Letter from the P.I.

Happy New Year from the ElectroScience Lab! We had a busy 2017 with the transition to a College of Engineering Center, our 75th Anniversary Celebration, and search for a new ESL Director. As the search moves into 2018, I will continue as the Interim Director, aided by our Senior Associate Director and CERF Co-PI Alissa Comella.

We had a great CERF meeting in August. Thank you to all who were able to attend the meeting and short courses. Everyone seemed to like the new meeting format where we had the students give a brief overview of their work before each Poster Session. This also left more time for discussion with you, the CERF Affiliates. Thank you for your feedback on the meeting format and your experience as a CERF member.

As a follow up to our discussion, I am happy to announce that this year, in addition to your regular CERF membership, our Affiliate member companies at the Silver, Gold, and Platinum levels may sponsor specific research projects for your company at the reduced CERF overhead rate. This will provide our CERF Affiliates with the opportunity to work with ESL PI’s and graduate students on projects that directly impact your company. If you are interested in funding a research project in addition to your CERF membership, please contact us to discuss the details and we will connect you with the right experts.

Please keep your schedule open for the 2018 CERF Technical Meeting and ESL Short Courses scheduled for August 7-10. An announcement with the Short Course titles will be coming in the Spring.

At your service,
Bob Burkholder
P.I., ESL-CERF
Interim Director, ESL

Save the Date for the 9th Annual CERF Technical Meeting and ESL Short Courses

Planning is underway for the 2018 annual meeting and the ESL Short Courses. Both will be held at The Blackwell Inn and Pfahl Conference Center. The meeting is scheduled for Tuesday, August 7th with the Affiliates dinner immediately following and the ESL Short Courses will run Wednesday, August 8th through Friday August 10th.

Congratulations to Landon Garry and Ramy Tantawy for receiving the best poster awards, first and second place respectively, at the 8th Annual CERF Meeting held at the Blackwell Inn and Pfahl Conference Center on Tuesday, August 1, 2017. Four sessions were held throughout the day that featured 33 posters focusing on the research performed at ESL on Antenna Design, Radar, Navigation and Sensing, EM Algorithms and Measurements, and RF Circuits and Optics.

We congratulate each recipient for their successful presentation.

1st place: Landon Garry, "Passive I-SAR: Framework and Experimental Trials", co-author: Graeme Smith (advisor)

2nd place: Ramy Tantawy, "High-speed, High-resolution Analog-to-digital Converter for STAR and Software Defined Radios", co-authors: Waleed Khalil (advisor), and Shane Smith.

Runner-ups:

3rd place: Matthew Larue, "A Four-Way Outphasing Transmitter", co-author: Waleed Khalil (advisor)


5th place: Qi Wang, "Range-Dependent Evaporation Duct Height Estimation from a Versatile Ship-Mounted X-band Receiving Array", co-authors: Robert Burholder (advisor) and Caglar Yardim.

Abstracts for the first and second place posters can be found on page 2 of the newsletter.
Excerpts from Winning CERF Poster Abstracts

1st place: Passive I-SAR: Framework and Experimental Trials
Authors: Landon Garry (presenter) and Graeme Smith

Passive radar systems have been proven to perform target detection and tracking to an accuracy suitable for air surveillance tasks. While these are arguably the most fundamental of all radar operations certain scenarios require additional information regarding the nature of potential threats. To support such scenarios, an architecture for passive ISAR imaging using narrowband illuminators of opportunity is presented to estimate target size to facilitate target classification. Most illuminators well-suited for passive radar possess atypical signal characteristics when compared to classical radar waveforms; consequently, many unique signal processing challenges arise to extract useful radar-related information. A holistic framework enabling multistatic passive ISAR imaging using spatially diverse, narrowband transmitters is developed in this work. The critical stages of motion compensation are considered, with simulated results demonstrating that classical autofocus techniques such as PGA, entropy, and contrast-based approaches do not converge to a focused image with narrowband systems. A parametric method of Doppler centroid estimation is proposed as an alternative, which is shown to result in imagery closely resembling a clairvoyant method of image formation. Target tracking data from the passive network is used to provide information regarding non-cooperative target rotation; enabling calculation of the cross-range scale factor and more advanced methods of image formation. Finally, the proposed architecture is applied to experimental ATSC data, demonstrating the ability of the technique to generate imagery for calculation of target size.

2nd place: High-speed, High-resolution Analog-to-Digital Converter for STAR and Software Defined Radios
Authors: Ramy Tantawy (presenter) and Waleed Khalil and Shane Smith

Software defined receivers enable highly efficient utilization of the RF spectrum by offering frontend band selectivity options, and when possible, an in-band full-duplex communication mode. In-band full-duplex communication can double the throughput of the available bandwidth by simultaneously transmitting and receiving (STAR) data at the same frequency. These software definable systems require wide-band ADCs at the RF frontend to provide support for RADAR and high data-rate communication. A wide-band ADC with IF/RF sampling capabilities can capture hundreds of data channels. Both STAR and multi-band operation require an ADC with a high signal-to-noise ratio (SNR). The need for high SNR and a push to generate digital signals right after the antenna requires the ADC to have high resolution. These competing requirements pose a challenge to the ADC design both architecturally and at the circuit level. The Naval Research Lab (NRL) has a research program employing STAR techniques and has teamed with Ohio State to produce and test a 12-bit, 65 dB SNR, 2.8 GS/s ADC capable of operating in the second Nyquist zone.
Researcher Spotlight: Alexandra Bringer

As part of the ElectroScience Laboratory (ESL) at The Ohio State University, Alexandra Bringer is helping to advance the technology behind climate science for future generations as an electrical and computer engineering (ECE) senior researcher associate.

“If we want to live longer on Earth, we have to know how to preserve it,” Bringer said. “You cannot just do nothing and see what happens. It is critical to think more about preserving it.”

Originally from France, Bringer came to Ohio State to get more involved in remote sensing research. She is part of a team led by ECE Professor and Chair Joel Johnson, currently assisting NASA on several projects in this realm.

For example, Bringer said, the “UWBRAD: Ultra-Wideband Software Defined Microwave Radiometer for Ice Sheet Subsurface Temperature Sensing” project is interesting because the physical temperature of the Greenland ice sheet can be directly retrieved from the multi-frequency measurements of its own thermal emissions.

She said knowing the physical temperatures inside the ice sheet is key for understanding its deformation and motion, as well as dynamics. Awareness of these forces is important for future prediction of ice coverage and rising sea levels. The UWBRAD radiometer provides real data on this front, she said. The tool was first deployed over Greenland in September 2016 and is scheduled for a second campaign deployment in September 2017 to back it up.

Student Spotlight: Brandon Mathieu

Congratulations to Brandon Mathieu who recently received the best student paper award at the 2017 IEEE Compound Semiconductor Integrated Circuit Symposium (CSICS), held in Miami, Fl held October 22—25, 2017. His paper is titled “An AC Coupled 10Gb/s LVDS-compatible Receiver with Latched Data Biasing in 130nm SiGe BiCMOS,” and was co-authored by J. McCue, B. Dupaix, V. J. Patel, S. Dooley, H. Lavaansani, J. Wilson, and W. Khalil.

Brandon competed with 7 student finalists and in addition to winning best paper, he has been invited to submit an expanded version of his work in the prestigious IEEE Journal of Solid State Circuits. Brandon is advised by professor Waleed Khalil.

75 Years of ElectroScience Innovation

ESL alumni, former faculty, researchers and friends along with university and college of engineering senior leadership came together at ESL to celebrate our past as well as our future with current faculty, students and staff as part of our 75th activities on Friday, October 6, 2017. Eric Evans, alumnus of ESL (Ph.D. 1988) and Director of MIT Lincoln Labs started the program with an invited talk focusing on ESL’s historic achievements, and being a breeding ground for future engineers, its role in paving the way for future advancements, and engineering centers and labs such as Lincoln Labs. The program continued with remarks from senior leadership from CoE and University, including Joel T. Johnson, the Chair of Department of ECE, Caroline C. Whitacre, Senior Vice President for Research at the University, David B. Williams, Dean of the College of Engineering, and Dorota A. Grejner-Brzezinska, Associate Dean for Research at the College.

Tour groups also visited the lab’s anechoic chamber, the Cognitive Remote Sensing Laboratory, wearable textile antennas lab, as well as the HELIOS Laboratory for terahertz research. Additionally, ESL students and researchers showcased their work during a poster session featuring 13 different projects.

After 75 years of research that led the way to today’s advancements in cell phones, stealth technology, satellite communications and antenna design, ESL researchers are focusing on the emerging technologies like wearable antennas, medical sensing, cognitive sensing and climate science technologies.
Maximize Your CERF Membership

There are many benefits to being a CERF Industrial Affiliate. Affiliates have access to state-of-the-art facilities, internationally recognized faculty, and top student researchers, as well as special training courses tailored to meet member needs.

We encourage you to take full advantage of your CERF benefits when you participate in the upcoming 9th Annual CERF Technical Meeting and Short Courses. Membership level determines the number of seats included at no cost for both the meeting and short course participation, so please see the chart below to determine your level of eligibility.

New for 2018

CERF Industrial Affiliates at the Silver, Gold or Platinum levels are eligible to fund specific research projects for your company at a reduced overhead rate in addition to your regular CERF membership. This will provide our CERF Affiliates with the opportunity to work with ESL PI’s and graduate students on projects that directly impact your company. If you are interested in funding a research project in addition to your CERF membership, please contact us to discuss the details and we will connect you with the right experts. We have extended the list of available on-site short courses to include courses from past years. The complete list is attached to this e-mail.

<table>
<thead>
<tr>
<th>CERF Membership Level</th>
<th>Annual Meeting Attendees</th>
<th>Short course Seats</th>
<th>On-Site Short Courses Provided</th>
<th>Opportunity to Fund Specific Research Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic*</td>
<td>1</td>
<td>4</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Silver</td>
<td>2</td>
<td>10</td>
<td>n/a</td>
<td>Yes</td>
</tr>
<tr>
<td>Gold</td>
<td>4</td>
<td>20</td>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>Platinum</td>
<td>8</td>
<td>40</td>
<td>4</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* Companies with less than 50 employees.

ESL-CERF

The faculty and researchers at ESL have formed a Consortium on Electromagnetics and Radio Frequencies (CERF) to share their expertise in training of undergraduate and graduate students as well as employees of the US-based RF industry. One of the main goals of ESL-CERF is to support industry professionals at the leading edge of their fields and to provide them with access to world-class research and knowledge in EM and RF areas. Under this consortium, members have access to state-of-the-art facilities, faculty and student researchers. Specialty training courses are tailored to member needs.

CERF Affiliates

BerrieHill Corp. BAE Systems Lockheed Martin
MIT Lincoln Laboratory Northrop Grumman Raytheon

Consortium Advisory Board Members

Robert Burkholder Alissa Comella Inder J. Gupta Ronald Reano Fernando Teixeira Waleed Khalil

9th Annual CERF Technical Meeting is scheduled for Tuesday, August 7, 2018 at the Blackwell Inn, Pfahl Hall.