

# ELECTROSCIENCE LABORATORY

The ElectroScience Laboratory (ESL) is a premier center focused on all aspects of electromagnetics and radio frequency (RF) systems, including remote sensing, radar systems, sensors and sensor fusion, antennas, mixed-signal integrated circuits, terahertz, millimeter waves, optics and photonics. Established in 1942, it is one of the oldest and largest electromagnetics laboratories in the United States. ESL employs nearly 170 faculty, researchers and students, and encompasses more than 60,000 square feet of laboratory and work space, including state-of-the-art measurement and computational facilities.

## RESEARCH AREAS

ESL has consistently maintained a national and international presence in electromagnetics and RF systems. Our faculty, research scientists and students are involved in all aspects of electromagnetics and RF technologies, including advancements in:

- Antenna development and characterization
- Remote sensing using microwave radiometry
- Radar systems, including cognitive radar and passive radar
- Global Navigation Satellite Systems (GNSS)
- Interference suppression
- Integrated photonics
- Sensor fusion and RFIDs
- Mixed-Signal integrated circuits
- Trusted microelectronics
- THz imaging and millimeter wave communication
- Satellite and ultra-wide bandwidth communication

Our researchers are also pursuing a variety of emerging technologies, including:

- Nano-technology and microsystems
- Biological electromagnetics
- Medical sensing and neurosensing
- Multi-physics engineering
- Micro-devices and reconfigurable systems
- Navigation and guidance



## FACILITIES AND CAPABILITIES

ESL features a 60,000-square-foot electromagnetics and radio frequency research facility. ESL is home to the largest academic anechoic chamber, measuring 60 feet by 40 feet by 20 feet, which is considered one of the finest compact ranges in the world and operates from 400 MHz up to 100 GHz. It has sensitivity down to  $-100$  dBm and can measure antenna patterns with 100 dB dynamic range. Our facilities also include:

- Remote Sensing Lab with specialized equipment for L-band and C-band Radiometer and a 37 channel, 2 to 18 GHz radiometer
- Integrated Optics Lab for fabrication, testing and measurement of planar lightwave circuits
- Cognitive sensing and MIMO radar labs
- Textile and wearable electronics lab
- Mixed-Signal Integrated Circuits Lab for evaluating application-specific integrated circuits (ASICs)
- Polymer manufacturing and printing capability—this novel printing procedure allows for printing on flexible substrates for 3-D integrated microwave designs
- RF/microwave vector analyzers from 10MHz up to 110GHz
- Extensive computational tools, both developed in-house and commercially, for large-scale modeling of antennas, arrays and complex scattering scenes.
- Outdoor facility dedicated to automotive RF measurements for antennas and EMI/EMC
- Millimeter wave and RF integrated circuits (RFIC) labs
- Terahertz laboratory for imaging spectroscopy, devices & method characterization from 60GHz up to 3THz





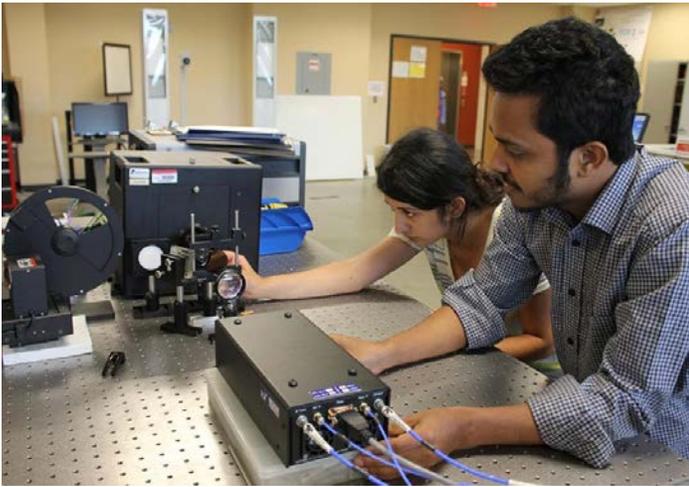
## Consortium on the Electromagnetics and Radio Frequencies (CERF)

Faculty and researchers at the ESL share their expertise with employees of the U.S.-based RF industry via the Consortium on Electromagnetics and Radio Frequencies. Under this consortium, member companies have access to state-of-the-art facilities, and faculty and student researchers provide specialty training courses (ESL Short Courses) tailored to member needs. Annual technical industry meetings are held to further cultivate research relationships with consortium members and to share latest research findings between members. Learn more:

[electroscience.osu.edu/cerf](http://electroscience.osu.edu/cerf)

## STUDENT TRAINING

While centering on all aspects of electromagnetics and RF systems, ESL is a cross-disciplinary center integrating research in electrical engineering, materials science, mechanical engineering and medical sciences. ESL has maintained a high ratio of U.S. citizens among its student population and has graduated more than 1,000 PhD and master's students since its inception in 1942.



## Hyperspectral Engine Lab for Integrated Optical Systems (HELIOS)

HELIOS provides access to high-end measurement and research in multispectral measurements up to 3 terahertz. Through HELIOS, researchers aim to develop smaller, faster and lower power terahertz devices. HELIOS' research focus areas include terahertz wave imaging, active monitoring of electronics chips and pharmaceutical products for purity and quality control on the production line, diagnosing skin hydration for a variety of medical and cosmetic applications, and the next generation of radio frequency integrated circuits for high data rate proximity communications. Learn more: [helios.osu.edu](http://helios.osu.edu)

## PARTNERSHIPS

ESL promotes and engages research partnerships with well-known defense and commercial companies. In addition, ESL has consistently maintained strong interactions with government labs and federally funded research and development center commercial sectors. Our faculty and researchers also work with small companies and start-ups through STTR/SBIR programs and consortiums. Through these collaborations, faculty and student researchers engage in technology transfer activities while our partners receive access to the state-of-the-art experimental facilities.

## CONTACTS

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