Defense Systems
Information Analysis Center

# DSIAC TECHNICAL INQUIRY (TI) RESPONSE REPORT

## U.S. Military Counter-Unmanned Aircraft Systems (C-UAS)

**Report Number:**
DSIAC-2019-1112
**Completed May 2019**

**DSIAC** is a Department of Defense
Information Analysis Center

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# ABOUT DSIAC

The Defense Systems Information Analysis Center (DSIAC) is a U.S. Department of Defense Information Analysis Center sponsored by the Defense Technical Information Center. DSIAC is operated by SURVICE Engineering Company under contract FA8075-14-D-0001.

DSIAC serves as the national clearinghouse for worldwide scientific and technical information for weapon systems; survivability and vulnerability; reliability, maintainability, quality, supportability, and interoperability; advanced materials; military sensing; autonomous systems; energetics; directed energy; and non-lethal weapons. We collect, analyze, synthesize, and disseminate related technical information and data for each of these focus areas.

A chief service of DSIAC is free technical inquiry (TI) research, limited to 4 research hours per inquiry. This TI response report summarizes the research findings of one such inquiry. For more information about DSIAC and our TI service, please visit www.DSIAC.org.

# ABSTRACT

The Defense Systems Information Analysis Center (DSIAC) received a technical inquiry requesting information on the latest counter-unmanned aircraft system (C-UAS) solutions for the U.S. Army, Navy, Air Force, and Marine Corps. DSIAC reached out to C-UAS subject matter experts (SMEs) at the Joint Improvised-Threat Defeat Organization (JIDO) for relevant systems. The JIDO SMEs provided the Secret Internet Protocol Router Network (SIPRNet) URL address for the collected repository of UAS and C-UAS technologies. DSIAC also searched open sources and the Unmanned Airspace C-UAS database for systems deployed or funded by each of the U.S. Armed Services. The collected C-UAS solutions were compiled in a response report, and the SIPRNet URL can be requested.

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# 1.0 TI Request

## 1.1 INQUIRY

What are the latest counter-unmanned aircraft systems (C-UAS's) in use or development by the U.S. Armed Forces?

## 1.2 DESCRIPTION

The inquirer requested information on the latest U.S. Navy, Marine Corps (USMC), Army, and Air Force solutions for C-UAS defense.

# 2.0 TI Response

The Defense Systems Information Analysis Center (DSIAC) searched open sources, the Defense Technical Information Center Research and Engineering Gateway, and the Unmanned Airspace C-UAS database to collect information on the latest technologies in use or development by the various U.S. Armed Forces for C-UAS defense. DSIAC contacted subject matter experts (SMEs) from the Joint Improvised-Threat Defeat Organization (JIDO) for data from their unclassified repository, the Propel database. There were 18 C-UAS technologies in this database, which can be accessed from the Secret Internet Protocol Router Network [1]. Other C-UAS technologies were compiled and organized by each of the U.S. Armed Services branches.

## 2.1 U.S. ARMY SYSTEMS

### 2.1.1 Boeing/General Dynamics: Mobile Expeditionary High-Energy Laser (MEHEL) 2.0

The MEHEL 2.0 improves upon the original model by upgrading its C-UAS capabilities (e.g., it upgrades the original 2-kW laser to a 5-kW laser). The MEHEL is a laser testbed on a Stryker armored fighting vehicle chassis (shown in Figure 1) and serves as a platform for research and development. The MEHEL 2.0 engaged small, fixed-wing UAS's and quad copters at the 2017 JIDO UAS Hard-Kill Challenge. The system, developed by the U.S. Army Space and Missile Defense Command, includes multiple U.S. Army Aviation and Missile Research, Development, and Engineering Center C-UAS components. The MEHEL 2.0 is the first use of an Army laser on a combat vehicle; this is a result of recognizing high-energy lasers (HEL) as potential low-cost compliments to other kinetic kill C-UAS options [2, 3].

**Figure 1: MEHEL Mounted on a Stryker Armored Fighting Vehicle Chassis (Source: U.S. Army) [3].**

### 2.1.2 Leonardo DRS: Mobile Low, Slow Unmanned Aerial Vehicle Integrated Defense Systems (MLIDS)

MLIDS is a collection of different sensors and weapon systems integrated by DRS and mounted on top of two separate mine-resistant, ambush-protected, medium all-terrain vehicles (M-ATVs) [2], as shown in Figure 2. The U.S. Army awarded a contract for the MLIDS to defeat small, inexpensive unmanned systems such as quadcopters and fixed-wing aircraft that operate as airborne improvised explosive devices (IEDs). One system is equipped with electrooptical and infrared sensors, while the other is equipped with the Moog's Reconfigurable Integrated-Weapons Platform [4].

**Figure 2: An MAT-V Equipped With the MLIDS C-UAS Solution (Source: Leonardo DRS) [4].**

### 2.1.3 CACI: CORIAN

The CORIAN system is a configuration of the CACI SkyTracker UAS tracking solution tailored to meet the U.S. Army's evolving Outside Continental United States mission needs. This system detects, identifies, tracks, and mitigates UAS's by exploiting their radio signals and can locate the system's ground operator. For U.S. Army use, the CORIAN is configured to host multiple electronic warfare (EW) capabilities to nonkinetically defeat UAS's at long ranges [2, 5].

### 2.1.4 Raytheon: Coyote

The Army bought Raytheon's Coyote UAS (Figure 3) and equipped the drone with a small-blast warhead and Raytheon's Ku-band radio frequency (RF) radar to track and engage enemy drones. The Coyote is a tube-launched, expendable drone that can be launched from land, ships, or aircraft. Raytheon is discussing similar sales with the U.S. Navy and USMC and has already tested the Coyote's swarming capabilities with the Navy as part of the Low-Cost Unmanned Aerial Vehicle Swarming Technology program [2, 6].

Figure 3: The Coyote UAS for Use in C-UAS and UAS Applications(Source: Raytheon) [6].

### 2.1.5 Rajant: Mobile Ad Hoc Networking (MANET) Solution

Rajant is one of the companies developing a MANET C-UAS solution for evaluation by the U.S. Army's Program Manager for Counter-Rockets, Artillery, and Mortars (PM CRAM). Rajant's solution is for a swarm of approximately 20 vertical take-off and landing drones to launch when rocket and mortar or UAS targets are detected [2]. The system was delivered to the U.S. Army's Program Manager for PM CRAM for evaluation in October 2017 [7].

### 2.1.6 Lockheed Martin: High-Powered Microwave (HPM) C-UAS

The U.S. Army awarded a $12.5 million contract to Lockheed Martin in late 2018 to produce an airborne HPM C-UAS to defeat other unmanned aircraft [8].

### 2.1.7 SRC Inc.: Counter-Drone System

The U.S. Army awarded SRC Inc. of Cicero a $108 million contract to counter and defeat small, slow, and low-flying drones in January 2019. The Army had initially ordered 15 counter-drone systems in 2017 as part of a $65 million contract, while the Air Force paid a $57 million contract for the systems in 2018 [9].

## 2.2 U.S. NAVY SYSTEMS

### 2.2.1 Northrop Grumman: Joint Counter, Radio-Controlled, Improvised Explosive Device Electronic Warfare (JCREW) System

JCREW is a software-programmable jammer that provides protection from IEDs, such as those equipped on UAS's [2]. Although JCREW was acquired by the U.S. Navy and Air Force, the Naval Sea Systems Command awarded them several contracts. JCREW devices are high-power,

modular, programmable, multiband RF jammers designed to deny enemy use of select ion portions of the RF spectrum. The devices can be either fixed, mounted (3.2 version), or dismounted (3.1 version). As of March 2019, Northrop Grumman was awarded a $245 million contract from Naval Sea Systems Command for the full-rate production of JCREW Increment 1, Block 1 systems [10, 11].

### 2.2.2 Lockheed Martin: HEL and Integrated Optical-Dazzler With Surveillance (HELIOS)

The U.S. Navy awarded a $150 million contract to Lockheed Martin in March 2018 to develop, manufacture, and deliver two high-power laser weapon systems by fiscal year 2020, including intelligence, surveillance, and reconnaissance (ISR) and C-UAS capabilities [2]. The HELIOS effort focuses on the rapid development and fielding of a 60-kW-class HEL and dazzler in an integrated weapon system to counter UAS's, small boats, and ISR sensors. One HELIOS system will be installed on a Navy Arleigh Burke (DDG-51) class Aegis destroyer (shown in Figure 4), and the other will be for land-based testing [12].

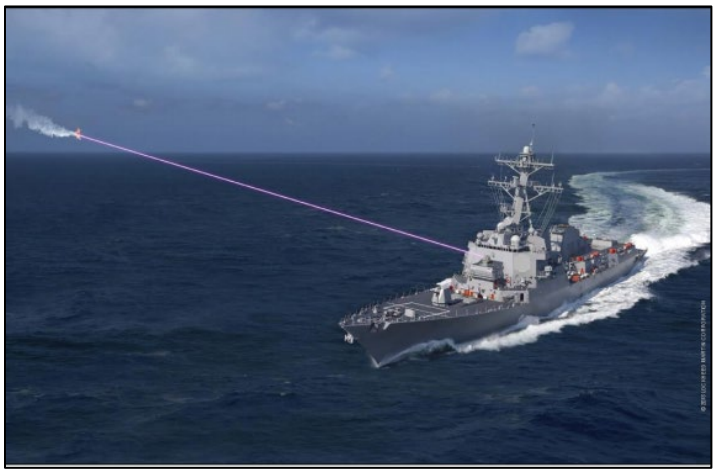

**Figure 4: An Artist's Rendition of HELIOS Installed on a DDG-51 (Source: Lockheed Martin) [12].**

### 2.2.3 SafeSky: C-UAS Solution

SafeSky is a startup company that received a $1.5 million contract from Defense Innovation Unit Experimental, a Pentagon innovative acquisition team, to develop RF technology to bring unwanted drones either crashing to the ground or back to its takeoff point. SafeSky worked with Naval Special Warfare to test their technology, and they plan to have a prototype ready for the field in 2018 [2, 13].

### 2.2.4 CACI: SkyTracker

The U.S. Navy awarded CACI a $48.5 million contract to deploy new and existing C-UAS technologies, including its SkyTracker suite. SkyTracker uses precision neutralization techniques to minimize collateral damage to surrounding RF spectrum and communications. The contract was awarded by the Naval Air Systems Command Naval Air Warfare Center Aircraft Division [14].

## 2.3 U.S. AIR FORCE SYSTEMS

### 2.3.1 Boeing: Counter-Electronics HPM Advanced Missile Project (CHAMP)

Boeing and the AFRL Directed Energy Directorate successfully tested the CHAMP system in October 2012, rendering electronic targets useless. CHAMP is a nonkinetic solution that could be an alternative to the traditional explosive methods to defeat a UAS [2]. The microwave weapons can be fitted on air-launched cruise missiles and fly while emitting sharp pulses of HPM energy to disable the targeted electronic devices without causing collateral damage [15].

### 2.3.2 Liteye: Containerized Anti-UAV Defense Systems (C-AUDS)

Liteye Systems received an $18 million follow-on contract to deliver C-AUDS (shown in Figure 5) for the Air Force. The U.S. version of AUDS was first deployed by the Army in late 2016 [16]. Liteye Systems is deploying and supporting multiple C-UAS solutions, including AUDS, Mobile-AUDS (M-AUDS), M-AUDS-Kinetic Energy, and C-AUDS [2].

Figure 5: Liteye's C-AUDS Solution (Source: Liteye) [16].

## 2.4 USMC SYSTEMS

### 2.4.1 Northrop Grumman: Ground/Air Task Oriented Radar (G/ATOR)

G/ATOR (shown in Figure 6) is a three-dimensional, short-/medium-range, multirole radar designed to detect UAS's, cruise missiles, air breathing targets, rockets, artillery, and mortars. G/ATOR is comprised of three major subsystems—the Radar Equipment Group, Communications Equipment Group, and Power Equipment Group. Northrop Grumman developed and manufactured the system employed by the Marines Air-Ground Task Force within the Air Combat Element and Ground Combat Element [17]. The U.S. Army is coordinating with the USMC to integrate G/ATOR with the Integrated Air and Missile Defense program, specifically the USMC AN/TPS-80 G/ATOR radar [18].

Figure 6: G/ATOR Setup at the USMC Air Station Cherry Point, NC (Source: Lance Cpl. Ethan Pumphret) [17].

### 2.4.2 Ground-Based Air Defense-Transformation (GBAD)

The GBAD system is a detection system that can track and destroy drones. The technology is mountable on the USMC's joint light tactical vehicle or high-mobility, multipurpose, wheeled vehicle and is still undergoing testing and evaluation [19]. GBAD combines existing systems like the RADA RPS-42 S-band radar, the Sierra Nevada Modi EW system, Lockheed Martin visual sensors, and Raytheon Coyote UAS's to detect, track, and destroy hostile drones. The current prototype version is built to operate from a forward operation base, a Marine M-ATV (as shown in Figure 7), or a Polaris MRZR off-road vehicle [20].

Figure 7: GBAD System Mounted on an M-ATV (Source: U.S. Naval Institute News) [20].

### 2.4.3 Light Marine Air Defense Integrated System (LMADIS)

LMADIS is comprised of two Polaris MRZR ATVs, a command node, and a sensor vehicle. The LMADIS can detect, track, identify, and defeat drones with an electronic attack. The LMADIS is currently deployed with the 13th Marine Expeditionary Unit [19].

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