



Bringing the
Science and
Engineering of
Electronics,
Sensors, and
Systems to the
Nation

Purpose: The MSSE Division performs research and development in measurement science associated with electronics; sensors; signals; patterns; informatics; communications; and the development of unique, integrated systems.

Sponsors: We provide applied scientific and engineering R&D for DOE, other federal and international agencies, and U.S. industry.

Features: More than 170 research and support staff with degrees in the engineering and physical sciences working in

- Microelectronic Systems Research
- RF, Communications, and Intelligent Systems
- Imaging, Signals, and Machine Learning
- Nanosystems & Structures
- Sensors and Controls Research
- Dynamic Systems Analysis and Simulation
- Electronic and Embedded Systems
- Robotics & Energetic Systems.

Research Facilities: Currently maintain more than 45,000 ft² of laboratory space including 5,658 ft² of clean room facilities.

- Electronics
- Sensors
- Photonics
- Communications
- Controls
- Systems Testing



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Overview of the Measurement Science and Systems Engineering Division

The Measurement Science and Systems Engineering (MSSE) Division at the Oak Ridge National Laboratory performs applied research and development in nationally relevant areas of energy security. Within ORNL, the mission of MSSE is to provide pathways for the translation of basic science to engineering applications. This is accomplished through the creation and realization of foundational capabilities and technologies in electronics, sensors, signals, and integrated systems. Our research agenda for science and technology (S&T) today is focused on energy efficiency, reliability, and sustainability, and environmental impact along with significant effort in national defense, homeland security, and international safeguards to counter nuclear proliferation and terrorism.

R&D Capabilities

The division's 170 research, technical, and administrative staff members are organized into eight technology-focused groups that specialize in R&D related to the creation, testing, integration, and application of S&T that support measurements and the consumption of measurements using appropriate modes of sensing at various spatial and temporal scales in a wide variety of physical environments. In general, we maintain core capabilities in three broad areas of R&D,

- **Electronics Research** - Embedded, micro-controlled instruments, custom analog and digital circuits/systems, RF/microwave systems, communication techniques
- **Sensors and Signals Research** - Functional materials, MEMS/NEMS, radiation sensors, sensor integration, signal conditioning, and machine learning

- **Integrated Systems Research** - system modeling and simulation, controls and actuation, communications systems, qualification testing, standards development and implementation.

Center for Instrumentation Testing and Standards

MSSE maintains more than 45,000 ft² of research laboratories, including 5,658 ft² of clean room facilities (e.g., Fig. 1). These laboratories form the core of our *Center for Instrumentation Testing and Standards* and span the range of instrument systems and subsystems developed for our many sponsors.



Fig. 1. Nanoscience, Engineering, and Technology Laboratory and associated SEM facility.

The center includes the following facilities and capabilities:

- Technical Testing and Analysis Center (TTAC)
- Sensor Integration Laboratory
- Extreme Measurement Communications Laboratory
- Optical Characterization Laboratory
- Neutron Imaging Instruments at HFIR and SNS

- Nuclear Sensors and Measurement Systems Laboratory
- Signal Solution Center (S2C)

Partnerships

The MSSE Division works closely with a number of ORNL facilities, research organizations, industries, and universities around the world including the following,

- **The Global Security Directorate (GSD)** has a mission to provide federal, state, and local government agencies and departments with the technology and expertise required to support national and homeland security needs. GSD achieves its primary missions by leveraging the science and technology capabilities of organizations like MSSE.
- **A wide variety of Department of Energy (DOE) Programs and Program Offices** impacting energy efficiency and electricity, energy materials, global security and nonproliferation, nuclear technology, and transportation (see Fig. 2).
- **The Center for Nanophase Materials Sciences** is a collaborative nanoscience user research facility for the synthesis, characterization, theory/modeling/ simulation, and design of nanoscale materials.
- **The Spallation Neutron Source** is an accelerator-based neutron source and user facility providing neutron scattering and imaging techniques for studying the structure and dynamics of materials.
- **United States Enrichment Corporation (USEC)**, Oak Ridge, Tennessee, is working with ORNL to develop USEC's next-generation uranium enrichment process based on U.S. centrifuge technology (see Fig. 3).

Partnering with MSSE provides collaborative opportunities to pursue programs and projects of various scales and complexity that address some of the most challenging science and engineering problems facing the nation today. Through strategic partnerships on a wide range of S&T efforts, MSSE has developed significant experience and capabilities that it brings to new partnerships and customers to make the nation and the world energy efficient, safe, and healthy.

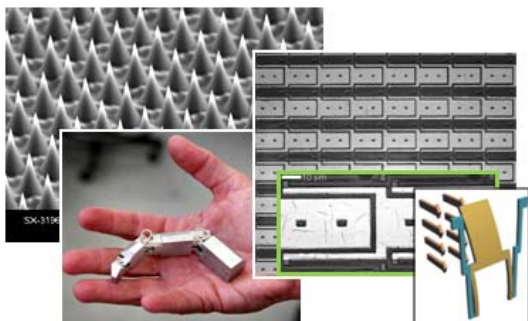


Fig. 2. Examples of functional nanomaterials (left), mesofluidic actuators (middle), and MEMS array (right).



Fig. 3. Centrifuge test stand at the USEC R&D Center in Oak Ridge, Tennessee.

Contact Information

For additional information about partnering with the MSSE Division, please contact

Kenneth W. Tobin, Ph.D.
Director/Corporate Research Fellow
Measurement Science and Systems Engineering Division
Oak Ridge National Laboratory
P.O. Box 2008, Bldg. 5700, MS 6168
Oak Ridge, TN 37831-6168
Phone: 865-574-0355
Email: tobinkwjr@ornl.gov
Fax: 865-576-7671

Assistant: Linda Stansberry
Phone: 865-574-0355
Email: stansberryl@ornl.gov