

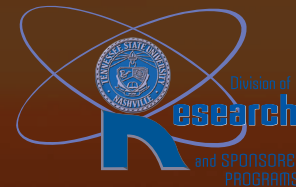


RESEARCH HORIZONS

2010
ANNUAL REPORT

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RESEARCH HORIZONS
2010

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The artwork is an artist reconstruction showing what a double sunset might look like on a distant world. Illustration of the new extrasolar planet discovered by TSU astronomers cited in article, TSU Astronomy.

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“Tennessee State University is dedicated to producing the next generation of global researchers because the institution is committed to continuing its long tradition of research excellence.”

Maria Thompson, Ph.D.



From the Vice President

Research and Sponsored Programs

Tennessee State University is dedicated to producing the next generation of global researchers because the institution is committed to continuing its long tradition of research excellence.

Our 2010 Annual Report profiles the continuing and effective efforts of Tennessee State University faculty researchers to train students in the methods of research. These invaluable academic sessions provide a competitive advantage to the repertoire of knowledge TSU students impart within their chosen careers beyond graduation. As our faculty advance the research mission of the university to ensure the quality of scholarly efforts that engage students, we hold a belief in future triumphs and recognition that Tennessee State University so richly deserves.

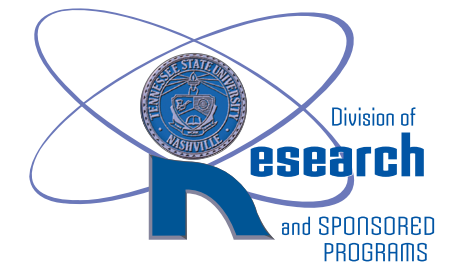
This Annual Report celebrates our effective processes of student preparation and mentorship within an educational environment that is fortified by the synergistic coordination of biological science, chemical science, engineering, agricultural science, physics, and astronomy initiatives at Tennessee State University. For example, the TSU College of Engineering, Technology, and Computer Science partnered with the Naval Sea Systems Command (NAVSEA) of the U.S. Navy to prepare a series of TSU students to be world-class naval systems engineers. These undergraduate and graduate Engineering students visited the multi-city sites of the NAVSEA Naval Surface Warfare Center (NSWC) and Naval Air Warfare Center (NAWC) and engaged in military research geared to elevate the state-of-the-art techniques of American warship design and building. In addition to this research within the field of Engineering, a cohort of TSU Science, Technology, Engineering, and Mathematics (STEM) students was assigned multi-disciplinary faculty mentors within the Undergraduate Research and Mentoring (URM) in the Biological Sciences program funded by the National Science Foundation (NSF). This mentorship inspired students to learn the discipline, practice, and presentation of professional research, and included the students spending the summer at a research site established via the National Science Foundation (NSF) and presenting their research findings at a scientific symposium.

Now that you have experienced a segment of the full spectrum of research activities spanning Tennessee State University, it is our hope that the 2010 Annual Report provides an inspiring glimpse and operating model of strategies and endeavors for preparing students for this global marketplace of innovation. Tennessee State University has been recognized by the Carnegie Foundation for the Advancement of Teaching as a "Doctoral/Research University." This is a significant national recognition of our high quality research and graduate programs which serves our students, the state, and the nation.

Sincerely,

A blue ink handwritten signature of Maria Thompson, Ph.D., consisting of stylized initials and a long horizontal flourish.

Maria Thompson, Ph.D., Vice President
Division of Research and Sponsored Programs
Tennessee State University



TSU Astronomy Research 2010 Profile

Dr. Matthew Muterspaugh, Center of Excellence in Information Systems

In 2009, Dr. Matthew Muterspaugh joined Tennessee State University (TSU) as an assistant professor in the Department of Mathematics and Physics with the astronomy team as a member of the TSU Center of Excellence in Information Systems (COE-IS). In the spring of 2010, Dr. Muterspaugh won a \$600,000 grant - along his spectrum of over \$1M in total competitive external funding - from the National Science Foundation (NSF) via the TSU Division of Research and Sponsored Programs for enhanced star research to be conducted through the 6-telescope array of the U.S. Naval Observatory's Navy Prototype Optical Interferometer (NPOI) near Flagstaff, Arizona. In the field of astronomy, an astronomical interferometer is such an array of telescopes or antennas engaged in concert to probe structures in space, such as stars, with higher resolution or detail by means of interferometry.

The Visible Imaging System for Interferometric Observations (VISION) is an optical camera and beam combiner proposed by Dr. Muterspaugh to improve even the higher resolution of NPOI interferometry by taking current state-of-the-art technological capabilities to a step above present capacity for the detection and analysis of the brighter objects in space. The system will sport a spatial resolution 200 times sharper than the Hubble Space Telescope which will make distant stars just as visually accessible as the relatively-nearby Sun for digital surface surveys.

The VISION system will use software to detect these stars that may look like just one star to the naked eye or the unassisted telescope and will use pixels to survey the surface of stars. Dr. Muterspaugh explained: "Most star systems are made up of more than one star and measuring the stars' orbits can be complicated to see. We have created the VISION system with the capabilities to see the orbit in full 3-D. This will enable us to conduct new science by combining imaging techniques to get a full view of the objects and implement the latest generation of technology to see stars that have been well known for centuries in a newer and more precise way." The COE-IS at TSU has recruited an additional post-doctoral researcher, Askari Ghasempour, and it will also add four undergraduate students for this project funded by the American Recovery and Reinvestment Act of 2009 (ARRA).

Dr. Muterspaugh believes that the VISION research will be a significant development to be added to the intellectual infrastructure of the University: "This new camera system will contribute to the legacy of research and discovery pioneered by TSU. The research will ultimately offer a greater understanding of the Sun and its ultimate effects on the Earth's climate change as a direct connection to the ability to better observe and study the stars."

The VISION project will complement the long-term research of Dr. Francis Fekel and other astronomers of COE-IS who have contributed to the global evolution of the study of space using spectroscopy. Based on this foundation of excellence, then-Governor Phil Bredesen issued a proclamation making March 31, 2009 Tennessee State University Astronomy Day heralding the 10th anniversary of TSU astronomers establishing the first direct telescopic observation of a planet in another solar system or "exoplanet", that is, extra-solar planet.

In the meantime, Dr. Muterspaugh has discovered another exoplanet, with two suns, in the constellation Lyra about 49 light years away from Earth. This dual-sun planet was found during the fall of 2010 using NASA's Palomar Testbed Interferometer (PTI) located in southern California, midway between Los Angeles and San Diego. The planet is about the size of Jupiter and was the first dual-sun planet to be discovered using astrometry, which is a geometric system of planetary measurement and detection facilitated by the unique features of PTI.

This latest TSU planetary discovery is challenging the leading theory about the formation of giant planets that a planet evolves from a process of clouds of dust and gas congealing or coagulating into a sphere that qualifies as a planet, because the discovered planet having formed despite the competing gravitational pulls of two stars compromised this theory toward confirming an alternate theory of giant planets gravitationally forming from massive swirls of space dust. The continuing process of epic discovery by the COE-IS team spanning light years of space, time, and theory positions TSU as a global pioneer of astronomy bringing science fiction ever closer to science reality.



*Tennessee State University
astronomers are building the
21st Century era of astrometry
with team-based research
expertise and external funding.*

Dr. Matthew Muterspaugh is shown working inside the Hamilton Spectrograph, a camera that has been used to find many of the planets known to orbit other stars.

Excellence

Dr. Todd Gary, Research and Sponsored Programs

The 32nd Annual University-Wide Research Symposium celebrated our environment of research excellence here at Tennessee State University which has produced the synergistic coordination of multiple undergraduate-research initiatives.

The programs for undergraduate research at TSU include the Symposium, the Undergraduate Engineering Capstone Research Projects, the Minority Access to Research Careers (MARC) Program, the Undergraduate Research and Mentoring (URM) Program in Ecology and Environmental Science, and the Tennessee Louis Stokes Alliance for Minority Participation (TLSAMP). Many successful TSU alumni conducted research as part of their undergraduate education such as Jesse Russell ('72), inventor of key cell-phone technology who served as the 2009 Symposium keynote speaker; Levi Watkins ('66), leading cardiologist at Johns Hopkins University Hospital; and Latasha Taylor ('04), candidate for the NASA astronaut program.

According to the Boyer Commission on Educating Undergraduates National Report, "Research-based learning must become the Standard for Undergraduate Education." Engagement in research and other scholarly activities has a profound impact on undergraduate students. According to S. Keith Hargrove, Dean of the TSU College of Engineering, Technology and Computer Science, all graduating engineering students complete the capstone research projects, and, over the past five years, a majority of these seniors have excelled in academics. This success is consistent with the findings of published studies that have concluded that undergraduate students engaged in scientific research tend to enjoy higher GPA's, effectuate greater retention in advanced courses, elevate their technical and communication skills, energize their self-confidence, and enter graduate education programs and the STEM (Science, Technology, Engineering and Mathematics) professions in higher numbers.

In its 2005 publication, *A Vision of Research and Graduate Education*, the Tennessee Board of Regents (TBR) recommended that each TBR campus establish a Center of Undergraduate Research. In this vein, Dr. Maria Thompson, Vice President for the Division of Research and Sponsored Programs, created the Undergraduate Research and Creative Activities (UReCA) program at TSU which has a mission to advance the student-centered research endeavors of the University. The UReCA program received initial TBR Access and Diversity Initiative Grant funding in 2009 to coordinate a STEM-focused research journey for students through the six disciplines of biological science, chemical science, engineering, agricultural science, physics, and astronomy. In addition, the "Creative Activities" portion of the UReCA program is a TSU initiative that supports grant proposals for faculty from all disciplines, including music and art. UReCA is a component of The Scholars Experience program at TSU which is also a unique network of university-wide student-development programs focused on creating the holistic scholar. As stated by Dr. Thompson, "UReCA supports the University's strategic integrative goal of becoming a premier public research land-grant university and a destination campus in the region."

2009-2010 UReCA Scholars: Agriculture, **Jenae Smith**, Astronomy, **Julia O'Connell**, Biology, **Hartman Madu**, Chemistry, **Deanna Bowman**, Engineering, **Carmen Hollingsworth**, Mathematics and Physics, **Kimberly Eakins**
UReCA Director - **Todd Gary, Ph.D.**, UReCA Coordinator - **Mrs. Robin Madison**



Right: LaTasha Taylor and Marcell Pickens conducting undergraduate research aboard NASA's reduced gravity KC-135 plane. LaTasha is currently a Lockheed Martin engineer designing the astronaut crew compartment for the NASA Orion spacecraft and has applied to the NASA astronaut program.



The acronym UReCA is pronounced identically to the exclamation "Eureka!" - which derives from a Greek word for discover - accordant with the future of research at the University.



Research and Mentoring 2010 Focus

TSU Biology

Dr. Dafeng Hui, Biological Sciences

Tennessee State University received a \$600,000 grant from the National Science Foundation (NSF) to enhance undergraduate research experiences in the fields of Ecology and Environmental Science.

Under the direction of Dr. Dafeng Hui, Assistant Professor of Biological Sciences, the award established the TSU Undergraduate Research and Mentoring (URM) in the Biological Sciences program. Over the 4-year period of the grant (2009-2013), a total of eighteen students will participate in the program with a cohort of six students being recruited each year in the first three years of the project. Each student will be supported by the grant for a total of two years.

These URM students at TSU will be groomed for graduate school by working with faculty mentors on independent projects, spending a summer at one of the NSF Research Experiences for Undergraduates (REU) sites, presenting their research findings at a scientific symposium, and receiving coaching for the Graduate Record Examination (GRE) necessary for entering graduate studies.

"This program will provide a unique opportunity for TSU students who are interested in environmental science," said Dr. Terrance Johnson, Professor and Chair of the Department of Biological Sciences. Dr. Johnson is one of the URM faculty mentors along with Dr. Hui, Dr. Emmanuel Dzantor, Associate Professor of Agricultural Science; Dr. Anthony Ejiofor, Associate Professor of Biological Sciences; Dr. Philip Ganter, Professor of Biological Sciences; Dr. Mohammad Al-Masum, Associate Professor of Chemistry; Dr. Xiaofei Wang, Associate Professor of Biological Sciences; Dr. Suping Zhou, Associate Professor of Agricultural Science; and Dr. Tom Byl, a U.S. Geological Survey scientist and TSU College of Engineering veteran. These seasoned researchers have committed to serving as mentors for students conducting research in ecological and environmental disciplines including global-change ecology, microbial ecology, environmental biology, water quality, bio/phytoremediation, and ecological modeling.

The URM grant was enhanced by a \$66,000 grant from NSF under the Major Research Instrumentation (MRI) program. This competitive funding allowed TSU to acquire the necessary equipment to expertly train URM students: a Li-Cor Environmental Education Fund (LEEF) III package including a Li-6400 Photosynthesis and Respiration System. "We are dedicated to this effort of preparing undergraduate students for this level of research," Hui said.

Based on these investments in the future, the number of under-represented minority students who are motivated and prepared to pursue graduate studies in the ecological and environmental disciplines will increase to meet the future of science.



Dr. Dafeng Hui
Principal Investigator



Dr. Mohammad Al-Masum



Dr. Tom Byl



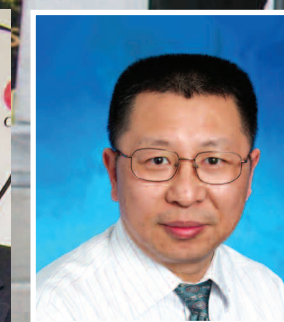
Dr. Emmanuel Dzantor



Dr. Anthony Ejiofor



Dr. Terrance Johnson



Dr. Xiaofei Wang



Dr. Suping Zhou

URM students and mentors

Mission

Dr. S. Keith Hargrove, College of Engineering, Technology, and Computer Science

The Naval Sea Systems Command (NAVSEA) of the U.S. Navy is the largest of the Navy's five system commands and it builds, buys, and maintains ships, submarines, and combat systems to meet the fleet's current and future operational requirements. In 2010, NAVSEA took the initiative to establish a pipeline of engineers for the 21st Century naval force, thus, founding a national Naval Engineering Education Center (NEEC) consortium. The NEEC consortium was funded with a \$50M grant and encompasses 15 institutions that include Florida Atlantic University, Florida State University, Georgia Institute of Technology, Old Dominion University, Pennsylvania State University, Stevens Institute of Technology, Tennessee State University, University of Iowa, University of Michigan, University of New Orleans, University of Texas-San Antonio, University of Washington, Virginia Polytechnic Institute, and Webb Institute.

As a member of the national consortium NEEC, Tennessee State University (TSU) holds the unique status as the sole Historically Black College and University (HBCU) within the engineering consortium and received \$1.7M of the total \$50M grant. TSU will receive tangible benefits from the NEEC \$50M arising from the enhancement of curriculum, research, and internships to prepare TSU students for careers in naval engineering. "The Navy will require 3,000 to 5,000 engineers over the next decade in order to meet its mandate of national defense," states S. Keith Hargrove, Dean of the College of Engineering, Technology, and Computer Science (CoETCS). Led by the University of Michigan, the mission of NEEC is to educate and develop world-class naval systems engineers for the fleet's civilian acquisition and science workforces by aggregating the respective strengths of the member institutions.

The NAVSEA NEEC national kick-off meeting held on July 26, 2010, in Ann Arbor, Michigan heralded the objectives of this new initiative to increase the number of students who graduate with an accredited degree, provide world-class faculty specialized in naval engineering, coordinate employee-development opportunities to retain naval engineering talent for the Navy, and to increase the availability of naval engineering education programs and courses across universities and colleges. "[NEEC] is the newest tool in NAVSEA's Talent Management Strategy to develop, attract and retain the broader, more capable work force," says Brian Persons, NAVSEA executive director. The consortium also will partner with TSU, the American Society of Naval Engineers (ASNE), and the Society of Naval Architects and Marine Engineers (SNAME) to extend this engineering pipeline to K-12 students via university outreach initiatives that are geared to inspire, recruit, and matriculate the next generation of naval engineers.

In addition to TSU students having access to the university's current degree offerings in architectural, civil, electrical, and mechanical engineering, NEEC consortium grant funds permit the development of a concentration or curriculum in naval engineering at TSU. NEEC also will engage TSU and other consortium students in real-world research projects, engineering challenges, at-sea internships, and other experiential-learning opportunities within the areas of marine, naval, and ocean engineering. These consortium-wide, collaborative student research projects will be designed by the NAVSEA Naval Surface Warfare Center



(NSWC) and Naval Air Warfare Center (NAWC) to provide stipend scholarships and paid internships for TSU students to be trained in the nanoscience and the other state-of-the-art elements of warship design and building performed within the spectrum of nationwide locations and specialties of these dual technology centers of the U.S. Navy.

NEEC serves to expand the existing educational partnership between the TSU Center for Academic Excellence in Intelligence Studies (CAEIS) and the technology-centered Crane (Indiana) Division of NSWC which CAEIS groundwork had resulted in laboratory equipment, personnel, and other support being loaned to the university for its science, technology, engineering, and mathematics (STEM) majors. In collaboration with CoETCS, CAEIS prepares TSU students for careers in national defense using *The Scholar in U* model of interdisciplinary training that was developed and implemented at TSU wherein students are rotated through substantive experiences in globalization, undergraduate research, leadership, service learning, and pre-professional organizations. A component of the TSU Division of Research and Sponsored Programs, CAEIS has made measurable strides since its inception in 2005 preparing TSU students for careers in national security such as NAVSEA. These independent, internal TSU enhancements to NEEC comprise a competitive avenue for the university to seek to supplement its NAVSEA funding.

TSU students accomplished rapid progress into NEEC during the balance of 2010 by visiting two NSWC locations to engage in a field study of nano-sensors for the detection of enemy explosive devices by the Fleet. The preliminary research was conducted by two undergraduate and two graduate students of CoETCS supported by the NSWC locations – Crane, Indiana; Panama City, Florida; and Dahlgren, Virginia.

CoETCS is developing an elective course in cost estimation and it has partnered with Oak Ridge National Laboratory (ORNL) located in Oak Ridge, Tennessee to provide an introductory nanotechnology course to TSU students toward the establishment of the requisite consortium-related concentration or curriculum in naval engineering. Based on these active first-year initiatives, NEEC provides a vision and vehicle for CoETCS to groom a series of TSU students into being naval engineers and to promote the broad options of naval careers.

"The Navy will require 3,000 to 5,000 engineers over the next decade in order to meet its mandate of national defense," states S. Keith Hargrove, Dean of the College of Engineering, Technology, and Computer Science (CoETCS).



Submissions

BY CENTER / COLLEGE / SCHOOL

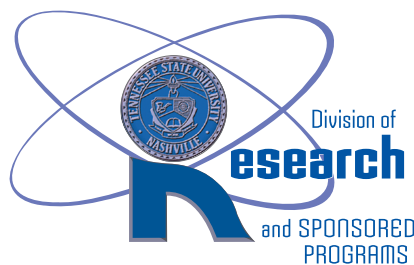
Academic Affairs	\$ 275,000
Agriculture and Consumer Sciences	29,412,587
Arts and Sciences	13,219,479
Business	891,814
Center for Health Research	6,944,021
Center of Excellence – Information Systems	1,352,003
Center of Excellence for Learning Sciences	6,225,236
Education	44,905,000
Engineering, Technology, and Computer Science	24,970,273
Health Sciences	350,511
Massie Chair of Excellence in Environmental Engineering	96,000
Nursing	2,557,404
President's Office	31,376
Public Service and Urban Affairs	292,437
Research and Sponsored Programs	45,375,504

TOTAL \$ 176,898,645

BY AGENCY / CORPORATION / FOUNDATION

Air Force Research Laboratory	\$ 886,776
Corporations	402,633
National Aeronautics and Space Administration	46,112
National Endowment for the Arts	25,000
National Geospatial Intelligence Agency	500,000
National Institute of Health	8,072,108
National Science Foundation	31,930,128
Private/Foundations	848,166
Tennessee State Agencies	46,518,627
U.S. Department of Agriculture	35,028,332
U.S. Department of the Army	1,490,000
U.S. Department of Defense/MDA	30,510,000
U.S. Department of Education	248,321
U.S. Department of Energy	6,267,683
U.S. Department of Health and Human Services/CDC/NIH	9,939,026
U.S. Department of Homeland Security	399,927
U.S. Department of Housing and Urban Development	800,000
U.S. Department of Justice	300,000
U.S. Department of the Interior	263,831
U.S. Embassy	171,944
U.S. Navy	2,250,031

TOTAL \$ 176,898,645



Awards

BY CENTER / COLLEGE / SCHOOL

Academic Affairs	\$ 547,094
Agriculture and Consumer Sciences	9,228,642
Arts and Sciences	1,734,084
Business	540,541
Center for Health Research	208,366
Center of Excellence – Information Systems	1,203,916
Center of Excellence for Learning Sciences	11,014,827
Education	2,520,836
Engineering, Technology, and Computer Science	1,091,925
Graduate Studies	23,000
Health Sciences	809,488
Massie Chair of Excellence in Environmental Engineering	1,592,770
Nursing	318,803
Office of the President	50,844
Public Service and Urban Affairs	294,018
Research and Sponsored Programs	415,787
Service Learning and Civic Engagement	1,159,760
Student Affairs	865,007
Title III	8,611,059

TOTAL \$ 42,230,767

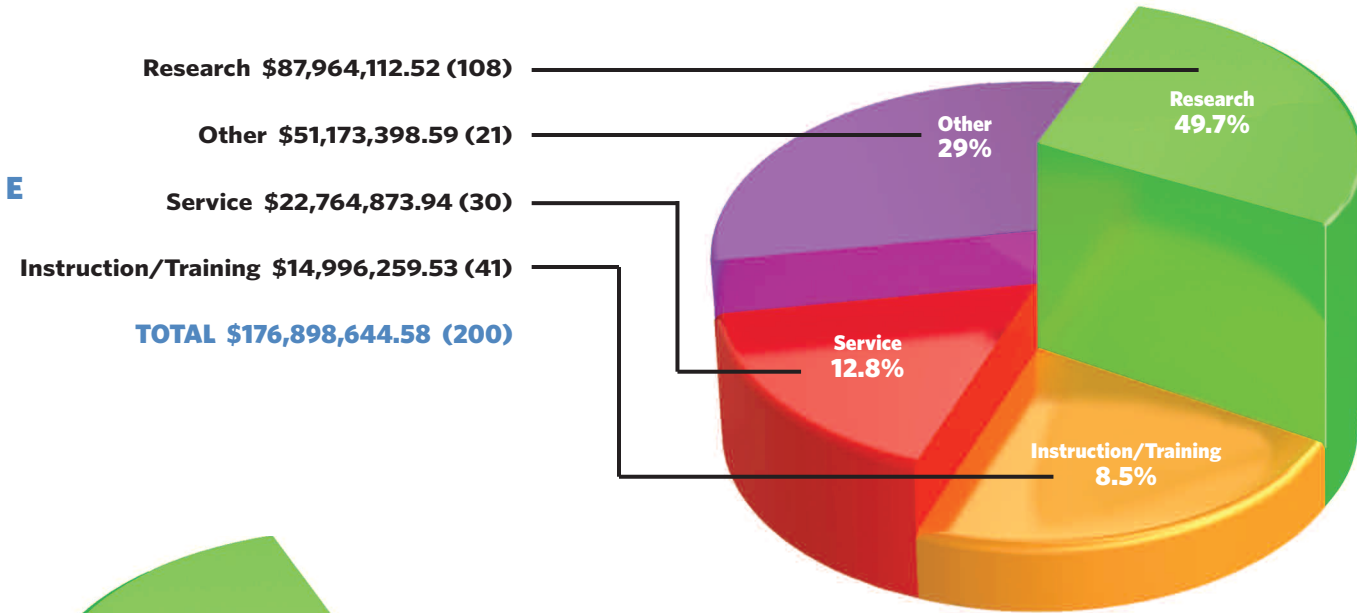
BY AGENCY / CORPORATION / FOUNDATION

Air Force Research Laboratory	\$ 309,782
Corporations	730,046
National Aeronautics and Space Administration	234,538
National Endowment for the Arts	25,000
National Geospatial Intelligence Agency	129,999
National Institute of Health	879,345
National Science Foundation	2,436,491
Private/Foundations	62,551
Tennessee State Agencies	1,306,244
U.S. Agency for International Development	10,000
U.S. Army	166,665
U.S. Department of Agriculture	9,224,642
U.S. Department of Commerce	25,000
U.S. Department of Defense	4,100
U.S. Department of Education	12,501,906
U.S. Department of Energy	850,307
U.S. Department of Health and Human Services	11,919,938
U.S. Department of Housing and Urban Development	800,000
U.S. Department of Transportation	336,718
U.S. Navy	90,000
U.S. NRC	37,000
U.S. Small Business Administration	150,495

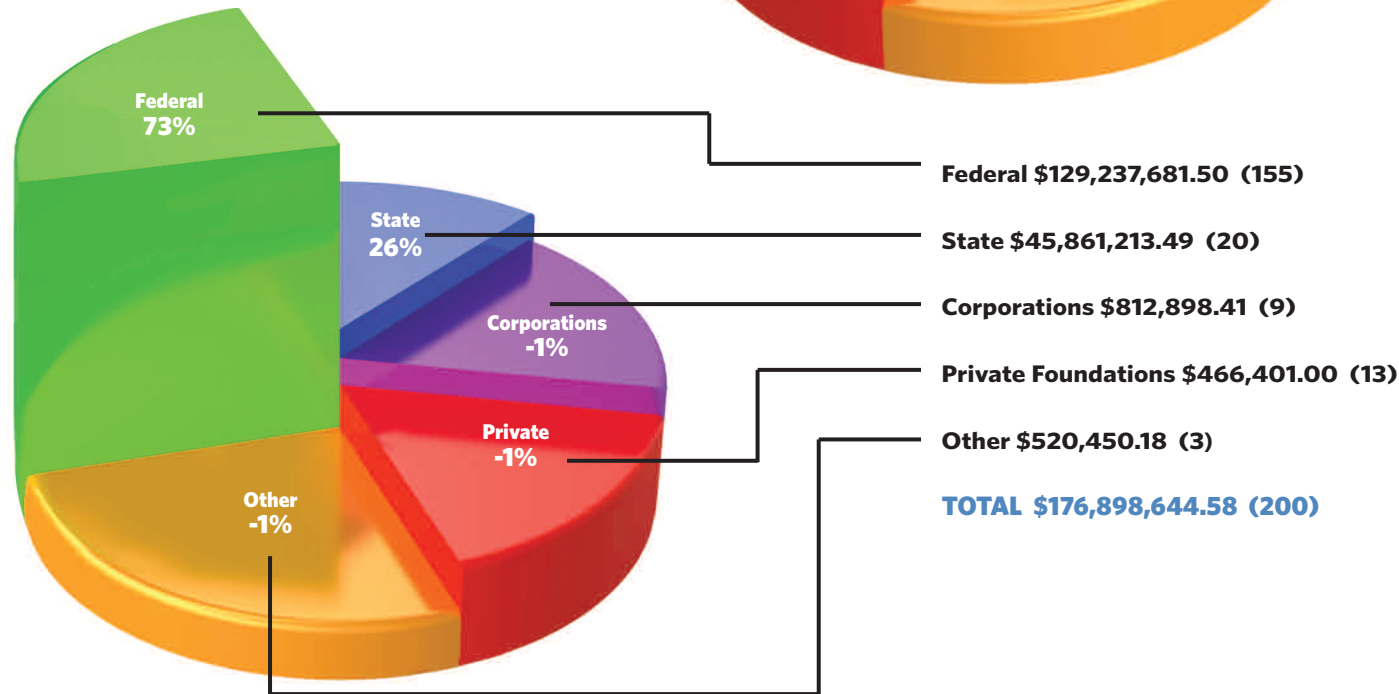
TOTAL \$ 42,230,767

Submissions

BY PROJECT TYPE

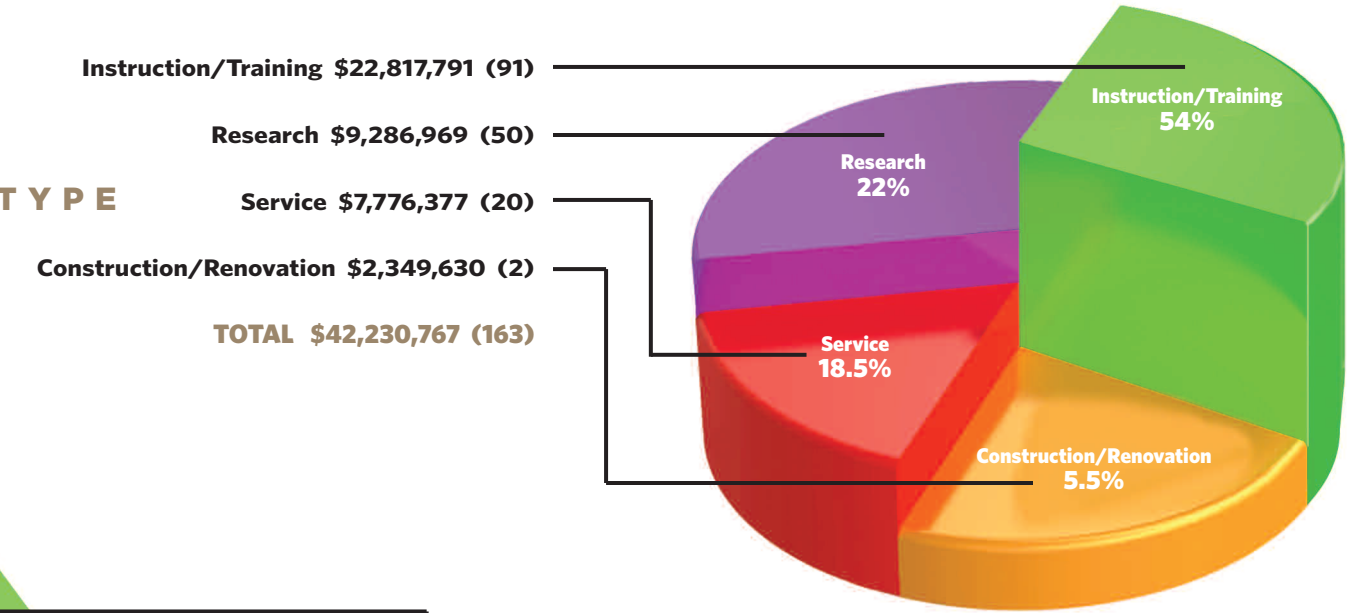


BY SOURCE



Awards

BY PROJECT TYPE



BY SOURCE

