

# *Grants Awarded Report*

**From:** 1/1/08 to 1/31/08

***Principal Investigator:*** Susan Gore, Curriculum and Instruction

***Co-PI's:***

***Support Personnel:*** Ray Jordan, Dan Combs/Biology; Julie Baker, Curriculum and Instruction; Margaret Phelps, STEM Center; Ellen Wolfe, Office of Research and Graduate Studies; Wendy Smith, Mathematics

***Project Title:*** Upper Cumberland Middle Grades Science Partnership

***Activation Amount:*** \$349,202.00

***Agency:*** Tennessee Department of Education

***Abstract:***

TTU Departments of Curriculum and Instruction, Biology, Physics, Earth Science, Chemistry, and the Oakley STEM Center proposes a middle grades science research partnership. Lebanon Special School District, Overton, and DeKalb are partners identified as "High Need." Other partners include Warren, Putnam, Smith, White, Macon, and Hamilton Counties. Fifty science middle school and special education teachers in grades 5-8 will be randomly assigned to an intervention group and 50 will be assigned to a control group. The control group will participate in all the pre/post tests and classroom observations as the intervention group; however, only the intervention group will participate in 3 two-week summer institutes aligned with state science standards and 5 follow-up professional development days that are based on district, teacher, and student needs. Teachers in the intervention and the control groups will take project developed content tests and will be observed using the LPIFA Science Classroom Observation Instrument. These data and the pre/post science achievement of their students will be compared to measure project success. This project is a controlled replication of the Cohort IV Upper Cumberland Middle Grades Mathematics Partnership. Results from this Science Partnership will be compared to the results of the Math Partnership.

**Principal Investigator:** Kenneth Hunter, Basic Engineering

**Co-PI's:** Margaret Phelps, STEM Center; Roy Loutzenheiser, Engineering Administration

**Support Personnel:** Paul Asunda, Curriculum and Instruction; Jessica Matson, Industrial and Systems Engineering; Jeffrey Austen, Electrical and Computer Engineering; Corinne Darvennes, Mechanical Engineering; Sandi Smith, Curriculum and Instruction; Holly Anthony, Curriculum and Instruction; Terry Webb, Extended Education; Ellen Wolfe, Office of Research and Graduate Studies

**Project Title:** TTU Pre-Engineering Math Science Research Partnership

**Activation Amount:** \$588,830.00

**Agency:** Tennessee Department of Education

**Abstract:**

The Tennessee Pre-Engineering Math Science Partnership Program is a comprehensive, three-year, research and professional development program for math, science, and career-technical teachers. The program is administered by the Millard Oakley Center for Teaching and Learning in Science, Technology, Engineering and Mathematics at Tennessee Tech. The program goals are to: 1) create a statewide cadre of teacher leaders for a sustainable pre-engineering program of study in grades 7-12; 2) provide teachers with the training and technology resources needed to integrate engineering principles into curricular and co-curricular programs; and 3) increase the number of students graduating from high school who are interested in and ready to pursue an engineering education. The partnership includes Tennessee Tech, Northeast State Technical Community College, the University of Tennessee at Martin, and 15-20 local education associations across Tennessee. Each partner LEA will have a four-teacher intervention team, a four-teacher control team, and a designated liaison to coordinate student data collection, testing, and evaluation activities. Each four-teacher team will consist of one middle school math or science teacher, one high school math teacher, one high school science teacher, and one career-technical teacher. Intervention teachers will attend a seven-day summer institute and four Saturday follow-up sessions each year. Instructional content includes engineering principles, the use of technology in the classroom, and field trips to engineering research centers and businesses. Teachers will assist in the development of engineering curriculum modules aligned with Tennessee students and will be trained to implement a pre-engineering certificate program for their students. Summer institutes will be held on the Tennessee Tech campus in July. Follow-up sessions will be held at regional locations in the fall and spring.

**Principal Investigator:** Robert Qiu, Manufacturing Center

**Co-PI's:**

**Support Personnel:** Nan Guo, Manufacturing Center

**Project Title:** Time-Reversal Based Range Extension Techniques for Ultra-Wideband (UWB) Sensors and Applications in Tactical Communications and Networking

**Activation Amount:** \$106,802.00

**Agency:** Office of Naval Research

**Abstract:**

The goal of this research is to develop measurable advances in UWB impulse radio technology that can directly enable and enhance the connectivity among widely dispersive naval, joint, allied and coalition forces. The proposed approach is to use a new time-reversal system paradigm for range extension. Land force operations can be characterized in any combination of dispersed or conventional operations, in the littoral environment, amphibious, and urban or other complex terrain. The adoption of the Network Centric Warfare (NCW) philosophy means that connectivity through networked communications, typically wireless for mobile operation, is of critical importance. The terrain and tactical deployment of the elements of the land force is not conducive to good wireless communications. Consequently the communication range of the radio equipment becomes a constraint in operational concepts and degrees of implementation of NCW. To overcome this range limitation, a series of communications techniques covered by the broad title "range extension techniques" are sought to directly enable and enhance the seamless, robust connectivity among "disadvantaged users". The use of UWB impulse radio for high capacity multimedia communications in urban, within buildings, and littoral environments is worthy of further research under this context. Ultrawideband (UWB) impulse radio is a revolutionary, power-limited technology for its unprecedented system bandwidth. The low emission and impulsive nature of UWB radio leads to enhanced security in communications. Good through-wall penetration capability makes UWB systems suitable for hostile, indoor environments. UWB impulse radio can be potentially implemented with extremely low-cost (sub-one dollar) and low-power (battery driven) consumption components. Time-hopping can be used to provide its robustness to interference. UWB systems are immune to fading (more reliable to use) as compared with narrowband systems, since the high resolution of short pulses (sub-nanosecond) leads to almost static channels with a large number of resolvable paths that are challenges to others but can be exploited by the proposed new techniques; this feature is relevant to "disadvantaged platforms and sensors" (e.g., small-deck combatants and dispersed ground units) in RF challenged environments of dense multipath in the presence of buildings and obstacles. Therefore, UWB impulse radio represents a secure solution to robust and extremely energy-efficient sensor networking (REEESN) for both unattended ground sensors and floating surveillance sensors in urban and littoral environments. Within buildings the-state-of-the-art is the capability to support a bit-rate of Mbps over distances of tens of meters. The most pressing challenge is, however, how to reduce the transceiver complexity of coherent reception. The proposed system paradigm uses time-reversal with noncoherent detection as an alternative to coherent reception. It exploits the hostile, rich-multipath channel as part of the receiver chain. This new method also combines time-reversal with MIMO, the most promising approach to use spectrum and transmission power. As a result, time-reversal trades the huge bandwidth of UWB radio and the high power efficiency of MIMO for the noncoherent detection of extremely low cost. This proposed new system paradigm is to take advantage of the impulsive nature of UWB signals. The new dimension of impulsive time-reversal adds more degrees of freedom in exploiting the spatiotemporal dimensions. The proposed system framework can potentially be a solution to the pressing problem of range extension for UWB sensors. The proposed research will potentially lead to revolutionary breakthroughs in many branches such as the wireless industry, UWB radar and sensors, underwater acoustics, remote sensing, and image-guided therapy and surgery.

**Principal Investigator:** Susan Elkins, Extended Education

**Co-PI's:** David Huddleston, Engineering Administration; Margaret Phelps, STEM Center; Kenneth Hunter, Basic Engineering

**Support Personnel:** Roy Loutzenheiser, Engineering Administration

**Project Title:** P-16 Outreach Partnerships: Increasing Diversity and Enrollment in Engineering and STEM Disciplines

**Activation Amount:** \$50,000.00

**Agency:** Tennessee Board of Regents

**Abstract:**

**Principal Investigator:** Ghadir Radman, Electrical and Computer Engineering

**Co-PI's:**

**Support Personnel:**

**Project Title:** Proposed Collaborative Research Between TVA and TTU and Graduate Student Support

**Activation Amount:** \$55,134.00

**Agency:** Tennessee Valley Authority

**Abstract:**

A graduate student with the potential of being employed by the Tennessee Valley Authority (TVA) would work toward his/her masters degree (two-year program) with the project director. The research topic for the student would be of interest to TVA and identified in consultation with the Transmission Planning Group within TVA. The student will be expected to visit TVA on a few occasions during the first two semesters in which he/she is taking a full course load. For the remainder of his/her two-year program in which the student is working full-time on the thesis topic, he/she would be available to travel to TVA as many times as needed.

**Principal Investigator:** Helen Dainty, Curriculum and Instruction

**Co-PI's:**

**Support Personnel:** Anthony Baker, English; Jane Baker, Curriculum and Instruction; Laura Graves, Curriculum and Instruction; Richard Bumbalough, Curriculum and Instruction

**Project Title:** ITQ Picture This: Even More Success for Students with Autism when Special and General Educators Collaborate

**Activation Amount:** \$57,500.00

**Agency:** Tennessee Higher Education Commission

**Abstract:**

Teachers who participate in "Picture This: Success for Teachers and their Students with Autism" will be asked to invite either a general educator or special educator to join them in the "Picture This: Even More Success for Students with Autism when Special and General Educators Collaborate" workshop. The general educators will be asked to recruit the special education teacher with whom they work and vice versa. The teachers will learn about autism, be given research-based strategies for teaching students with autism, and learn about effective collaborative practices. The new participants will receive approximately 14 hours of instructional and interactive sessions on content knowledge, pedagogical skills, and professional disposition for working effectively with children who have autism. Teachers will learn about autism and how to create daily and individual picture schedules, academic narratives, social stories, and accommodate and/or modify for students with autism. The main areas of concentration will be communication in language arts and math. The returning participants will study autism more in depth, especially in use of the Picture Exchange Communication System (PECS) and the Ziggurat model for approximately 14 hours. The remaining 14 hours will involve collaborative activities and effective practices. It is a goal of this workshop that teachers will learn effective collaborative practices and continue collaboration within their LEA and respective schools as well as increase the awareness and utilization of best and effective practices for teaching children with autism. In the fall the teachers will be asked to participate in a two-hour workshop where ideas will be shared with other interested teachers.

***Principal Investigator:*** Holly Anthony, Curriculum and Instruction

***Co-PI's:***

***Support Personnel:*** Wendy Smith, David Smith, Kristin Gooch/Mathematics

***Project Title:*** ITQ-Developing Algebraic Reasoning in Grades 3-5 Classrooms

***Activation Amount:*** \$70,000.00

***Agency:*** Tennessee Higher Education Commission

***Abstract:***

This project provides a 5-day summer institute focused on developing algebraic reasoning in Grades 3-5. The goal of the summer institute is to provide activities and strategies for developing student's algebraic reasoning skills in preparation for pre-algebraic concepts in the middle school. The institute will emphasize the development of algebraic content via investigations, problem solving, hands-on and group activities, and use of manipulatives. Participant teachers will receive manipulatives, books, and standards-aligned lessons to use in their teaching of mathematics. A follow-up day in August 2008 will provide a forum for teachers to showcase how they will use materials/content from the summer in their teaching in the 2008-09 school year.

***Principal Investigator:*** Shannon Collins, Curriculum and Instruction

***Co-PI's:*** Anthony Baker, English

***Support Personnel:***

***Project Title:*** ITQ-Write On! Developing Teachers of Writers and Readers

***Activation Amount:*** \$54,000.00

***Agency:*** Tennessee Higher Education Commission

***Abstract:***

***Principal Investigator:*** Hugh Mills, Earth Sciences

***Co-PI's:*** Evan Hart, Peter Li/Earth Sciences

***Support Personnel:***

***Project Title:*** Cookeville Sinkhole Flood Plain Map Project

***Activation Amount:*** \$42,500.00

***Agency:*** City of Cookeville

***Abstract:***

***Principal Investigator:*** Kenneth Hunter, Basic Engineering

***Co-PI's:***

***Support Personnel:*** Anabelle Frink, Extended Education; Martha Wells, Water Center

***Project Title:*** Governor's School for Emerging Technologies

***Activation Amount:*** \$180,000.00

***Agency:*** Tennessee Department of Education

***Abstract:***

The Governor's School for Emerging Technologies, hosted by the Office of Extended Programs and Regional Development at Tennessee Technological University, is a summer enrichment program for rising high school juniors and seniors designed to stimulate interest in science, technology, engineering and mathematics through the study of current topics in biotechnology, nanotechnology, information technology, and other emerging technologies. The school capitalizes on partnerships with a unique array of high technology research and development organizations located across the state of Tennessee to provide students with the opportunity to learn from leading researchers and experience cutting-edge research facilities through weekly field trips. Previous partners for summer enrichment programs have included Oak Ridge Associated Universities, Oak Ridge National Laboratory, Vanderbilt Institute for Nanoscale Science and Engineering (VINSE) at Vanderbilt University, Arnold Engineering and Development Center, and the University of Tennessee Space Institute. One the Tennessee Tech campus, students engage in traditional classes, discussions, laboratory exercises, seminars, team projects, individual classes, and individual research projects. Students also develop and maintain an electronic portfolio of their work and may earn a total of six college credits in introduction to engineering, computer programming, and a new emerging technologies course. The program is also designed to provide students with a complete college experience. Students reside in a university residence hall, dine in the university cafeteria, and have access to university recreational facilities. The Governor's School for Emerging Technologies is funded by the Tennessee Department of Education and Tennessee Tech University.

***Principal Investigator:*** Ferdinand Difurio, Economics, Finance and Marketing

***Co-PI's:*** Kenneth Wiant, Steven Isbell/Economics, Finance and Marketing

***Support Personnel:***

***Project Title:*** Life Cycle Cost Analysis-Independent Review

***Activation Amount:*** \$19,845.00

***Agency:*** Babcock & Wilcox Technical Services Y-12, LLC (via DOE)

***Abstract:***

This project will provide an independent review of a life cycle cost analysis for a processing facility. The project requirements include analyzing the economic model used, validating assumptions, verifying appropriate rates, etc.

***Principal Investigator:*** Kevin Liska, Business Media Center

***Co-PI's:***

***Support Personnel:***

***Project Title:*** Post-Katrina Marketing for Southern University of New Orleans

***Activation Amount:*** \$24,990.00

***Agency:*** State of Louisiana

***Abstract:***

Develop and assist Southern University of New Orleans with mission critical marketing for the University and the new E-Learning Department. This project is a direct result of Hurricane Katrina and the devastation it caused to SUNO. TTU is providing valuable assistance that has been nationally recognized as a key factor in the rebuilding of SUNO.

***Principal Investigator:*** Hayden Mattingly, Biology

***Co-PI's:***

***Support Personnel:***

***Project Title:*** Population Status and Monitoring of the Imperiled Barrens Topminnow, *Fundulus julisia*, 2007-2009

***Activation Amount:*** \$6,000.00

***Agency:*** Tennessee Wildlife Resources Agency

***Abstract:***

***Principal Investigator:*** Daniel Combs, Biology

***Co-PI's:***

***Support Personnel:***

***Project Title:*** Distribution, Status, and Species-Habitat Relationships of the Green Salamander, *Aneides aeneus*

***Activation Amount:*** \$20,000.00

***Agency:*** Tennessee Wildlife Resources Agency

***Abstract:***