Oak Ridge National Laboratory

Oak Ridge National Laboratory (ORNL), born as part of the Manhattan Project in 1943, was established in the dark days of World War II when American scientists feared that Germany was rapidly developing a new weapon of unimaginable power. From this, ORNL scientists developed the world's first sustained nuclear reaction, leading to the atomic bomb that ended the war. ORNL's involvement with nuclear weapons ended after the war. The laboratory's scientific expertise shifted in the 1950s and 1960s to peacetime research in medicine, biology, materials, and physics. Following the creation of the Department of Energy in 1977, ORNL's missions broadened to include research in energy production, transmission, and consumption. As the laboratory entered the 21st Century, new cross-disciplinary programs in nanophase materials, computation sciences, and biology led to the term "nano-info-bio" to describe the emerging synthesis in ORNL's research agenda. Managed today by the University of Tennessee and Battelle Memorial Institute, with an annual budget of $1.3 billion, ORNL is the Department of Energy's largest multi-purpose laboratory.

ORNL's mission supports six scientific themes:
- Biological Systems: Whether converting biomass to fuel or understanding the impacts of climate change, biological research at ORNL is helping develop new options for energy, environmental protection, and human health.
- Neutron Science: The Spallation Neutron Source and the High Flux Isotope Reactor together make ORNL the world's foremost center for neutron science.
- Advanced Materials: With DOE's first Nanoscience Center, the world's most powerful electronic microscope, and High Temperature Materials Laboratory, ORNL plays a critical role in American industrial competitiveness.
- National Security: From biochemical sensors to stopping the proliferation of nuclear weapons, technologies that make Americas safer are among the laboratory's top research priorities.
- High Performance Computing: With unmatched computational capacity for open scientific research, ORNL is on a path by 2009 to reach a petaflop, one quadrillion mathematical calculations per second, making it possible to model the most complex scientific problems.
- Energy: Increased production, improved transmission, reduced consumption – ORNL is addressing our energy challenges on all fronts, from safer nuclear power to more energy-efficient cars and homes.

ORNL is nearing completion of the largest modernization program in the laboratory's 65-year history. Since 2002 ORNL has constructed more than 1.2 million square feet of state-of-the-art and efficient office, laboratory, and support facilities. A unique combination of federal, state, and private funds made possible the accelerated construction of 13 new buildings that were instrumental in the recruitment of world-class talent. These state-of-the-art facilities were also used to leverage successful competitions for major new research programs in bioenergy, nanoscience, and high-performance computing. Some of these new facilities have been designated as "user facilities" by the U.S. Department of Energy. These user facilities give industry and universities access to expensive, unique, sophisticated facilities and equipment at ORNL. These facilities are used by scientists from ORNL, industry, academia and other national laboratories.   A listing of these facilities is below:

- Bioprocessing Research Facility
- Buildings Technology Center

- Californium User Facility for Neutron Science
- Center for Nanophase Materials Sciences
- Cooling, Heating and Power Integration Laboratory
- Fuels, Engines, and Emissions Research Center
- High Flux Isotope Reactor
- High Temperature Materials Laboratory
- Holifield Radioactive Ion Beam Facility
- Metals-Processing Laboratory Users Facility
- Mouse Genetics Research Facility
- National Center for Computational Sciences
- National Transportation Research Center
- Oak Ridge Electron Linear Accelerator
- Power Electronics and Electric Machinery Research Facility
- Safeguards Laboratory National User Facility
- Shared Research Equipment Collaborative Research Center
- Spallation Neutron Source

The National Security Directorate at ORNL has a wide array of technologies and capabilities in the areas of advanced materials, chemical and biological detection, mass spectroscopy, modeling and simulations, personal protection, sensors, and software development. Below is a sampling of programs relevant to homeland security.

- **Southeast Region Research Initiative (SERRI):** SERRI's key objective is to assist local, state and regional leaders within the Southeast Region in developing tools and methods required to anticipate and deter terrorist events and to enhance disaster response.
- **Community and Regional Resilience Initiative (CARRI)**: CARRI is a program of the Congressionally-funded SERRI program. CARRI is a regional program with national implications for how communities and regions prepare for, respond to and recover from catastrophic events. CARRI will develop the processes and tools with which communities and regions can better prepare to withstand the effects of natural and man-made disasters. In its first year, CARRI will create a standard for community resilience that is accurate, defensible, welcomed, and applicable to communities across the region and the nation.
- **Protective Security Analysis Capabilities (PSAC):** PSAC's key objective is to take in critical infrastructure and key resources (CI/KR) information from the private sector, state, local authorities, and other Federal agencies. The information will be used to conduct analysis and integrate analytical processes from a variety of program efforts, and ensure an end product that maps risk against CI/KR stakeholders' capabilities. There are three main initiatives:
  - Chemical Security Assessment Tool (CSAT)
  - TRIPwire Field Tool
  - Land Scan

ORNL has a proven track record of producing top-notch scientists through award winning science.
- Nobel Prize: Clifford Shull for his development of neutron-scattering techniques

- Fermi Awards: one of America's oldest and most prestigious science and technology awards given by the U.S. Government – ORNL has seven Enrico Fermi Award recipients.
- PECASE: The Presidential Early Career Award for Scientists and Engineers recognizes the nation's outstanding young researchers. ORNL's researchers have received 12 PECASE awards.
- R&D Awards: R&D 100 awards are given annually to scientists and engineers on the cutting edge of technological innovation. ORNL ranks first among Departement of Energy laboratories and second among all laboratories in the number of R&D 100 awards.

Projects Available

Decision Engineering Group, Energy and Transportation Science Division

The Decision Engineering Group consists of staff members who develop integrated inter-modal transportation solutions through innovative and cost-effective research and development. The group's activities encompass transportation energy and environmental concerns, safety and security challenges, planning and policy issues, systems engineering, military transportation, supply chain management, and freight systems. The group develops systems for air, highway, maritime, rail, and multimodal transportation. The Group's research and development work has contributed to the secure, efficient, safe, and free movement of people and goods in the United States. Specific expertise in the group includes transportation engineering, data acquisition and analysis, simulation, optimization, GIS, software engineering, and knowledge management.

Responsibilities & Qualifications: The selected candidate should have training and experience in transportation network modeling, .NET programming, and SQL server skills, and must have demonstrated experience in applications development. The selected candidate will conduct research and development in the areas of transportation security, transportation planning, GIS, and simulation-based analysis. The candidate will design and develop algorithms, software, simulations, and application interfaces. The candidate will work with researchers in the Decision Engineering Group, throughout the Energy and Transportation Science Division, and across ORNL. The candidate will interface with the U.S. Department of Energy (USDOE), Department of Homeland Security, other federal agencies, and other existing and potential customers, sponsors, and collaborative partners. The candidate will also be expected to participate and make presentations at technical conferences associated with professional societies and support the publication of original work in peer-reviewed journals. Over the long term, the candidate will be expected to lead research and development project teams and work directly with sponsors.

The position requires a Ph.D. in computer science or an equivalent combination of education and experience. The candidate must have a working knowledge of Visual Basic .NET and C++. The candidate must have excellent writing skills for preparing reports, proposals, and publications/journal articles, and possess excellent communication skills to effectively give presentations as well as to interface with project sponsors and project teams. The candidate must possess the desire to work in a team environment on technically challenging projects involving national and international security and transportation system infrastructure. The candidate will maintain a strong commitment to the adherence to and demonstration of a high level of technical and scientific integrity. The candidate must be a self-starter who knows how to learn and is interested in broadening his/her knowledge.

Contact: Dr. Rekha Pillai, Group Leader, Decision Engineering Group, (865) 576-5324, pillairs@ornl.gov

Sensor Science and Technology Group, Measurement Science & Systems Engineering Division

Research on Micro/Nano-structured Materials for Sensors

The Oak Ridge National Laboratory, Measurement Science & Systems Engineering Division (MSSED) engages in the conception, design, development and demonstration of advanced sensors and measurement technologies to support missions of national importance. The MSSED has developed micro/nano-fabrication techniques capable of enabling unbiquitous unmanned multi-sensor networks (UNMs). UNMs are applicable to large-scale security applications such as boarder protection, ellicit material identification, tracking and interdiction measures and explosive detection. A successful candidate will participate in the design, fabrication and testing of advanced sensor system concepts.

Contact: Timothy J. McIntyre, Leader, Sensor Science and Technology Group
Measurement Science and Systems Engineering Division
Phone: (865) 576-5402
E-mail: mcintyretj@ornl.gov

Southeast Region Research Initiative

Background: The Southeast Region Research Initiative (SERRI) is a ground breaking program managed by Oak Ridge National Laboratory (ORNL) for the US Department of Homeland Security to assist local, state and tribal leaders in developing the tools and methods required to anticipate and forestall terrorist events and to enhance disaster response. SERRI combines science and technology with validated operational approaches to address regionally unique requirements and suggest regional solutions with potential national implications. SERRI's regional approach capitalizes on the inherent power resident in the Southeast US. The partnership of ORNL, the Nation's largest multi-purpose scientific laboratory, the Y-12 National Nuclear Security Agency Site and the Savannah River National Laboratory all tightly linked to the full spectrum of regional and national research universities provides a window into cutting-edge science and technology development unmatched by any other homeland security organization and allows the creation of technology based programs that enable regional leaders and organizations to address user defined homeland security and emergency preparedness challenges. The long history of regional collaboration in natural disaster response, economic development and inter-governmental agreement provides in-place vehicles for regional cooperation. The robust cross-section of homeland security environments, recurrent natural disasters, large cities and sparsely settled rural areas, major ports and rivers, critical power and transportation infrastructure – creates a ready-made test bed for science and technology and an incubator for best practices development, dissemination and codification. SERRI sponsored research leverages world-class regional research universities with the power of the national laboratory system to identify science and technology solutions to user identified challenges. But laboratory research is only one part of the answer. As importantly, SERRI builds a pathway from the laboratory to the user for each research project completing the cycle of requirement to fielded solution in the shortest time possible. Program imperatives include a regional and local homeland security focus and research results that culminate in integrated product development with a clear path to usability and interoperability across the region. The SERRI web site is at www.serri.org.

Specific SERRI Project Description for Post-Doctoral Fellowship Opportunity: Oak Ridge National Laboratory's (ORNL) Community and Regional Resilience Initiative (CARRI) is a program of the Congressionally-funded Southeast Region Research Initiative. CARRI has a post doctoral opportunity for a Public Policy Research Analyst to collaboratively develop, synthesize and test the processes, tools, and policy frameworks with which communities and regions can better prepare to withstand the effects of natural and man-made disasters. This development will use studies and analysis from CARRI's partner communities and researchers.

From its beginning, CARRI has been designed to combine community engagement activities with research activities. Resilient communities are the objective but research is critical to ensure that CARRI's understanding is based on knowledge and evidence. A network of private businesses, government agencies and non-governmental associations is critical to the CARRI research and engagement process and provides CARRI the valuable information necessary to ensure that we remain on the right path. Frequent conversation with business leaders, government officials and volunteer organizations provide a bottom up knowledge from practitioners and stakeholders with real-world, on-the-ground, experience. To help with this

research, CARRI has commissioned a series of summaries of the current state of resilience knowledge by leading experts in the field. In conjunction with this project CARRI is working with three partner communities: Gulfport, Mississippi; Charleston, South Carolina; and Memphis, Tennessee. These partner communities are helping CARRI define community resilience and test it at the community level. In addition to its partner communities and national and local research teams, CARRI has established a robust social network of private businesses, government agencies and non-governmental associations. Of critical importance, CARRI will demonstrate that resilient communities gain economically from resilience investments

The postdoctoral fellow will use input from the partner communities, lessons learned from around the nation, and the guidance of ORNL-convened researchers who are experts in the diverse disciplines that comprise resilience, to collaboratively develop a community resilience framework outlining processes and tools that communities can use to become more resilient.

This project is designed to synthesize and test the findings and evidence developed through the commissioned series of summaries. This synthesis will develop hypotheses and test the skill of the models.

This project is a program which may result in both internal reports and peer-reviewed manuscripts. The fellow will concurrently initiate planning for projects to provide a framework to generalize the results to other communities. The CARRI web site is at www.resilientus.org

Mentor Contact Information: Steven Fernandez, PhD (fernandezsj@ornl.gov, 865-576-3565)