



TENNESSEE STATE UNIVERSITY
**RESEARCH
HORIZONS**

2012 ANNUAL REPORT

*Sustaining the Legacy
Through Research*

RESEARCH AND SPONSORED PROGRAMS

CENTENNIAL EDITION

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Research and Sponsored Programs Building
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R E S E A R C H H O R I Z O N S

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RESEARCH HORIZONS 2012

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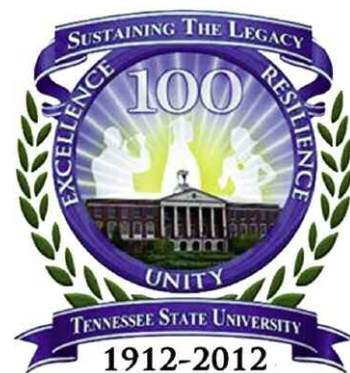
Web Site

www.tnstate.edu/research



MICHAEL BUSBY, PH.D.

FROM THE
ASSOCIATE VICE PRESIDENT
 INTERIM



Welcome to the land of golden sunshine and the centennial edition of Research Horizons, the annual report of the Office of Research and Sponsored Programs (RSP) at Tennessee State University.

We are especially pleased to present this Fiscal Year 2012 research report during our 100-year celebration. The University secured in excess of \$48 million in external funding for TSU research in 2011-2012. This annual funding level is the largest ever received by the University for sponsored programs. Such external support serves to promote innovative scholarship and discovery by TSU faculty and students which in turn creates new knowledge and skills, unveils new areas of thinking and commerce, and plays an effective role in enhancing the life, business, and career experiences of each stakeholder.

This robust funding strength has also allowed TSU faculty to advance the

research mission of the University and to engage TSU students in broad multi-disciplinary scholarly activities as these minds prepare for rewarding careers. As a result, students and faculty have presented their research findings not only at local, national, and international symposia and conferences, but also in numerous refereed, peer-reviewed professional journals and scholarly publications. In order to expand this productive research base, RSP has organized and offered grant-writing workshops during the academic year to support those faculty members who are interested in advancing their research careers.

In the following report, a selection of projects is highlighted featuring both research faculty and staff together with the students mentored by them to *Think, Work, and Serve*. Our annual report concludes with a financial summary of grant proposal submissions and awards

totaling the above-stated 100-year record amount of external funding for TSU research.

At RSP, we look forward to continuing a close working relationship with faculty and staff in pursuing opportunities for enhancing research-based discovery at Tennessee State University in 2013 and into the next century.

Sincerely,

A handwritten signature in blue ink that reads 'Michael Busby'.

Michael Busby, Ph.D.

*Associate Vice President
 for Research and Sponsored Programs,
 Interim*

ADVANCE IT CATALYST

The need to attract and retain women faculty in STEM (science, technology, engineering, mathematics) continues to be one of the greatest challenges in higher education. The three main challenges are increasing the number of women completing doctoral degrees in STEM areas, recruiting them to academia, and providing the conducive environment for their success towards tenure and the administrative ranks. Recognizing this need by the former Vice President of Research and Sponsored Programs (Dr. Maria Thompson) and Dr. S. Keith Hargrove, Dean of the College of Engineering, Tennessee State University applied for a grant sponsored by the National Science Foundation that targets these challenges in academia. The result was a \$195,200 award to assess the academic climate for women faculty and recommend strategies to improve it.

The NSF ADVANCE IT (Institutional Transformation) Catalyst project seeks to attract, retain, and promote women faculty engaged in STEM disciplines at TSU. The purpose of the project is to provide STEM women faculty with the support and coordination necessary to propel them to greater numbers and success in academia with an emphasis on scholarly and research productivity. Specifically, the project collected and assessed data in order to design a sustainable, institution-wide strategic and tactical plan to attract and retain tenure-track women faculty in STEM fields. IT Catalyst support finance personnel to assemble and assess statistical data on the comparative status of TSU

STEM women. Our metrics were geared to elevate the probability that these professionals will engage and advance in their academic careers.

The intellectual merit of the proposed project is grounded in several key themes, including: the systematic collection and analysis of faculty data regarding recruitment, development and retention of women, including women of color, in STEM fields at TSU; the use of comprehensive source data; and the investigation into the suitability and effectiveness of best practices developed by emerging research institutions, research intensive institutions and ADVANCE institutions.

The broader impact of the proposed project lies in enhancing the research enterprise such that the institution builds its capacity to serve as a resource for economic growth in the region. A greater broader impact of this project is that its findings will be useful for other HBCUs and minority serving institutions and serve as an ADVANCE model for these institution types.

With more than a 50% response rate from the faculty, the climate survey suggests that more than 75% of the faculty are satisfied with their employment at TSU. Further review of the survey also



S. KEITH HARGROVE, Ph.D.
PRINCIPAL INVESTIGATOR

concluded that women are more satisfied working at TSU than men, and more STEM women faculty are also more satisfied than non-STEM employees. Faculty also suggested an improvement in business processing will enhance their academic experience.

Principal Investigator Dr. Hargrove manages the project and serves as a mentor for several women faculty in STEM at TSU. Janice Emerson, Ph.D. (Co-Principal Investigator) and Ms. Princess Gordon-Patton also assisted with the project, and are now working to prepare for submitting a subsequent grant for project implementation that will include administrative and policy strategies to enhance the retention of women faculty at TSU.

PROJECT TITLE

ADVANCE IT CATALYST:
TOWARDS GENDER EQUITY IN
RESEARCH PARTICIPATION WITHIN
STEM DISCIPLINES AT TENNESSEE
STATE UNIVERSITY

FUNDING AGENCY

NATIONAL SCIENCE FOUNDATION

AMOUNT AWARDED

\$195,200



PARTNERING TO ELIMINATE CANCER DISPARITIES

The Vanderbilt-Ingram Comprehensive Cancer Center (VICC) of the Vanderbilt University Medical Center (VUMC) and Meharry Medical College (MMC) established the MMC-VICC Cancer Partnership in 1999 based on a collaborative National Institutes of Health grant proposal developed by Dr. Harold Moses, Professor of Cancer Biology of the Vanderbilt University School of Medicine (VUSM) and Director of VICC, and Dr. Samuel Adunyah, Professor and Chairman of the Department of Biochemistry of MMC. Tennessee State University received \$537,968 in 2011 and \$753,044 in 2012 of this 5-year (2011-2016) cycle grant.

The MMC-VICC Cancer Partnership won competitive renewals of this U54-program funding from the National Cancer Institute (NCI) of NIH on an annual basis and eventually incorporated Tennessee State University (TSU) as a subcontractor for its community health-outreach services. TSU possessed the community infrastructure to contribute outreach expertise to the MMC-VICC Cancer Partnership based on the three-

decade legacy of health-disparity research of the TSU Center for Prevention Research (née TSU Center for Health Research) under the founding and funding leadership of TSU Professor Emeritus Baqar Husaini. Dr. Husaini established the TSU Center in 1976 and sustained most of its years of health-research initiatives via competitive external funding, with eventual university support, before his retirement from TSU as Professor of Sociology in 2011.

Dr. Husaini is well-known and regarded nationwide for his work in the areas of breast and prostate cancer, dementia, diabetes, stroke, and the prevalence and treatment of heart failure. Dr. Husaini has conducted research in racial disparities in breast cancer morbidity and mortality; has collaborated with a series of African-American churches over the years to promote mammography and breast cancer screening education and to promote prostate cancer screening education. Additionally, he has studied both access to and utilization of physician services by African Americans with the goal of decreasing racial



BAQAR A. HUSAINI, Ph.D.
PRINCIPAL INVESTIGATOR

disparities in health status and health care. Dr. Husaini's research has been funded by various federal agencies and programs including CDC, DHHS-AHRQ, DHHS-CMS, DOD, NCI, NCCR-RCMI, NIGMS-MBRS, NIH, and USDA, and also by state agencies and programs.

Based on the productive community-outreach efforts of this initial TSU-MMC-VICC collaboration, TSU became a full partner within the MMC-VICC Cancer Partnership in 2011 with Dr. Husaini as the principal investigator (PI) and Margaret Whalen, Ph.D. TSU Professor of Chemistry, as the TSU Co-principal investigator (Co-PI) for the resultant Meharry-Vanderbilt-Tennessee State University Cancer Partnership (MVTCP) funded by NCI for 2011-16. TSU is the hub of the MVTCP Cancer Outreach Core (COC), which conducts community-based participatory research (CBPR) for MVTCP by maintaining an active liaison with the community via the COC Community Advisory Board with Elizabeth Williams, Ph.D., TSU



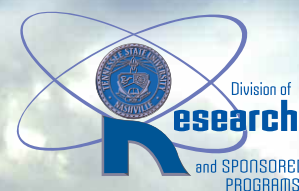
Above Left to Right: Linda Quinones, Breia Jefferson, Jade Readus, and Tysha Martin. Mentorees of Dr. Margaret Whalen completed the Summer Cancer Research Program 2012 for rising junior and senior undergraduate biology and chemistry majors.

Assistant Professor of Public Health, Health Administration and Health Sciences, as the TSU Community Outreach Core Leader. The TSU-based COC of MVTCP coordinates community health research both with Progreso Community Center (PCC)- which is the first Hispanic grassroots community organization in Nashville, founded in 2006, and its sister organization The Nashville Latino Health Coalition (NLHC) that fosters research initiatives to improve health within the local Latino community.

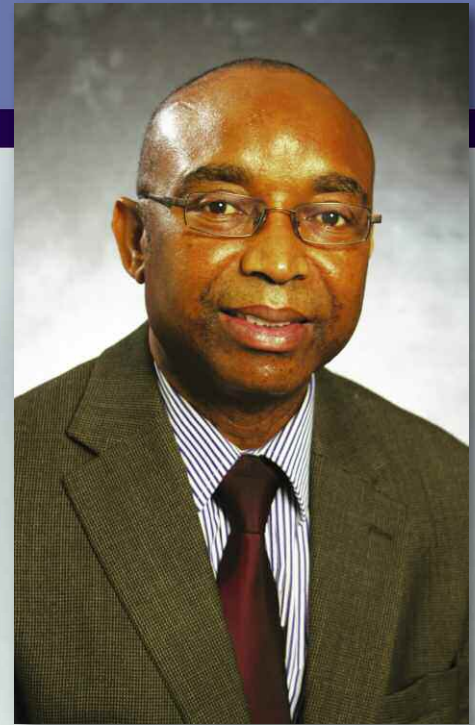
Tennessee State University is employing the NIH-NCI U54 grant to develop intellectual and institutional infrastructure toward creating an active environment of collaborative cancer education and research at TSU. To achieve these goals, TSU students

Breia Jefferson, Tysha Martin, Linda Quinones, and Jade Readus received training at Vanderbilt University in cancer research techniques during the summer of 2012. In order to expand its competitive cancer research capability, TSU is also in the process of recruiting a Cancer Behavioral Researcher with a search committee consisting of faculty from each of the MVTCP partner institutions. It is anticipated that this dedicated, resident cancer researcher for TSU will be hired early in the second year of the TSU U54 grant (Fall 2012). Dr. Whalen has also convened a Cancer Research Workgroup (CRW) at TSU in order both to develop a core group of basic-science cancer researchers stationed at TSU and to facilitate collaborations between these TSU faculty researchers and MMC and

VICC researchers. The TSU U54 grant also funds graduate students along with the respective institutional efforts of Dr. Whalen, Dr. Williams, Janice Emerson, Ph.D., Associate Director of the TSU Center for Prevention Research; Owen Johnson, Ph.D., TSU Assistant Professor of Public Health, Health Administration and Health Sciences; and David Shen-Miller, Ph.D., TSU Assistant Professor of Psychology.



BOEING PROJECT I CENTER FOR SEAT COMFORT DESIGN



LANDON ONYEBUEKE, Ph.D.
PRINCIPAL INVESTIGATOR

The Boeing Company makes many commercial and military products. The need for comfortable and safe seats is paramount to the company. Longer missions or flights have made it necessary to re-look and re-think comfort for the passenger or warfighter.

In 2008, Boeing approached Tennessee State University for a solution to the problem of seat comfort design and prediction. Boeing brought this research project to TSU due to its past experience with TSU research team led by Dr. Landon Onyebueke, a Professor in the Department of Mechanical Engineering. In 2005, Boeing and TSU received a USA joint patent on a project titled "Expanded Accommodation Analysis Technique for Cockpit Design", a project led by Dr. Onyebueke as the Principal Investigator and Mr. Edward Winkler of Boeing as the Technical Monitor.

The controversial concern of comfortable seats grows considerably as the era of technology brings more dependence on sitting to perform daily activities. Hence, individuals spend more time seated to work, travel, and play. Uncomfortable sitting may reduce the quality of such activities and can cause the sitter to have some health

complications. Currently, seat comfort analyses are mainly executed post-production, i.e. a fully produced seat is required for testing. In some procedures, subjective and objective measurements are obtained using human testing. In any case, these procedures are tedious and resource improvident.

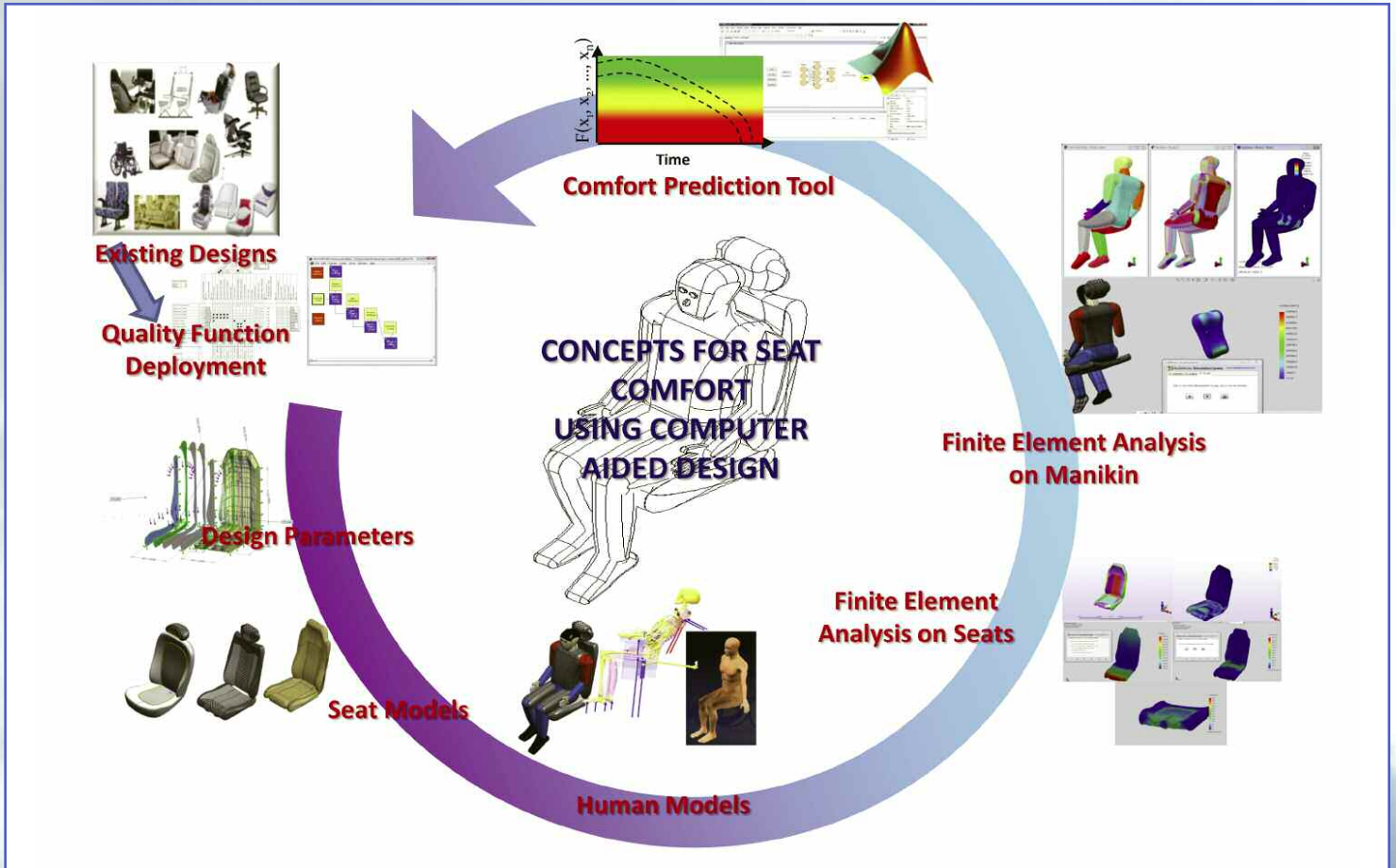
The customer's input during the early stages of design for comfort would broaden the ideas and optimize design approach. Unfortunately, such practice is usually not considered in conventional seat comfort evaluation techniques. An innovative tool is therefore needed to employ the voice of the customer in the design and evaluation for seat comfort with less resource exploitation. TSU research team led by Dr. Onyebueke is developing a system that performs seat comfort design and evaluation by integrating a Quality Function Deployment (QFD) tool with Computer Aided Design/Computer Aided Engineering (CAD/CAE) techniques to continuously improve the product with concurrent interaction with the customer. The project is in its final stage and is expected to be completed by the end of 2012.

The project is fully funded by the Boeing Company. To date, Boeing has awarded TSU \$1,380,000 for this project.

Several laboratory tests have been performed to validate the proposed technique and the obtained results verify that the system is a valid tool that replaces traditional techniques for comfort analyses with less resource exploitations. The system offers a comprehensive and systematic tool for the design and prediction of seat comfort by integrating the voice of the customer via QFD into CAD/CAE. The proposed system is expected to eliminate the need for physical prototyping, limit the involvement of human subjects, and facilitate information sharing.



DEVELOPMENT OF SEAT COMFORT DESIGN TOOL



Members of the seat comfort design team



Seat comfort test bed experiment for the sitting mode



Seat comfort experimental measurements



The Seat Comfort Test Bed



Members participate in the sitting experiment

PROTECTING THE NATION AGAINST CYBER CRIMES

Tennessee State University College of Engineering is preparing graduate students to protect the nation against cyber crimes and intrusions with a grant from the U.S. Department of Homeland Security (DHS). The grant entitled, "Prepare Minority Scholars to Protect the Nation's Critical Infrastructure and Key Assets through Integrative Education, Research and Professional Development at TSU," is funded from February 2011 through January 2016.

The DHS Scientific Leadership Award for Minority Serving Institutions granting graduate degrees funded the University's initiative, in the amount of \$301,679 to develop a joint research and education initiative for interdisciplinary research and education aimed at protecting the United States critical infrastructure and key assets. The project highlights two DHS-STEM disciplines: Advanced Data Analysis and Visualization and Command Control and Interoperability.

To meet the project goal, the project activities focused on three main objectives: a) Prepare Homeland Security Scholars; b) Strengthen research and education infrastructure; c) Impact Institution Infrastructure and Sustainability. The project team is comprised of Dr. Sachin Shetty (Assistant Professor, Electrical and Computer Engineering and principal investigator) and graduate and undergraduate students from Computer and Information Systems Engineering (CISE) and Electrical Engineering (EE) programs. The student team is comprised of Kimberly Gold, CISE Ph.D. student; Hellen Maziku, CISE M.S. student; and Nicholas Luna and Keith Bones, two EE undergraduate students. During the first year of the project, the team developed cyber

defense techniques to protect digital infrastructure.

Specifically, the techniques involved IP geolocation and network router risk assessment techniques to detect and isolate attacks on the Internet. The team has published three conference proceedings and two poster presentations in international conferences. Maziku and Luna won first place prizes at the oral research presentation competition at the NSF Emerging Research Network (ERN) conference. Gold is working on a project on a secure mobile imaging project as part of her internship at VACCINE, DHS Center of Excellence at Purdue University.

"It is becoming increasingly important that policies are developed to deter the growing threat of cyber crime and state-sponsored intrusions throughout the nation. Through this initiative, we hope to determine which components are likely to be targeted in a potential cyber attack, investigate the intelligence of an attacker's motivations, and determine how the intelligence improves policies," explained Dr. Sachin Shetty. "The research we conduct at Tennessee State University will be carried out through video analytics, machine learning, and risk analysis research, as well as with resources and facilities that we currently have available at the institution."

The research will address three inter-connected thrusts (planning, countermeasures, and assessment) in the area of cyber security. The planning thrust will focus on models of effective surveillance and allocation of resources under uncertainty. Countermeasures will be responsible for proactive and defensive policies to help deter attacks and identify potential threats. Finally, assessment will be used to develop risk

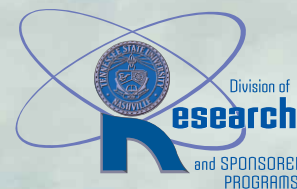


SACHIN SHETTY, PH.D.
PRINCIPAL INVESTIGATOR

analysis and strategies to create defensive resources that protect critical infrastructure and key assets.

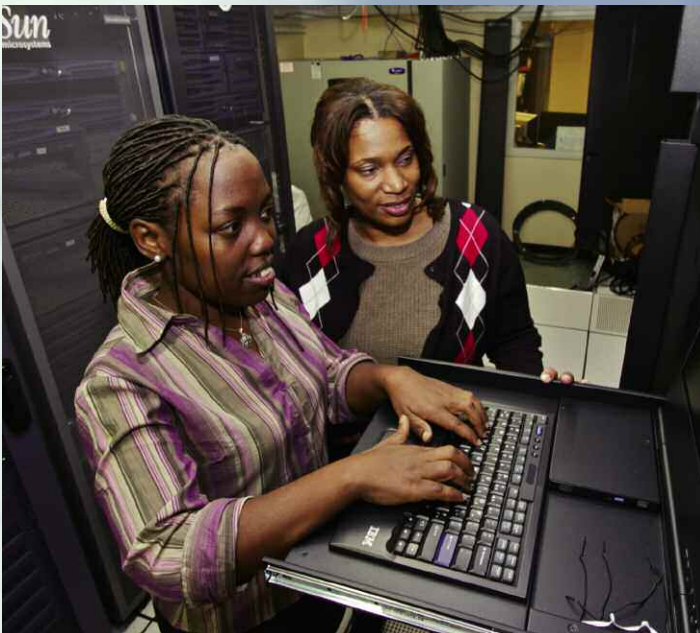
Dr. S. Keith Hargrove, Dean of the College of Engineering, hopes the initiative will develop students' competency in homeland security in data mining, risk analysis and visual analytics research. "By the incorporation of new courses and research seminars in the areas of visual analytics, cyber security, and risk analysis and assessment, we believe this initiative will provide our students with a thorough understanding of the complexities associated with the protection of our nation's critical infrastructure and key assets. Additionally, the curriculum enhancement and collaborative relationships with the Department of Homeland Security, federal labs, and related industries will help enhance our graduate program at the Ph.D. level," said Hargrove.

The funding will also support and leverage a previous infrastructure grant received from the National Science Foundation to establish the TSU Interdisciplinary Graduate Engineering Research Institute (TIGER) and help promote research activity in one of our thrust areas. Shetty, along with senior faculty in the College of Engineering will work collaboratively with graduate students to implement the research.





In front (left to right): Kimberly Gold (Ph.D. student) and Hellen Maziku (M.S. student). In back (left to right): Keith Bones and Nicholas Luna (Electrical Engineering undergraduate students) and Dr. Sachin Shetty. The students and Dr. Shetty are assembled at the site of TSU's cloud data center at the Communication and Information Technology server room located in the Humanities Building.



Maziku and Gold are working on the TSU cloud data center.



Dr. Shetty (left) is demonstrating to Luna (right) the inside of TSU's cloud data center. He is pointing to one of the Blade servers. These Blade servers are part of the cloud data center.

SUBMISSIONS

BY CENTER/COLLEGE/SCHOOL

Academic Affairs	\$ 1,548,327
Agriculture, Human, and Natural Sciences	38,875,768
Education	1,566,967
Engineering, Technology, and Computer Science	9,620,557
Health Sciences	4,112,552
Liberal Arts	104,856
Office of the President	95,670
Public Service and Urban Affairs	6,000
Research and Sponsored Programs	8,377,291
Service Learning and Civic Engagement	424,900
Student Affairs	425,000
University Library	215,674
Total	\$ 65,373,563

BY AGENCY/CORPORATION/FOUNDATION

Administration for Children and Families-Office of Family Assistance	\$ 776,784
Air Force Office of Scientific Research	149,167
Corporations	215,000
Local Agencies	6,000
National Aeronautics and Space Administration	586,957
National Endowment for the Humanities	285,350
National Institutes of Health	1,565,865
National Science Foundation	14,678,350
Nuclear Regulatory Commission	699,254
Private Foundations	468,191
Tennessee State Agencies	2,818,998
U.S. Department of Agriculture	1,684,683
U.S. Department of Agriculture- 4-H	123,000
U.S. Department of Agriculture- Agriculture and Food Research Initiative	1,069,827
U.S. Department of Agriculture-CSREES-CYFAR	573,328
U.S. Department of Agriculture- Forestry Service Northern Research Station	7,580
U.S. Department of Agriculture-Institute of Food and Agriculture	21,591,699
U.S. Department of Agriculture-NIFA- Agriculture and Food Research Initiative	6,270,176
U.S. Department of Agriculture- Risk Management Education and Outreach Partnership	95,402
U.S. Department of Agriculture- Scientific Cooperation Research Program	39,973
U.S. Department of Education	4,570,869
U.S. Department of Energy	2,052,821
U.S. Department of Energy- National Nuclear Security Administration	425,830
U.S. Department of Health and Human Services	3,400,000
U.S. Environmental Protection Agency	106,694
U.S. Health Resources & Services Administration	1,056,114
United States Army	50,470
University Corporation for Atmospheric Research (UCAR)	5,180

Total	\$ 65,373,563
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AWARDS

BY CENTER/COLLEGE/SCHOOL

Academic Affairs	\$ 367,191
Agriculture, Human, and Natural Sciences	12,989,931
Business	516,802
Center of Excellence – Information Systems	1,366,446
Center of Excellence for Learning Sciences	6,650,115
Education	8,505,098
Engineering, Technology, and Computer Science	4,250,084
Health Sciences	980,281
Liberal Arts	53,999
Massie Chair of Excellence in Environmental Engineering	2,163,651
Office of the President	48,610
Public Service and Urban Affairs	519,679
Research and Sponsored Programs	24,999
Service Learning and Civic Engagement	1,089,031
Student Affairs	100,000
Title III	8,592,912

Total	\$ 48,219,586
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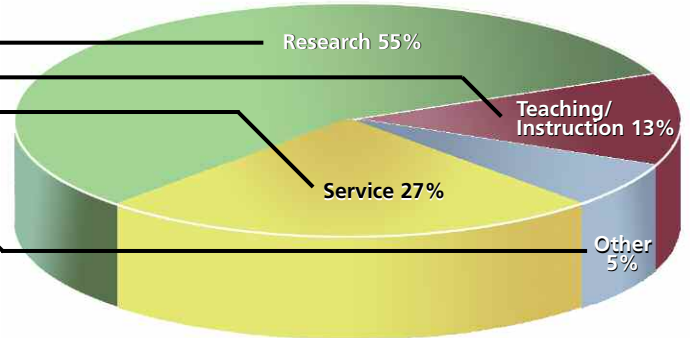
BY AGENCY/CORPORATION/FOUNDATION

National Aeronautics and Space Administration (5)	\$ 172,132
National Institutes of Health (8)	1,592,904
National Science Foundation (19)	4,138,123
Private (13)	728,544
Tennessee State Agencies (13)	3,167,561
U.S. Department of Defense (1)	5,200
U.S. Department of Energy (8)	771,555
U.S. Department of Education (49)	15,930,397
U.S. Department of Homeland Security (1)	500,000
U.S. Department of Labor (1)	50,000
U.S. Department of Transportation (12)	296,638
U.S. Environmental Protection Agency (1)	8,630
U.S. Nuclear Regulatory Commission (4)	177,007
U.S. Air Force (12)	485,864
U.S. Agency for International Development (3)	173,438
U.S. Army Research Office (4)	808,722
U.S. National Park Service (2)	27,000
U.S. Navy (2)	149,999
U.S. Small Business Administration (2)	135,833
U.S. Department of Agriculture (62)	10,752,302
U.S. Department of Health and Human Services (16)	7,358,706
U.S. Department of Housing and Urban Development (1)	789,031

Total	\$ 48,219,586
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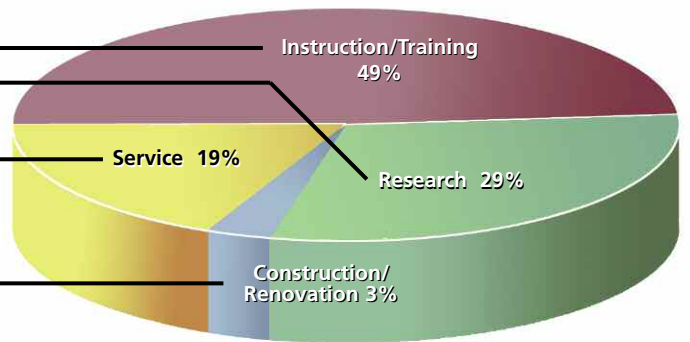
SUBMISSIONS BY PROJECT TYPE

Research	\$36,175,705	(72)
Teaching/Instruction	\$8,417,675	(23)
Service	\$17,456,046	(24)
Other	\$3,324,136	(15)
TOTAL	\$65,373,563	(134)



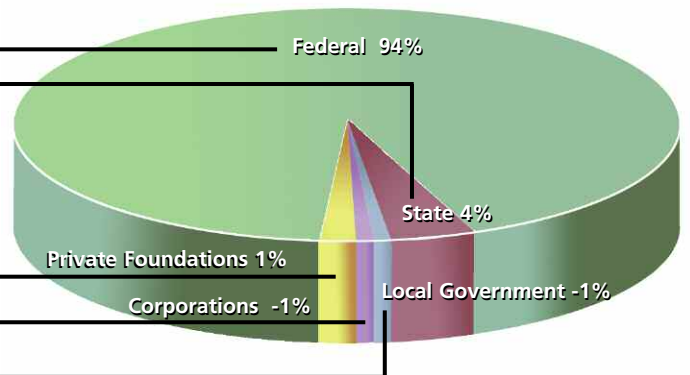
AWARDS BY PROJECT TYPE

Instruction/Training	\$23,680,457	(96)
Research	\$14,006,998	(96)
Service	\$9,199,131	(45)
Construction/Renovation	\$1,333,000	(2)
TOTAL	\$48,219,586	(239)



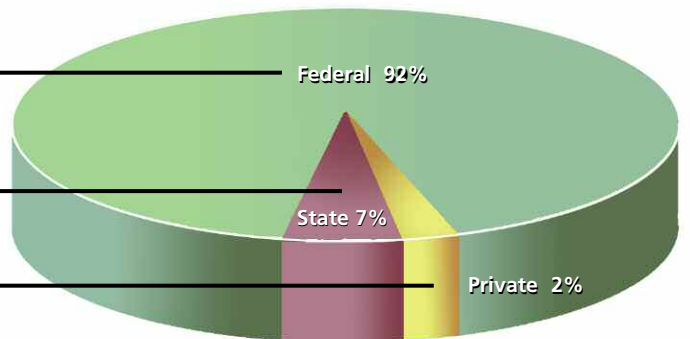
SUBMISSIONS BY SOURCE

Federal	\$61,737,194	(107)
State	\$2,818,998	(15)
Private Foundations	\$980,886	(8)
Corporations	\$215,000	(3)
Local Government	\$6,000	(1)
TOTAL	\$65,373,563	(134)



AWARDS BY SOURCE

Federal	\$44,323,481	(213)
State	\$3,167,561	(13)
Private	\$728,544	(13)
TOTAL	\$48,219,586	(239)





TENNESSEE STATE UNIVERSITY

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TSU Publication Number: TSU-13-0034 (B) - 15c-61010

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