



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

**Purpose:** The MSSE Division was formed to perform 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 130 research and support staff with degrees in the engineering and physical sciences working in

- Analog and digital electronics.
- Signal and image analysis.
- RF and microwave systems.
- Nanosystems and sensors.
- Robotics and energetic systems.
- Dynamic systems.
- Systems integration and engineering.

**Research Facilities:** Currently maintain more than 45,000 ft<sup>2</sup> of laboratory space including 5,658 ft<sup>2</sup> of clean room facilities.

- MEMS, NEMS, radiation, and other sensor modalities.
- Electronic device development and testing.
- Microscopy development.
- Environmental testing and analysis.



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## Overview of the Measurement Science and Systems Engineering Division

The Measurement Science and Systems Engineering (MSSE) Division was formed at the Oak Ridge National Laboratory (ORNL) in March of 2008. Although the division is relatively new, our resources, including the talent, expertise, and capabilities of our staff, encompass more than 60 years of electronics, instrumentation, controls, and systems research and development (R&D) at ORNL. Today, we provide a unique blend of applied science and engineering in measurement, sensing, signals, communications, robotics, and integrated systems that help bridge the gap between basic research and the practical implementation of new technologies. These technologies address our research portfolio in the areas of

- Energy research.
- National security.
- Biomedical engineering.
- U.S. competitiveness.
- Basic science.

### Capabilities

The division's 130 research, technical, and administrative staff members are organized into nine technology-focused groups that specialize in R&D related to the creation, testing, integration, and application of science and technology (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:

- Analog and Digital Systems.
- Dynamic Systems.
- Image Science and Machine Vision.
- Monolithic Systems Development.

- Nanosystems and Structures.
- Real-Time Systems.
- RF and Microwave Systems.
- Robotics and Energetic Systems.
- Sensors and Controls Research.

Within the ORNL research environment, MSSE provides an important pathway for the translation of basic science into engineering and technology applications. Our core competencies include capabilities in electronics, photonics, sensors, systems, models, and methods that interface science and engineering to produce technology solutions.

### Research Facilities

MSSE maintains more than 45,000 ft<sup>2</sup> of research laboratories, including 5,658 ft<sup>2</sup> of clean room facilities (e.g., Fig. 1). These laboratories contain semiconductor production systems, measurement and characterization tools, environmental test equipment, robotics systems, and optical and



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

scanning electron microscopes for both S&T development and materials and device testing.

## Partnerships

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

- **The National Security Directorate (NSD)** 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. NSD 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, fusion energy science, 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).



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

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

## 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](mailto:tobinkwjr@ornl.gov)  
Fax: 865-576-7671

Assistant: Linda Stansberry  
Phone: 865-574-0355  
Email: [stansberryl@ornl.gov](mailto:stansberryl@ornl.gov)

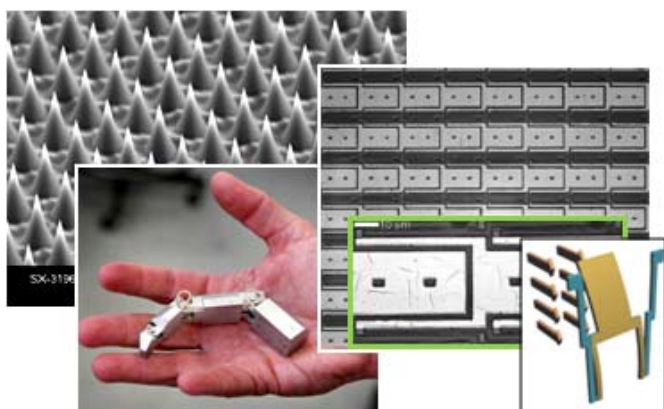


Fig. 2. Examples of functional nanomaterials (left), mesofluidic actuators (middle), and MEMS array (right).