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Directed Energy Maturity for Airborne Self-Defense Applications

Abstract

Recent advances in Directed Energy (DE) technologies indicate that their implementation on large airborne platforms may be possible in the near term. Air Force Special Operations Command (AFSOC) has expressed strong interest in two particular DE capabilities for implementation on the AC-130 gunship: high energy lasers (HEL) and Active Denial Systems (ADS). However, previous US Air Force efforts to field DE systems have been met with challenges such as platform integration and lack of effectiveness. Therefore, Air Force leadership tasked the Air Force Scientific Advisory Board (SAB) to conduct a study to assess the "Directed Energy Maturity for Airborne Self Defense Applications (DEA)." This study is commissioned to determine AFSOC operations (both defensive and offensive) that may benefit from DE technologies, to identify potential DE systems that are mature enough to meet the requirements of the missions, and to establish whether the DE systems can be for integration into the AC-130 for operational use. The report presents the major findings and recommendations from the study.

Solid state HEL systems have seen a significant advance in terms of the power generated per total system mass, which is a particularly important parameter for airborne application. Two main classes of such HEL systems are being developed based on slab and fiber technologies. The SAB study finds that airborne HEL capabilities can provide utility to AFSOC for both defensive and offensive operations of the AC-130. For defensive operations, current platform measures have some gaps against evolving threats. Through analysis conducted in the study, it is determined that a HEL can address these threats. A system designed for this self-defense application would also offer auxiliary offensive capability against some targets. In addition, the size, weight, and power (SWaP) required by a defensive HEL system may allow retention of all kinetic weapon systems on the platform. A purely offensive HEL capability would generate operationally useful effects such as setting fires and disabling infrastructure. Further trade space analysis is required to determine the relative benefits of HEL defense versus offense, of HEL offensive compared to kinetic weapons, and to determine the level of covertness feasible for certain applications.

Further analysis was conducted in the study to determine the characteristics of the HEL systems that can be accommodated on the AC-130 to augment AFSOC operations. Important considerations in this analysis included the location of the system on the platform, the system duty cycle (lase time and re-charge time), and SWaP available. The results of the analyses indicate that low to mid-power HEL systems can be accommodated on the platform. It is therefore concluded that a flight demonstration of a HEL system on the AC-130 can be accomplished in the 2020 timeframe. The SAB panel recommends that a HEL Demo be performed and that it is structured to focus on defensive operations in order to maximize utility for a follow-on operational capability. In addition, the Demo should be used for experimentation to establish auxiliary offensive capability. Due to the evolving progress in HEL performance, the study further recommends that technology development be continued on the various laser source approaches to determine which is best suited to AFSOC mission needs.

Finally, the SAB finds that ADS cannot provide operational utility on the AC-130 by 2020. Currently, the underlying technology is at a low readiness level for airborne implementation, and the existing system is not compatible with AC-130 SWaP capacity. It is recommended that a watch posture is assumed as other federal and civil agencies work to advance ground-based systems.

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