Letter from the P.I.

The 7th annual CERF meeting was held in August and we'd like to thank all who attended. We have included some pictures as well as an article about the top 5 recipients of the Best Poster award. Congratulations to all participants for their excellent presentations.

We would love to hear your comments about the annual meeting and the short courses you participated in. We are also seeking your suggestions for short course topics for next year. If you have any ideas please let me know.

As you will read on the following pages, there have been a lot of changes in leadership at ESL. In early June, I moved close to Huntsville, Alabama on the Tennessee River to pursue my love for boating. I remain part of the ESL team as a Research Scientist working 50% time to finish up projects and continue overseeing CERF. Towards the end of this calendar year we will revisit my role with CERF as I transition to life in Alabama. I am committed to providing the time to ensure CERF continues to provide, as always, outstanding value to its affiliates. I hope you enjoy this newsletter.

Sincerely,
Greg Creech
P.I., ESL-CERF

7th Annual CERF Technical Meeting

We had over 60 participants attend this year's meeting which was held at the Blackwell Inn and Pfahl Conference Center on Tuesday, August 2, 2016. Those who attended included representatives from our industrial affiliates, as well as ESL faculty and students. Ryan Horns of the ECE Dept. photographed the event and wrote an article featuring meeting highlights [ece.osu.edu/news/2016/08/cerf-2016-research-winners-announced]. His collection of photos can be found at the ESL Photo Library [electroscience.osu.edu/news-events/photo-library].

2016 CERF Best Poster Award Recipients

During the Annual CERF Meeting, 40 presenters competed for the Best Poster award. Many of the posters highlighted research that was either fully or partially funded by the Consortium. Four sessions were held that focused on topics including: Antenna Design; Radar, Navigation and Sensing; EM Algorithms and Measurements; and RF Circuits and Optics. The majority of the presenters were ESL graduate students showcasing their research. Students had the opportunity to network with their peers, ESL members and representatives from CERF affiliates, who then had the task of selecting the top 5 posters based on academic content, appeal to audience and overall quality of layout. The first and second place poster awardees received $200 and $100, respectively. We congratulate the winners for their successful presentations.
Excerpts from Winning CERF Poster Abstracts

1st place: Situational Awareness Using GNSS Adaptive Antennas
 Authors: Nicole Tchorowski (presenter) and Inder J. Gupta

Adaptive antennas, i.e., Controlled Reception Pattern Antennas (CRPA), are commonly used with military GPS receivers for electronic protection. An adaptive antenna consists of multiple elements and the signals received by these elements are weighted and summed together to suppress incident interfering signals. The element weights are calculated in real time and depend on the incident signal scenario. In general, the weights are adapted to form antenna pattern nulls in the directions of the interfering signals. The stronger the interfering signal is, the deeper the null is in its direction. Thus, one should be able to use the adapted pattern of these antennas for situational awareness.

In this poster the Average Adapted Patterns (AAP) obtained from flight data are presented and discussed. The data was collected using a six-element airborne antenna mounted underneath the fuselage of a Piper Saratoga aircraft, flown over the metropolitan Columbus, Ohio area. The antenna elements were designed to receive signals in the ISM radio frequency band (902 - 928 MHz). The signals received by various antenna elements were digitized and stored for post processing. The objective was to apply AAP to locate four ground based RF emitters. The true locations of the four transmitters were accurately known. The results show AAP is quite useful in generating situational awareness from adaptive antenna arrays.

2nd place: ESL Passive Radar E-Scanned Phased Subarray Antenna
 Authors: Matt Barr (presenter), J. Landon Garry and Graeme E. Smith

This poster reports on the design of a large receiver array to be used with The Ohio State University’s MULTistatic digital TElevision RAdar system (MUTERA). Electronically scanned arrays are highly beneficial for use in passive radar systems due to their adaptive beam- and null-steering capabilities, which enable wide area surveillance, multi-target tracking and direction of arrival estimation. Furthermore, the lack of moving components needed to perform scanning operations reduces long term maintenance costs. The use of a subarray architecture reduces the number of analogue-to-digital converters required without compromising gain or beamwidth. However, the subarray approach does limit the maximum achievable scan angle due to grating lobes. By overlapping the subarrays and through the use of amplitude windowing, grating lobes and sidelobe levels can be controlled. This leads to an increased system scanning range and maximizes passive radar performance by reducing the system’s effective direct signal interference.

3rd Place: Tightly-Coupled Array with Integrated Reconfigurable Balun for Tunable Band Rejection
 Authors: Dimitrios Papanonis (presenter) and John L. Volakis

4th place: Studies of TDS-1 GNSS-R Ocean Altimetry Using a Full DDM Retrieval Approach
 Authors: Jeonghwan Park (presenter), Joel T. Johnson, Andrew O’Brien and Stephen T. Lowe

5th place: Ultra Wideband (UWB) Lower Atmospheric Propagation (LATPROP) Measurement System
 Authors: Luyao Xu (presenter) and Caglar Yardim
After nearly fourteen years of service, John L. Volakis stepped down as the Director of ESL effective September 1st. Current and former ESL and ECE faculty, staff, researchers and students gathered to honor John for his service on October 4, 2016. Under his leadership since 2003, ESL went from 50 graduate students and $2.8 million in research funding, to 96 graduate students and $9.4 million in funding. John will continue to play a major role at ESL by directing cutting-edge research (see news on “Magnetic Resonance Research” on page 4) and advising Ph.D. and Masters students as a Professor and R. & L. Chope Endowed Chair.

As John stepped down, Bob Burkholder accepted the position of Interim Director of ESL while the search for the Director position takes place. Bob has been at ESL since 1984 when he became a graduate student at the urging of Dennie Burnside. He worked with Dennie and Prabhakar Pathak who trained him in the Uniform Geometrical Theory of Diffraction and other asymptotic methods for electromagnetics. Bob worked at ESL as a researcher after receiving his Ph.D. in 1989 and is now a Research Professor. His work has been primarily in the areas of EM theory and computer modeling with applications in scattering, remote sensing, microwave imaging, and RFID. He has been very active in ESL governance and served on just about every committee at one time or another. Bob is a Fellow of the IEEE and currently serves as Track Editor for the IEEE Transactions on Antennas and Propagation.

With Greg Creech stepping down as Assistant Director of ESL and moving to Huntsville, Alabama, Alissa Comella joins us as ESL’s Senior Associate Director. She oversees administrative operations at ESL and is responsible for the planning, directing and development of ESL programs. Her focus will be on strengthening collaborations with industry and identifying new opportunities for consortia, sponsors, and partnerships. Alissa received her MBA degree focusing on Operations from the Fisher College of Business at The Ohio State University and has more than 25 years of management responsibility, including extensive experience in human resources, budgeting, and business planning. She has had long-term success in attracting funds and securing transformational resources and a track record of enhancing efficiency and effectiveness in large organizations.

Maximize Your CERF Membership

There are many benefits to being a CERF Industrial Affiliate. Affiliates have access to state-of-the-art facilities, faculty and student researchers, and specialty training courses tailored to member needs. The funds collected through the membership fee are used to develop new short courses, organize short courses and technical meetings, and sponsor student training and research.

Take full advantage of your CERF membership when you participate in the upcoming 8th Annual Technical Meeting and Short Courses. Membership level dictates eligibility for the number of seats for both the meeting and short course participation without charge to the participants.

<table>
<thead>
<tr>
<th>Member Level</th>
<th>Annual Meeting Attendees</th>
<th>Short Course Seats</th>
<th>On-Site Short Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>1</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Silver</td>
<td>2</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Gold</td>
<td>4</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>Platinum</td>
<td>8</td>
<td>40</td>
<td>4</td>
</tr>
</tbody>
</table>

For more information on ESL-CERF contact Dr. Greg Creech (creech.41@osu.edu) or visit [https://electroscience.osu.edu/cerf].

Raytheon On-Site Short Courses

On-site short courses will be conducted by Prof. Graeme Smith on November 4th at Raytheon’s McKinney, TX, location. The courses are titled: “Cognitive Processing for Radar Systems: From Theory to Practice” and “Radar Micro-Doppler Signatures”.

Upgrade your membership to Gold or Platinum so you too can get the benefits of hosting a variety of ESL short courses at your own facility.
Ohio State: Midwestern Hub of Next-Gen Magnetic Resonance Research

An interdisciplinary team of physics and engineering faculty and researchers wins $1.071 million award from the National Science Foundation's Major Research Instrumentation program (NSF-MRI) to help advance the study of magnetic resonance technology at the nanoscale level. Over the next three years, they will work to develop and build new equipment capable of discovering novel magnetic resonance phenomena at a very high frequency range up to 330 Ghz. The team includes IMR Associate Director Fengyuan Yang, Principal Investigator (PI) on the project, with co-investigators P. Chris Hammel, professor of Physics; John L. Volakis, professor of Electrical and Computer Engineering (ECE); Joseph Heremans, professor of Mechanical and Aerospace Engineering and Physics; Rolando Valdes Aguilar, assistant professor of Physics; Zeke Johnston-Halperin, associate professor of Physics; and Denis Pelekhov, director of the NanoSystems Laboratory. For more information on the story, please visit ECE [ece.osu.edu/news/2016/09/ohio-state-midwestern-hub-next-gen-magnetic-resonance-research] and CoE [engineering.osu.edu/news/2016/09/nsf-award-funds-novel-magnetic-resonance-research] news pages to read featured articles.

OSU ElectroScience Laboratory

The ElectroScience Laboratory (ESL) is a major “Center-of-Excellence” within the Ohio State University Department of Electrical and Computer Engineering and is one of the largest Radio Frequency (RF) research and Optics laboratories in the world. Our faculty, research scientists, and students are involved in all aspects of electromagnetic and RF technologies. ESL has its own separate building with more than 60,000 square feet that house state-of-the-art measurement and computational facilities.

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
- MIT Lincoln Laboratory
- Northrop Grumman
- Raytheon
- Rockwell Collins

Consortium Advisory Board Members

Chi-Chih Chen
Greg Creech
Inder J. Gupta
Ronald Reano
Fernando Teixeira
Justin Kasemodel

Become a Member

US industries can benefit from ESL-CERF by joining the consortium as Industrial Affiliates. As an Industrial Affiliate, the industry pays an annual membership fee to ESL-CERF. Funds collected through the membership fee are used to develop and organize new short courses and technical meetings.

Any US-based organization can join the consortium as Basic, Silver, Gold or Platinum Industrial Affiliate. The benefits vary with the membership level. Agreements to join ESL-CERF can be found on our website under “Join CERF”:

[https://electroscience.osu.edu/cerf/join]

For more information on ESL-CERF, contact Dr. Greg Creech.

Contact Us

The Ohio State University
ElectroScience Laboratory
Consortium on Electromagnetics
and Radio Frequencies

1330 Kinnear Road
Columbus, OH 43212

Information re: CERF
Dr. Greg Creech
E-mail: creech.41@osu.edu
[https://electroscience.osu.edu/CERF]

Information re: ESL Short Courses
Michelle Diefenbach
E-mail: diefenbach.8@osu.edu
TEL: (614)292-6191
[https://electroscience.osu.edu/esl-short-courses]