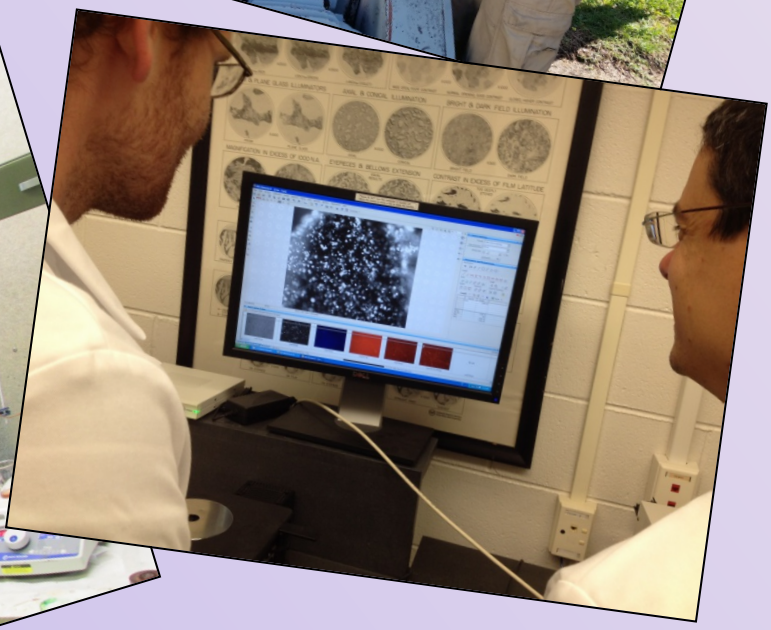
Center for Manufacturing Research
Tennessee Tech University
ANNUAL REPORT
FY 2014—2015



21ST CENTURY
RENAISSANCE
ENGINEERS
REVOLUTIONIZING ENGINEERING

TENNESSEE TECH
UNIVERSITY

About the Cover

(Clockwise from Upper Left)

Interns with the NSF Research Experiences for Undergraduates (REU) Manufacturing and Techno-Entrepreneurship program visit the Oak Ridge National Laboratory's Manufacturing Demonstration Facility.

Anthony Taylor and Ian Swagerty, Industrial Assessment Center (IAC) lead students and Mechanical Engineering MS students, collect data during an industrial energy efficiency assessment to make recommendations about potential energy savings.

Patrick Kent, MS student in Chemical Engineering, and **Dr. Jeffrey Rice**, Assistant Professor of Chemical Engineering, use the fluorescence microscope to view an EGFP (Enhanced Green Fluorescent Protein) which fluorescents green when excited by light waves.

Elizabeth Bickel, undergraduate Chemical Engineering student, processes flexible solar cell platform films through a novel annealing process called gas expanded polymer annealing, using supercritical CO2 as the solvent.

Center for Manufacturing Research

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Tennessee Technological University
Center for Manufacturing Research
Annual Report – FY 2014 – 2015

Mission Statement

"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 1985 by THEC and achieved and maintained the Center of Excellence status since 1990.

Director

Vahid Motevalli, Ph.D., P.E.
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Faculty Associate Director

Stephen Canfield, Ph.D.
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Center for Manufacturing Research

CMR Faculty and Staff

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Dr. Cynthia Rice, Asst. Prof., ChE
Dr. Kwun-Lon Ting, Professor, ME

Brian Bates, R&D Engineer I
Michelle Davis, Outreach Coordinator
Dr. Nan (Terry) Guo, R&D Engineer III
E. Wayne Hawkins, Mat. Science Lab Mgr.
Suzanne Henry, Contract Compliance Asst.
Sue Richardson, Administrative Associate, II
Mike Renfro, R&D Engineer II
Joel Seber, Engr. Computer Support Mgr.
Phyllis Stallion, Administrative Associate, III
Darlene Wiegand, Financial Analyst

CMR Faculty Associates

Dr. Ali Alouani, Professor, ECE
Dr. Adam Anderson, Asst. Professor, ECE
Dr. Steven Anton, Asst. Professor, ME
Dr. Pedro E. Arce, Chair, Professor, ChE
Dr. Joe J. Biernacki, Professor, ChE
Dr. Stephen Canfield, Professor, ME
Dr. Hicham Chaoui, Asst. Professor, ECE
Dr. Glenn Cunningham, Assoc. Professor, ME
Dr. Corinne Darvennes, Professor, ME
Dr. William Eberle, Assoc. Professor, CS
Dr. Omar ElKeelany, Assoc. Professor, ECE
Dr. Ahmed ElSawy, Chair, Professor, MET
Dr. Ismail Fidan, Professor, MET
Dr. Sheikh Ghafoor, Asst. Professor, CS
Dr. Syed Rafay Hasan, Asst. Professor, ECE
Dr. Ada Haynes, Professor, Sociology & Political Sci.
Dr. Wayne Johnson, Chair, Professor, ECE
Dr. Ehsan Languri, Asst. Professor, ME
Dr. Wayne Liemer, Professor, Earth Sciences
Kevin R. Liska, Director, Bus. Media Ctr.
Dr. Satish Mahajan, Professor, ECE
Dr. Mohamed Mahmoud, Asst. Professor, ECE
Dr. Vahid Motevalli, Assoc. Dean of Research and Innovation, College of Engineering & ME
Dr. Lachelle Norris, Prof., Sociology & Political Sci.
Dr. Jennifer Pascal, Asst. Professor, ChE
Dr. Sally Pardue, Assoc. Professor, ME/ Director, Millard Oakley STEM Center
Dr. Awni Qasaimeh, Asst. Professor, MET
Dr. Mohan Rao, Chair, Professor, ME
Dr. Jeffrey Rice, Asst. Professor, ChE
Dr. Jonathan (Robby) Sanders, Asst. Professor, ChE
Dr. Stephen Scott, Professor, CSC/ECE
Dr. Pezhman Shirvanian, Asst. Professor, ME
Dr. Ambareen Siraj, Asst. Professor, CS
Dr. Holly Stretz, Assoc. Professor, ChE
Dr. Meenakshi Sundaram, Professor, ME
Dr. Doug Talbert, Chair, Assoc. Professor, CS
Dr. Chris Wilson, Assoc. Professor, ME
Dr. Dale Wilson, Professor, ME
Dr. Jeanette Wolak, Asst. Professor, Earth Sciences
Dr. Ying Zhang, Professor, ME
Dr. John Zhu, Professor, ME

EXECUTIVE SUMMARY

The Center for Manufacturing Research has maintained its leading role among THEC Centers of Excellence for the past several years in terms of activities, accomplishments and external funding. The downward trend in the CMR external funding that was started in FY09, and was only subsided by infusion of stimulus funding in FY10, reached the lowest level in FY13. This trend has now been convincingly reversed with a strong increase in external funding evident in the FY15 of over $2.4 M compared to the low of $0.9M in FY13. In addition, the proposal activities of the Center have dramatically increased over the past two years and is projected to increase further. The investment of the Center in new faculty start-up, College of Engineering leadership and focus in areas of strategic research are important factors in this positive change. At the same time, the Center has been operating with less staff who have generated release time thus allowing the Center budget to absorb the reductions in the State Appropriation as well as increased salaries and benefits.

The Center continues to be true to its mission "*to advance and support scientific and engineering knowledge in areas related to manufacturing*" whereby more than half of the external funding is in the areas of Advanced Manufacturing and Materials research. At the same time, the CMR supports industry via the work of the DoE funded Industrial Assessment Center (IAC) which provides a great service to Tennessee manufacturing by reducing energy use in manufacturing facilities across the State (externally funded at nearly $350K). Additional industry supported technical assistance is provided through problem solving, advance material characterization and testing services. The Center provides a valuable service to the University and the State via educational programs and outreach (with over $360K of external funding), thus serving another important part of the Center's mission to positively impact instructional programs in manufacturing related areas.

During the past year, the total funding managed by the CMR resulted in support of 32 graduate students, numerous undergraduate students and engagement with about 40 faculty across the College of Engineering and other colleges in the University. The Center will have the advice of a 3-member faculty advisory committee during the FY16, will continue to submit competitive external proposals and increase external funding. In addition, the re-constitution of an industry advisory committee will be a top priority.

Strategic Research Areas

The CMR focuses on three strategic research areas:

Advanced Manufacturing centers upon improving the performance of US industry through the innovative application of technologies, processes and methods to product design and production. This topic makes extensive use of computer, high precision, and information technologies integrated with a high performance work force into a production system capable of furnishing a heterogeneous mix of products in small or large volumes with both the efficiency of mass production and the flexibility of custom manufacturing in order to respond rapidly to customer demands. Advanced machines, intelligent robotics, sensors, control systems and processes are included.

Materials for Energy Storage and Conversion addresses the rising instability of energy prices and sources and the resulting need to develop the next generation of energy storage/conversion devices and energy efficiency technologies that are environmentally friendly and cost-effective compared to existing fossil fuel-based technologies. Research in this thrust focuses on the following areas: Fuel cells and batteries; photovoltaic; physics-based energy conversion; materials/coatings for extreme environments; wind turbines, combined heat and power, and heat recovery; and biomass-based fuels and chemicals production.

Networking and Algorithms for Big Data assists in acquiring and transmitting data in a timely, effective and efficient manner. Big data refers to a collection of information that is too vast and complex to be effectively collected, processed and analyzed using traditional algorithms, tools, and approaches. In their quest to comprehend and utilize big data, researchers, businesses, and governments are focusing efforts on datasets characterized by three research challenges: volume, velocity, and variety. These challenges require research and innovation at all levels of computing, from the physical network needed for capturing and transporting such data to advanced algorithms for efficiently and effectively securing, organizing, processing, and, ultimately, making effective use of such data. This strategic research area addresses the following topics: Networks for the acquisition of big data; computation for big data; knowledge discovery in big data, and privacy and security of big data. Each of these topics plays a vital role in the acquisition, processing, and analysis of big data in domains such as smart grid, healthcare, earth sciences, resilient infrastructure, cyber-security and national defense.

Table 1. Activated Grants by Strategic Research Area

Strategic Research Area	Activated Amount
Advanced Manufacturing	$919,021
Materials for Energy Storage and Conversion	$490,087
Networking and Algorithms for Big Data	$281,678
Tennessee Industry Support	$349,122
Education and Outreach	$363,769
Total	**$2,403,677**

Selected Highlights from FY 2014 – 2015

External Funding Highlights

The CMR has increased activation funding over previous fiscal year (FY) by 40%. Twenty-three externally funded projects were activated this past FY, resulting in funding of $2,403,677 compared to the previous FY 2013 – 2014 total activation of $1,711,145.

CMR's new matching funds for the past FY were $2,099,031. This amount excludes $433,422 of indirect costs associated with this year's funded projects. The matching funds, however, does include $112,996 of equipment donations received this year from an industrial donor.

Research proposals submitted by CMR faculty and faculty associates increased 30% over the previous year. Fifty-one proposals with a total value of $12,179,250 were submitted during this past FY, compared to a value of $9,387,001 at the end of FY 2013 – 2014.

CMR supported 32 graduate students during the past FY. Fifteen M.S. students and 17 Ph.D. students were funded from both State appropriations and grants received by faculty. Of the 17 graduate students funded by external funds, nine are M.S. students and eight are Ph.D. students. Among the graduate students funded by CMR, three M.S. and one Ph.D. students were from underrepresented minorities.

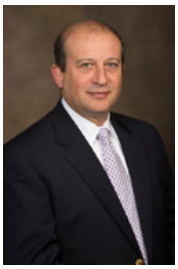
CMR continues to heavily invest in new faculty with a manufacturing focus hired into the College of Engineering. As a result of this investment, 19 proposals for external funding were submitted by new faculty members in the Departments of Chemical, Electrical and Computer, and Mechanical Engineering.

The CMR continued to see a significant increase in external funding of graduate research assistant support as shown in Table 1 below. Table 1 provides a summary of various sources of external revenues for the past three years that were used to "release" or "free up" State appropriations for other strategic investment areas. It is the CMR's goal to continue to increase the amount of income (resources), both internally and externally, that can be used to expand research in the Center's strategic research focus areas as described on page 3.

Table 2. Salary and Supplies Released by External Funding

Performance Metric	FY 2012-13	FY 2013-14	FY 2014-15
Faculty and staff release time	$120,651	$83,621	$99,224
Graduate student stipend and fees from external sponsors	$108,803	$265,734	$325,719
Percentage of GRA support from external sponsors	27%	63%	65%
Total "Soft Money" (F&A return, testing income, GRA support, equipment usage, and release time)	$396,429	$457,172	$558,390

Personnel Highlights



Dr. Vahid Motevalli, Associate Dean for Research and Innovation in TTU's College of Engineering, was appointed as the CMR's Interim Director effective July 31, 2014. This appointment is in addition to his regular duties as Associate Dean.

Dr. Stephen Canfield, Professor of Mechanical Engineering, was appointed as Faculty Associate Director in August 2014. In this role, Dr. Canfield will be the Strategic Research Area (SRA) Coordinator for Advanced Manufacturing and will encourage existing CMR faculty to work with other colleagues in this area, seek collaboration with faculty in other SRAs and develop teams to respond to funding opportunities. This is a partial appointment while Dr. Canfield continues his activities as Professor of Mechanical Engineering.

Dr. Kenneth R. Currie, former CMR Director, was named Chair of Industrial and Management Systems Engineering Department at his alma mater, West Virginia University, effective July 31, 2014. Dr. Currie served as the CMR's director for 14 years from July 2000 to July 2014. He initially came to Tennessee Tech University in August 1989 as a professor in the Industrial Engineering Department. In August 1985, he became a faculty member in the CMR.

Research Highlights

Dr. Wayne Johnson, Chair of the Electrical and Computer Engineering Department and Faculty Associate of the Center, was awarded a three- year funded research project for $1,748,298 from the MIT Lincoln Laboratory to pursue research in the Advancement of Cryogenic Electronics. This award is one of the largest grants in recent College of Engineering and CMR history. Dr. Johnson will lead this funded research along with Co-Principal Investigators Drs. Satish Mahajan, Jie Cui, Holly Stretz, and Chris Wilson. The first year activation for this project is $749,444.

Dr. Ambareen Siraj, Assistant Professor of Computer Science, organized TTU's Second Annual Women in CyberSecurity Conference (WiCyS) in Atlanta, Georgia. By 2015, security professionals were expected to increase to nearly 4.2 million worldwide. Despite growing demand and tremendous opportunities in the job market, however, cybersecurity remains an area in which there is significant shortage of skilled professionals regionally, nationally, and internationally. Furthermore, women's representation in the male-dominated field of security is alarmingly low. Through the WiCyS community and activities, the CMR expects to raise awareness about the importance and nature of a cybersecurity career. WiCyS is an effort to bring together women (students, faculty, researchers, and professionals) in cybersecurity from academia, research and industry for sharing knowledge and experience, networking and mentoring. After the successful organization of the first WiCyS Conference in Nashville, Tennessee in 2014 (with over 300 participants), Dr. Siraj secured external funding for a second year with financial support of $120,817 from the National Science Foundation, Award

#1303441 (Capacity Building in Cybersecurity: Broadening Participation of Women in Cybersecurity through the Women in Cybersecurity Conference and Professional Development). TTU's second WiCyS Conference was held in March 2015 in Atlanta, Georgia with over 500 participants in attendance. Dr. Siraj also raised $169,581 in matching commitments for this conference from 45 different sponsorships, including Facebook, Google, Microsoft and other large IT focused corporations. Cumulative funding for this area of cybersecurity research is $482,751; NSF has awarded $244,160 of grant funding and $238,591 in additional program income has been secured from various sponsorships. CMR provided staff support to the conference and assisted with the logistics. Drs. Motevalli, Talbert, and Eberle also attended the conference and provided support and Dr. Motevalli presented the opening remarks.

Second Annual Women in CyberSecurity Conference, March 27-28, 2015, Atlanta, Georgia

Tennessee EPSCoR (TN-SCORE) issued sub-awards to CMR and Drs. Cynthia Rice, Holly Stretz, and Sally Pardue to perform research in solar, energy conversion, and energy efficiency as well as to conduct educational outreach to rural Tennessee counties. In September 2010, the State of Tennessee EPSCoR committee was awarded a $20 million Research Infrastructure Improvement grant from the National Science Foundation to research materials and devices focused on renewable energy and efficient energy conversions. Dr. Cynthia Rice is serving as a statewide co-thrust leader for Thrust #2 (Components and Devices for Energy Storage and Conversion) and is leading the TTU effort. Dr. Holly Stretz is supporting Thrust #1 (Advanced Solar Conversion and Innovation). Previously, Dr. Ken Currie (former CMR Director) was supporting Thrust #3 (Nanostructures for Enhancing Energy Efficiency). In 2014-2015, Dr. Rice was awarded a total of $217,642 for the fifth year of the five-year NSF-funded Research Infrastructure Improvement grant. Dr. Rice was responsible for approximately 70% of the total TTU award, while Dr. Stretz was responsible for 30%. Drs. Pardue and Rice were also awarded $68,101 for the UCRSI STEMmobile and TN-SCORE Education Outreach to Rural Tennessee Counties. Outreach activities for this year include "Engineering a Future" (Drs. Pardue, Rice and Stretz); Dr. Rice participating at Prescott South Elementary School Career Day (Fuel Cell Car Lab and Alternative Energy Lab); and Dr. Rice participating in Fab Friday at the STEM Center at TTU. At the request of Dr. Motevalli, TN-SCORE provided $28,000 in additional funds for equipment purchase for one of the new faculty. This amount is included in the above reported amount.

Dr. Joseph Rencis, Dean of College of Engineering, and Dr. Vahid Motevalli, Interim Director of the CMR and Associate Dean of Research and Innovation in the College of Engineering, received an award from the National Science Foundation (NSF) to conduct a program for Research Experiences for Undergraduate (REU) in Manufacturing and Techno-Entrepreneurship at Tennessee Tech University. This 3-year NSF Award #1461179 from the Division of Engineering Education and Centers for $373,907 provided financial support for 10 competitively selected students from different universities to participate in the REU program conducted over a ten-week period. The first year program was conducted from June 1 to August 7, 2015 and a total of $124,577 of funding was activated for the first year. The interns had the opportunities to self-assess their interest in techno-entrepreneurship by their participation in a summer course on the Lean LaunchPad approach. Their research projects allowed them to explore their interest in research and graduate education in manufacturing-related areas.

REU Interns at the final presentation, August 6, 2015 (Back row, left to right: Gera Groshev, Taylor Fresques, Alexander Simpson, Derrick Cantrell. Front row, left to right: Omari Smith, Charles Forstall, Stephanie Sandoval, Riana Menezes, Elizabeth Bickel, Gabin Kamgang-Foche)

CMR and TTU continued a partnership with Auburn University and University of Alabama Huntsville (UAH) to launch an Industry/University Collaborative Research Center (I/UCRC) for Advanced Vehicle Manufacturing. The CMR, TTU, Auburn University, and UAH have continued their partnership with funding from NSF in a collaborative effort to establish an I/UCRC in the Southeast for Advanced Vehicle Manufacturing. This proposed Southern Alliance for Advanced Vehicle (SAAV) manufacturing will focus on research that could save companies resources through improved manufacturing processes. TTU's primary expertise is in mass customization, smart manufacturing, and improving the linkage between technologies such as vision systems, robotics, material handling, and throughput/efficiency. CMR interim-Director and faculty associates, CMR staff and Office of Research and Economic Development at TTU have been assisting Dr. Canfield to recruit industry members for the proposed Center over this reporting period.

Center Activities

Tennessee Three-Star Industrial Assessment Center

The Tennessee Three-Star Industrial Assessment Center (IAC) was established in the CMR in 2006 with funding from the U.S. Department of Energy. The mission of the IAC is two-fold: 1) Assist small to medium sized manufacturers become more energy efficient, and 2) Instruct engineering students in best practices of industrial energy efficiency to prepare them for the workforce. In nine years, over 150 assessments have been conducted at no cost to the requesting companies, with total implemented savings of almost $5.5 million. Sixty students have participated in the IAC with 38 receiving DOE certification in the program.

Ian Swagerty, Dr. Glenn Cunningham, and Melissa Moffett conduct an energy assessment at a tool manufacturer.

FY 2014 – 2015 IAC Highlights

Dr. Ehsan Languri, Assistant Professor of Mechanical Engineering, was named Associate Director of the Industrial Assessment Center. In addition to leading energy efficiency assessments, Dr. Languri will be focusing his research on cooling tower modeling.

Lead student Ian Swagerty was certified as a DOE Qualified Fan Systems Specialist.

Four students participated in summer internships with manufacturers such as Nissan, Volvo-Penta, and Schneider Electric. During these internships, the students were responsible for planning and conducting projects related to industrial energy efficiency improvements.

Workshops on compressed air efficiencies were conducted by IAC Director, Dr. Glenn Cunningham, in locations across Tennessee. Almost 100 industry end-users, electric distributor employees, and TVA personnel participated. These workshops were funded through a partnership between area electric distributors, TVA, and DOE.

Dr. Glenn Cunningham developed two web-based short courses on steam system efficiencies and compressed air efficiencies. These courses are self-paced, multi-media modules that can be taken by students, other university personnel, and industry end-users.

IAC Students Ian Swagerty and Anthony Taylor led a web-based seminar on Cloud Storage for Effective Communications, File Sharing, and Report Write-ups in a Team-Based Environment. This seminar was attended by IAC students and directors at Centers across the country.

Ian Swagerty led a seminar on "Assessing Industrial Energy Efficiency in Manufacturing Plants" during the CMR Faculty Spring Seminar Series.

Other Center Activities

Dr. Robert Qiu offered the first course as a part of the PhD in engineering with focus in the electrical and computer engineering department's communication program at the Oak Ridge National Laboratory (ORNL). About 17 PhD students are enrolled in this program where all the courses will be offered onsite at the ORNL. The international reputation and expertise of Dr. Qiu in the cognitive radio wireless communication area is a key to this new infusion of PhD students. The engagement with ORNL will involve other CMR Faculty Associates and is expected to expand engagement and research activities.

Dr. Adam Anderson, CMR Faculty Associate, taught the second course in the above communications PhD area at ORNL and was appointed as a summer Laboratory Faculty at ORNL.

A number of CMR faculty associates and Dr. Motevalli visited NSF, DARPA and other agencies in Washington, DC on April 27-28, 2015. This has led to new opportunities for the faculty. The trip was organized by Dr. Motevalli with assistance from Office of Research. No CMR funds were used.

Seminar Presentations

Robert Qiu

CMR Spring Faculty Seminar Series – April 7, 2015. "Big Data Analytics for Wireless Networks".

Cynthia Rice

CMR Spring Faculty Seminar Series – April 16, 2015. "Direct Formic Acid Fuel Cells for Portable Power".

Kwon-Lon Ting

CMR Spring Faculty Seminar Series – April 21, 2015. "Rotability Laws and the Whole Motion of Linkages and Manipulators".

Visiting Scholars

The following visiting international researchers joined Dr. Robert Qiu's Wireless Communications / Networking Systems Research Group in 2014 to pursue research in Big Data Using Large Random Matrices Theory and Signal Processing.

- Dr. Guohong Liu
- Mr. Quan Nan
- Dr. Bo Wang
- Mr. He Yue
- Ms. Yanping Zhao

Faculty, Staff and Student Accomplishments and Awards

Dr. Steve Anton named Air Force Summer Faculty Fellow: Mechanical Engineering Professor and Center faculty associate, Dr. Steve Anton, has been selected for the 2015 Air Force Summer Faculty Fellowship Program. This program, sponsored by the Air Force Office of Scientific Research, allows faculty to gain first-hand exposure to Air Force research challenges through summer residencies at participating Air Force research facilities. Anton, along with his Ph.D. student, Ryan Kettle, will spend 10 weeks beginning May 18 at Eglin Air Force Base in Florida performing research in the Munitions Directorate on a proposal entitled "Real-Time Monitoring of Structures under Highly Dynamics Environments."

Center Faculty Associate, Dr. Ying Zhang, and Center R&D Engineer, Brian Bates, received the Kinslow Award for Outstanding Journal Article: Dr. Ying Zhang, Professor of Mechanical Engineering and Center Faculty Associate, along with Brian Bates, Center R&D Engineer, received the University's Kinslow Award at TTU's College of Engineering Awards Banquet in February 2015. This award was given based on their outstanding journal article entitled "Creep Behavior of Pack Cementation Aluminide Coatings on Grade 91 Ferritic-Martensitic Alloy", Surface & Coatings Technology, Vol. 240, (2014), pp. 32-39. This paper was also co-authored by S. Dryepondt, and B. A. Pint.

Dr. Stephen Canfield received the T. S. McCord Faculty Fellow in Innovation and Techno-Entrepreneurship Award: Dr. Stephen Canfield, Professor of Mechanical Engineering and Center Faculty Associate, received the T. S. McCord Faculty Fellow in Innovation and Techno-Entrepreneurship Award at TTU's College of Engineering Awards Banquet in February 2015. Dr. Canfield has been instrumental in building TTU's early intervention and mechanical projects, in which students design, test and build assistive devices for children with disabilities across the Upper Cumberland.

Dr. Ismail Fidan received the Faculty Fellow in Innovation and Techno-Entrepreneurship Award: Dr. Ismail Fidan, Professor of the Manufacturing and Engineering Technology Department and Center Faculty Associate, received the Faculty Fellow in Innovation and Techno-Entrepreneurship Award at TTU's College of Engineering Banquet in February 2015. Dr. Fidan recently organized a service learning exchange between TTU and Turkey's Celal Bayar University which gave business and engineering students a chance to develop packaging and plan a market launch of Turkish products in the U.S.

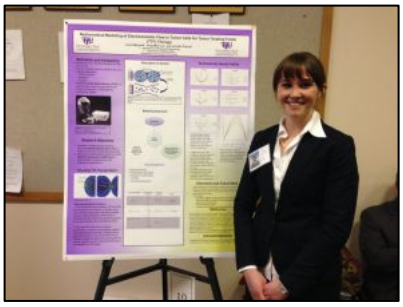
Dr. Vahid Motevalli, Associate Dean of Research and Innovation and Interim Director of the CMR, was invited by the Tennessee Board of Regents (TBR) to be a part of the Critical Conversation. The video tape interviews are hosted on the TBR web site (https://www.tbr.edu/academics/criticalconversations/conversations/critical-conversation-dr-vahid-motevalli-december-10). He also published a paper in the inaugural edition of the new

TBR Journal on Critical Conversations and is also serving on the TBR Committee that is advising the Academic Affairs on these initiatives.

Center Faculty Associate, Dr. Jiahong (John) Zhu, received the Leighton Sissom Innovation and Creativity Award: Dr. Jiahong (John) Zhu, Professor of Mechanical Engineering and Center Faculty Associate, received the Leighton Sissom Innovation and Creativity Award at TTU's College of Engineering Awards Banquet in February 2015. Dr. Zhu received this award as voted by his peers for his research efforts in Environmentally Assisted Reactive Sintering. Dr. Zhu is currently engaged in research with solid oxide fuel cells, rechargeable metal-air batteries, alloy design and coating development for energy-related applications.

Brian Bates, Research & Development Engineer in the CMR, received Outstanding Staff Award: Brian Bates, Research & Development Engineer in the CMR, received the Outstanding Staff Award at TTU's College of Engineering Awards Banquet in February 2015. Brian serves as the CMR's Safety Coordinator and plays a key role in providing engineering and development support to Center Faculty Associates for their internal/external research projects in the materials science area. He also provides primary support for the Center's x-ray diffraction machine and other lab equipment.

Chemical Engineering and Center Supported Undergraduate Student, Leora Maxwell, Won Award at National Conference: Chemical Engineering undergraduate student and Center supported hourly student, Leora Maxwell, recently won third place in the Food, Pharma and Biotechnology II Division of the undergraduate student poster competition at the American Institute of Chemical Engineers annual meeting for her research entitled, "Mathematical Modeling of Electroosmotic Flow in Tumor Cells for Tumor Treating Fields Therapy." Her research was supported by TTU's Undergraduate Research and Creative Activity (URECA) Program. Leora also received the COE Eminence award. She has worked with Center Faculty Associate, Dr. Jennifer Pascal, for almost two years and plans to continue her education with a Master's degree and possibly Ph.D. at TTU. She has also collaborated with Yung-Way Liu in the Mathematics Department to assist in solving an equation.



Kierna Mason, Undergraduate in Chemical Engineering, Won Award in Tennessee Conference: CMR-supported undergraduate Chemical Engineering student Kierna Mason was awarded the Engineering Division Winner Award at the Tennessee Louis Stokes Alliance for Minority Participation Conference for her oral presentation "Water Uptake Analysis of Fuel Cell Membranes".

Publications[1]

Robert Qiu

Conference Publications

1. **R. C. Qiu**, "Big Data of a Large-Scale Cognitive Radio Network: Testbed, Data Representation and Analytics," Wireless Networks for Big Data, Hefei, Anhui, China, September 29-30, 2014. INVITED PAPER

Cynthia Rice

Journal Publications

1. **Rice, C.A**., P. Urchaga, A.O. Pistono, B.W. McFerrin, B.T. McComb, and J. Hu, 'Platinum Dissolution in Fuel Cell Electrodes: Enhanced Degradation from Surface Area Assessment in Automotive Accelerated Stress Tests', Journal of The Electrochemical Society, 2015, 162, F1175.
2. **Rice, C.A**.; Betancourt, D.; Hepel, M. 'Platinum Oxide Growth on Pt/C Fuel Cell Catalysts Using Asymmetric Scan Electrochemical Quartz Crystal Nanogravimetry', Electrocatalysis, 2015, 6, 1.
3. Pistono, A.O; Burke, C.S.; Cisco, J.; Wilson, C.; Adams, B.J.; **Rice, C.A.** Inhibition of Bismuth Dissolution during Anode Catalyst Layer Pore Former Removal in a Direct Formic Acid Fuel Cell', ECS Electrochemistry Letters, 2014, 3, F65.
4. Rinaldo, S.G.; Urchaga, P.; Hu, J.; Lee, W.; Stumper, J.; **Rice, C.;** Eikerling, M. 'Theoretical analysis of electrochemical surface-area loss in supported nanoparticle catalysts', Phys. Chem. Chem. Phys., 2014, 16, 26876.

Conference Presentations

1. J. Cisco, C. Burke, **C.A. Rice** 'Catalyst layer design in direct formic acid fuel cells', TTU Student Research Day, April 2015, Poster.

Invited Seminars

1. **C. Rice**, 'Direct Formic Acid Fuel Cells', Seminar at the University of Southern Mississippi, February 6th, 2015.

Kwun-Lon Ting

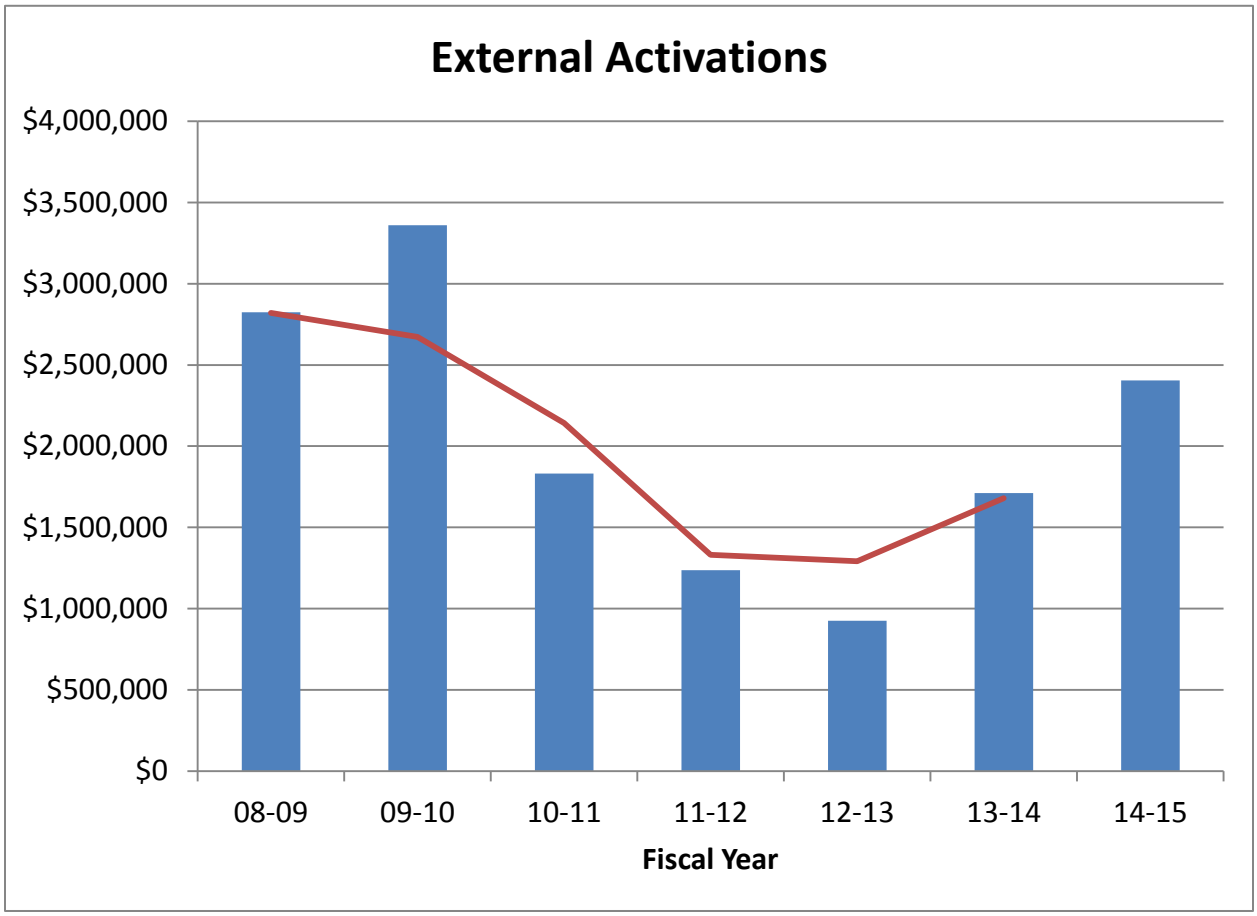
Journal Publications

1. Wang, J., **Ting, K. L.** and Zhao, D. X., 2014 "Equivalent Linkages and Dead Center Positions of Planar Single-DOF Complex Linkages." Journal of Mechanisms and Robotics. doi: 10.1115/1.4029187.

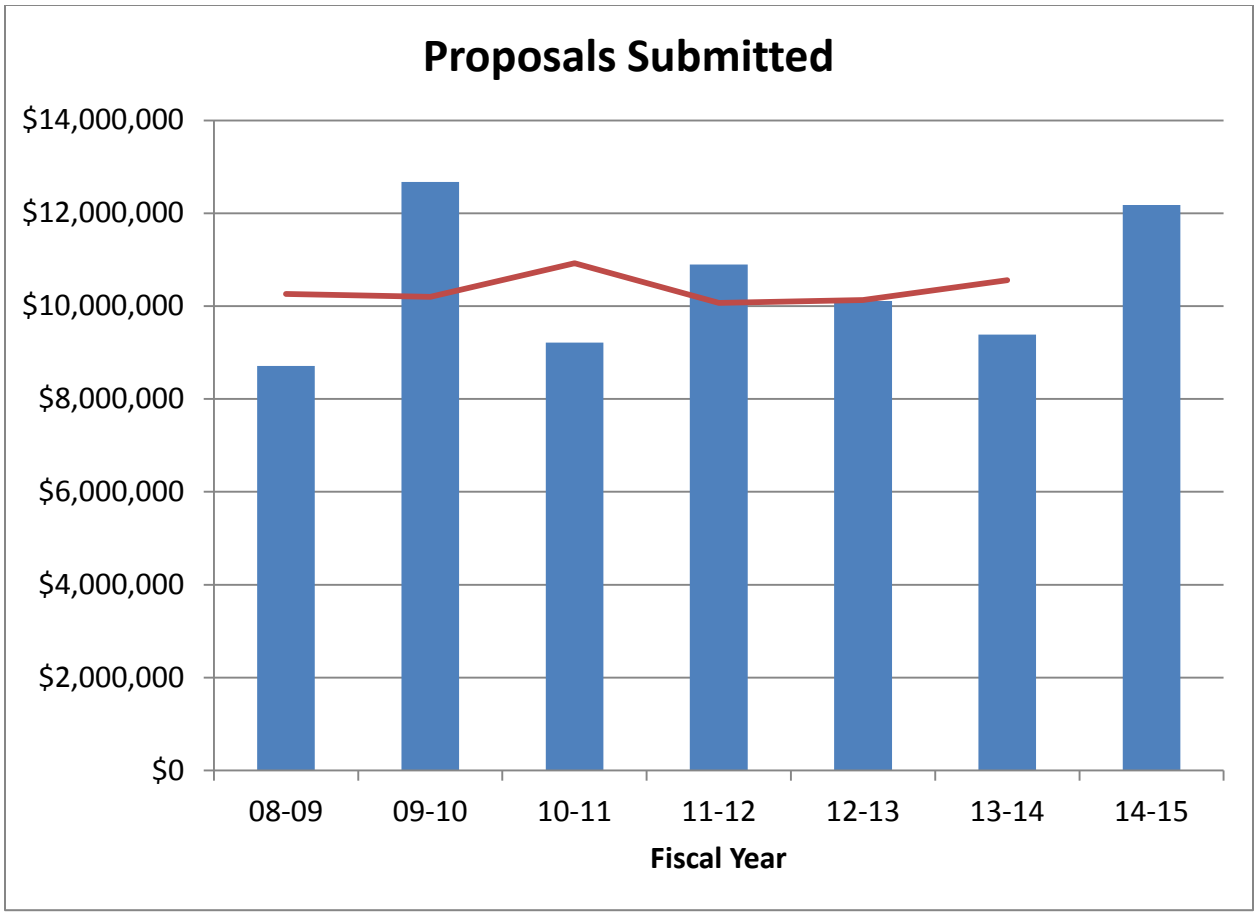
[1] Only CMR "Center Faculty" scholarly activities are included here.

Conference Publications

1. Zhiyuan Yu, **Ting, K. L.**, “Explicit Dynamics Analysis for Harmonic Drives,” ASME 2014 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference IDETC/CIE 2014, August 17-20, 2014, Buffalo, New York, USA, DETC2014-34759
2. Wang, J., **Ting, K. L.**, Wang, Q., Sun, J.F., You, Y., Zhao, D. X., Nie, L.Y., 2014, “Full Rotatability of Watt Six-Bar Linkages ,” ASME 2014 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference IDETC/CIE 2014, August 17-20, 2014, Buffalo, New York, USA, IDETC2014-34207.
3. Wang, J., Nie, L.Y., Wang, Q., Sun, J.F., You, Y., Zhao, D. X., **Ting, K. L.**, 2014, “Singularity Analysis of Planar Multiple-DOF Linkages,” ASME 2014 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference IDETC/CIE 2014, August 17-20, 2014, Buffalo, New York, USA, IDETC2014-34213.



FY	08-09	09-10	10-11	11-12	12-13	13-14	14-15
3 Year Moving Avg.	$2,819,801	$2,671,969	$2,142,862	$1,331,496	$1,291,253	$1,680,204	
External Activations	$2,824,148	$3,359,888	$1,831,872	$1,236,826	$925,789	$1,711,145	$2,403,677



FY	08-09	09-10	10-11	11-12	12-13	13-14	14-15
3 Year Moving Avg.	$10,265,452	$10,200,289	$10,927,246	$10,072,301	$10,130,421	$10,558,412	
Proposals Submitted	$8,714,399	$12,673,820	$9,212,641	$10,895,277	$10,108,985	$9,387,001	$12,179,250

Grants and Contract Awards

	Project Description / Source / Acct. No.	Principal Investigators	Activated Amount	Project Duration	Estimated 12-month Expenses
1.	CMR Testing and Design 2014-2015 Various Industries Account # 5-38585	Vahid Motevalli	$64,122	07/01/2014 – 06/30/2015	$45,612
2.	UT-CIS Contract for Employee Services 2014-2015 University of Tennessee Center for Industrial Services Account # 5-33515	Meenakshi Sundaram	$20,000	07/01/2014 – 06/30/2015	$2,590
3.	UT-CIS Senior Design Services 2014-2015 University of Tennessee Center for Industrial Services Account # 5-33514	Meenakshi Sundaram	$15,000	07/01/2014 – 06/30/2015	$10,000
4.	UCRSI Stemmobile and TN-SCORE Education Outreach to Rural Tennessee Counties University of Tennessee (via NSF EPSCoR funds) Account # 5-31229	Sally Pardue Cynthia Rice	$68,101	11/01/2014 – 07/31/2015	$68,101
5.	Components and Devices for Energy Storage and Conversion University of Tennessee (via NSF EPSCoR funds) OR-A11-0171-001.04 Amendment 8 Account # 5-31228	Cynthia Rice	$182,642	10/07/2014 – 12/31/2015	$182,642
6.	Components and Devices for Energy Storage and Conversion University of Tennessee (via NSF EPSCoR funds) OR-A11-0171-001.04 Amendment 8 Account # 5-31228	Cynthia Rice	$35,000	10/07/2014 – 07/31/2015	$35,000
7.	Public-Private Partnership for a Comprehensive Workforce Development Plan to Stimulate Industrial Energy Efficiency and Demand Reduction US Department of Energy DE-EE0005533 – Modification #10 Account # 5-32290	Glenn Cunningham	$150,000	09/30/2014 – 09/30/2015	$130,000
8.	Public-Private Partnership for a Comprehensive Workforce Development Plan to Stimulate Industrial Energy Efficiency and Demand Reduction US Department of Energy DE-EE0005533 – Modification #10 Account # 5-32290	Glenn Cunningham	$100,000	09/30/2014 – 09/30/2015	$100,000

Project Description / Source / Acct. No.		Principal Investigators	Activated Amount	Project Duration	Estimated 12-month Expenses
9.	Collaborative Research: Design, Analysis and Implementation of Social Interactions in Cognitive Radio Networks National Science Foundation CNS-1247778, Year 3 of 3 Account # 5-31212	Robert Qiu	$47,794	10/10/2014 – 12/31/2015	$35,530
10.	Program Income for Women in Cybersecurity Project, Various Individuals and Companies Account # 5-31274	Ambareen Siraj	$169,851	07/01/2014 – 06/30/2015	$169,851
11.	Collaborative Research: Capacity Building in Cybersecurity: Broadening Participation of Women in Cybersecurity through Women in Cybersecurity Conference and Professional Development National Science Foundation, DUE-1303441, Year 2 of 2 Account # 5-31273	Ambareen Siraj	$120,817	09/15/2014 – 08/31/2015	$50,000
12.	III:Small:Collaborative Research: Anomaly Detection in Graph Streams National Science Foundation, IIS-1318957, Year 2 of 3 Account # 5-31271	William Eberle	$69,655	09/15/2014 – 09/14/2015	$69,655
13.	REU Supplement to "Collaborative Research: A Multi-Scale Environmental and Kinetics Study on the Pyrolysis of Sustainable Biomass Feedstock National Science Foundation, CBET-1337033-REU Account # 5-31222	Joseph Biernacki Scott Northrup	$10,000	09/01/2013 – 08/31/2016	$10,000
14.	Collaborative Research: A Multi-Scale Environmental and Kinetics Study on the Pyrolysis of Sustainable Biomass Feedstock National Science Foundation, #CBET-1337033, Year 2 of 3 Account # 5-31222	Joseph Biernacki Scott Northrup	$149,003	09/01/2014 – 08/31/2015	$126,650
15.	Stephen Scott JFA FY 2014-2015 Oak Ridge National Laboratory – Subcontract 40000102091 Account # 5-39305	Stephen Scott	$70,040	08/01/2014 – 05/31/2015	$70,040
16.	GOALI: Environmentally-Assisted Reactive Sintering of Conductive Spinel Layers for Solid Oxide Fuel Cell National Science Foundation, CMMI-1362680, Year 1 of 3 Account # 5-31203	Jiahong Zhu	$110,442	08/15/2014 – 08/14/2015	$67,000

Project Description / Source / Acct. No.		Principal Investigators	Activated Amount	Project Duration	Estimated 12-month Expenses
17.	Supplement to GOALI: Simply Low-Cost Methods for Making Conductive Interfacial Coatings for Solid Oxide Fuel Cells National Science Foundation, 1362680-REU, Year 1 of 2 Account # 5-31203	Jiahong Zhu	$3,000	12/08/2014 – 12/07/2015	$3,000
18.	High Throughput Manufacturing of Nanoparticles for Biomedicine, Chemtor (via NIH funds) Subcontract 14-2 (NIH Prime 1R41AG050381-01A1) Account # 5-39370	Holly Stretz	$45,000	10/01/2014 – 12/31/2015	$43,738
19.	REU Site- Summer Research Internships in Manufacturing and Techno-Entrepreneurship Preparation National Science Foundation, 1461179, Year 1 of 3 Account # 5-31232	Joseph Rencis Vahid Motevalli	$124,577	03/15/2015 – 03/14/2016	$114,000
20.	Secure Computing Enclaves Oak Ridge National Laboratory, Modification #1 Subcontract 4000134889 Account # 5-39311	Stephen Scott	$78,079	11/30/02014 – 06/30/2015	$78,079
21.	Secure Computing Enclaves Oak Ridge National Laboratory, Subcontract 4000134889 Account # 5-39311	Stephen Scott	$16,110	10/03/2014 – 11/30/2014	$16,110
22.	Advancement of Cryogenic Electronics, MIT Lincoln Laboratory – Purchase Order 7000293007, Year 1 of 3 Account # 5-39376	Wayne Johnson Mahajan / Cui / Stretz / Wilson	$749,444	11/01/2014 – 10/31/2015	$592,075
23.	Intel-NSF-GTISC Security Education Micro-Grant Program, Georgia Tech Information Security Center (GTISC) Account # 5-31202	Sheikh Ghafoor	$5,000	11/01/2014 – 10/31/2015	$4,715
	Total		**$2,403,677**		**$2,024,388**

Schedule 7

CENTERS OF EXCELLENCE/CENTERS OF EMPHASIS
ACTUAL, PROPOSED, AND REQUESTED BUDGET

Institution Tennessee Technological University **Center** Center for Manufacturing Research

	FY 2014-15 Actual			FY 2015-16 Proposed			FY 2016-17 Requested		
	Matching	Appropr.	Total	Matching	Appropr.	Total	Matching	Appropr.	Total
Expenditures									
Salaries									
Faculty	390,774	322,397	**713,171**	375,000	518,227	**893,227**	400,000	475,000	**875,000**
Other Professional	22,668	398,560	**421,228**	35,000	402,256	**437,256**	40,000	400,000	**440,000**
Clerical/ Supporting	0	51,746	**51,746**	0	50,403	**50,403**	0	60,000	**60,000**
Assistantships	201,000	93,382	**294,382**	150,000	214,578	**364,578**	200,000	175,000	**375,000**
Hourly Students	93,145	39,350	**132,495**	40,000	52,446	**92,446**	50,000	30,000	**80,000**
Total Salaries	**707,587**	**905,435**	**1,613,022**	**600,000**	**1,237,910**	**1,837,910**	**690,000**	**1,140,000**	**1,830,000**
Fringe Benefits	232,097	361,724	**593,821**	210,000	369,344	**579,344**	230,000	370,000	**600,000**
Total Personnel	**939,684**	**1,267,159**	**2,206,843**	**810,000**	**1,607,254**	**2,417,254**	**920,000**	**1,510,000**	**2,430,000**
Non-Personnel	**NOTE: Appropriations Expenditures in Fringe Benefits include $54,060 for Graduate Student Fees for FY 2014-15.**								
Travel	74,047	17,531	**91,578**	75,000	32,602	**107,602**	85,000	20,000	**105,000**
Software	0	0	**0**	0	0	**0**	0	0	**0**
Books & Journals	0	0	**0**	0	0	**0**	0	0	**0**
Other Supplies	441,539	36,064	**477,603**	133,980	32,854	**166,834**	175,000	24,210	**199,210**
Equipment	335,855	20,000	**355,855**	436,255	20,000	**456,255**	400,000	0	**400,000**
Maintenance	5,700	0	**5,700**	10,000	0	**10,000**	0	0	**0**
Scholarships	0	0	**0**	0	0	**0**	0	0	**0**
Consultants/Subcontracts	182,060	0	**182,060**	125,000	0	**125,000**	130,000	0	**130,000**
Renovation	0	1,264	**1,264**	0	0	**0**	0	0	**0**
Seminars/Workshops/Conf	38,005	0	**38,005**	35,000	0	**35,000**	40,000	0	**40,000**
Total Non-Personnel	**1,077,206**	**74,859**	**1,152,065**	**815,235**	**85,456**	**900,691**	**830,000**	**44,210**	**874,210**
GRAND TOTAL	**2,016,890**	**1,342,018**	**3,358,908**	**1,625,235**	**1,692,710**	**3,317,945**	**1,750,000**	**1,554,210**	**3,304,210**
Revenue	**NOTE: Actual Matching Funds do not include Indirect Costs of $433,422 for FY 2014-2015.**								
New State Appropriation	0	1,506,300	**1,506,300**	0	1,480,200	**1,480,200**	0	1,554,210	**1,554,210**
Carryover State Appropriation	0	48,228	**48,228**	0	212,510	**212,510**	0	0	**0**
New Matching Funds	2,099,031	0	**2,099,031**	1,518,980	0	**1,518,980**	1,750,000	0	**1,750,000**
Carryover from Previous Matching Funds	24,114	0	**24,114**	106,255	0	**106,255**	0	0	**0**
Total Revenue	**2,123,145**	**1,554,528**	**3,677,673**	**1,625,235**	**1,692,710**	**3,317,945**	**1,750,000**	**1,554,210**	**3,304,210**

NOTE: Carryover appropriation funds of $212,510 are designated for new faculty recruitment commitments.

FY 2016 – 2017 Budget Request and Justification

The CMR is requesting a 5% increase in the FY 2016-17 State appropriations to account for increasing salaries, supplies, and travel costs. Tennessee Tech University had a 1% salary increase as of January 1, 2015 for all faculty and staff. The Center had to absorb this increase through the appropriated funds, which is further amplified by the corresponding increase in the benefits costs. The increase is particularly important to allow CMR to pay the graduate student salaries at a level consistent with the College of Engineering and be competitive with other universities in Tennessee and cover the increased tuition and fees. Attracting and retaining quality graduate students are key to CMR's ability to continue a high-level of research and service to Tennessee manufacturing industries. In addition, the CMR seeks to incentivize more faculty to contribute to the research and industry engagement in the manufacturing area and erosion of the State support makes starting new initiatives and providing incentives difficult.

Costs for supplies, benefits, and travel continue to increase on a yearly basis and inflationary increases also need to be considered in the budget adjustment.

SUPPORTING MATERIALS

CMR Supported Graduate Students Degrees Awarded

Masters

David Clifford
"The Coupled Multi-Physics Finite Element Analysis of a High Temperature Measurement Device"
December 2014
Advisors: Dr. Christopher Wilson and Dr. Glenn Cunningham
Mechanical Engineering

James Pogge
"Distributed IEEE 802.11 Senor Network Security Using Datagram Authentication"
December 2014
Advisor: Dr. Stephen Scott
Computer Science

Sarah Russell
"Effects of Surface Modification and GXP Annealing on PCBM Dispersion in Organic Photovoltaic Solar Cells"
May 2015
Advisor: Dr. Holly Stretz
Chemical Engineering

Shaun Tipton
"Neon-CTF: A Different Kind of Capture-The-Flag"
December 2014
Advisor: Dr. Ambareen Siraj
Computer Science

CMR Supported Graduate Student Degrees Awarded

PhD

Samgopiraj Chellapandi Velraj
"Performance and Cycle Life of Carbon and Conductive Based Air Electrodes for Rechargeable ZN – Air Battery Applications"
December 2014
Advisor: Dr. Jiahong Zhu
Mechanical Engineering

Shuji Hou
"Spectrum Sensing and Kernel-Based Machine Learning in Cognitive Radio Network: Algorithms and Data Processing"
December 2014
Advisor: Dr. Robert Qiu
Electrical and Computer Engineering

Feng Lin
"Spectrum Sensing in Cognitive Radio Networks: Algorithms, Analysis, Data Processing and Testbed"
May 2015
Advisor: Dr. Robert Qiu
Electrical and Computer Engineering

Changchun Zhang
"Large Scale SDR Networking Testbed-Prototyping, Data Collections, and Processing Applications"
May 2015
Advisor: Dr. Robert Qiu
Electrical and Computer Engineering

CMR Graduate Students Supported from State Appropriations

Masters

Brita Anderson
Advisor: Dr. Jeffrey Rice
Chemical Engineering

David Clifford
Advisor: Dr. Glenn Cunningham
Mechanical Engineering

Amruth V. Halematha
Advisor: Dr. Awni Qasaimeh
Mechanical Engineering

Seth Latture
Advisor: Dr. Jeffrey Rice
Chemical Engineering

Jonathan Miller
Advisor: Dr. Jiahong (John) Zhu
Mechanical Engineering

Abdul Salam Mohammad
Advisor: Dr. Joe Biernacki
Chemical Engineering

Ian Swagerty
Advisor: Dr. Glenn Cunningham
Mechanical Engineering

PhD

Corey Cooke
Advisor: Dr. Adam Anderson
Electrical and Computer Engineering

Kuan-Lun Hsu
Advisor: Dr. Kwun-Lon Ting
Mechanical Engineering

Clint McCullough
Advisor: Dr. Jennifer Pascal
Chemical Engineering

Koteswara Medidhi
Advisor: Dr. Jennifer Pascal
Chemical Engineering

Behnaz Papari
Advisor: Dr. Adam Anderson
Electrical and Computer Engineering

Antonio (Tony) Pistono
Advisor: Dr. Cynthia Rice
Chemical Engineering

Khaled Mohamed Rabieh
Advisor: Dr. Mohamed Mahmoud
Electrical and Computer Engineering

Zhiyuan Yu
Advisor: Dr. Kwun-Lon Ting
Mechanical Engineering

CMR Graduate Students Supported from External Funds

Masters

Christopher Blackburn
Advisor: Dr. Chris Wilson
Mechanical Engineering

Ronald Divilbiss
Advisor: Dr. Holly Stretz
Chemical Engineering

Jonathan Dugas
Advisor: Dr. Satish Mahajan
Electrical and Computer Engineering

Tingke Fang
Advisor: Dr. Jiahong (John) Zhu
Mechanical Engineering

Matthew Kelley
Advisor: Dr. Joe Biernacki
Chemical Engineering

Zachary Parchman
Advisor: Dr. Stephen Scott
Computer Science

Sarah Russell
Advisor: Dr. Holly Stretz
Chemical Engineering

Jason Steward
Advisor: Dr. Ying Zhang
Mechanical Engineering

Lingzhu Zhang
Advisor: Dr. Ying Zhang
Mechanical Engineerimg

PhD

William Aderholdt
Advisor: Dr. Stephen Scott
Computer Science

Lahiru Prasad Gamage
Advisor: Dr. Cynthia Rice
Chemical Engineering

Lenin Mookiah
Advisor: Dr. William Eberle
Computer Science

James Pogge
Advisor: Dr. Stephen Scott
Electrical and Computer Engineering

Brett Witherspoon
Advisor: Dr. Robert Qiu
Electrical and Computer Engineering

Jason Witman
Advisor: Dr. Ying Zhang
Mechanical Engineering

Changchun Zhang
Advisor: Dr. Robert Qiu
Electrical and Computer Engineering

Ali Zolghar
Advisor: Dr. Joe Biernacki
Chemical Engineering

External Funding – Proposals Submitted

	Status	Title	PI's	Department	Total Funds
1	5-38585	CMR Testing and Design 2014-2015 Various Industries	Motevalli	COE	$64,122
2	5-33515	UT-CIS Contract for Employee Services 2014-2015 The University of Tennessee Center for Industrial Services	Sundaram	ME	$20,000
3	5-33514	UT-CIS Senior Design Services 2014-15 The University of Tennessee Center for Industrial Services	Sundaram	ME	$15,000
4	5-31228	UCRSI STEMmobile and TN-SCORE Education Outreach to Rural TN Counties University of Tennessee (via NSF EPSCoR funds)	Pardue Rice	ME CMR	$103,101
5	5-39305	Stephen Scott JFA FY2014 -2015 - For summer funding Oak Ridge National Laboratory	Talbert	CompS	$4,718
6	5-31203	Supplement to GOALI: Simple Low Cost Methods for Making Conductive Interfacial Coatings for Solid Oxide Fuel Cells National Science Foundation - Supplement to Award 1362680	Zhu	ME	$8,000
7	Rejected	Career: Big Communications: Going Small with Big Data Analytics and Massive Wireless Communications National Science Foundation	Anderson	ECE	$541,845
8	Rejected	Autonomous Self-Leveling and Traction Control for Leg-Wheeled Robotic Probes University of Alabama Huntsville (via NASA funds)	Canfield	ME	$96,413
9	5-31232	REU Site: Summer Research Internships in Manufacturing and Techno-Entrepreneurship Preparation National Science Foundation	Rencis Motevalli	COE COE	$373,907

	Status	Title	PI's	Department	Total Funds
10	5-39311	Secure Computing Enclaves Oak Ridge National Laboratory	Scott	CompS	$94,189
11	5-39376	Advancement of Cryogenic Electronics MIT Lincoln Laboratory	Johnson Mahajan	ECE ECE	$1,748,298
12	Rejected	CRII: SaTC: Secure and Privacy-preserving Vehicle-to-Grid Communications via AMI Networks National Science Foundation	Mahmoud	ECE	$174,927
13	Rejected	Collaborative Research: Catalyst Durability in Electrochemical Systems: From Establishing Fundamental Understanding to Innovative Materials and Operational Conditions National Science Foundation	Rice	CMR	$295,069
14	Rejected	RapidTech National Center for Rapid Technologies University of California - Irvine (via NSF funds)	Fidan	MET	$239,705
15	Rejected	Additive Manufacturing Workforce Solutions: The Generation of Manufacturing Pellissippi State Technical Community College (via NSF funds)	Fidan	MET	$170,000
16	Rejected	Breakthrough: Protecting data confidentiality against traffic analysis: A new dimension for the security and privacy preservation in the smart grid National Science Foundation	Mahmoud Guo	ECE CMR	$430,389
17	Rejected	Self-Powered in Vivo Force and Implant Wear Sensing in Knee Arthroplasty National Institute of Health (NIH)	Anton	ME	$417,296
18	Rejected	Improving Clinical Outcomes of Total Knee Arthroplasty through Self-Powered in Vivo Force and Implant Wear Sensing National Science Foundation	Anton	ECE	$327,510
19	Rejected	Collaborative Research: Thermal and Ferroelectric Behavior of PVDF/nano-ZnO in Electrospun Nanofibers and Microfilms National Science Foundation	Stretz	ChemE	$210,000

	Status	Title	PI's	Department	Total Funds
20	Rejected	Modeling and Analysis of Tumor and Primary Cell Response to Alternating Current Applied Electrical Fields National Science Foundation	Pascal Rice	ChemE ChemE	$301,799
21	5-31202	Intel-NSF-GTISC Security Education Micro-Grant Program Georgia Tech Information Security Center (GTISC)	Ghafoor	CompS	$5,000
22	Rejected	Collaborative Research: Catalyst Durability in Electrochemical Systems: From Establishing Fundamental Understanding to Innovative Materials and Operational Conditions National Science Foundation	Rice	CMR	$296,033
23	Rejected	Multiple-Element Impact Dampers with Piezoelectric Energy Harvesting Vibration Institute	Anton	ME	$10,000
24	Rejected	Evaluating the Effects of Distance Learning in Fundamental Engineering Courses Tennessee Board of Regents	Henderson Wilson	CEE ME	$30,000
25	Rejected	Developing a Novel Bioreporter Organism to Track the Health of Methanogens in Anaerobic Codigesters Tennessee Board of Regents	Rice Datta	ChemE CEE	$30,000
26	Rejected	Design, Development and Validation of Innovative Sound Package Treatments to Reduce Railroad Noise NineSights	Rao Darvennes	ME ME	$152,920
27	Rejected	Integrating Research in Robotics, Controls, BioMechanics and Additive Manufacturing into Engineering Education through the EIME Model (Merging Assistive Technology for Children and Mechanical Engineering) Tennessee Board of Regents	Canfield Fidan	ME MET	$40,000
28	Rejected	MRI: Acquisition of Field Emission Scanning Electron Microscopy to Characterize Nanoscale Research for Advanced Energy Materials National Science Foundation	Rice Stretz	CMR ChemE	$361,084

	Status	Title	PI's	Department	Total Funds
29	Rejected	NRI: Artificial Intelligence Based Adaptive Control for Mobile Manipulator Systems with High Elasticity and Slipping National Science Foundation	Chaoui Canfield	ME ECE	$495,098
30	Rejected	Predicting Enhanced Drug and Nanomaterial Perfusion Due to Radiofrequency (RF) Electric Fields Baylor University (via NIH funds)	Pascal	ChemE	$781,000
31	Rejected	NeTS: Small: Collaborative Research: Autonomous Traffic Management System through Participatory-sensing and Secure Data Sharing National Science Foundation	Mahmoud	ECE	$195,000
32	Rejected	TWC: Small Collaborative Research: Cross-layer Schemes for Preserving Base-Station Anonymity in Wireless Ad-hoc Networks National Science Foundation	Mahmoud	ECE	$165,000
33	Rejected	E-MAA Pre-natal Remote Monitoring Unit: High Impact, Maximum Outreach US -AID	Hasan	ECE	$132,767
34	Rejected	Engineering of Novel Extracellular Matrix Proteins for Improved Wound Healing Oak Ridge Associated Universities	Rice	ChemE	$5,000
35	Rejected	Characterization of Hot-Dipping Aluminide Coating on Stainless Steels for SOFC Balance-of-Plant Components Application DRS Research (via DOE funds)	Zhu	ME	$59,999
36	Rejected	Molecularly Imprinted Polymer (MIP) Coordinators for Selective Uranyl Ion Extraction from Aqueous Solutions University of Tennessee Space Institute (via NEUP funds)	Pascal	ChemE	$120,000
37	Rejected	Whole Motion and Clearance-Induced Motion Uncertainty of Linkages and Manipulators National Science Foundation	Ting	CMR	$299,984
38	Pending	RET Site: Innovation and Techno-entrepreneurship in Advanced Manufacturing (ITAM) National Science Foundation	Fidan Canfield	MET ME	$597,479

	Status	Title	PI's	Department	Total Funds
39	Awarded	Development of Low-Cost, Highly-Sinterable, Co-Free (Ni1Fe)3O4 Spinel-Based Contact Materials for SOFC Cathode-Side Contact Application U.S. Department of Energy - Office of Fossil Energy, National Energy Technology	Zhu	ME	$200,000
40	Pending	Thin Film Ink Technology as a Novel Fuel Cell Electrocatalyst US Department of Energy, Office of Energy Efficiency and Renewable Energy	Shirvanian	ME	$700,075
41	5-35235	Idea to Commercially-Viable Healthcare Solutions: Enhancement and Expansion of Clinical Immersion at Disciplinary Interfaces Course VentureWell	Sanders Geist	ChemE Nur	$40,000
42	Pending	CPS: Breakthrough: Collaborative Research: Towards Privacy-Preserving Vehicular CPS for Large-Scale Electric Vehicle Charging National Science Foundation (in collaboration with Florida International University)	Mahmoud	ECE	$190,000
43	Rejected	DiMaH-Digital Manufacturing Hub VentureWell	Fidan Canfield	MET ME	$37,369
44	Rejected	Improving Interfacial Strength of 3-D Printed ABS Weld Lines, the Janus Filament Oak Ridge National Laboratory	Stretz	ChemE	$95,227
45	Pending	TTU-NSF Innovation Corps Sites National Science Foundation	Canfield Fidan	ME ME/M	$299,868
46	Pending	Collaborative Research: Defining a Universal Spectral Language to Enable Evolutionary Biomimicry in Autonomous Radio Networks National Science Foundation	Anderson	ECE	$246,767
47	Pending	Collaborative Research: Design, Analysis and Implementation of Millimeter Wave Distributed Massive MIMO Network National Science Foundation	Qiu Guo	CMR CMR	$399,947
48	Pending	Self-Powered in Vivo Force and Implant Wear Sensing in Knee Arthroplasty National Institute of Health	Anton	ME	$417,372

	Status	Title	PI's	Department	Total Funds
49	Rejected	Real-Time Damage Detection in Highly Dynamic Environments National Instruments	Anton	ME	$50,000
50	Awarded	iPDC: Integrating Parallel and Distributed Computing in Introductory Programming National Science Foundation - Award 1549812	Ghafoor Rogers	CompS CompS	$49,973
51	Rejected	A Novel Air Conditioning Peak Load Shaving for Residential, Commercial, and Industrial Buildings Tennessee Board of Regents	Languri Cunningham	ME ME	$40,000
			Proposals Submitted in FY 2014-15		**$12,179,250**

Index number = funded.
"Awarded" = funded, awaiting documents
"Pending" = no decision made