

Office of Research and Economic Development

Annual Report
Fiscal Year 2015-2016



Tennessee
TECH

Table of Contents

Annual Report Fiscal Year 2015-2016

Executive Summary.....	2
Priorities.....	3
Outcomes.....	4
Progress and Improvements.....	5
Innovation and Entrepreneurship Outcomes.....	6
Economic Development Outcomes.....	7
Grants, Contracts and Awards.....	9
Faculty Engagement Outcomes-Trainings.....	15
Faculty Committee Engagement Outcomes.....	17
Student Outcomes.....	19



Tennessee
TECH

Executive Summary

The Office of Research and Economic Development (ORED) is the administrative hub for the academic enterprise of research, scholarship, creative, and economic and community development activities. The vision and mission of the ORED are designed based on a core value of the comprehensive development strategy, known as the Flight Plan 2013-2018: *to conduct research, to expand scholarly profiles and to increase creative activities of distinction within the state, region, and nation.*

Vision

The TECH that will change your world — Tennessee Tech will emerge as a leading technological university for research and innovation-driven economic and community development in the Southeast.

Mission

To foster and promote **collaborative-interdisciplinary-innovative-creative-entrepreneurial** culture driven-research and development to solve societal and industrial problems of critical importance to the economic and community development of the Upper Cumberland region and the State of Tennessee. This is accomplished through a three-fold mission:

- **Sponsored and Scholastic Research:** Support, inspire, and provide incentives for faculty to pursue sponsored and scholastic research and grow a sponsored research program.
- **Innovation:** Develop and inspire innovation and an entrepreneurial culture on campus through student and faculty involvement.
- **Economic Development:** Play a support role in the economic and community development of the Upper Cumberland region and the State by fully leveraging the University's intellectual capital and knowledge base.

Goals and Objectives

Goal 1: Develop and encourage activities to increase extramural funding.

Objective 1.1: Provide initiation grants for individual and interdisciplinary research projects.

Objective 1.2: Provide assistance with proposal preparation.

Objective 1.3: Offer proposal and faculty research development workshops and training.

Executive Summary

Goal 2: Develop and encourage activities to enhance innovation.

- Objective 2.1: Provide initiation grants for innovative ideas that might result in invention disclosures.
- Objective 2.2: Provide funding for filing patents and copyrighted materials.
- Objective 2.3: Seek opportunities to inform angel investors and venture capitalists of inventions to fully explore commercial/marketing of candidate innovations from the intellectual property portfolio.

Goal 3: Identify activities with the most potential for improving the economic environment within the entire region.

- Objective 3.1: Promote increased cooperation and coordination between public and private sectors in the formulation of economic development plans and programs.

Priorities for 2015-2016

To improve the academic posture, research priorities and the University research agenda are aligned with the *Flight Plan to Create Distinctive Programs and Invigorate Faculty*.

University Research Priorities:

- **STEM and Education/Training** — Teaching and Assessment Innovations linking with K-12
- **Advanced Manufacturing** — Robotics, Automation and Intelligent Mobility in collaboration with CHEC, other community colleges, academic institutions, federal/state agencies and industry
- **Renewable/Alternate Energy/Energy Efficiency**
 - Battery
 - Smart-Grid
 - Sensors and Instrumentation
- **Big Data Analytics and Cybersecurity**
 - Center for Data Analytics: Focused on Healthcare, Finance and Homeland Security Applications
 - Cybersecurity Education, Research and Outreach Center (CEROC)
- **Agricultural Products and Agricultural Tourism**
 - Center for Sustainable Agriculture — Farm-to-Fork and Farm-to-Fashion Focus
 - Sustainable Mountain Agriculture partnerships including those with Tennessee State Parks and Upper Cumberland Tourism

Executive Summary

- **Environment/Water Sustainability**
Water Resource Management Center with focus on
Water-Energy-Food Nexus: Water, Energy and Food Security
Biodiversity and Sustainability
Water Quality and Wastewater Management
- **Care Giving for Aging and Multi-handicap Population**
Care Giving Center (CGC): Care giving education, training, service/outreach
involving care coordination, social well-being, health and safety awareness, and daily
essential activities
- **Chemical Compound Design and Manufacturing**
Pharmaceutical Processing Center (P²C)

Outcomes for Fiscal Year 2015-2016

The ORED has made considerable improvement in the three main functional areas: (1) Sponsored and Scholastic Research Program Development and Administration, (2) Infusion of faculty and students in an Innovation and Entrepreneurship Culture and initiation of the Tennessee Tech Research Foundation, and (3) Economic and Community Development. Several initiatives were undertaken to (a) develop and strengthen strategic alliances and relationships with federal and state agencies, industry, and private sector businesses to further enhance the acquisition of grants and contracts; (b) strengthen existing and develop new research centers/institutes and interdisciplinary teams in response to emerging national research priorities; and (c) provide support for grant application development and pre- and post-award sponsored program logistics and compliance support.

More significantly, the number of proposals submitted increased from 161 to 215; the value of proposals submitted increased from \$46 million to \$61.4 million; the activations increased from \$11.2 million to \$12.9 million; and the number of disclosures increased from 5 to 13.

The ORED provided \$212,202.85 in start-up packages to faculty and provided cost share in the amount of \$130,000 for the NSF major research instrumentation award.

The ORED was also involved in the following significant contributions in the 2015-2016 fiscal year:

- Establishment of the Cybersecurity Education, Research and Outreach Center (CEROC), which received National Security Agency (NSA) recognition and an NSF workforce education/training award

- NSF CAREER and DOD scholar awards to a young faculty member in physics and engineering and an NIH grant award to the Counseling Center
- Aggressive state-level collaborative initiative to address Tennessee's critical automotive research and development needs
- Establishment of iCube, which has earned the highest number of sponsored research awards, as a destination for collaborative and innovative solutions
- Addition of Academy Sports and FICOSA to the Cookeville region. The TTI expansion also collectively added 2,500 jobs to the regional economy.

Progress and Improvements

Sponsored Programs

The ORED has seen several improvements with the issues regarding pre-award, compliance and post-award activity, and oversight resulting in additional analysis to resolve the high risk areas. To ensure quality control and efficiency in reporting, these modifications are instituted in the assessment plan for administrative procedures and measures:

- Proposals will be monitored annually according to the number submitted to funding agency.
- Faculty receiving proposal preparation and budget assistance will be monitored annually for assessment.
- Patents issued will be monitored annually for assessment.
- Pre- and post-award analysis staff person will be recruited.
- Faculty training for research compliance using the Collaborative Institutional Training Initiative (CITI) in responsible conduct of research, human subjects, animal care and use, and export controls will be monitored annually for assessment.

Faculty and students are motivated and have acquired an incentive for research. Significant progress is demonstrated in the participation of professional development trainings and the number of proposal submissions. The data reports an upward trend in faculty attendance and the number of proposals submitted to funding agencies. It is predicted that the anticipated impact of these services will be realized in the next two to five years. The data included in this report illustrates the outcomes and efforts in the target areas.

University Wide Centers

The ORED continues to provide guidance to all University wide Centers, including the three State-supported Centers of Excellence, iCube and other Centers. The following activities are noteworthy:

- The vision and mission of the Center for the Management, Utilization and Protection of Water Resources has been revitalized, and its thrust areas have been developed with a strategic focus on water, energy and food security, biodiversity, water quality, and wastewater

management. The amount of sponsored research by the Center is increasing. The sponsored research link with the Tennessee Department of Environment and Conservation and the Tennessee Department of Transportation will result in more sponsored research funding soon.

- The directors of the University's Centers meet quarterly, and the directors and key leadership staff reporting to the ORED meet monthly to discuss budgets, progress, barriers to progress, and Center needs.
- The Oakley STEM Center continues to make progress on linking with the Tennessee Tech community, providing leadership roles on regional- and state-level workforce and educational training programs. The STEM Center has also been successful in receiving an Army Education outreach program for STEM educators with a funding of \$1.64 million spread over 10 years. The Center also earned Tennessee Department of Education Math and Science Partnership funds of \$543.4 thousand. The Center will continue to explore avenues to reach a 100% level of sustainability by 2018.
- The iCube has become the on-campus destination for "*Collaborative and Innovative Solutions.*" Several interdisciplinary educational research projects are being conducted by representatives from all colleges. Forty to 50 graduate and undergraduate students participate in experiential learning with a paid internship in the development of virtual and IT content.

Innovation and Entrepreneurship Outcomes

Innovation and Entrepreneurship

The Office of Research and Economic Development ensures the protection of the innovative and intellectual creativity of the university, as well as markets the talent for future investment. The following initiatives illustrate the efforts and outcomes:

- SES (Social Entrepreneur Society) – Student Society active in organizing entrepreneurship workshops and inspiring students
- Successful EagleWorks – Student entrepreneurship competition resulting in two spin-off companies.
- iCube and iMakerSpace provide a location for innovative virtual and physical prototype creations and group projects requiring development of new ideas/creations and/or collaborative design projects.
- Strong Linkage with BizFoundry (Launch TN Accelerator) and Launch TN
- EagleWorks Student Innovative Team Competition
Michael Aitken: Entrepreneurship Director
2016 Competition
Year of Shark Tank
44 Teams reduced to 15 and to 8 by two competitions, final competition four selected for award (2015: 6 Teams)
- Fifteen IP disclosures filed by faculty members.
- Chemistry educational game licensed to Carolina Biological Company.

- Certificate Program in Entrepreneurship and Certificate Program in Virtual Reality are being developed.
- I-Corp NSF sponsored Entrepreneurship Program (PI: Steve Canfield) has been very successful with three University Innovation Fellows trained by Stanford University.
- Incubation space (3,000 sq. ft) has been reserved for supporting spin-off companies.
- Biz Foundry – TN Launch Accelerator on-going partnership in most entrepreneurship activities at Tennessee Tech.
- Southern Middle Tennessee Entrepreneur Center – Board of Directors
- Development of a campus “Reverse Pitch” for industry to pitch issues to students and faculty.
- autoXLR8R / autoVATION – Board of Directors / Executive Committee
- Southern Middle Tennessee Entrepreneur Center – Board of Directors
- Launch Tennessee – Mentor

Economic Development Outcomes

Economic Development

The University plays a vital role in the economic development of the Upper Cumberland region and the state and develops networks and visibility at the national level. The University played an important role in recruiting Academy Sports and Ficoso companies and inspiring TTI to expand its operation, resulting in 2,500 new jobs in the Upper Cumberland region. The activities reported demonstrate a diverse, multi-dimensional approach to strengthening the community.

Collaborations with Regional Economic Agencies and City/County Government:

- The ORED provided support and proposal development services in support of the Highland’s Economic Partnership’s TN ReConnect Community Grant Submission. The submission was one of three funded statewide.
- Upper Cumberland Talent Development Roundtable
- Governor’s Rural Economic Development Task Force – Workforce Development Committee
- Tennessee Chamber of Commerce/Manufacturers Association – Workforce Development Council
- Highlands Economic Partnership Workforce and Education Committee
- DOL Grant Application (Middle TN – Training mid-high skilled workforce in Healthcare and Advanced Manufacturing (On-going)

Contributions to State Agencies and Key National Links:

- TDEC (Tennessee Tech to become Secondary Testing Laboratory – \$2M program)
 Developing TTU Water Center as a TDEC Secondary Analytical Lab
 Falling Water River Watershed Planning
 Falling Water River Sampling
 TDEC Cookeville Office Annual Water Sampling
 TDEC State of Tennessee Annual Water Sampling

- TDOT (\$421,000 in projects)
Highway Water Runoff Sampling
Track Source of Nitrogen Pollutants
- Investing in Manufacturing Communities Partnership (IMCP) – DRIVE – Board of Directors/
Executive Committee
- Lightweight Innovation for Tomorrow (LIFT) – Workforce Development Council
(National Manufacturing Innovation Institute)
- TAMA, AAMA, MAMA, GAMA (SAC – Southern Automotive Conference)
- White House Office of Science & Technology (Advanced Manufacturing and Water Sustainability)

Industry Contacts and Collaboration:

- TTI Floorcare (Plant Floor Organization & Flow Processes)
- Calsonic Kansei (Automotive Instrument Panel Assembly Training in Virtual Reality)
- Custom Tool (CNC Machining/Workforce Development)
- B&G Safety Systems (Prototype Design of Circuit Board Housing)
- C&S Plastics (Injection Molding Tooling Processes in the U.S. versus China)
- Ficosa (Spain) (Automotive R&D Center in Tennessee) – October Grand Opening
- Teknia Group (Spain) (Automotive R&D Center in Tennessee)
- IDIADA Automotive Testing & Proving Grounds (Spain) (Partnership Opportunities to
develop in Tennessee)
- Oak Ridge National Lab (Automotive R&D Center in Tennessee)
- Top Five (Business Partner Opportunities)
- Ryder Logistics (Fork Truck Operations Training in Virtual Reality)
- Scenic Industries (Computational Modeling of Heat Transfer in a Lost Foam Mold)
- Lightweight Innovations for Tomorrow (LIFT) – Detroit iCube presence and \$200K project –
www.MakerMinded.com – five states to start with – National Visibility)
- Cullman, AL School System and County Government – iCube linkage (Environmental
influence of a dam and diabetes contents for teaching)
- Fitzgerald Glider Kits (Emissions and Fuel Economy Testing compared to U.S. EPA Regula-
tions - \$70K Project)
- U.S. Pillars (Business Partner Opportunities)
- Bridgestone USA (Automotive R&D Center and Test Track in Tennessee)
- Gayle Technologies (Ultrasonic Leak Detection in Auto Assembly Process)
- Hankook Tire USA (Automotive R&D Center and Test Track Facilities in Tennessee)
- BASF (STEM Training in High Schools)
- Nissan (Automotive R&D Center and Test Track in Tennessee)
- Volkswagen (Germany)(Automotive R&D Center in Tennessee)
- General Motors LLC (Automotive R&D Center in Tennessee)
- Mercedes Benz (Germany)(Automotive R&D Center in Tennessee)
- High Value Manufacturing Systems (Advanced Manufacturing Processes & Improvements)
- Denso Mfg (IUCRC Industry University Collaborative Research Center)
- Nematik Foundry (TTU Patent - Sand Compaction Measurement Device)
- Mueller Foundry (TTU Patent - Sand Compaction Measurement Device)
- Toyota/Bodine Aluminum (Die Cast Tooling Process for Aluminum Automotive Engine Parts
- Make vs Buy)
- LyondellBasell Chemical (Business Partnering /Coop Program)
- Split Second Inc. (Manufacturing Process Development)

- Hope Industries (Manufacturing Partnership with Split Second Inc.)
- DCS Electronics Manufacturing Partnership with Split Second Inc.)
- Innophos Inc. (School of Engineering Coop Candidates)
- Mahle Engine Components (Workforce Development/Training in Manufacturing)
- Axandus/Electricfil Corp (Automotive Start Up Company Accelerator Partnership)
- Autoliv (Automotive R&D Center in Tennessee)
- Second Generation Capital (Intellectual Property and Commercialization Funding from Private Venture Capital Group)
- BLG Logistics (Supply Chain Process Training in Virtual Reality)
- Honda Motors (Automotive Underbody Welding Design Development in Virtual Reality)
- Stites & Harbison (Intellectual Property/Prototype Development)
- Borbet Automotive Wheels (Auburn University)(Product Design in Virtual Reality)
- Harbison & Stites LLC (IP/Patent Attorneys) - Instituted process for H&S Clients to partner with iMAKERSPACE - Match clients and students to develop/produce/fine tune commercial products
- Electric Violin Project
- Fish Pond Filtration Project

Grants, Contracts, Awards

The Office of Research and Economic Development assists faculty in initiating and managing all types of sponsored programs as well as the resulting technologies, patents and copyrights through a broad variety of activities and services. The office plays an important role in the underpinning of these creative activities in the public and private sectors in the region.

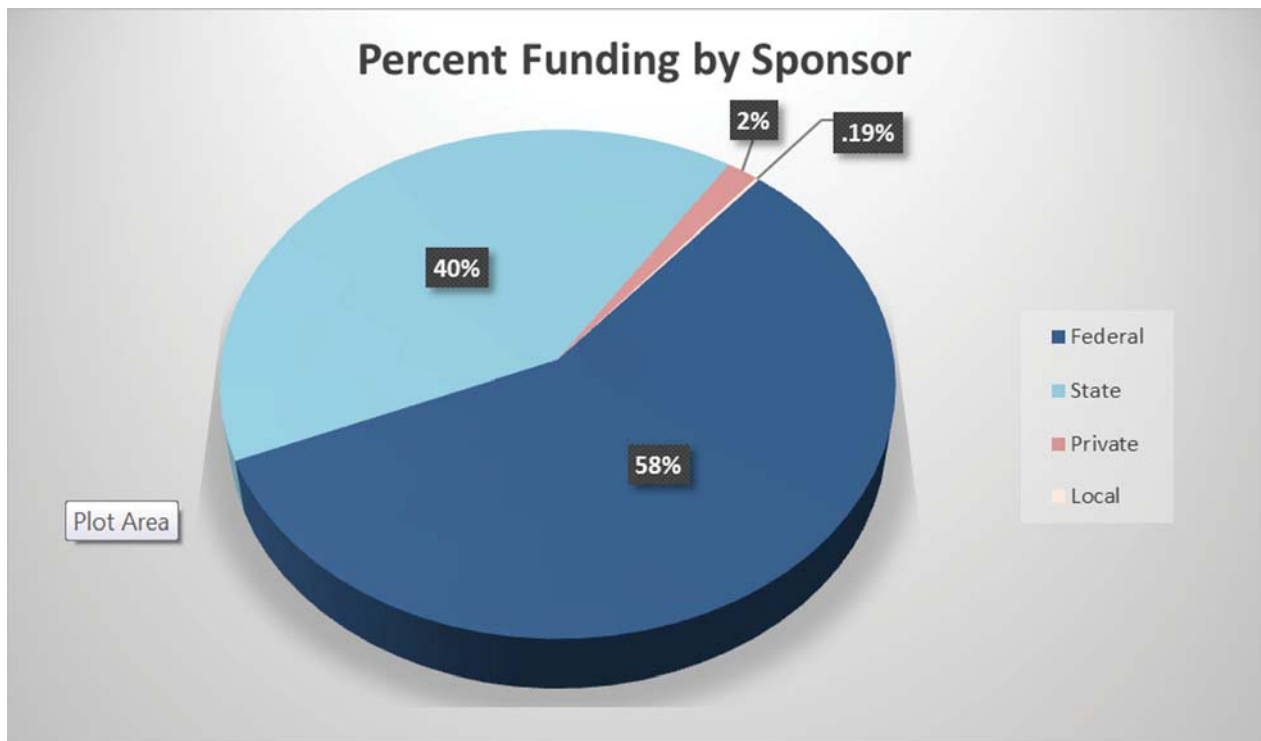
Agreements, Contracts and Grants \$12,849,541 (est.) ---

Faculty conducted research through the support of federal, state and private funding of considerable magnitude that produced numerous benefits. The total of the awards for Fiscal Year 2015-2016 of agreements, contracts and grants is estimated as \$12.8 million dollars. The following tables demonstrate the distribution of these awards.

Please note: These numbers and the ones in the following charts (pages 10-14, 16) were current as of July 7, 2016.

Grants, Contracts, Awards

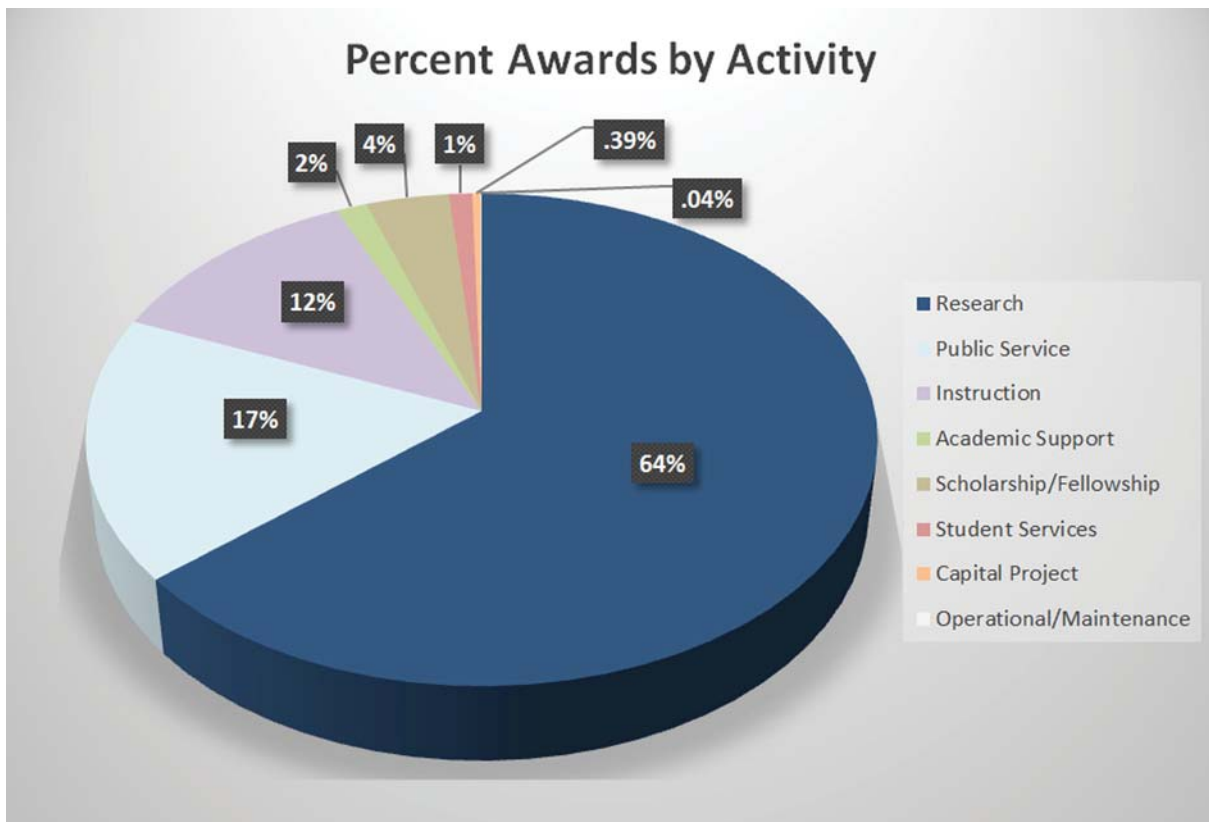
Total Funding by Sponsor			
Sponsor	Activations		
	# of Activations	\$ Activated	
Federal	89	\$7,399,496.00	
State	25	\$5,212,596.00	
Private	13	\$213,949.00	
Local	3	\$23,500.00	
Totals	131	\$12,849,541.00	



Total Awards by Activity

Activity	Activations	
	# of Activations	\$ Activated
Research	83	\$8,212,159.00
Public Service	25	\$2,230,963.00
Instruction	9	\$1,546,639.00
Academic Support	5	\$180,467.00
Scholarship/Fellowship	3	\$489,316.00
Student Services	4	\$134,998.00
Capital Project	1	\$50,000.00
Operational/ Maintenance	1	\$4,999.00
Total	131	\$12,849,541.00

Percent Awards by Activity

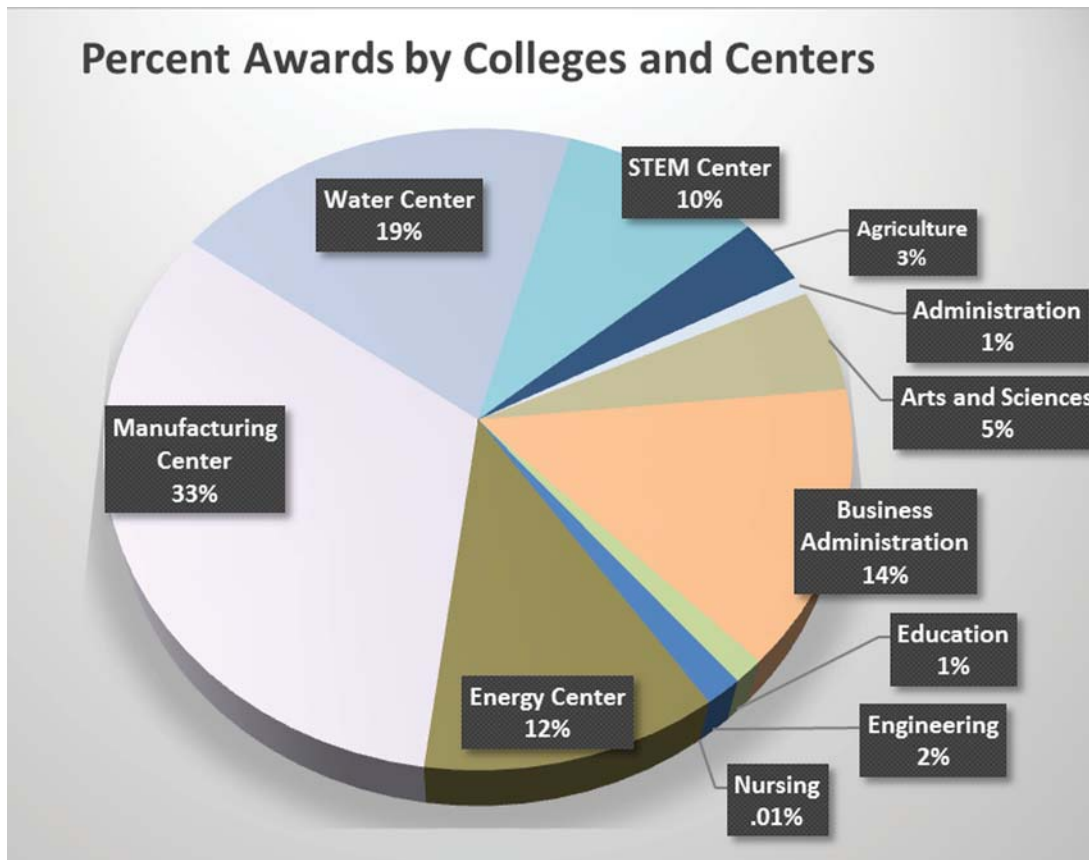


Total Awards By Colleges and Centers

Colleges and Centers	Activations	
	# of Activations	\$ Activated
Agriculture and Human Ecology	5	\$438,933.00
Administration	3	\$119,997.00
Arts and Sciences	8	\$668,489.00
Business Administration	14	\$1,808,426.00
Education	6	\$160,572.00
Engineering	5	\$192,295.00
Nursing	1	\$1,000.00
*CE/Energy Systems	17	\$1,516,081.00
*CE/Manufacturing	36	\$4,220,154.00
*CE/Water Center	27	\$2,481,042.00
STEM Center	9	\$1,227,552.00
Total	131	\$12,849,541.00

Note: *CE is the Centers of Excellence.

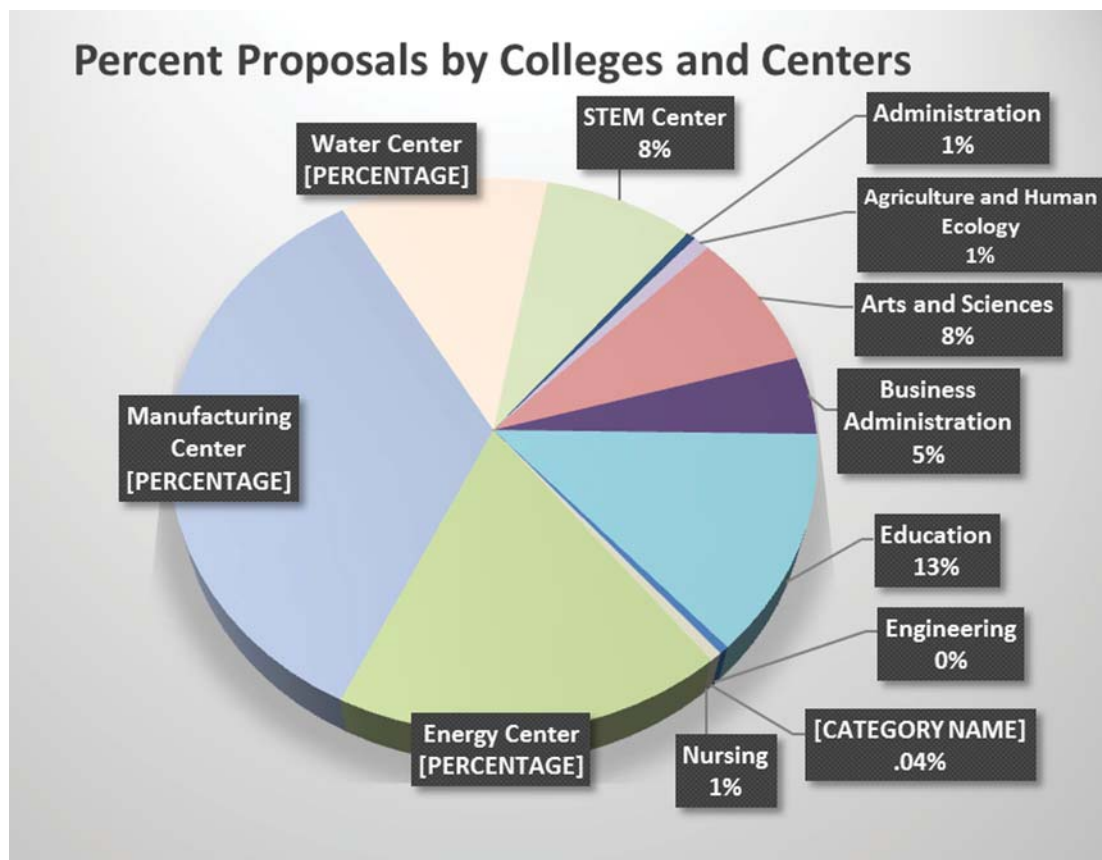
Percent Awards by Colleges and Centers

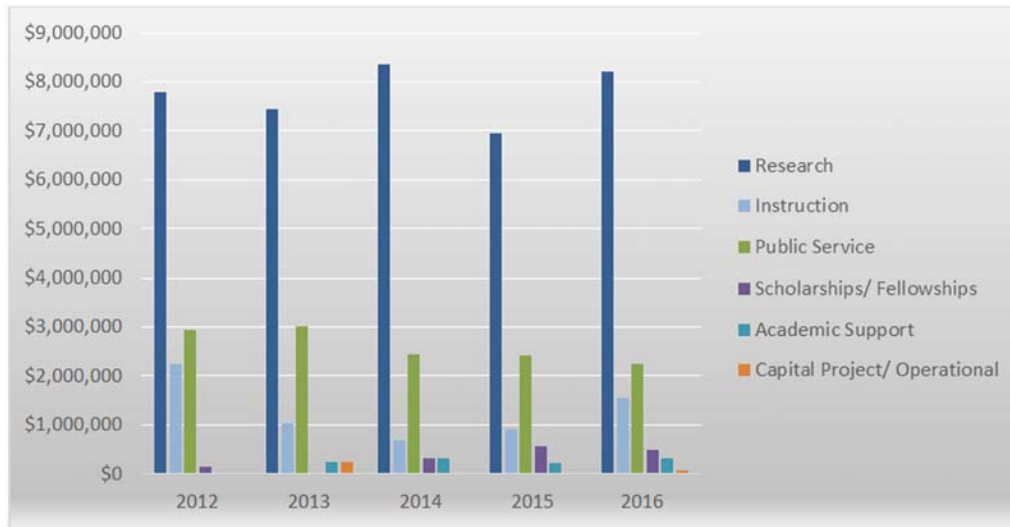
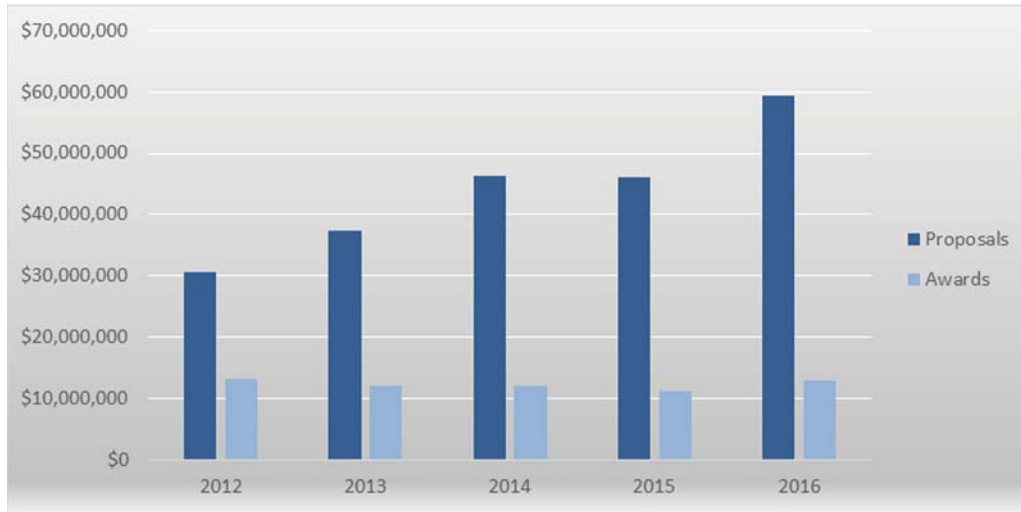


Proposals Submitted By Colleges, Schools, and Centers

Colleges, Schools, and Centers	Proposals Submitted	
	# of Proposals	\$ Requested
Administration	6	\$301,979.00
Agriculture and Human Ecology	4	\$534,623.00
Arts and Sciences	20	\$4,839,404.00
Business Administration	17	\$2,699,304.00
Education	11	\$7,686,784.00
Engineering	4	\$246,351.00
Interdisciplinary Studies	1	\$25,000.00
Nursing	5	\$336,809.00
*CE/Energy Systems	39	\$10,645,282.00
*CE/Manufacturing	56	\$20,444,398.00
*CE/Water Center	37	\$6,736,143.00
STEM Center	11	\$4,848,858.00
Total	211	\$59,344,936.00

Note: *CE is the Centers of Excellence.





Fiscal Year	Proposals Submitted	Amount Requested	Awards Received	Amount Funded
2012	136	\$30,525,667	133	\$13,784,423
2013	125	\$37,315,847	131	\$13,084,966
2014	153	\$46,245,166	115	\$11,974,879
2015	163	\$46,001,271	106	\$11,197,912
2016	211	\$59,344,936	131	\$12,894,541

Faculty Engagement & Outcomes

Faculty and Student Engagement & Training

Twenty attendees attended two Faculty Forums held in November 2015 to ensure faculty and staff were aware of the services offered by the Office of Research and Economic Development and share updates regarding sponsored programs policies and procedures. Office staff attended the College of Engineering New and Recent Faculty Roundtable held on December 15, 2015, providing information regarding how to increase success rate and improve proposal quality and the resources the office can provide to the new faculty.

Office staff attended the Mechanical Engineering departmental meeting in February 2016 to discuss sponsored programs policies and procedures.

One of two planned Junior Faculty Meetings was held on June 15, 2016 (the second meeting is planned for September 2016). The purpose of this meeting was to gather information regarding how the office can assist these faculty as they progress along their career path. There were twelve attendees at this meeting.

Other engagement activities include the following:

- Faculty Engagement (i.e. Faculty Forum, Junior Faculty meeting, Mechanical Engineering department meeting; COE New and Recent Faculty Roundtable), Annual Survey;
- Student training (EDU 7040 and Dr. Haynes grant-writing course);
- URAC – summary report provided in Spring 2016
- Economic Development – collaboration with the Highlands Economic Partnership on the TN Reconnect proposal
- College of Engineering New Faculty Orientation (August 2015)
- Dean's Retreat (July 2015)
- REU Workshop, Presentation Skills and Report Writing (June 9, 2015)
- REU Workshop, Research and Ethics (June 25, 2015)
- Fiscal clerk training (April 2015)
- Office of Research and Economic Development staff spoke to the following classes regarding finding grant funding and the proposal development process: SOC 4990 and 5990, 12 students; EDU 7040, 12 students

Faculty Engagement & Outcomes

Faculty Research Grants Program Recipients

Author(s)	Title	Dept.	Amt.	Type
Driggers, Allen	Boundary Stones: Communities of Medico-Chemistry and the Atlantic	History	\$2,971	Track I
Loftis, Mark	Alexithymia and Suicide Risk in Nonclinical Populations	Counseling and Psychology	\$3,000	Track I
Michael, Tony	The Adult Scale of Parental Attachment: Item Selection, Factor Structure and Psychometric Properties	Counseling and Psychology	\$3,000	Track I
Stepp, Julie	The Impact of Full-Time Libraries on Student Achievement in K-12 Schools in Tennessee	Curriculum and Instruction	\$3,000	Track I
			\$11,971	

Author(s)	Title	Dept.	Amt.	Type
Bhattacharya, Indranil	Development and Modeling of High-Energy-Density Solid State Lithium Sulfur Battery	Electrical and Computer Engineering	\$10,000	Track II
Hasan, Syed	Towards Run-Time Hardware Trojan Detection Using Circuit Behavior Profiling: Leveraging Game Theory and Formal Verification	Electrical and Computer Engineering	\$10,000	Track II
Jiang, Xiaohua	Studying the mechanism of thiosemicarbazone inhibiting topoisomerase II	Chemistry	\$10,000	Track II
Languri, Ehsan/Johnson, Wayne	Innovative Diamond Nanofluid for Enhanced Electronics Thermal Management	Mechanical Engineering/Electrical and Computer Engineering	\$10,000	Track II
Leckie, Brian	Characterization of Southern Appalachian Heirloom Green Bean	Agriculture	\$10,000	Track II
Pascal, Jennifer	Optimizing Dielectrophoretic Separation of Circulating Tumor Cells from Blood	Chemical Engineering	\$10,000	Track II
Walker, Donald	Spatial and temporal changes of fish communities, the fish microbiome and fungal pathogenicity under conditions of increased human water use	Biology	\$9,987	Track II
Zhan, Xuanzhi	The Self-activation Mechanisms of Apoptosis Signal-regulating Kinase I	Chemistry	\$10,000	Track II
			\$79,987	

Faculty Engagement & Outcomes

Faculty Committee Engagement

Compliance Committees:

Oversight by committees to govern compliance was enforced (Advisory Committee on Patents and Copyrights, University Research Advisory Committee, Faculty Research Committee, Institutional Animal Care and Use Committee, and Institutional Review Board for the Protection of Human Subjects). All committees operate according to the TTU bylaws.

Institutional Animal Care and Use Committee (IACUC):

Outcomes

- **Laboratory Inspections**

Inspections of TTU lab facilities housing animals for research or teaching purposes are conducted twice annually, in accordance with national and institutional guidelines. Fall laboratory inspections were conducted on September 25, 2015. Spring inspections were conducted on March 28, 2016. Reports of these inspections are kept on file in the Office of Research and Graduate Studies; copies were sent to supervisors of the respective animal laboratories.

- **Research Proposal Evaluation**

Two applications to use animals in research have been received and considered by the Committee so far during the 2015-2016 academic year. Dr. Donald Walker's (Department of Biology) project entitled "Identifying the skin and gut microbiota of amphibians and reptiles from the southeast U.S." was approved during Fall 2015, and Dr. Brian Carver's (Department of Biology) project entitled "Feasibility of GPS collars to study eastern spotted skunks" was approved during Spring 2016.

- **IACUC Policy and Procedures**

Policy and procedures regarding the use of animals in research, training and testing were updated and approved. The policy and procedures are consistent with the U.S. Department of Agriculture and Office of Laboratory Animal Welfare requirements.

- **IACUC Training Modules**

Use of CITI'S IACUC Training Modules was discussed during the Fall 2015 and Spring 2016 meetings.

Faculty Engagement & Outcomes

Intellectual Properties Advisory Committee (IPAC):

Outcomes

Invention Disclosures Received

- Antimicrobial therapy using multifunctional engineered bacteriophage by Jeffrey Rice and Paige Spencer
- Apparatus used for producing coatings by Jason Witman, Ying Zhang, and Brian Bates
- Compressed gas flow meter on inlet side of gas compressor by Glenn Cunningham and Anthony Taylor
- Displacement sensing apparatus using curved edge diffraction by ChaBum Lee
- Method and apparatus for noninvasive mechanical-based assessment of heart performance by Hamidreza Ghasemi Bahraseman
- Mine detector integration and GPS eyeglass by Christopher Aghwacha
- Perfect-Fit Ostomy wafer and punch by Toni Roberts and Rebecca Turpin
- Redesigned wound vac (negative pressure system) by Ann Hellman
- Training with Tikes --- A system to allow a child with visual impairment to ride a bike by seeing through haptic feedback by Stephen Canfield, April Parkison, and Chance Williams

Provisional Applications Filed

- Advanced selectivity gas permeable anode flow field design for efficient removal of carbon dioxide in a direct formic acid fuel cell by Cynthia Rice, Shadi Saeed, Michael Renfro, and Antonio Pistono
- Apparatus used to produce coatings by Jason Witman, Ying Zhang, and Brian Bates (in process, filed June 2016)
- Compressed gas flow meter on inlet side of gas compressor by Glenn Cunningham and Anthony Taylor (M.S. student) (filed May 2016)
- Method and apparatus for non-invasive mechanical-based assessment of heart performance by Ehsan Languri and Hamidreza Bahraseman (in process, filed April 2016)
- Reduced-temperature sintering of spinel-type coatings and layers with metallic alloy powder precursors by Jiahong Zhu (filed June 2016)
- Reduction or potential inhibition of autogenous and dry shrinkage of Portland cement concrete by Joe Biernacki, Don Visco and Hamed Kayello (Univ. of Akron), one filed for acetates and one for amines

Inventions Licensed

- Chemistry Games by Janet Coonce licensed to Carolina Biological Company

Additional Actions

- Added a staff member to the IPAC committee
- Revised Intellectual Property Policy to include students and committee addition
- Revised the flowchart explaining the patent process at TTU

Faculty Engagement & Outcomes

Institutional Review Board for the Protection of Human Subjects (IRB):

For the academic year 2015-2016, 233 exempt proposals were processed. Two full-board applications were reviewed, and nine proposals were submitted for expedited review.

The IRB has published new requirements for training and certification for all TTU faculty, staff and students who are involved in research with human subjects. The new training requirements became effective on July 1, 2016. TTU has updated requirements for review of human subjects research by departmental review committees. TTU is in full compliance with federal rules and regulations regarding the protection of human subjects.

University Research Advisory Committee:

The Office of Research and Economic Development provided a report detailing information related to the status of the strategic goals and objectives listed in the Strategic Plan for Research document developed by the Committee.

Student Outcomes

Student Research and Creative Activities Day

The 2015/2016 Student Research and Creative Activities Day drew in participants from six colleges and one school, for a total of 217 abstracts representing 107 undergraduate students and 110 graduate students. This is an increase over last year's 174 abstracts from 100 undergraduate students and 74 graduate students.

