computationally Efficient Model Predictive Control." IFAC-PapersOnLine 55, no. 37 (2022): 700-705.
68. **Su, Zifei**, and **Pingen Chen**. "Extremum Seeking Control-based Control Framework for Electric Vehicle Platooning." IFAC-PapersOnLine 55, no. 24 (2022): 123-128.
69. **Su, Zifei**, and **Pingen Chen**. "Optimal Platoon Merging and Catch-up Approach for Connected Electric Vehicles." In 2022 American Control Conference (ACC), pp. 1964-1969. IEEE, 2022.

Book Chapters

1. Adetokun, Bukola Babatunde, **Joseph Olorunfemi Ojo**, and Oyinlolu Ayomidotun Odetoye, "Energy Challenges in Nigeria and Their Solutions, in the Book Nigeria's Multifaceted Problems and Their Solutions," Lap Lambert Academic Press 2022.
2. **Arce, Pedro E., Andrea Arce-Trigatti***, and **J. Robby Sanders**, "The Renaissance Foundry: A Self-Guided Instrument for Faculty Development in Holistic-Centered Learning," invited Chapter in Faculty

Development on a Shoestring Book, Editors: Diane Chapman and Michelle Bartlett, Information Age Publishing Inc., P.O. Box 79049, Charlotte, NC-USA, 2022 (Accepted)

3. **Gupta, Maanak**, Smriti Bhatt, Asma Hassan Alshehri, and Ravi Sandhu. Access control models and architectures for IoT and cyber physical systems. Cham, Switzerland: Springer, 2022.
4. **Gupta, Maanak**, Smriti Bhatt, Asma Hassan Alshehri, and Ravi Sandhu. "Access Control Oriented Architectures Supporting IoT and CPS." In Access Control Models and Architectures For IoT and Cyber Physical Systems, pp. 19-38. Cham: Springer International Publishing, 2022.
5. **Gupta, Maanak**, Smriti Bhatt, Asma Hassan Alshehri, and Ravi Sandhu. "Attribute Based Access Control for Intelligent Transportation." In Access Control Models and Architectures For IoT and Cyber Physical Systems, pp. 125-145. Cham: Springer International Publishing, 2022.
6. **Gupta, Maanak**, Smriti Bhatt, Asma Hassan Alshehri, and Ravi Sandhu. "Authorization Frameworks for Smart and Connected Ecosystems." In Access Control Models and Architectures For IoT and Cyber Physical Systems, pp. 39-61. Cham: Springer International Publishing, 2022.
7. **Gupta, Maanak**, Smriti Bhatt, Asma Hassan Alshehri, and Ravi Sandhu. "Fine Grained Communication Control for IoT and CPS." In Access Control Models and Architectures For IoT and Cyber Physical Systems, pp. 147-164. Cham: Springer International Publishing, 2022.
8. **Gupta, Maanak**, Smriti Bhatt, Asma Hassan Alshehri, and Ravi Sandhu. "Introduction: Requirements for Access Control in IoT and CPS." In Access Control Models and Architectures For IoT and Cyber Physical Systems, pp. 1-17. Cham: Springer International Publishing, 2022.
9. **Gupta, Maanak**, Smriti Bhatt, Asma Hassan Alshehri, and Ravi Sandhu. "Secure Virtual Objects Communication." In Access Control Models and Architectures For IoT and Cyber Physical Systems, pp. 97-124. Cham: Springer International Publishing, 2022.
10. Mamun, Mohammad and **Ali T. Alouani**, “Automatic Detection of Heart Diseases Using Biomedical Signals: A Literature Review of Current Status and Limitations,” Lecture Notes in Networks and Systems 439, pp. 420-440, 2022.

Reports

1. CHEUNG, APRIL, **ISMAIL FIDAN**, VENANCIO L. FUENTES, and MARTIN REED. "Overview of ABET Accreditation from the Perspective of Two-Year Programs." (2022).
2. Wohlers, Terry, Noah Mostow, Ian Campbell, Olaf Diegel, Joseph Kowen, **Ismail Fidan**, “Wohlers Report 2022: 3D Printing and Additive Manufacturing – Global State of Industry,” March 2022, ISBN: 978-0-9913332-9-5, ASTM International.
3. **Stretz, H. A., Ayeni, O. O**., “Multiphysics Modeling of Salt Extraction (Separation) in Two Phase Flows in a Fiber Reactor” report to Visionary Fibers, 08-30-2022.

External Activations

	Project Description	P.I.	Department	Total Funds
1	Autonomous Intelligent Robot (AIRobot) for TVA Substation Inspection Tennessee Valley Authority Account #: 5-32605 836MC-Y4	Ali Alouani	ECE	$185,792
2	Integration of the Engineering for One Planet Model as a Structured Approach to Sustainable Design via the Renaissance Foundry ASEE - American Society for Engineering Education Account #: 5-35305 961MC	Pedro Arce Robbie Sanders	ChE ChE	$8,000
3	Medium-duty eTruck: Pilot Electrified Fleets in Urban and Regional Applications UT-Austin (via DOE funds) - UTAUS-SUB0000346AM2 - Period 2 of 3 (formerly UTA20-001055) Account #: 5-39221 852MC-Y2	Pingen Chen Stephen Canfield	ME ME	$122,378
4	Rural Reimagined: Building an EV Ecosystem and Green Economy for Transforming Lives in Economically Distressed Appalachia US Department of Energy - Award DE-EE0009862 - Period 1 Account #: 5-32627 907MC-P1	Pingen Chen	ME	$2,047,532
5	Improving Technician Skills in Advanced Manufacturing with a Low-Cost Virtual Reality Platform Somerset Community College (via NSF funds) Account #: 5-31330 871MC-Y3	Ismail Fidan	MET	$27,858
6	Collaborative Research: Sensing by Leveraging Cellular Communication Networks: A Framework of Medium Distance Baseline Interferometry National Science Foundation - Award 2135275 - Year 2 of 3 Account #: 5-31329 903MC-Y2	Terry Guo Allen MacKenzie	CMR ECE	$66,574
7	Investigations into the Design Rules for the Control of Wire-Arc Additive National Science Foundation - Year 3 of 3 - Award 2015693 Account #: 5-31315 840MC-Y3	Duckbong Kim	MET	$75,786

	Project Description	P.I.	Department	Total Funds
8	CAREER: Wire Arc Additive Manufacturing of Molybdenum Alloy Structures for High-temperature Applications: Residual Stresses and Porosity Considering Ductile-to-Brittle Transition Temperature National Science Foundation - Award 2131905 - Year 2 of 5 Account #: 5-31333 914MC-Y2	Duckbong Kim	MET	$79,187
9	Development of Near Optimal Process through Microstructure and Mechanical Analysis of Steel-based Dissimilar Metals using DED Process KITECH (Korean Institute of Industrial Technology) Account #: 5-35204 958MC-R	Duckbong Kim	MET	$12,900
10	Proof of Concept of Steel to AL Alloy Transitions Joints by Wire Additive Manufacturing Oak Ridge National Laboratory - PO 4000206210 Account #: 5-32460 973MC	Duckbong Kim	MET	$50,000
11	Public-Private Partnership to Promote Efficient, Resilient and Secure Manufacturing and Workforce Development US Department of Energy (DOE) - Cooperative Agreement DE-EE0009722- Modification #2 - Balance Year 1 & Partial Year 2 Account #: 5-32623 901MC-M2	Ethan Languri Stephen Idem	ME ME	$220,000
12	Public-Private Partnership to Promote Efficient, Resilient and Secure Manufacturing and Workforce Development US Department of Energy (DOE) - Cooperative Agreement DE-EE0009722 Modification #3 - Balance Year 2 Account #: 5-32623 901MC-M3	Ethan Languri Stephen Idem	ME ME	$146,341
13	Control of Modular Multi-Dual Active Bridge Converters for Integrated Ship-Board Power System Office of Naval Research - Award N00014-21-1-2114 - Modification #5 Account #: 5-32618 877-M5	Joseph Ojo	ECE	$105,000
14	Control of Modular Multi-Dual Active Bridge Converters for Integrated Ship-Board Power System Office of Naval Research - Award N00014-21-1-2114 - Modification #3 Account #: 5-32618 877MC-M3	Joseph Ojo	ECE	$25,000

	Project Description	P.I.	Department	Total Funds
15	Control of Modular Multi-Dual Active Bridge Converters for Integrated Ship-Board Power System Office of Naval Research - Award N00014-21-1-2114 - Modification #4 Account #: 5-32618 877MC-M4	Joseph Ojo	ECE	$45,000
16	UT-CIS 2022-2023 Capstone The University of Tennessee Center for Industrial Services Account #: 5-33634 189MC-22	Mohan Rao	ME	$30,000
17	High Power Density Carbon Neutral Electrical Power Generation for Air Vehicles Department of Energy-Advanced Research Projects Agency-Energy Account #: 532620 CESR-RR2	Rory Robert	ME	$257,470
18	Atmosphere Independent Bipropellant Consuming Additively Manufactured Solid Oxide Fuel Cells (SOFCs) for Assured On-Orbit Space Power Southwestern Ohio Council for Higher Education (SOCHE) via DOD funds - RQ19-TN-20-7-AFRL2 Modification #3 Account #: 5-39238 868-M3	Rory Roberts	ME	$54,669
19	Cryo Thermal Management of High-Power Density Motors and Drives Hyper Tech (via ARPA-E funds) Account #: 5-32619 884MC-P3	Rory Roberts	ME	$24,159
20	CarbonLess Electric AviatioN (CLEAN) - Grant # 80NSSC23M0060 - Allocation #1 NASA ULI Account #: 5-32066 974MC-A1	Rory Roberts Bruce Jo Ahmad Vaselbehagh	ME ME ME	$300,000
21	Fiber Reactor Extraction Simulation Visionary Fiber Technologies Account #: 5-35309 976MC	Holly Stretz	ChE	$83,490
22	Making Computerized Trauma Triage Decision Support Accurate, Fair and Trustworthy National Institute of Health (NIH) -Award 1R15LM013824 - Year 1 of 3 Account #: 5-31343 929MC-Y1	Doug Talbert	CS	$127,364
23	Manufacturing Testing and Design 2022-Various Industries Account #: 5-38585 100MC-20	Ying Zhang	CMR	$10,600

	Project Description	P.I.	Department	Total Funds
24	Pack Aluminide Coatings on Ti-Containing Ni-base Alloys - Reference PR73702 Oak Ridge National Laboratory (ORNL) - PO 40000204172 Account #: 5-32455 950MC	Ying Zhang	CMR	$13,932
25	Pack Aluminide Coatings on F82H Alloy Oak Ridge National Laboratory - PO 400205045 Account #: 5-32456 971MC	Ying Zhang	CMR	$22,092

External Activations in FY 2022 – 2023 $4,141,124

Schedule 7

CENTERS OF EXCELLENCE
ACTUAL, PROPOSED, AND REQUESTED BUDGET

Institution	Tennessee Technological University			Center			Center for Manufacturing Research		
	FY 2022-23 Actual			FY 2023-24 Proposed			FY 2024-25 Requested		
	Matching	Appropr.	Total	Matching	Appropr.	Total	Matching	Appropr.	Total
Expenditures									
Salaries									
Faculty	309,025	299,680	**608,705**	400,000	349,425	**749,425**	425,000	380,000	**805,000**
Other Professional	125,385	331,247	**456,632**	175,000	663,564	**838,564**	200,000	550,000	**750,000**
Clerical/ Supporting	0	17,075	**17,075**	0	23,529	**23,529**	0	0	**0**
Assistantships	289,426	256,675	**546,101**	300,000	513,847	**813,847**	300,000	425,000	**725,000**
Hourly Students	60,317	17,422	**77,739**	60,000	41,752	**101,752**	60,000	30,000	**90,000**
Total Salaries	**784,153**	**922,099**	**1,706,252**	**935,000**	**1,592,117**	**2,527,117**	**985,000**	**1,385,000**	**2,370,000**
Fringe Benefits	307,050	363,096	**670,146**	350,000	529,352	**879,352**	375,000	325,000	**700,000**
Total Personnel	**1,091,203**	**1,285,195**	**2,376,398**	**1,285,000**	**2,121,469**	**3,406,469**	**1,360,000**	**1,710,000**	**3,070,000**
Non-Personnel	**NOTE: Appropriation Expenditures in Fringe Benefits include $153,604 for Graduate Student Fees in FY 2022-23.**								
Travel	49,224	17,010	**66,234**	60,000	27,888	**87,888**	60,000	30,000	**90,000**
Computer Maint./Software	7,980	2,769	**10,749**	15,000	0	**15,000**	15,000	0	**15,000**
Books & Journals	0	0	**0**	0	0	**0**	0	0	**0**
Other Supplies	227,949	104,729	**332,678**	325,000	174,554	**499,554**	325,000	102,240	**427,240**
Equipment	217,944	158,522	**376,466**	375,000	128,856	**503,856**	375,000	125,000	**500,000**
Lab. Upgrades/Mainten.	0	39,713	**39,713**	0	0	**0**	0	0	**0**
Scholarships for Service	17,940	0	**17,940**	0	0	**0**	0	0	**0**
Subcontracts/Subawards	1,708,535	0	**1,708,535**	1,457,183	0	**1,457,183**	1,350,000	0	**1,350,000**
Renovation	0	0	**0**	0	0	**0**	0	0	**0**
Seminars/Workshops/Con	26,873	0	**26,873**	15,000	0	**15,000**	15,000	0	**15,000**
Total Non-Personnel	**2,256,445**	**322,743**	**2,579,188**	**2,247,183**	**331,298**	**2,578,481**	**2,140,000**	**257,240**	**2,397,240**
GRAND TOTAL	**3,347,648**	**1,607,938**	**4,955,586**	**3,532,183**	**2,452,767**	**5,984,950**	**3,500,000**	**1,967,240**	**5,467,240**
Revenue	**NOTE: Actual Matching Funds do not include Indirect Costs of $749,606 for FY 2022-23.**								
New State Appropriation	0	1,706,900	**1,706,900**	0	1,788,400	**1,788,400**	0	1,967,240	**1,967,240**
Carryover State Appropriation	0	565,405	**565,405**	0	664,367	**664,367**	0	0	**0**
New Matching Funds	3,397,128	0	**3,397,128**	3,200,000	0	**3,200,000**	3,500,000	0	**3,500,000**
Carryover from Previous Matching Funds	282,703	0	**282,703**	332,183	0	**332,183**	0	0	**0**
Total Revenue	**3,679,831**	**2,272,305**	**5,952,136**	**3,532,183**	**2,452,767**	**5,984,950**	**3,500,000**	**1,967,240**	**5,467,240**

NOTE: Carryover funds of $664,367 are committed to the following areas: 1) cost-sharing for external grants; i.e., $189,754 for Year 2 of a continued DOE Project; $84,948 and $56,629 for Year 1 of two new DOE projects; 2) graduate student support; 3) supporting early-career faculty in manufacturing-related research; 4) equipment maintenance and upgrades.

FY 2024 – 2025 Budget Request and Justification

The CMR is requesting a 10.0% increase in the FY 2024-25 State appropriations to account for increasing salaries, benefits, student support, tuition and fees, supplies, and other costs as well as annual inflationary increases in these budget areas.

Even though the CMR has been successful in securing substantially increased external funding over the past few years, additional State appropriations are being requested to support the research/operational plans listed below.

- While we anticipate continued growth in FY24-25, there are functions within the Center that support the research infrastructure and the state manufacturing industry. These functions cannot be covered by external grants and cost recovery alone. It is crucial for the CMR to allocate partial funding annually to upgrade or replace capital equipment, ensuring the maintenance of state-of-the-art research capabilities.

- The requested budget increase will enable the CMR to continue its efforts to increase the number of graduate students supported by the Center, offering graduate student assistantships at levels consistent with other units in the College of Engineering. This ensures competitiveness and equitable compensation for our graduate students. One of CMR's missions is to prepare the future advanced manufacturing workforce, making the attraction and retention of quality graduate students of paramount importance to fulfill this mission.

- The increased core funding will also enable the CMR to meet cost sharing obligations for external grants, promote new research initiatives, and incentivize faculty associates for research activities and industry engagement in the areas related to advanced manufacturing.

SUPPORTING MATERIALS

CMR Supported Graduate Students Degrees Awarded in 2022-2023 Fiscal Year

Masters

Alshaikh Ali, Mohammad
"Benchmarking Studies on Energy Usage and Lattice Infill Pattern for Common Additive Manufacturing Technologies"
Summer 2022
Advisor: Dr. Ismail Fidan
Mechanical Engineering

Bain, Aaron
Fall 2022
Advisor: Dr. Rory Roberts
Mechanical Engineering

Brady, Kaydn
"Design of an Add-On Autonomous Navigation and Control System for an Outdoor Electric Wheelchair"
Spring 2023
Advisor: Dr. Ali Alouani
Electrical and Computer Engineering

Buchanan, Ranger
"Knowledge Base Development for Iron-PLA Composite Filaments in Additive Manufacturing"
Summer 2022
Advisor: Dr. Ismail Fidan
Mechanical Engineering

Buida, William
"High-Temperature Erosion Performance of Tribaloy-Based Alloys and Coatings"
Summer 2022
Advisor: Dr. Ying Zhang
Mechanical Engineering

Hines, Brandon
Spring 2023
Advisor: Dr. Steven Anton
Mechanical Engineering

Innis, Cody
Summer 2022
Advisor: Dr. Pingen Chen
Mechanical Engineering

Lam, Steven
"Mass Transport Optimization of the Direct Formic Acid Fuel Cell Catalyst Layer Via Pore-Formers"
Summer 2022
Advisor: Dr. Bahman Ghorashi
Chemical Engineering

CMR Supported Graduate Students Degrees Awarded in 2022-2023 Fiscal Year

Masters (continued)

Lawson, Nicholas
"Comparing Analytical and Portability Functions of Structural Analysis Programs in Relation to BIM Tools and Applications"
Fall 2022
Advisor: Dr. Craig Henderson
Civil Engineering

Messerschmidt, Laurie
Summer 2022
Advisor: Dr. Ethan Languri
Mechanical Engineering

Patel, Brandon
Spring 2023
Advisor: Dr. Pingen Chen
Mechanical Engineering

Su, Zifei
Spring 2023
Advisor: Dr. Pingen Chen
Mechanical Engineering

Wu, Yun
"Energy Management of Electric Truck Fleet Considering Cargo Load, Platooning, and Charging"
Summer 2022
Advisor: Dr. Pingen Chen
Mechanical Engineering

CMR Supported Graduate Student Degrees Awarded in 2022-2023 Fiscal Year

Ph.D.

Aboah Boateng, Emmanuel
"Unsupervised Machine Learning Methods for Detecting Process Control Anomalies in Industrial Control Systems"
Spring 2023
Advisor: Dr. J.W. Bruce
Electrical and Computer Engineering

Abdelfattah, Sherif
"Efficient and Privacy-Preserving Data Search and Medical Diagnosis for Cloud-Based E-Health Systems"
Fall 2022
Advisor: Dr. Mohamed Mahmoud
Electrical and Computer Engineering

Bain, Aaron
"Design and Operation of Solid Oxide Electrochemical Cell Systems for Space Applications"
Spring 2023
Advisor: Dr. Rory Roberts
Mechanical Engineering

Badr, Mahmoud
"Security and Privacy Preservation for Smart Grid AMI Using Machine Learning and Cryptography"
Summer 2022
Advisor: Dr. Mohamed Mahmoud
Electrical and Computer Engineering

Li, Xuebin
"Design and Analysis of Decentralized User Multi-Association in Ultra-Dense mmWave Network"
Spring 2023
Advisors: Dr. Allen MacKenzie and Dr. Nan Guo
Electrical and Computer Engineering

Odetola, Tolulope
"Hardware Verification and Security Challenges in Distributed Convolutional Neural Network Inference"
Fall 2022
Advisor: Dr. Syed Hasan
Electrical and Computer Engineering

Yilmaz, Ibrahim
"Security-Enhanced Authentication and Privacy Preserving Schemes for Smart Grid"
Summer 2022
Advisor: Dr. Ambareen Siraj
Computer Science

CMR Graduate Students Supported from State Appropriations

Masters

Avornyo, Joshua
Advisor: Dr. Olorunfemi Ojo
Electrical and Computer Engineering

Bowen, Craig
Advisor: Dr. Pingen Chen
Mechanical Engineering

Buida, Will
Advisor: Dr. Ying Zhang
Mechanical Engineering

El-Shazly, Amr
Advisor: Dr. Mohamed Mahmoud
Computer Science

Hott, Jacob
Advisor: Dr. Steven Anton
Mechanical Engineering

Lam, Steven
Advisor: Dr. Bahman Ghorashi
Chemical Engineering

Midgett, Micah
Advisor: Dr. Jiahong Zhu
Mechanical Engineering

Swiecichowski, Patrick
Advisor: Dr. Ethan Languri
Mechanical Engineering

Ph.D.

Abdelfattah, Sherif
Advisor: Dr. Mohamed Mahmoud
Electrical and Computer Engineering

Adeyemo, Adewale
Advisor: Dr. Syed Hasan
Electrical and Computer Engineering

Alkunte, Suhas
Advisor: Dr. Ismail Fidan
Mechanical Engineering

Alshaikh Ali, Mohammad
Advisor: Dr. Ismail Fidan
Mechanical Engineering

Arogunjo, Ezekiel
Advisor: Dr. Olorunfemi Ojo
Electrical and Computer Engineering

Dunlap, Caleb
Advisor: Dr. Pingen Chen
Mechanical Engineering

Gothard, Andrew
Advisor: Dr. Steven Anton
Mechanical Engineering

Haris, Anfal
Advisor: Dr. Robbie Sanders
Chemical Engineering

Hines, Brandon
Advisor: Dr. Steven Anton
Mechanical Engineering

Imeri, Astrit
Advisor: Dr. Chris Wilson
Mechanical Engineering

Innis, Cody
Advisor: Dr. Pingen Chen
Mechanical Engineering

CMR Graduate Students Supported from State Appropriations (continued)

Ph.D.

Islam, Saiful
Advisor: Dr. Duckbong Kim
Mechanical Engineering

Odetola, Tolulope
Advisor: Dr. Syed Hasan
Electrical and Computer Engineering

Patel, Brandon
Advisor: Dr. Pingen Chen
Mechanical Engineering

Rashid, Mamunur
Advisor: Dr. Nan Chen
Electrical and Computer Engineering

Shoummo, Md Mashiur Rahman
Advisor: Dr. Bruce Jo
Mechanical Engineering

Su, Zifei
Advisor: Dr. Pingen Chen
Mechanical Engineering

Swiecichowski, Patrick
Advisor: Dr. Ethan Languri
Mechanical Engineering

CMR Graduate Students Supported from External Funds

Masters

Alshaikh Ali, Mohammad
Advisor: Dr. Ismail Fidan
Mechanical Engineering

Buchanan, Ranger
Advisor: Dr. Ismail Fidan
Mechanical Engineering

Edwards, Tyler
Advisor: Dr. Rory Roberts
Mechanical Engineering

Hines, Brandon
Advisor: Dr. Steven Anton
Mechanical Engineering

Layhew, Griffin
Advisor: Dr. Rory Roberts
Mechanical Engineering

Meacham, Jimmy
Advisor: Dr. Rory Roberts
Mechanical Engineering

Mink, Abby
Advisor: Dr. Ethan Languri
Mechanical Engineering

Oliver, Jared
Advisor: Dr. Ethan Languri
Mechanical Engineering

Owu, Taiye
Advisor: Dr. Olorunfemi Ojo
Electrical and Computer Engineering

Sanderson, Jonathan
Advisor: Dr. Syed Hasan
Electrical and Computer Engineering

Ph.D.

Abdulmagued, Magdy
Advisor: Dr. Pingen Chen
Mechanical Engineering

Al Amiri, Wesam
Advisor: Dr. Allen MacKenzie
Electrical and Computer Engineering

Ayeni, Oluwaseyi
Advisor: Dr. Holly Stretz
Chemical Engineering

Bain, Aaron
Advisor: Dr. Rory Roberts
Mechanical Engineering

Brown, Katherine
Advisor: Dr. Doug Talbert
Computer Science

Ellicott, Andrew
Advisor: Dr. Rory Roberts
Mechanical Engineering

Jadhav, Sainand
Advisor: Dr. Duckbong Kim
Mechanical Engineering

Joshi, Sachin
Advisor: Dr. Pingen Chen
Mechanical Engineering

Lamantia, Maxavier
Advisor: Dr. Pingen Chen
Mechanical Engineering

Mahdi, Mohammad
Advisor: Dr. Duckbong Kim
Mechanical Engineering

Mansour, Mohamed Ashraf
Advisor: Dr. Olorunfemi Ojo
Electrical and Computer Engineering

CMR Graduate Students Supported from External Funds (continued)

Ph.D.

Nevills, Miles
Advisor: Dr. Ethan Languri
Mechanical Engineering

Nnadi, Olivia
Advisor: Dr. Olorunfemi Ojo
Electrical and Computer Engineering

Rajeshirke, Mathila
Advisor: Dr. Ismail Fidan
Mechanical Engineering

Raju, Md Abdul Goni
Advisor: Dr. Duckbong Kim
Mechanical Engineering

Schafer, David
Advisor: Dr. Rory Roberts
Mechanical Engineering

Shuaibu, Musayyibi
Advisor: Dr. Olorunfemi Ojo
Electrical and Computer Engineering

Tanvir Hossain, Gazi Md.
Advisor: Dr. Duckbong Kim
Mechanical Engineering

Wagale, Dipendra
Advisor: Dr. Pedro Arce
Chemical Engineering

External Funding – Proposals Submitted

	Status	Title	P.I.	Dept.	Total Funds
1	978MC 1/31/2023	Simulation of Synthetic Layered CT Training Data for Defect Detection via Machine Learning Tetrahive Technologies (via SBIR)	Steven Anton	ME	$36,842
2	985MC 6/5/2023	Self-Powered Compartmental Contact Mechanics Sensing in Total Knee Replacements National Institute of Health (NIH)	Steven Anton Charles Van Neste	ME ECE	$2,676,821
3	961MC 12(22-23) 5-35305	Integration of the Engineering for One Planet Model as a Structured Approach to Sustainable Design via the Renaissance Foundry ASEE - American Society for Engineering Education	Pedro Arce Robbie Sanders	ChE ChE	$8,000
4	927-S1 5-35300	On-board Diagnostic Algorithm Research and Development for Selective Catalytic Reduction System Aging Detection. Cummins Advanced Engineering Controls - Supplement to Order No. IND7039900	Pingen Chen	ME	$65,803
5	963MC 7/19/2022 3(22-23)	Second-life Battery in Mobile EV Charging Application for Rural Transportation (SMART) Department of Energy	Pingen Chen Nan Chen Joseph Ojo	ME ECE ECE	$4,531,539
6	969MC	Rural EV Infrastructure - an Opportunity to Revitalize Challenging Economy in Appalachia (REINFORCE Appalachia) U.S. Department of Energy	Pingen Chen Michael Aikens	ME Research	$1,669,992
7	972MC 10/31/2022 36(22-23)	Efficient Rural Delivery Services by Connected, Automated, and Electric Mobility UT-Austin (via U.S. Department of Energy funds)	Pingen Chen	ME	$450,000
8	965MC	Hardware Solutions for Cyber Vulnerable Smart Meters Tennessee Valley Authority (TVA)	Tarek Elfouly Ali Alouani	ECE ECE	$315,769
9	966MC 10/6/2022	Applied Research Experience for Technician Education in Additive Manufacturing for Competitiveness in the United States (AMTechEd4C) National Science Foundation	Ismail Fidan Duckbong Kim	MET MET	$649,998
10	968MC 10/6/2022	Creating a Sustainable Innovation and Entrepreneurship Framework for Community College Education CUNY New York City College of Technology (via NSF funds)	Ismail Fidan	MET	$495,579
11	903MC-Su 531329	Supplement to: Collaborative Research: Sensing by Leveraging Cellular Communication Networks: A Framework of Medium Distance Baseline Interferometry National Science Foundation	Terry Guo Allen MacKenzie	CMR ECE	$15,000

	Status	Title	P.I.	Dept.	Total Funds
12	975MC 12/22/2022	CSR: Medium: Collaborative Research: Distributed Edge Intelligence for Resilient Internet of Things National Science Foundation	Syed Hasan Terry Guo	ECE CMR	$350,000
13	979MC-AG	Cybersecurity for Autonomous Ground Vehicle: Towards Hardware in the Loop Simulation for Autonomous Vehicles' Cybersecurity Applied Research Associates, Inc. (ARA) (Originally submitted through Cornerstone)	Syed Hasan Terry Guo Doug Talbert	ECE CMR CS	$1,812,925
14	979MC-AV	Cybersecurity for Autonomous Vehicles: Investigation of Sensors' Vulnerability in Zero Trust Architecture Applied Research Associates, Inc. (ARA)	Syed Hasan Terry Guo	ECE CMR	$830,851
15	990MC	iGargoor: An AI-based Multi-Robot System for Plastic Detection and Capture in Qatari shores QRDI (Qatar Research Development and Innovation) via Qatar University	Syed Hasan Terry Guo	ECE CMR	$150,000
16	973MC 37(22-23) 5-32460	Proof of Concept of Steel to AL Alloy Transitions Joints by Wire Additive Manufacturing Oak Ridge National Laboratory - PO 4000206210	Duckbong Kim	MET	$50,000
17	981MC	MRI: Track 1 Acquisition: Acquisition of an Electron Backscatter Diffraction (EBSD) System for the Newly Installed Field Emission Scanning Electron Microscope (FE-SEM) National Science Foundation	Duckbong Kim Ying Zhang Indranil Bhattacharya	MET CMR ECE	$239,425
18	983MC 4/24/2023	Centrifugal Electrolysis for Metal Extraction and Wire DED Manufacturing on the Moon North Carolina State University (via NASA funds)	Duckbong Kim	MET	$499,999
19	980MC	Southeast Industrial Assessment Center of Excellence (Southeast IACE) U.S. Department of Energy	Ethan Languri	ME	$3,749,999
20	984MC 4/21/2023	Southeast Onsite Energy TAP University of Alabama (via DOE funds)	Ethan Languri	ME	$172,183
21	986MC 4/21/2023	Southeast Onsite Energy Technical Assistance Partnership (TAP) North Carolina State University	Ethan Languri	ME	$31,759
22	988MC 6/1/2023	Tennessee Manufacturing Advancement Initiative: Empowering Small and Medium-Sized Manufacturers through SMART Solutions TDEC (via DOE funds)	Ethan Languri	ME	$1,356,630
23	992MC	Review of Decarbonization Tools and Materials University of California - Davis (via DOE funds)	Ethan Languri	ME	$4,000
24	964MC 9/6/2022	REU Site: CyberAI: Cybersecurity Solutions Leveraging Artificial Intelligence for Smart Systems National Science Foundation	Mohamed Mahmoud Syed Hasan	ECE ECE	$405,002

	Status	Title	P.I.	Dept.	Total Funds
25	189MC-22 11/17/2022 5-33634	UT-CIS 2022-2023 Capstone The University of Tennessee Center for Industrial Services	Mohan Rao	ME	$30,000
26	974MC 1/11/2023	CarbonLess Electric AviatioN (CLEAN) NASA ULI	Rory Roberts Bruce Jo Ahmad Vaselbehagh	ME ME ME	$7,998,932
27	976MC 45(22-23) 5-35309	Fiber Reactor Extraction Simulation Visionary Fiber Technologies	Holly Stretz	ChE	$83,490
28	953MC	Additively Manufactured Lost Polymer Casting Process AFS and the Institute	Fred Vondra Ismail Fidan	MET MET	$117,090
29	939MC-R 10/12/2022	Gas Atomization of Titanium-Niobium (Ti-Nb) Powder Utilizing the VersaMelt Inert Gas Atomizer Consolidated Nuclear Security, LLC (CNS)	Ying Zhang Jiahong Zhu Brian Bates	CMR ME CMR	$351,976
30	950MC 22(22-23) 5-32455	Pack Aluminide Coatings on Ti-Containing Ni-base Alloys - Reference PR73702 Oak Ridge National Laboratory (ORNL) - PO 40000204172	Ying Zhang	CMR	$13,932
31	971MC 11/29/2022 5-32456	Pack Aluminide Coatings on F82H Alloy Oak Ridge National Laboratory - PO 400205045	Ying Zhang	CMR	$22,092
32	989MC 6/1/2023	Novel High-Temperature Coatings for Protecting Critical Components in Concentrating Solar-Thermal Power Systems U.S. Department of Energy	Ying Zhang Jiahong Zhu	CMR ME	$400,000
33	967MC 10/6/2022	Spray Deposition of Coal-Derived Graphene-Copper Nanocomposites for Advanced Conductors US Department of Energy	Jiahong Zhu Ying Zhang	ME CMR	$1,000,000

Proposals Submitted in FY 2022-2023 **$30,585,628**