Chesapeake Bay Roost Newsletter

January, 2025

This Issue:

- Members Enjoyed a Great Evening at Guinness Brewery!
- Nature's Equivalent Electromagnetic Warfare
- First of series of EW Environment Generation Tech Talks completed Dec 17
- Future 5 Awards

Upcoming Events

Please mark your calendars for our upcoming event:

Feb 19, 11:30AM: Lunch & Learn
Rohde and Schwarz: EW Environmental Generation Part 2

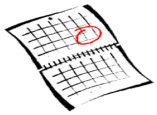
Walks the user through the basics of EW environmental generation and considerations on setting up and configuring a simulation of the electromagnetic spectrum (EMS).

Pizza lunch to be provided, please RSVP at https://www.evite.com/event/001427LG55ZKM4FM2EPPZOVGTGXKJI/

Onsite at :
Johns Hopkins University APL
11100 Johns Hopkins Rd, Laurel, MD
Kossiakoff Center KC7/8 Rooms

Also on Zoom (but you will miss provided lunch!):
https://jhuapl.zoomgov.com/j/1601356458?pwd=uvA1uQI1QrKykxWvbXuria0mcFwuuK.1

UPCOMING EVENTS



Tech Talks

Feb 19, 11:30 AM: Rohde and Schwarz: EW Environmental Generation, Part 2
Johns Hopkins APL 11100 Johns Hopkins Road
Kossiakoff Center KC7/8

In Person:
https://www.evite.com/event/001427LG55ZKM4FM2EPPZOVGTGXKJI/

Remote:
https://jhuapl.zoomgov.com/j/1610940223?pwd=ze7xEpwnPDia8A1XffvOCi6xubRaCN.1

Sincere Thanks to Our Chapter Sponsors!

We'd like to put out a special shout-out to our chapter sponsors. As we reestablish the Roost's responsibilities to host chapter events, awards, and local college-bound STEM student scholarships, we have quickly exceeded what the chapter can achieve simply on AOC chapter funds. We are truly thankful for Parker Meggitt, Annapolis Micro Systems, and Keysight Technologies for contributing financially in support of these endeavors. Please consider working with them for your product needs.

Parker MEGGiTT

https://www.meggitt-baltimore.com/
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Annapolis Micro Systems

https://www.annapmicro.com/
190 Admiral Cochrane Dr Ste 130, Annapolis, MD

KEYSIGHT TECHNOLOGIES

www.keysight.com
1900 Garden of the Gods Road, Colorado Springs, CO

We are seeking financial sponsorship to support our club activities and scholarship benefits we provide to the community. Please contact the board at AOC.ChesapeakeBay@gmail.com for reasonable rates.

Chapter Social at Guinness Brewery Held October 3rd 2024

Thanks to everyone who made it out to the Guinness Brewery Chesapeake Bay AOC Chapter social on the evening of October 3rd. We had over 26 members make the trek out on a beautiful evening to the second floor terrace of the Guinness Brewery. We have to highlight our appreciation to Annapolis Micro Systems that provided support to make the event possible!

We have been experimenting with different approaches and venues to engage with our members. This year we opted for this October event in lieu of the December Holiday Social that was held in the previous years. We are starting planning for 2025 and hope to have some events at other locations where other members reside, such as Hunt Valley. Please let us know if you have ideas for our Chapter events!

Our Chapter Member Recognized at National AOC Event

The AOC showcased five young professionals as the year's Future 5 at the Annual AOC International Symposium & Convention at the National Harbor in DC in December. Future 5 recognizes those under the age of 29 who actively innovate and strive for excellence as they build their careers in the EMS/EW/IO industry. Our Awards/Scholarships Director, Paul Kennedy received the award at the 2024 AOC Symposium. Paul had also received the 2024 Chesapeake Bay Roost Outstanding Chapter Support award. Paul is a Section Supervisor and Project Manager for the EW Advanced Development Group – Signal Processing Section at Johns Hopkins Applied Physics Lab. Congratulation's Paul!

Figure 1. 2024 Future5 Award Winners, from left to right, Michael Gutierrez, Paul Kennedy, President Brian 'Hinks' Hinkley, Matthew Copeland, and Paul Wilkowski. Not shown, Imani Davis.

First in Series of EW Environmental Generation Engineering Series of Technical Talks Held on December 17th

Chapter members enjoyed a light lunch and participated in the first talk in a series of three provided courtesy of Rohde & Schwartz held at Johns Hopkins University/APL in Laurel, MD.

Figure 2 Duncan d'Hemecourt of Rohde & Schwartz discusses RF environment generation for EW system test during a Lunch & Learn on December 17

This presentation walked the user through the basics of EW environmental generation and considerations on setting up and configuring a simulation of the electromagnetic spectrum (EMS). With simple examples and smaller-scale problem spaces and diagrams, the audience now better understands the problem space from a conceptual foundation, paving the way for more complex engineering challenges that will be covered in the next two technical talks in this series. The presentation helped the audience frame the problem space: Why are we simulating? What do we need to simulate? And what do we need to be thinking about when we are planning our simulation test system? This presentation will also go over some key test terms and what they mean to a test engineer.

Be sure to check this issue for the February 19th information to attend the Part 2 session of the series of talks!

Attend The Part 2 Technical Lunch & Learn on EW Environmental Generation February 19th

The series of technical talks will address challenges of testing Electronic Warfare equipment. Simulating an electromagnetic environment relevant for testing electronic warfare devices is a challenging engineering problem that is full of trade-offs and design complexities. This multi-part presentation series will walk the audience through common engineering challenges and design considerations to help the test engineer be more knowledgeable about the intricacies of creating an EW environment. The next generation of EW devices and platforms bring new difficulties: modern threats get faster, more agile, and more complex. The testing challenges for our friendly devices scale accordingly with these modern threat enhancements. This presentation series is meant to frame those problems and allow the test engineer to consider multiple possible solutions, the engineering design trade-offs of each one, and to more intelligently go about solving these environmental generation test challenges in the future.

Part 2 – Electronic Warfare RF Stimulus Architectural Fundamentals and Tradeoffs
(11:30AM-1:00PM February 19, 2025)

Abstract: This presentation will cover the fundamental concepts of Electronic Warfare signal generation from a bottom-up approach. The discussion will cover the conversion chain from the digital backend EW scenario generation interface through the analog RF output. Topics covered will include: pulse descriptor word fundamentals, RF emitter bandwidth, frequency, and level considerations, multiple RF port system architectures, alignment of multiple RF ports in time, level, and phase, and phase locking a multi-port RF system. The audience will walk away with a deeper understanding of the tradeoffs between a variety of architectural details in evaluating an EW signal generation system.

Join us to Lunch & Learn (light pizza fare) at
Johns Hopkins APL, Kossiakoff Center KC7/8, 11100 Johns Hopkins Rd, Laurel, MD

Please RSVP if attending In Person to ensure enough pizza is provided:
https://www.evite.com/event/001427LG55ZKM4FM2EPPZOVGTGXKJI/

Remote Zoom link:
https://jhuapl.zoomgov.com/j/1610940223?pwd=ze7xEpwnPDia8A1XffvOCi6xubRaCN.1

Part 3 – Calibration and Uncertainty for Angle-of-Arrival (AoA) Simulation
(To Be Announced)

Abstract: In this presentation, we discuss calibration and uncertainty for angle-of-arrival (AoA) simulation using RF signal generators. After reviewing the three dominant types of direction finding (DF) used in radar warning receivers (RWRs), we explain how to calibrate for AoA according to each DF method. For phase AoA calibration, we show how the vector network analyzer is the gold standard and explain the three contributors to uncertainty in phase AoA simulation – systemic error, random error, and drift. Finally, we show how to scale calibrations for RWRs with higher port counts and distributed apertures.

Note: The content of articles is taken directly from open source, unclassified materials cited below each article for the purposes of stimulating relevant EW discussions between chapter members.

Countermeasures in Nature

Inventions are often inspired by the amazing evolutions developed by nature. The soft kill evolution between missile threat radars and their targets has forever been a circular game; as soon as a discovered weakness is used against the threat, the threat is updated to counter the weakness. While humans toil and invent new methods of controlling the electromagnetic spectrum to maintain advantage, nature has been optimizing the game for many centuries.

The bat mammal has a sonar that is similar to sonar/radar, emitting acoustic chirps that echolocate insects for its nightly dinner flights. "At night, bats and bugs are locked in sonic warfare."[2] Recent discoveries have revealed the insect world threatened (eaten) by the bat with its advanced sonar system have their own version of Counter Measures that is quite similar to Electronic Attack(EA) used in Electromagnetic Spectrum Operations(EMSO) that would be familiar to the Old Crow's readership.

Figure 3. A bat successfully localizing its prey. From https://birdnote.org/podcasts/birdnote-daily/shift-change-swallows-bats

Bats use sound waves typically above the frequencies humans can hear, emitting chirps of sound that reflect off the insects in their environment.

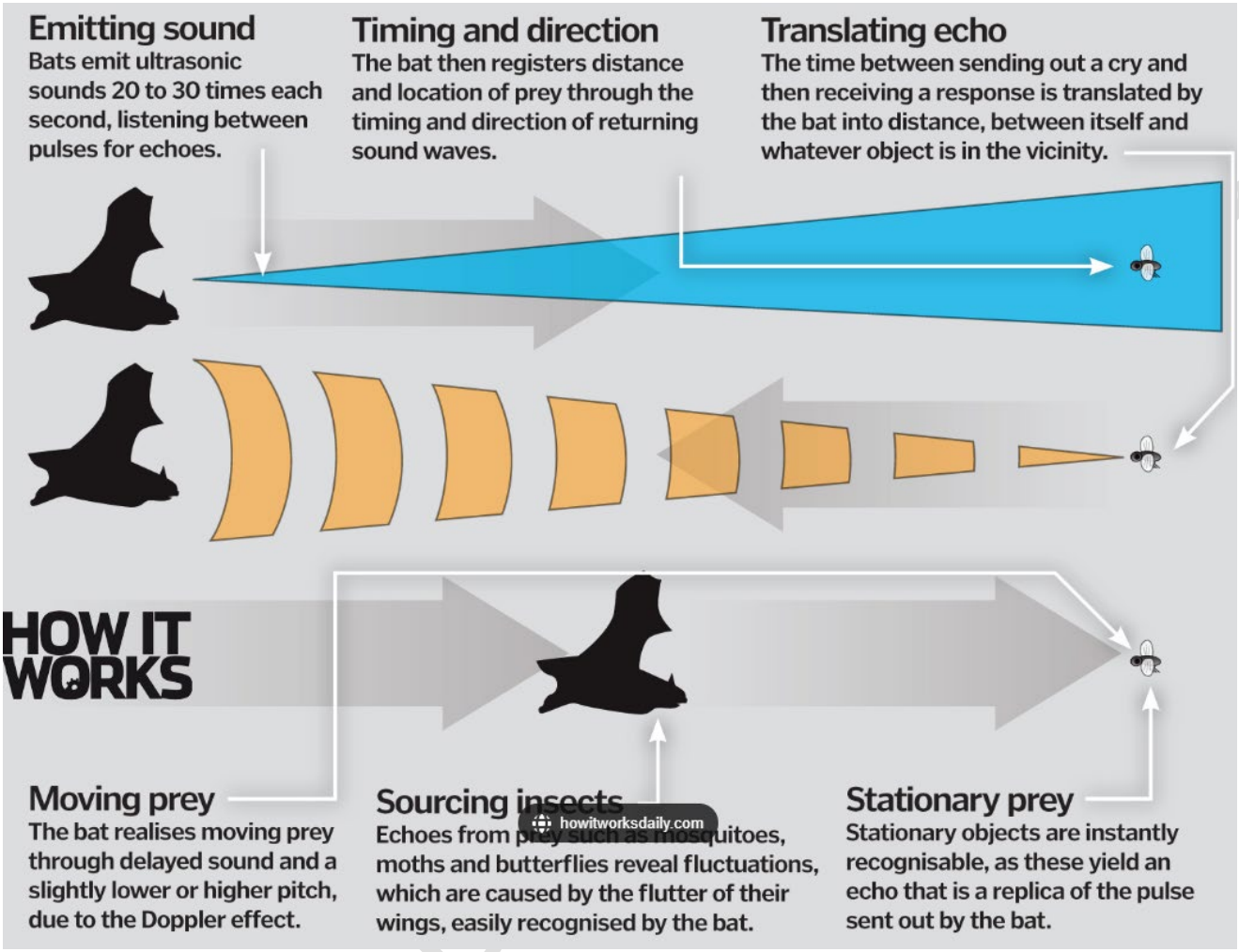

Figure 4. From https://www.howitworksdaily.com/bat-sonar-how-do-bats-hear-their-prey/

"The waveforms are very similar to RF radar waveforms, where FM chirps are used to improve range resolution. The frequencies used by echolocating bats range generally from 20 kHz to 100 kHz, with some outliers using frequencies below 10 kHz or above 200 kHz. Higher frequencies improve resolution, but they attenuate at a greater rate and the detection distance is reduced accordingly."[1]

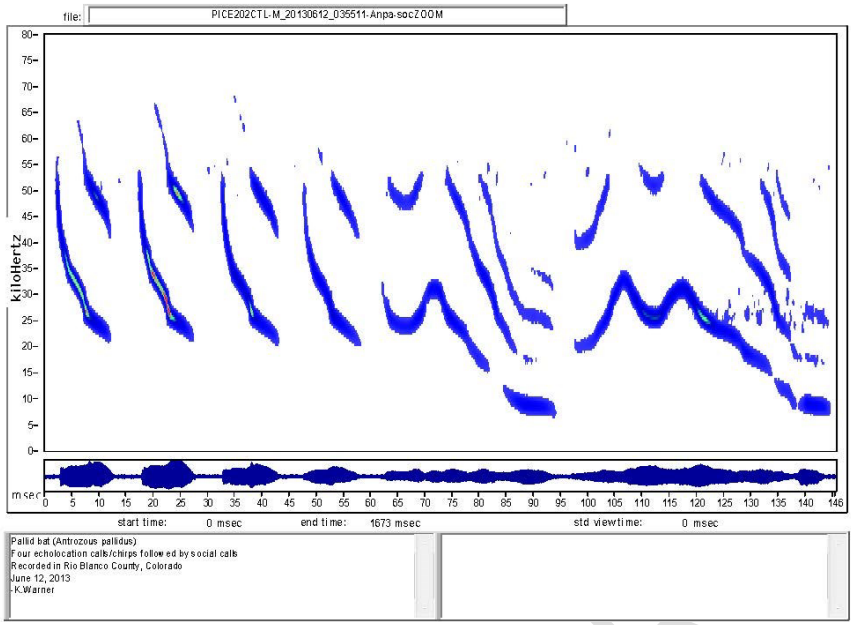

Figure 5. Pallid Bat echolocation call sequences, Audio Frequency Vs Time. From https://www.nps.gov/subjects/bats/echolocation.htm

Electronic Surveillance (ES): Detect a Threat is Out There!

Some of the insect community that is on the bat's dining menu have developed mechanisms to protect themselves from the bat's exotic acoustic machinery. At least seven major insect groups have ears sensitive to bat echolocation pitches, and many often flee in response.[2] The ability to hear the acoustic chirps from the bat gives the insect the ability to take evasive action. Moths that have ears can hear bats coming, and can quickly swerve out of the way of their predators, dipping and diving in dizzying directions. Moths far from the source often turn and fly away, whereas those close to the source show zigzag and looping flight, power dives, or passive falls.[3] The ability for the insect to hear the bat is nearby is the EMSO equivalent of Electronic Surveillance (ES).

Electronic Attack (EA): Actively Obfuscate your Detection!

"Among moths, evasive flight is often accompanied by the production of ultrasonic sounds. Three functions of these sounds have been proposed: to startle the bat, to warn of distastefulness, or to "jam" the bat's sonar system. A species of tiger moth emits a particularly dense series of ultrasonic clicks and the interception behavior of big brown bats is presented with silenced or sound-producing tethered moths. If the moth sounds evoke startle, naïve bats should initially break off their attacks, but then the bats should habituate to the sounds and complete subsequent attacks. In contrast, if the moth sounds have a warning effect, naïve bats should initially complete their attacks on sound-emitting moths, discover that the moths are distasteful, and refuse to capture them in future trials. Most of the bats in the tests reliably caught the silenced moths but avoided completing attacks on sound-producing moths, with no evidence of increasing or decreasing probability of capture from the first to the last trial, which suggests that the moths effectively jammed the bats' sonar." [4] p"Using ultrasonic recording and high-speed infrared videography of bat-moth interactions, the palatable tiger moth Bertholdia trigona defends against attacking big brown bats (Eptesicus fuscus) using ultrasonic clicks that jam bat sonar. Sonar jamming extends the defensive repertoire available to prey in the long-standing evolutionary arms race between bats and insects." [4]

Stealth: Avoid Detection!

Another method some insects have developed is to reduce the reflected signal from their bodies from the bat chirp illuminating them. "These moths, without ears that might alert them to an approaching predator, have instead developed scales of a size, shape and thickness suited to absorbing ultrasonic sound frequencies used by bats, the researchers found."[3] This is similar to radar stealth technology, where strategic materials and methods are used to reduce the radar cross section, making the target hard to detect by a radar. Some moths also have long tails on their wings that researchers suspect can be twirled to disrupt bats' sound waves.[3]

Figure 6. The cabbage tree emperor moth has wings with tiny ridged scales. A new study finds that the structures help the insects hide from hunting bats. From (3) https://www.sciencenews.org/article/sound-absorbent-wings-and-fur-help-some-moths-evade-bats

The insights of the evolutionary features of nature may be used as inspiration to Old Crows in the hunt of new methods to dominate the electromagnetic spectrum.

(1) BioScience, Volume 51, Issue 7, July 2001, Pages 570–581, https://academic.oup.com/bioscience/article/51/7/570/268256
(2) Tiger beetles may weaponize ultrasound against bats, Jake Buehler, May 14, 2024, Science News
(3) https://www.sciencenews.org/article/sound-absorbent-wings-and-fur-help-some-moths-evade-bats
(4) Tiger Moth Jams Bat Sonar, Science, Aaron J Corcoran et al., Jul 17 2009, p. 325-327

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Did you know as of 03/09/24 this Chesapeake Bay Roost has over 447 current members in its database?

Our membership represents major EW centers in this area, including:

- Parker Meggitt
- BAE Systems
- Boeing
- Booz Allen Hamilton
- CACI
- CEA Technologies
- Johns Hopkins Applied Physics Laboratory
- Multiple branches of the Department of Defense
- Northrop Grumman Corporation
- Rohde & Schwarz
- Raytheon
- Textron Systems
- WGS Systems
- And many others!

We are seeking sponsorship to support our club activities and scholarship benefits we provide the community.

Space is available here to target your advertisement/ announcements to our select membership!

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AOC Events

Mar 11-13
Collaborative EW Symposium
Pt. Mugu, CA

Apr 29- May 1
Cyber Electromagnetic Activity (CEMA)
Aberdeen Proving Ground, MD

June 3-4
Cyber/Electronic Warfare Convergence
Charleston, SC