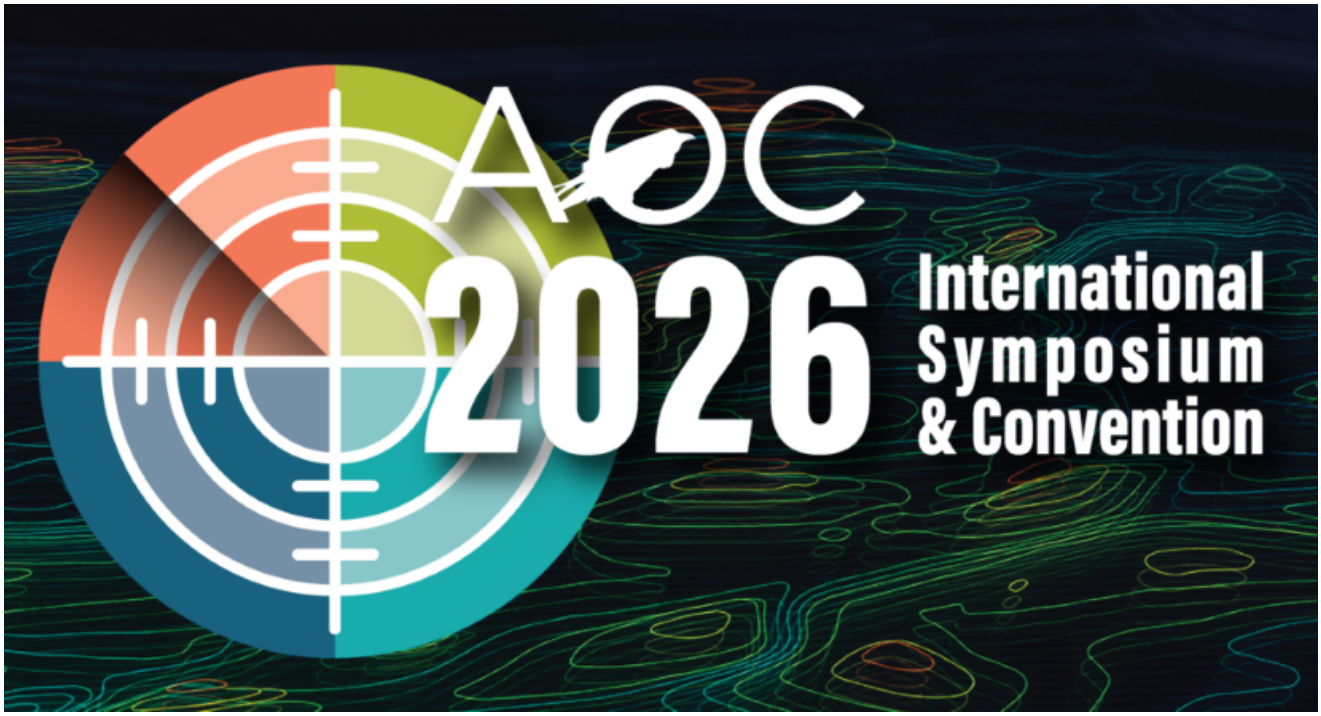
Electromagnetic Spectrum Superiority in a Regionally Contested World



By Kevin Finch, AOC Board Director and AOC 2025 and 2026 Symposium Chair

Thank you to everyone who joined us last year and contributed to the success of the 2025 AOC International Symposium & Convention. Your engagement and insights made last year's theme, **Charting a Path to 2035: Navigating the Future of Electromagnetic Spectrum Operations**, a powerful catalyst for dialogue and innovation. As we look ahead to **AOC 2026**, we are excited to build on that foundation with a theme that pushes the conversation forward: **EMS Superiority – Challenges and Opportunities Across the Globe**.

Why the Spectrum Defines Today's Fight

For those of us who have spent our careers in electromagnetic warfare (EW) and electromagnetic spectrum operations (EMSO),

the growing importance of the spectrum is not a theoretical concept, it is a lived experience. What has changed is the speed and scale at which the spectrum is contested. Advances in digital technologies, the convergence of EW and RF cyber effects, and the proliferation of commercial systems have transformed the EMS into a maneuver space where advantage is fleeting and hesitation is costly.

AOC 2025 captured this moment and challenged our community to think beyond individual systems and toward a holistic vision for EMS superiority, one that recognizes the spectrum as foundational to multi-domain operations, deterrence, and decision advantage.

As we look toward the AOC 2026, the question is no longer whether EMSO is decisive, but how we operationalize that understanding across a world defined by regional complexity, diverse adversaries, and accelerating technological change.

> **AOC 2026 International Symposium & Convention – December 8-10, 2026, National Harbor, MD**
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> - The industry's leading, three-day event, bringing together more than 2,500 professionals from 40+ countries spanning industry, military, and government sectors.
> - **Call for Papers now open!** Submit your abstract by June 30.
> - Registration opens later this summer.
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From Concept to Commitment: Lessons from AOC 2025

AOC 2025 established a critical baseline: Achieving EMS dominance will require synchronized change across DOTMLPF-P, enabled by technology but driven by people, policy, and organizational agility.

Panelists for the Spotlight Session titled Strategic Vision for EW in 2035 emphasized that the future of EW is increasingly software-defined, data-centric, and algorithmically driven. Cognitive EW, AI-enabled signal processing, and machine-speed decision aids are already reshaping how we sense, decide, and act in the spectrum. At the same time, these technologies place new demands on doctrine, training, and cybersecurity. Systems that adapt in real time must also be trusted, secured, and validated under operational conditions.

Breakout discussions on multi-domain operations reinforced the idea that EW can no longer exist at the margins of planning. EMS effects must be integrated with kinetic and non-kinetic fires, cyber operations, and space control. In this construct, EW becomes both sensor and effector, feeding data into joint kill chains while simultaneously shaping the adversary's perception, access, and decision-making.

Industry-focused sessions highlighted the reality that affordability and scalability matter. Adversaries are not pursuing exquisite, limited-quantity systems alone; they are fielding large numbers of capable, networked, and often expendable technologies. Our response must include open architectures, modular designs, and low-cost or attritable EW capabilities that can be deployed, upgraded, and replaced at the speed of war.

Technology as Enabler – and Disruptor

The path to 2035 will be shaped by several interrelated technological trends.

Artificial intelligence and machine learning are transforming EW from emitter-level management to environment-level orchestration, enabling systems to correlate signals across platforms, domains, and time for actionable insight. This evolution demands rapid reprogramming to ingest new threat

signatures and deploy updated techniques in near real time versus days or weeks, facilitating the compression of decision cycles. Future architectures must also embrace approaches that are platform-agnostic for seamless integration across air, land, sea, space, and cyber capabilities to dynamically select jamming, spoofing, deception, sensing, or cyber-enabled effects based on mission context. These capabilities, driven by AI decision engines, enhance resilience and scalability while reducing reliance on static libraries and proprietary hardware solutions. As autonomy grows, human-machine teaming and trust in the data presented become critical, requiring transparent AI models and training that shifts operators from button-pushers to mission supervisors. Together, AI/ML, rapid reprogramming, and the ability for hardware to effectively employ agnostic techniques position EW as a proactive, predictive capability that dominates the spectrum across all domains.

Electromagnetic battle management (EMBM) is the connective tissue that turns disparate sensors, effectors, and decision-makers into a coherent EMSO force. As the electromagnetic spectrum grows more contested, congested, and dynamic, the ability to sense, understand, decide, and act at machine speed is no longer optional. EMBM provides commanders with the ability to visualize the spectrum in near real time, prioritize effects, deconflict friendly use, and synchronize electromagnetic actions across domains and echelons. More importantly, it enables human-machine teaming, where automation and AI assist with pattern recognition, course-of-action development, and rapid re-tasking, while humans retain decision authority. Without effective EMBM, even the most advanced EW capabilities risk becoming isolated tools rather than integrated contributors to multi-domain operations and decision dominance.

Equally critical to achieving the vision to rapidly equip the force is the creation of dedicated EMSO integration

laboratories designed to accelerate the integration, testing, and deployment of emerging capabilities. These labs serve as operationally informed environments where government, industry, and partners can rapidly connect software-defined EW systems, EMBM tools, cyber capabilities, and mission systems using open architectures and digital engineering. By enabling continuous integration and continuous delivery pipelines, integration labs reduce the traditional lag between development and fielding, uncover interoperability issues early, and allow capabilities to be evaluated against realistic threat representations. When coupled with mission-based testing and streamlined cybersecurity and accreditation approaches, these labs become force multipliers, turning innovation into operational capability at the pace required for today's spectrum fight and ensuring EMSO solutions are ready to scale across regions and coalitions.

Software-defined and open systems architectures are equally transformative. They allow capabilities to be updated through code rather than hardware refreshes, accelerating adaptation to new threats. Open standards also enable coalition interoperability and reduce vendor lock-in, critical advantages in both operational and acquisition contexts.

Autonomy and attritable systems are changing the economics of the spectrum fight. Uncrewed platforms equipped with EW payloads can extend sensing and effects into denied areas, accept higher risk, and complicate adversary targeting. When paired with modular payloads and low-cost designs, these systems offer commanders new options for distributed and resilient EMSO.

At the same time, cybersecurity and resilience have become inseparable from EW effectiveness. As systems grow more connected and data-driven, they present expanded attack surfaces. The modernization of Information Assurance and Test & Evaluation processes — emphasizing automation, continuous monitoring, and mission-based testing — is essential to

ensuring that speed does not come at the expense of survivability.

Why Regionally Aligned EMSO Matters

While these technologies are globally relevant, their application must reflect regional realities.

In the Indo-Pacific, the EMS fight is defined by scale, distance, and peer competition. Advanced adversary EW, dense A2/AD networks, and reliance on space-based capabilities demand distributed, resilient architectures. Here, technologies such as autonomous sensing platforms, mesh networks, and AI-enabled spectrum management are essential to sustaining operations across vast maritime and air spaces.

In Europe, ongoing conflict has demonstrated the importance of adaptability. Rapid software updates, electronic protection of civilian infrastructure, and coalition interoperability are not future goals, they are current necessities. Lessons learned from operational EW employment are shaping how technologies are fielded, modified, and integrated in near-real time.

In the Middle East, EMSO is shaped by persistent conflict, hybrid threats, and the proliferation of advanced commercial and military technologies. Adversaries blend state-sponsored capabilities with irregular tactics, creating a spectrum environment where unmanned systems, GPS denial, and sophisticated communication deception are routinely employed. Operations here reinforce the need for rapid detect-to-protect cycles, resilient PNT alternatives, and technologies that thrive in cluttered urban and electromagnetic environments. Lessons from the region highlight the importance of counter-UAS integration, agile EW employment, and the fusion of ES with real-time targeting, demonstrating that EMSO must be both anticipatory and adaptable in an area where threats evolve faster than traditional acquisition cycles.

Across Latin and South America, EMSO often supports counter-transnational and security cooperation missions. Here, scalable spectrum monitoring, low-cost jamming, and commercial-derived technologies can deliver significant impact without requiring large footprints or exquisite systems.

In North America, the focus is on resilience. The convergence of commercial and military spectrum use, coupled with cyber and space dependencies, demands technologies that enable persistent awareness, rapid response, and protection of critical infrastructure in a highly congested environment.

In Africa, expeditionary and partner-focused EMSO benefits from modular, transportable systems that can be rapidly deployed and sustained with limited infrastructure. Technology here must emphasize simplicity, robustness, and adaptability.

Enabling the Workforce and the Institution

Technology alone will not deliver spectrum superiority. AOC 2025 underscored the need to modernize requirements generation, moving beyond rigid, time-consuming processes toward agile, threat-informed models. Digital engineering, rapid prototyping, and iterative upgrades are becoming essential tools for aligning capability development with operational demand.

Equally important is how we fund innovation. Emerging reforms to the Planning, Programming, Budgeting, and Execution (PPBE) process, particularly more flexible Research, Development, Test, and Evaluation (RDT&E) funding and mission-based resourcing, offer an opportunity to better align investment with the pace of the threat. For EMSO, these changes could enable faster experimentation, transition, and scaling of promising technologies.

Finally, none of this is sustainable without people. Recruiting and training the EW workforce of 2035 requires new approaches leveraging advanced simulation, AI-enabled training

tools, and continuous learning models. Doctrine and organizational structures must also evolve to reflect the convergence of EW, cyber, and space operations.

Looking Forward

The conversation that began at AOC 2025 continues to mature. The AOC 2026 theme reflects a shift from defining a destination to executing a strategy, one that acknowledges regional diversity, technological acceleration, and institutional constraints.

Electromagnetic spectrum superiority will not be achieved through a single program or breakthrough. It will be built deliberately, through linked regionally aligned strategies, adaptable technologies, and sustained collaboration across government, alliances, industry, and the Science and Technology community. The spectrum is already contested. The task before us is to ensure that, by 2035, it remains decisively, and enduringly, ours. Please ***mark your calendar for December 8-10, 2026, and join us at the AOC 2026 International Symposium & Convention in National Harbor, Maryland***, where thought leaders and innovators will come together to discuss the challenges and opportunities of electromagnetic spectrum superiority across the globe.