The ElectroScience Laboratory is a premier center focused on all aspects of wireless communications and electro-optics, including remote sensing, radar signal processing, sensors and sensor fusion, antennas, radio frequency (RF) integrated circuits, terahertz, millimeter waves, optics and photonics.
ESL Background
Established in 1942, the ElectroScience Laboratory is one of the oldest and largest RF and optics laboratories in the United States. ESL employs nearly 150 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.
1940 - 1990 Timeline

1942
Antenna Laboratory is founded by Bill Everett and George Sinclair. Research on the war-time requirements of aircraft antennas begins.

1945
Techniques for Airborne Radome Design was prepared under Dr. Thomas E. Tice.

1955
Experimental facilities moved to Kinnear Road.

1961
New areas of study: Lasers, Quantum Detectors, Satellite Communications, and Plasmas.

1967
Antenna Lab renamed ElectroScience Lab to reflect broad research programs.

1967
ElectroScience researchers introduced The Uniform Geometrical Theory of Diffraction.

1974
ElectroScience researchers introduced The Uniform Geometrical Theory of Diffraction.

1983
NASA contracts enable ESL to further expand its research areas and grow.

1984
Stealth Era: Compact antenna and radar measurement range development begins.
**1990 - 2014 Timeline**

**1995**
The advent of supercomputers merged with advanced computational electromagnetics algorithms enabled numerical analysis of large and complex structures.

**2004-2005**
The communication and imaging system for NASA’s New Horizon Spacecraft were measured and characterized at ESL’s anechoic chamber before their integration into the spacecraft.

The ESL building on 1320 Kinnear Road is renovated.

**2010**

**2011**
Ribbon cutting ceremony is held on September 30, 2011 for the new ESL building on 1330 Kinnear Road.

**2013**
ESL Researchers develop a THz camera that can "see" through practically any material.

**2014**
Researchers led by Dr. Joel Johnson receive a grant from NASA to develop an Ultra Wideband Software Defined Microwave Radiometer.
ESL Faculty, Researchers, and Students

- Faculty count: 17
- Researcher count: 13
- Graduate Student count: 87
- Undergraduate Student count: 11
# ESL Graduates 2011 – Summer 2016

<table>
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<th>Year</th>
<th>M.Sc.</th>
<th>Ph.D.</th>
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</table>
The ElectroScience Laboratory features 60,000 ft² wireless communication and radio frequency research lab space. This facility includes an indoor anechoic chamber radio frequency measurement facility, a complete complement of electromagnetics test facilities, and 4,000 ft² of rental space available to companies that focus in areas relevant to the ESL.

**ESL Facilities**

- Atmospheric & Oceanographic Electromagnetics and Marine Systems (ATOM) Laboratory
- Ceramics Fabrication Facility
- Cognitive Remote Sensing Laboratory
- Compact Range
- Distributed Memory Parallel Supercomputer & Software
- Hyperspectral Engine Lab for Integrated Optical Systems (HELIOS) Laboratory
- Integrated Optics Lab
- PCB Prototyping Facility
- RF/Microwave Facility
- RFID Laboratory
- Radar & Remote Sensing Lab
- Software Defined Radios/Radars
- Textile Antennas & Electronics Lab
- Circuit Laboratory for Advanced Sensors & Systems (CLASS)
ESL has consistently maintained a national and international presence in electromagnetics and electro-optics, influencing radio research like no other institution in the world. Our faculty, research scientists and students are involved in all aspects of electromagnetic and RF technologies.
Research Focus:
- Antennas, propagation, and wireless communications
- Electromagnetic scattering and measurements
- Remote sensing and software defined radar
- Radar signal processing and GNSS
- Cognitive sensing, sensor fusion, RFID, RFIC
- Terahertz sensing and imaging
- Millimeter Waves, Optics and Photonics

Covering entire EM spectrum:
From RF-to-mmW-to-THz-to-IR-to-Optics

www.electroscience.osu.edu
Visit our research web page:
https://electroscience.osu.edu/research-areas

Research Areas

The Ohio State ElectroScience Laboratory is a major center-of-excellence and one of the largest radio frequency and optics research laboratories in the world. Since 1942, ESL has consistently maintained a national and international preeminence in electromagnetics, influencing radio research like no other institution in the world.

While centering on all aspects of wireless communications and sensing, the ElectroScience Laboratory has become a cross-disciplinary center integrating research in electrical engineering, materials science, mechanical engineering and bioengineering. The goals of ESL are to continue its influence in cutting edge discoveries; maintain its excellent experimental and computational laboratories in its areas of strength; and pursue multidisciplinary research.
Student Opportunities
Student Training

ESL student researchers are actively enrolled as students within the Department of Electrical and Computer Engineering (ECE). We have exciting research opportunities for both graduate and undergraduate students. While centering on all aspects of wireless communications and sensing, ESL is a cross-disciplinary center integrating research in electrical engineering, materials science, mechanical engineering and medical sciences.

Student Organizations

ESL Student Committee
Institute of Electrical and Electronics Engineers (IEEE) Student Organizations

Funding Through Special Programs and Industry

University Fellowships
Industrial Fellowships
Government Fellowships
Graduate Research Associate (GRA) appointments
ESL Partnerships

ESL promotes and engages research partnerships with well-known defense and commercial companies. ESL has consistently maintained strong interactions with government labs, and federally funded research and development center commercial sectors. Our faculty and researchers work with small companies and startups as well as consortiums.
## Examples of ESL Partnerships

<table>
<thead>
<tr>
<th>Government</th>
<th>Industry</th>
<th>Consortiums</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defense Advanced Research Project Agency (DARPA)</td>
<td>MIT Lincoln Laboratory</td>
<td>Consortium on Electromagnetics and Radio Frequencies (CERF)</td>
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<tr>
<td>National Science Foundation (NSF)</td>
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<td>Air Force Research Lab (AFRL)</td>
<td>Lockheed Martin</td>
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<tr>
<td>Air Force Office of Scientific Research (AFOSR)</td>
<td>ANSYS</td>
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<td>U.S. Dept. of Agriculture</td>
<td>Battelle</td>
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<td>Space and Naval Warfare Systems Command (SPAWAR)</td>
<td>Boeing</td>
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<tr>
<td>Environmental Protection Agency (EPA)</td>
<td>MITRE Corporation</td>
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</tbody>
</table>
Recognition

2016 National and International Awards
Dr. Inder “Jiti” Gupta
Institute of Navigation Weems Award

Awarded for recognition for his continuing contributions to the art and science of navigation.

Dr. John L. Volakis
Distinguished Scholar

Awarded for recognition for his scholarly activity, research and other creative works which represent exceptional achievements in his field.
Dr. Jin-Fa Lee  
**IEEE APS Harrington-Mittra Award**

Awarded for recognition of his technical accomplishments and future potential of an outstanding contributor to the area of Computational Electromagnetics.

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Dr. Chi-Chih Chen  
**2016 AMTA Distinguished Achievement Award**

Awarded for outstanding and pioneering contributions to the development, practice and commercialization of antenna and radar technologies.
Luke Duncan
2nd Place in the Kraus Memorial Poster Competition


Advised by: Dr. Waleed Khalil

Matt Buchanan
3rd Place in the Kraus Memorial Poster Competition


Advised by: Dr. Inder “Jiti” Gupta
Ushemadzoro Chipengo
1st Place for the best student paper competition at the USNC/URSI National Radio Science Meeting

**Paper:** Experimental Validation of Mode Dominance Reversal in Novel Slow Wave Structures for High Power Backward Wave Oscillators

**Co-Author:** Dr. John L. Volakis

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Ersin Yetisir
2nd Place for the best student paper competition at the USNC/URSI National Radio Science Meeting

**Paper:** A Novel Array with 6:1 Bandwidth and 70° Scanning using Frequency Selective Surface Superstrates

**Co-Authors:** Dr. Nima Ghaliachechian and Dr. John L. Volakis
Seckin Sahin
3rd Place at the IEEE Antennas and Propagation Society and URSI Meeting

Paper: “On-chip UWB Phased Arrays for mmW Connectivity”

Co-Authors: Dr. Niru K. Nahar and Dr. Kubilay Sertel

Shubhendu Bhardwaj
Receives Presidential Fellowship & Prestigious Louise B. Vetter Award (Spring 2016)

- The Fellowship is a prestigious award given by the Graduate School at OSU that recognizes outstanding scholarly accomplishments.
- Awarded the Vetter Award for his excellence in research. He was one of two winners to receive $1,500.00.
Dimitrios Papantonis Receives Best Poster Award at IWAT

**Paper:** “Tunable Band Rejection in a Tightly-Coupled Array Using Varactor Diodes”

**Co-Authors:** Dr. Ersin Yetisir, Dr. Nima Galichechian and Dr. John L. Volakis

Stephen Watt Receives National Defense Science & Engineering Graduate Fellowship

**Proposal:** “Interference Immune and Self-Protected Medical Devices”

**Advised by:** Dr. John L. Volakis
Dong-Yeop Na
Receives Presidential Fellowship (Fall 2016)

• The Fellowship is a prestigious award given by the Graduate School at OSU that recognizes outstanding scholarly accomplishments.

• Includes a taxable monthly stipend of $2,168 for up to three terms or until graduation; covers academic tuition and fees, health insurance, parking, plus a $250 travel allowance to help encourage presentations of his research at professional meetings.

• Advised by Dr. Fernando Teixeira.
IEEE AP/MTT Columbus Chapter Graduate Poster Competition


ESL Alumni

ElectroScience Laboratory has graduated over 1,000 Ph.D. and Master’s students. Numerous alumni are now recognized academic leaders worldwide. Most prominent authors, faculty, and industry leaders in RF/Wireless have come from ESL.
Some Notable ESL Alumni

Brian Kent – CTO of AFRL/Retired
Stephen Schneider – Acting Chief Scientist of AFRL Sensors Directorate
Charlie Rhoads – CTO at Raytheon-Dallas
Eric Evans – Director, MIT Lincoln Labs
Matt Ganz – Boeing Company European Operations President
Levent Ersoy – CTO, Lorral Corp.
Jim Armitage – VP and Chief Technology Officer at Northrop Grumman/Retired
Tom Miller – Chief Technology Officer at Raytheon West Coast/Retired
William Lee – former CTO of Airtouch, now part of Verizon, author of popular wireless communication book and wideband CDMA inventor

Celebrated authors in microwaves and electromagnetics
  Roger Harrington, Gary Thiele, Warren Stutzman, Dave Pozar, Costantine Balanis

Many company start-ups:
  Gene Bulman, Wayne Masters, Al Dominek, Harry Shamansky, Jeff Berrie, Paul Swetnum, Bob Puskar, Errol English, Carl Mentzer, Tom Kornbau, Bill Kent, Terry Fry, Yakup Bayram, Johnson Wang