Directed Energy: Where Does It Fit in the Electromagnetic Spectrum Operations Puzzle?

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The realm of directed energy (DE) technologies, while promising, remains a challenging field in terms of its integration into broader electromagnetic spectrum (EMS) operations. Despite significant advancements and growing interest in DE systems, these technologies struggle to find a definitive place within Department of Defense (DOD) programs, primarily due to a lack of sustained leadership support, coherent funding streams and clear demonstration of value to potential military customers. Recently I had the opportunity to attend the Directed Energy Professional Society (DEPS) Directed Energy Science & Technology Symposium. The conference was busy with a jam packed agenda sharing information with more than 550 directed energy professionals. Some of my key takeaways follow:

Current Status and Challenges
Directed energy encompasses a variety of technologies, including high-energy lasers (HEL) and high-power microwaves (HPM), each with unique operational benefits and challenges. However, DE systems are yet to establish a program of record within the DOD, meaning they lack the formal recognition and sustained funding typically associated with established defense programs. This absence hinders long-term planning and integration efforts, leaving DE initiatives primarily confined to research and development phases within laboratory settings.
One of the primary challenges DE technologies face is securing consistent leadership support. The complexity and novelty of these systems often lead to skepticism among military leaders

who may prefer to invest in more conventional and proven technologies. This hesitancy is compounded by the difficulty in demonstrating the tangible value of DE systems to potential users. Unlike kinetic weapons, whose effects are immediately observable and measurable, the impacts of DE weapons can be more subtle and varied, requiring sophisticated assessment tools and methodologies to fully understand their operational potential.

Funding and Development

The funding landscape for directed energy is another significant hurdle. Currently, DE projects receive funding from various research grants and temporary programs, which are often insufficient for transitioning these technologies from the lab to the field. The agenda of the DEPS Science & Technology Symposium highlights numerous technical sessions and reviews that focus on ongoing research in DE technologies, indicating a vibrant and active research community. However, without stable and substantial funding commitments, these initiatives struggle to progress beyond experimental and prototype stages.

For instance, during the symposium, discussions on topics such as laser sources, beam control and HPM systems underscored the technical complexities and the need for continued innovation in these areas□□. Yet, the transition from these technical achievements to practical, deployable systems remains sluggish due to inconsistent funding and the challenge of a coordinated effort to push these technologies into operational use.

Space: The Next Frontier for Directed Energy

One promising avenue for the future deployment of directed energy weapons is space. The unique environment of space offers several advantages for DE systems, such as the absence of atmospheric interference and the potential for long-range, high-precision targeting. During my attendance at the DEPS Science & Technology Symposium, several sessions hinted at the potential applications of DE technologies in space operations.

The ability to integrate DE systems into satellite platforms could revolutionize space-based defense and offer unparalleled capabilities for missile defense, satellite protection and space situational awareness.

The Path Forward

To overcome these obstacles, several measures could be considered:

- Establishing or leveraging a Program of Record: Creating a dedicated program for directed energy within the DOD would provide the necessary structure and sustained funding to support the development and integration of DE systems. This program could also facilitate better coordination among various branches of the military, ensuring a unified approach to DE technology adoption. At a minimum, find a program of record to leverage future funding for DE programs.
- Leadership Advocacy: Increasing advocacy from high-ranking officials and influential leaders within the defense community can help garner the necessary support for DE initiatives. Highlighting successful case studies and demonstrable benefits of DE systems in controlled environments could aid in building this support. The Optical Dazzler Interdictor Navy (ODIN) is an example of how directed energy systems are starting to find their place. ODIN’s integration into the fleet demonstrates the potential for DE systems to enhance naval operations by providing non-lethal deterrence and protection against optical threats□□. This success story could pave the way for further integration of DE technologies in space and other domains.
- Demonstrating Operational Value: Conducting comprehensive field tests and operational demonstrations that clearly showcase the effectiveness and advantages of DE systems in real-world scenarios is crucial. These demonstrations should be designed to address the

specific concerns and operational needs of potential military users.

- Streamlined Funding: Simplifying and securing the funding process for DE projects is essential. This could involve dedicated budget allocations and multi-year funding commitments that provide researchers and developers with the financial stability needed to advance their work.

Collaboration with the Association of Old Crows

The Association of Old Crows (AOC) can play a pivotal role in supporting DEPS and advancing the cause of directed energy technologies. By leveraging its extensive network and influence within the defense community, the AOC can help raise awareness about the importance and potential of DE systems. Advocacy efforts could focus on educating policymakers and military leaders about the strategic advantages of DE technologies, thereby helping to secure the necessary support and funding. Additionally, outreach initiatives aimed at fostering collaboration between government, industry and academia can further drive innovation and facilitate the transition of DE technologies from research to operational deployment.

Conclusion

Directed energy technologies hold significant potential to enhance electromagnetic spectrum operations and provide the military with powerful new capabilities. However, realizing this potential requires overcoming significant hurdles related to leadership support, funding and the demonstration of value. By establishing a clear program of record, securing consistent leadership advocacy, demonstrating operational value and streamlining funding processes, the DOD can effectively integrate DE systems into its arsenal, ensuring that these cutting-edge technologies transition from the lab to the battlefield. The discussions and reviews at the DEPS Science & Technology Symposium offer a roadmap for addressing these

challenges, but concerted effort and strategic commitment are necessary to transform these insights into tangible operational capabilities.