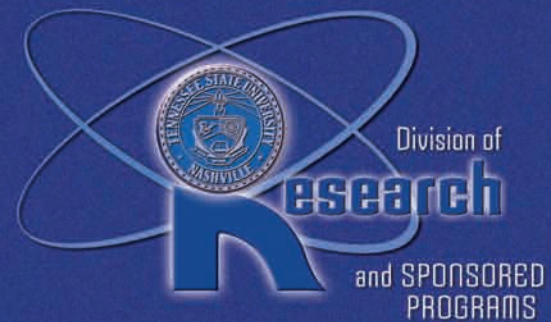




TENNESSEE STATE UNIVERSITY
**RESEARCH
HORIZONS**

2009
ANNUAL REPORT



RESEARCH HORIZONS

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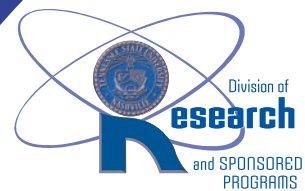
RESEARCH HORIZONS

RESEARCH HORIZONS

2009

THE SEED OF INNOVATION

2009



> RESEARCH HORIZONS

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Research represents the seed of innovation. A lesson that we can learn from this truth in the midst of the recession that rocked the American economy during the 2009 fiscal year is that public and private investment in innovation is a key component of economic recovery. As the founder of digital cellular technology who holds over 75 patents, Tennessee State University alumnus Jesse E. Russell ('72) is an inspirational example of such transformational innovation. Mr. Russell helped create the 21st Century global economy during the early research and development phase of commercial cellular service - which innovation has touched every corner of today's world - beginning with his entry into Corporate America soon after completing his education in the 1970s. With his keynote address to TSU students during our 2009 Research Symposium, Mr. Russell imparted his long-term technological vision to the current and next generations of TSU researchers consistent with our continuing research endeavors.

Effectuating technology reminiscent of James Bond films, TSU engineers have developed disposable, self-sustaining micro-sensors for the battlefield to protect U.S. troops. Endowing machines with human abilities, TSU technicians have designed robots that can take commands in natural language for routine

tasks. Expanding human cognizance of the final frontier, TSU astronomers have discovered one-half of the 300+ known planets outside of our solar system by devising and implementing unique telescopic observation techniques. There are many other on-campus illustrations of such applied innovation.

This report features the continuing efforts and accomplishments of TSU researchers to design reconnaissance technology for the United States Air Force, develop best practices and methods for supply chain management for The Boeing Company and other multinational corporations, establish food-safety guidelines for the FDA to protect the nation's food supply, provide TSU psychology students with new technology to explore the link between human psychology and physiology, study the career pathways of women who have persisted and persevered in STEM (science, technology, engineering, and mathematics) areas in order to identify effective methods to mentor STEM women students and prepare students for majors and careers in the sciences via the TSU Historically Black Colleges and Universities Undergraduate Program (HBCU-UP).

The 2009 Annual Report is a chronicle of the caliber of innovation to which we continually strive for the acceleration of global progress.

Sincerely,

Maria Thompson, Ph.D.
Vice President
Research and Sponsored Programs
research@tnstate.edu

RESEARCH
 REPRESENTS
 THE SEED OF
 INNOVATION



> AGNES KILONZO-NTHENGE



> FUR-CHI CHEN



> LESLIE SPELLER-HENDERSON



> SANDRIA GODWIN

Tennessee State University researchers have explored the home refrigerators of consumers to conduct what the national media have dubbed "refrigerator work" in order to determine actual consumer behavior - such as improper storage, unsafe food handling, lack of cleanliness, and poor refrigerator maintenance - and to promote safe food practices.

Faculty researchers Dr. Sandria Godwin, Dr. Fur-chi Chen, Dr. Agnes Kilonzo-Nthenge, and Leslie Speller-Henderson of the School of Agriculture and Consumer Sciences at Tennessee State University are national pioneers in the serious work of both promoting food safety throughout the supply chain and saving lives against poisonous food-borne pathogens such as Campylobacter, Escherichia coli (E. coli), Staphylococcus aureus, and Salmonella.

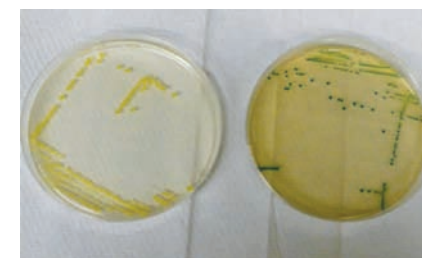
With funding from FDA and the USDA National Integrated Food

ten (10) refrigerated ready-to-eat (RTE) foods.

The resulting data, which is the largest database of its kind, was



posted on www.foodrisk.org - the website of the Joint Institute for Food Safety and Applied Nutrition (JIFSAN) of the University of Maryland, College Park - and such data assisted the Food Safety and Inspection Service (FSIS) of the USDA to improve both its and FDA protection of the public from listeriosis, which is a food-borne illness caused by the bacterium Listeria monocytogenes (L. monocytogenes).



Listeriosis is a serious infection, causing high fever, severe headache, stiff neck, muscle aches, diarrhea, nausea, loss of balance, confusion, and/or convulsions, that, based on Centers for Disease Control statistics, causes an estimated 2,500 persons within the United States to become ill each year and about 500 of these victims to die. The disease affects primarily persons of advanced age, pregnant

women, newborns, and adults with weakened immune systems. However, persons without these risk factors can also rarely be affected. Pregnant women with listeriosis may experience a mild, flu-like illness; however, infections during pregnancy can lead to miscarriage or stillbirth, premature delivery, or infection of the newborn.

Of the nineteen (19) high risk foods, RTE deli meat sliced for sale over the counter at retail presents a comparatively higher risk of listeria relative to RTE deli meat that is prepackaged at processing plants for retail sale. The FSIS utilized TSU survey data to update its "deli meat pathway model" which - among the many food products that can contain listeria - provides deli-meat risk managers with a practical decision-support tool to understand and evaluate such relative risk between these two particular distribution forms of RTE meats.

The TSU team has also developed a comprehensive food-safety guide for adults aged 60 and over entitled, *Take Control of Food Safety* which incorporates the gathered consumer-behavior data into a handy, informative guide concerning a variety of foods and practices to help seniors avoid life-threatening food-borne illnesses. TSU has conducted a first printing of 10,000 of these food-safety guides for distribution

to Tennessee seniors. Copies of the guide and/or a group presentation and training can be available through the School of Agriculture and Consumer Sciences.

EXPLORING
 REFRIGERATORS
 TO CONDUCT
 WHAT HAS BEEN
 DUBBED
 REFRIGERATOR
 WORK IN
 DETERMINING
 ACTUAL
 CONSUMER
 BEHAVIOR



> STIMULATING STUDENT INTEREST IN
EARTH, SPACE AND BIOLOGICAL SCIENCE



>MARINO ALVAREZ



>ROBERT NEWKIRK



>ORVILLE BIGNALL



>MICHAEL BUSBY



>JOSHUA MOORE



>MICHAEL REED

In 2000, the National Science Foundation (NSF) established the Historically Black Colleges and Universities-Undergraduate Program (HBCU-UP) to provide grant awards to enhance undergraduate science, technology, engineering, and mathematics (STEM) education and research at HBCUs as a means to broaden minority participation in the national STEM workforce.

For example, the Exploring Minds Network (EMN) is an original TSU virtual community that facilitates professor-student academic collaboration for enhanced learning

within the earth, space, and biological sciences. Also, Concept Mapping (Cmap) is an assessment tool adopted by the TSU HBCU-UP Project — which was funded by NSF in 2007 — to measure the interactive dynamics of teacher instruction and student learning on EMN.

Dr. Marino Alvarez developed EMN within the TSU Center of Excellence in Information Systems (COE-IS) via NASA funding, and Dr. Robert Newkirk administered the TSU HBCU-UP Project in 2009. The synergy amassed between TSU COE-IS and TSU HBCU-UP has created this effective electronic learning environment for TSU STEM students.

Cmap is based on a building-block theory of learning originally developed by Joseph Novak at Cornell University in 1972 and currently honed by Dr. Alvarez and the TSU HBCU-UP Faculty Professional Development Team, which consists of Dr. Orville Bignall, Associate Professor of Physics; Dr. Michael Busby, Professor of Mechanical Engineering; Dr. Joshua Moore, Assistant Professor of Chemistry; Dr. Michael Reed, Assistant Professor of Mathematics; Dr. Tamara Rogers, Assistant Professor of Computer Science; and Dr. Sachin Shetty, Assistant Professor of Electrical Engineering. Cmap



>TAMARA ROGERS



>SACHIN SHETTY

permits student learning to be evaluated by identifying the state of individual student knowledge before engaging EMN and comparing such prior knowledge to progressive intervals of continuing education.

In lieu of rote learning and fixed teaching, the partnership of EMN and Cmap provides an analytical process for these TSU educators both to determine the viability of various pedagogical methods and to make adjustments as needed in order to deliver a relevant education to TSU STEM students.



COLLABORATION BETWEEN THE TSU
CENTER OF EXCELLENCE IN
INFORMATION SYSTEMS AND THE
TSU HBCU-UP PROGRAM PRODUCES
AN EFFECTIVE LEARNING
ENVIRONMENT FOR SCIENCE,
TECHNOLOGY, ENGINEERING, AND
MATHEMATICS STUDENTS.

> TSU FACULTY AND STUDENTS ENGAGED IN BIOLOGICAL RESEARCH FOR HBCU-UP PROJECT



> HBCU-UP STUDENTS JUST COMPLETED ENVIRONMENTAL FIELD WORK AT TSU AGRICULTURAL RESEARCH CENTER (MAIN CAMPUS).

NANOPARTICLES AND NEUTRON DIFFRACTION

> PRESENTS RESEARCHER WITH NEW FOCUS

BY SCOTT GIBSON

Dr. Tasneem Siddiquee is an architect of chemistry, because he designs molecules rather than buildings.

Dr. Siddiquee, an Assistant Professor of Chemistry at Tennessee State University experienced in forming and studying new molecular structures, participated in the 2009 Oak Ridge National Laboratory (ORNL)/Oak Ridge Associated Universities (ORAU) Historically Black Colleges and Universities (HBCU) and Minority Education Institutions (MEI) Faculty Summer Research Program at ORNL. The program enabled him to broaden his academic credentials by exploring neutron scattering within a project led by ORNL's Dr. Andrew Christianson and entitled, *Neutron Scattering Study of Magnetic and Spin Dynamic Behavior in Amine-Stabilized Transition Metal and Transition Metal Oxide Nanoparticles*.

Neutron scattering refers to techniques in which neutrons are used to study the structure and physical properties of matter, and, for this project, to study the magnetic properties of materials. The goal of the project is to contribute to the body of knowledge concerning nanoparticles, which are pieces of material so tiny as to exhibit physical and chemical properties that are different from the bulk sample of the material. "This project is looking at how

magnetic properties are affected by the variation of nanoparticle sizes. I am working on optimizing the yield, controlling the size and shape of the nanoparticles," Dr. Siddiquee said.

For example, molecules could be synthesized to "mop up" hazardous substances; however, depending on their physical properties, they may clump together and be rendered unable to do their jobs. "When nanoparticles are better understood, new molecules having the shape of a container, or 'cage,' may be anchored to them for delivery in environmental cleanup or cancer therapy applications," Dr. Siddiquee stated. Dr. Siddiquee continued, "Suppose you have a chemical hazard composed of molecules that are small enough to fit into these cage molecules, you could have several cage molecules anchored to nanoparticles which would serve to separate the molecules. All you would need to do is dump some of these modified nanoparticles into the waste, and the molecules anchored to them would take up the toxic materials. Next, you could filter these modified nanoparticles soaked with toxic materials. Then, you could release the toxic materials in a controlled chamber by chemical treatment or physical treatment; for example, heating and oxidizing, when appropriate."

Because these nanoparticles maintain a slight chemical separation from one another, these cage molecules could be anchored to them and thus remain separated, thereby making them effective molecular gatherers of hazardous spills, dumps, and wastes.

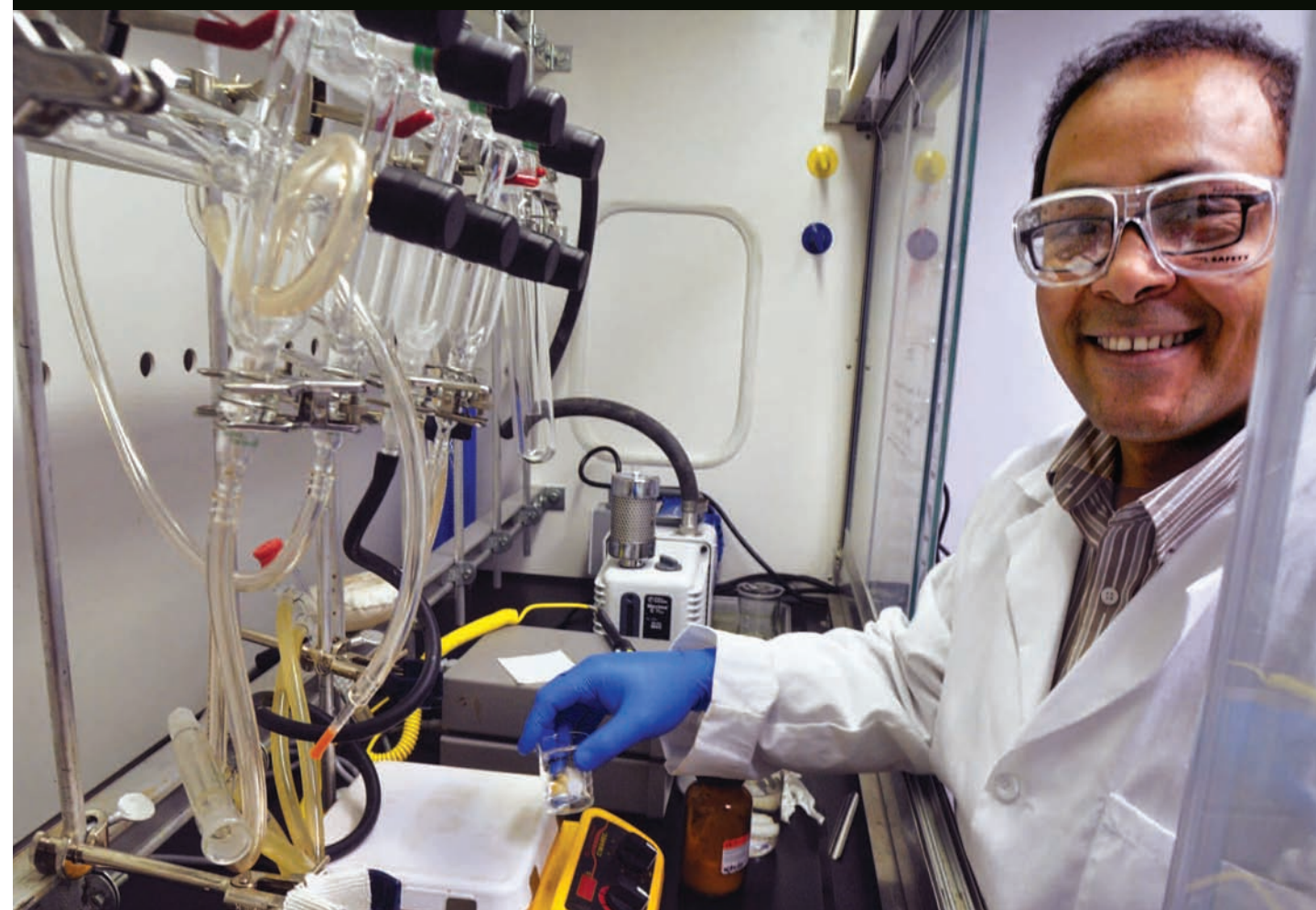
"Relative to cancer treatment, nanoparticles assembled with cage molecules could be used to carry and deliver cancer-healing drug molecules to destroy tumor cells with radiation therapy without harming the good cells," Dr. Siddiquee explained.

"Participation in this program is enhancing my professional development," Dr. Siddiquee said, and "I am gaining practical experience working with nanoparticles and neutron diffraction, which are new areas for me; what I learn will make me a better teacher and researcher."

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THIS TENNESSEE
STATE UNIVERSITY
PROFESSOR IS AN
ARCHITECT OF
CHEMISTRY BECAUSE
HE DESIGNS
MOLECULES RATHER
THAN BUILDINGS.

> DR. TASNEEM SIDDIQUEE CONDUCTING RESEARCH AT THE OAK RIDGE NATIONAL LABORATORY DURING SUMMER OF 2009



> 2009 IS THE PILOT YEAR OF A \$100,000 GRANT FROM THE BOEING COMPANY



> JOEL JOLAYEMI



> FESTUS OLORUNNIWO



> XIAOMING LI



> CHUNXING FAN

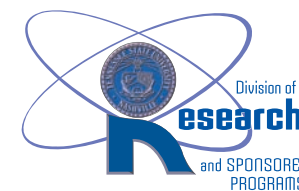
In this 21st century era of globalization, the suppliers for any business may be located in any part of the country or the world. Each of these suppliers may employ other suppliers having similar geographical divergence. In this complex environment, "There is a great and growing need for the development of new methods and techniques for Supplier Relationship Management (SRM)," states Dr. Joel Jolayemi of the TSU College of Business. Supplier relationship management is a set of principles, processes, templates, and tools that assist companies to maximize relationships, minimize risks, and manage costs throughout the supplier relationship cycle.

Fiscal year 2009 is the pilot year of a \$100,000 grant from The Boeing Company to TSU for developing new methods and techniques for SRM. Boeing has earned a reputation for applying best-practices models and methods in supply chain management. Many firms in partnership with the supply chain program at TSU have achieved similar corporate prominence in SRM. The other partners are Dell, Corning, Genco Supply Chain Solutions, Northrop Grumman, Microsoft, Lexmark International, Wal-Mart, and MEDIA Mail Packaging.

The project kick-off was February 5, 2009 with the first task for TSU researchers Dr. Jolayemi, Dr. Festus Olorunniwo, Dr. Xiaoming Li, and Dr. Chunxing Fan being to conduct an SRM survey based on their initial interviews of

corporate executives. Data was collected using three methods to ensure accuracy. The survey responses will be tools to develop a database that can be used by TSU researchers to create SRM solutions.

"THERE IS A GREAT AND GROWING NEED FOR THE DEVELOPMENT OF NEW METHODS AND TECHNIQUES FOR SUPPLIER RELATIONSHIP MANAGEMENT"



> FINDING, ENCOURAGING AND EDUCATING WOMEN WITH
NATIONAL SCIENCE FOUNDATION GRANT



> MARIE HAMMOND

To elevate the recruitment of minority women into Science, Technology, Engineering, and Mathematics (STEM) careers, Tennessee State University researchers are both identifying successful minority women STEM students in college and studying the personal traits that drive these students to persist and persevere through the challenges of male-dominated STEM education. TSU

research findings will be used to develop methods to transmit inspiration and encouragement from these college women to middle school girls, who are on a critical developmental cusp of either choosing or rejecting STEM education in grade school.

The Milestones and Danger Zones for Talented Women in STEM grant project is funded through the National Science Foundation (NSF) to study the reasons that young women tend to opt out of STEM education, though this education leads to the STEM careers which represent about 95% of the highest-paying jobs in the nation. Research by Catalyst, which is a national organization promoting women and business, indicates that there is about equal interest in STEM-related classes between girls and boys in sixth and seventh grades. But by ninth grade, boys tend to predominate STEM-related curricula.

Within this vein of concern, TSU researcher Dr. Marie Hammond, Associate Professor of Psychology, collaborated with Kansas State University and Arizona State University to identify the individual coping skills, life strategies, and world views of those college women who continued in STEM education despite the disruptive forces, expectations, and cultures that tend to bombard girls during these middle-school stages of education. Dr. Hammond received assistance to identify and recruit TSU students as participants in this

survey-based research from Dr. Lonnie Sharpe, Professor of Engineering, Massie Chair of Excellence, and from the Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) program, which was established by NSF in 2000 to assist HBCUs to enhance and enrich STEM programs.

In addition to surveys, a series of on-campus banquets that celebrated the success of these persisting women students served as supplemental research vehicles to analyze mentoring strategies. One such banquet, "Women Succeeding in STEM Majors and Careers," honoring over 70 TSU students was held on January 29, 2009 in the Farrell-Westbrook Agriculture Research Extension Complex (The Barn). The luncheon session positioned successful STEM-career women to network with persistent STEM-major women culminating in a motivational address by Dr. Sandra Holt, Director, Honors Program, who has served as a TSU faculty member and administrator for over 30 years.

This active TSU research was presented at the annual convention of the American Psychological Association during the summer of 2009; thereby, extending the national knowledge base to assist educators around the country to motivate, recruit, and retain women in STEM education and careers.

> STUDYING THE INTERACTION
BETWEEN HUMAN PSYCHOLOGY AND PHYSIOLOGY

The National Science Foundation (NSF) selected Tennessee State University for a competitive federal grant to equip a pilot experimental psychology laboratory with psycho-physiological technology that enables students to study the interaction between human psychology and physiology.

Funding for the project emanated from the intersection of an NSF Targeted Infusion program within HBCU-UP and a successful TSU funding proposal entitled, "Development of an Experimental Psychology Teaching and Research Laboratory at Tennessee State University" created by Dr. Kiesa Kelly with the leadership of Dr. Linda Guthrie of the TSU Psychology Department. Such funding commenced in January 2009 with \$145,888, and the proceeds were used to convert an existing classroom into a functioning lab. NSF established the Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) in 2000 to assist HBCUs to enhance and enrich such science, technology,

engineering, and mathematics (STEM) programs. NSF "targeted infusion" channels grant funds to specific academic research infrastructure within the STEM fields in order to implement the broad goals of HBCU-UP.

The TSU psychology lab has acquired, during its current initial phase, an electroencephalograph (EEG) having a price tag of \$85,000. The EEG permits students to engage research participants in various cognitive exercises while using computers to record electrical activity within the brain via sensors placed on the surface of the scalp. Other such psychophysiology instruments are being acquired by the lab to monitor and measure heart rate and blood pressure. This experimental psychology lab will be complemented by both a computer lab and a databank of psychology and neuropsychology tests for IQ, language, and memory.

The TSU lab is designed to be a comprehensive, experimental psychology facility slated for incorporation into the TSU psychology curriculum, which will be expanded to include new courses – such as Brain Waves and Cognition – to train students on the acquired technology.

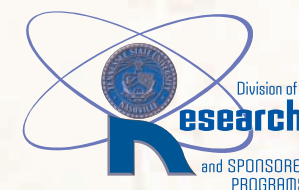
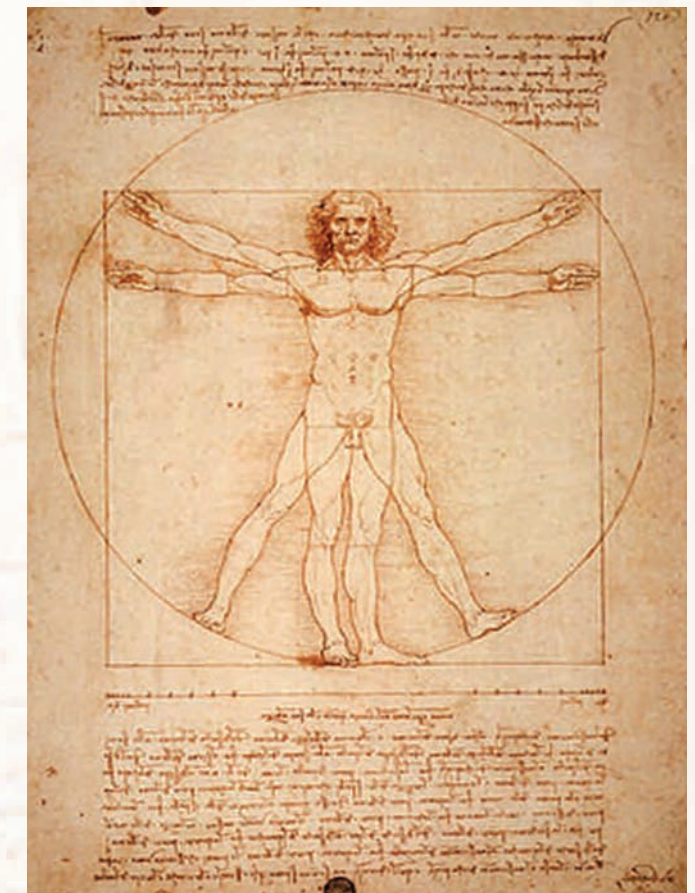


> LINDA GUTHRIE



> KIESA KELLY

FEDERAL GRANT TO EQUIP
BEHAVIORAL LABORATORY WITH
SENSORY TECHNOLOGY FOR
STUDENTS TO STUDY THE
INTERACTION BETWEEN HUMAN
PSYCHOLOGY AND PHYSIOLOGY.



TSU RESEARCH FINDINGS WILL
DEVELOP METHODS TO INSPIRE
AND ENCOURAGE GIRLS ON THE
DEVELOPMENTAL CUSP IN
CHOOSING OR REJECTING STEM
EDUCATION IN GRADE SCHOOL.



> MOHAN MALKANI



> SALEH ZEIN-SABATTO



> TAMARA ROGERS

Tennessee State University faculty engineers are designing reconnaissance technology for the U.S. Air Force. These seasoned researchers are training the emerging research minds enrolled in the TSU College of Engineering, Technology, and Computer Science to develop high-tech solutions to improve security and rescue operations worldwide. TSU engineering students engage and hone these design skills during the annual Lone Star Challenge Design Competition, which is sponsored by the Air Force.

TSU students under the tutelage of Dr. Mohan Malkani are nationally competitive in developing robot technology to permit tactical rescue teams confronted by siege situations to remotely map and monitor the interior of buildings and to accurately decipher and discern between the hostage and hostile persons inside of these buildings. Design teams from the University of Texas at Austin, Texas A&M University, and the Minority Leaders Program (MLP) Consortium - consisting of Tennessee State University as lead HBCU,

Southern University, and Prairie View A&M University - were invited to compete in the 2009 Lone Star Challenge held at Texas A&M in College Station, Texas on April 25, 2009. These student teams were evaluated in three major categories: (1) Solution Effectiveness Measures such as locating hostages and captors, (2) Solution Subjective Measures such as instituting stealth and craftsmanship, and (3) Education, Teamwork, and Reporting Measures such as promoting student participation and presentation. Dr. Saleh Zein-Sabatto led the MLP team and coached TSU students jointly with Dr. Amir Shirkhodaie for the competition, wherein TSU ranked second place ahead of the University of Texas (Austin) at third place. A new team of TSU students assembled from the departments of Mechanical Engineering, Electrical Engineering, and Computer Science will compete in the 2010 Lone Star Challenge.

The engineering skills of students sharpened at these annual Lone Star challenges are also implemented closer to home on the TSU campus. TSU students develop campus security strategies. University Beat is a project that employs multiple building-mounted cameras to survey and track vehicles and to convert such anonymous data into models for cataloguing patterns of human behavior, such as parking decisions. TSU students also operate advanced remote-controlled robotic vehicles on land and in the air, such as an unmanned aerial vehicle (UAV) funded by the Air Force.

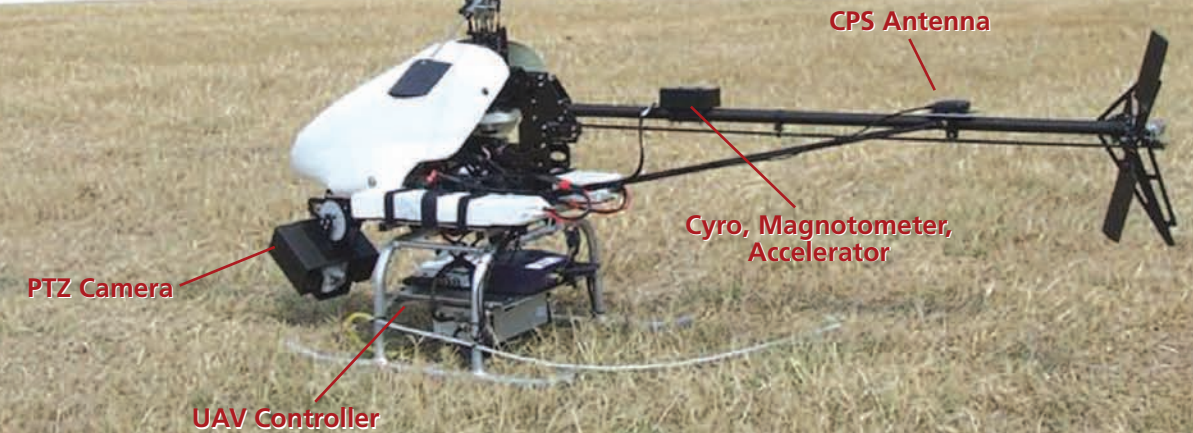
Such technological capability exercised under the supervision of Dr. Fenghui Yao, Dr. Tamara Rogers, and Dr. Zein-Sabatto permits students to train in "layered sensing" using camera, radar, acoustic, magnetic, and seismic sensors in order to detect, identify, record, and track mock intruders to the TSU campus. These stationary and mobile vantage points compile sight, scan, sound, pulse, and vibration data into multi-dimensional surveillance reports permitting students to engage in real-world exercises for their future government and private security endeavors.

Based on the achievements of some of these research endeavors, TSU faculty and students were also invited to participate in the 2009 Tech Warrior exercise of the Air Force Research Lab (AFRL) held in Fort Drum, New York. These TSU researchers teleoperated a mobile robot via a wireless network to detect chemical contaminants. Dr. Tamara Rogers, Dr. Zein-Sabatto, and graduate student Gary Pepper developed and delivered the robot as a key component of this joint effort with fellow researchers from Louisiana Tech University and the AFRL. Their demonstration was well-received and highly-acclaimed resulting both in a prime spot in the Top 20 showcase of AFRL's Tech Warrior cutting-edge technologies and in a competitive proposal for TSU participation in the 2010 Tech Warrior exercises.

DEVELOPING
HIGH-TECH
SOLUTIONS FOR
IMPROVING
SECURITY AND
RESCUE
OPERATIONS



> RECONNAISSANCE TECHNOLOGY DESIGNED FOR THE U.S. AIR FORCE
BY TSU FACULTY ENGINEERS INCLUDES UNMANNED AERIAL VEHICLES (UAV).





SUBMISSIONS

BY CENTER/COLLEGE/SCHOOL

Academic Enrichment	\$ 125,000
Agriculture and Consumer Sciences	22,786,049
Arts and Sciences	6,005,456
Business	973,965
Center for Health Research	6,087,984
Center for Service Learning and Civic Engagement	884,375
Center of Excellence – Information Systems	2,467,519
Center of Excellence for Learning Sciences	13,338,427
Education	2,015,338
Engineering, Technology, and Computer Science	18,572,850
Equity, Diversity and Compliance	31,844
Facilities Management	2,596,298
Health Sciences	1,305,355
Nursing	1,106,325
Police Department	564,431
Public Service and Urban Affairs	332,973
Research and Sponsored Programs	42,138,669
Student Affairs	100,000
Total	\$ 121,432,858

BY AGENCY/CORPORATION/FOUNDATION

Air Force Research Laboratory	\$ 160,936
Army Research Office	6,700,416
Corporations	492,051
Defense Threat Reduction Agency	85,000
Federal Highway Federation	30,000
Health Resources and Services Administration	464,677
Intelligence Advanced Research Project Activity	500,000
Metropolitan City Government	1,052,100
Morehouse School of Medicine's Center for Community	15,000
National Aeronautics and Space Administration	6,702,999
National Center for Marriage Research	19,750
National Endowment for the Arts	40,999
National Geospatial Intelligence Agency	101,271
National Parks Service	2,594,298
National Science Foundation	16,031,023
Oak Ridge Institute for Science and Technology	14,361
Office of Naval Research	250,000
Private/Foundations	980,886
Tennessee State Agencies	5,335,510
U.S. Agency for International Development	3,228,739
U.S. Department of Agriculture	16,571,060
U.S. Department of Defense	36,779,980
U.S. Department of Education	800,000
U.S. Department of Health and Human Services/CDC/NIH	20,804,480
U.S. Department of Housing and Urban Development	699,990
U.S. Department of Justice	564,431
U.S. Department of the Interior	199,919
U.S. Department of Transportation	42,368
U.S. Environmental Protection Agency	170,614
Total	\$ 121,432,858

AWARDS

BY CENTER/COLLEGE/SCHOOL

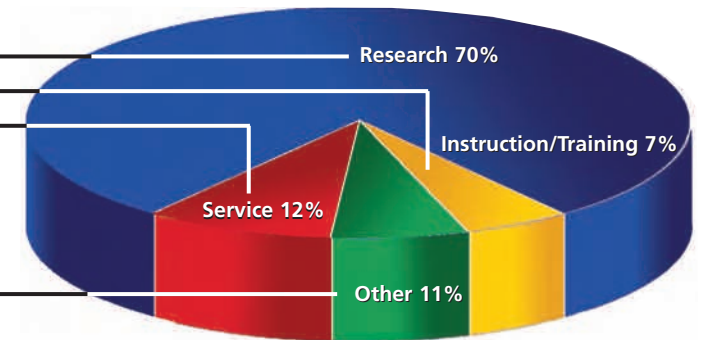
Academic Affairs	\$ 452,018
Agriculture and Consumer Sciences	9,064,408
Arts and Sciences	2,435,769
Business	260,995
Center for Health Research	1,156,248
Center for Service Learning & Civic Engagement	20,450
Center of Excellence – Information Systems	1,335,175
Center of Excellence for Learning Sciences	9,020,529
Communication & Information Technology	72,983
Education	2,476,398
Engineering, Technology, & Computer Science	1,673,913
Health Sciences	705,602
Massie Chair of Excellence in Environmental Engineering	1,393,842
Office of the President	16,000
Public Service and Urban Affairs	230,067
Research and Sponsored Programs	469,339
Student Affairs	950,019
Title III	8,612,551
Total	\$ 40,346,306

BY AGENCY/CORPORATION/FOUNDATION

Air Force Research Laboratory	\$ 603,406
Corporations for National & Community Service	20,450
Corporations	685,083
National Aeronautics and Space Administration	440,930
National Science Foundation	1,456,657
Private/Foundations	281,040
Tennessee State Agencies	3,204,435
U.S. Department of Agriculture	10,554,732
U.S. Department of Defense	1,314,486
U.S. Department of Education	8,781,487
U.S. Department of Energy	665,000
U.S. Department of Health and Human Services	11,908,862
U.S. Department of Housing and Urban Development	10,500
U.S. Small Business Administration	150,495
U.S. Department of Transportation	268,743
Total	\$ 40,346,306

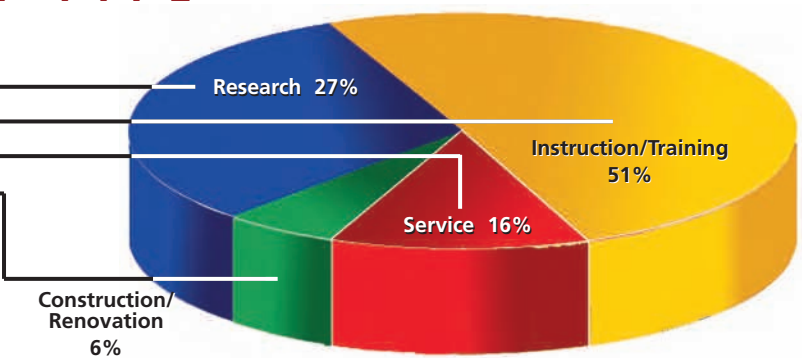
SUBMISSIONS BY PROJECT TYPE

Research	\$84,990,182 (118)
Instruction/Training	\$8,102,031 (23)
Service	\$15,315,708 (16)
Other	\$13,024,937 (23)
TOTAL	\$121,432,858 (180)



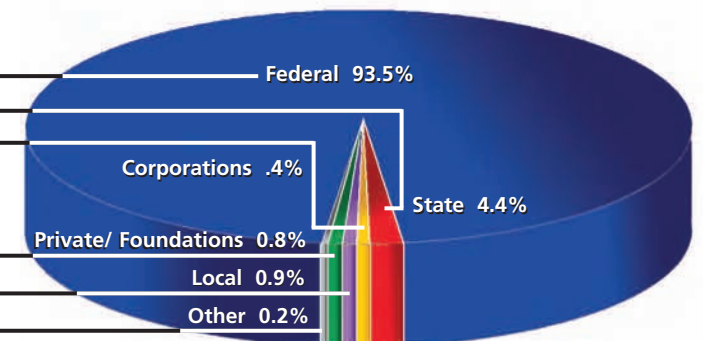
AWARDS BY PROJECT TYPE

Research	\$10,933,381 (60)
Instruction/Training	\$20,487,379 (69)
Service	\$6,318,643 (20)
Construction/Renovation	\$2,606,903 (3)
TOTAL	\$40,346,306 (152)



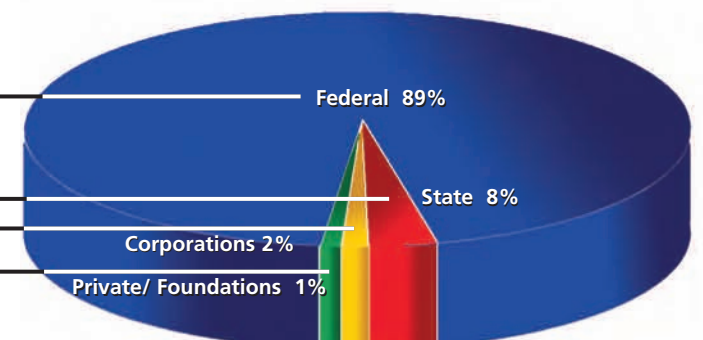
SUBMISSIONS BY SOURCE

Federal	\$113,542,950 (116)
State	\$5,335,510 (39)
Corporations	\$492,051 (3)
Private/Foundations	\$980,886 (10)
Local	\$1,052,100 (10)
Other	\$29,361 (2)
TOTAL	\$121,432,858 (180)



AWARDS BY SOURCE

Federal	\$36,175,748 (124)
State	\$3,204,435 (14)
Corporations	\$685,083 (6)
Private/Foundations	\$281,040 (8)
TOTAL	\$40,346,306 (152)





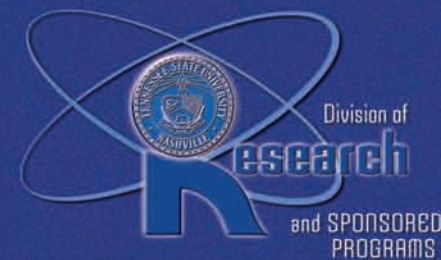
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