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Department of Defense Counter-Unmanned Aircraft Systems

Unmanned aircraft systems (UAS), commonly called drones, have proliferated rapidly and are available to nation states and to nonstate actors and individuals. These systems could provide U.S. adversaries with a low-cost means of conducting intelligence, surveillance, and reconnaissance missions against—or attacking—U.S. forces. Furthermore, many smaller UASs cannot be detected by traditional air defense systems due to their size, construction material, and flight altitude. As a result, in FY2021, the Department of Defense (DOD) plans to spend at least $404 million on counter-UAS (C-UAS) research and development and at least $83 million on C-UAS procurement. As DOD continues to develop, procure, and deploy these systems, congressional oversight of their use may increase, and Congress may have to make decisions about future authorizations, appropriations, and other legislative actions.

C-UAS Technology

C-UAS can employ a number of methods to detect the presence of hostile or unauthorized UAS. The first is using electro-optical, infrared, or acoustic sensors to detect a target by its visual, heat, or sound signatures, respectively. A second method is to use radar systems. However, these methods are not always capable of detecting small UAS due to the limited signatures and size of such UAS. A third method is identifying the wireless signals used to control the UAS, commonly using radio frequency sensors. These methods can be—and often are—combined to provide a more effective, layered detection capability.

Once detected, the UAS may be engaged or disabled. Electronic warfare "jamming" can interfere with a UAS's communications link to its operator. Jamming devices can be as light as 5 to 10 pounds and therefore man-portable (see **Figure 1**), or as heavy as several hundred pounds and in fixed locations or mounted on vehicles. UAS can also be neutralized or destroyed using guns, nets, directed energy, traditional air defense systems, or even trained animals such as eagles. DOD is developing and procuring a number of different C-UAS technologies to try to ensure a robust defensive capability.

Air Force

The Air Force is testing high-powered microwaves and lasers—both forms of directed energy—for C-UAS missions. For example, in October 2019, the Air Force received delivery of a vehicle-mounted C-UAS prototype—the High-Energy Laser Weapon System (HELWS)—that will undergo a year-long overseas field test. HELWS is intended to identify and neutralize hostile or unauthorized UAS in seconds and, when connected to a generator, to provide "a nearly infinite number of shots." As stated in its 2016 Small UAS Flight Plan, the Air Force may additionally pursue airborne C-UAS options, although the status of such efforts is unclear.

Figure 1. Man-Portable Counter-UAS Technology

Source: https://www.military.com/daily-news/2020/01/15/new-pentagon-team-will-develop-ways-fight-enemy-drones.html.

Navy

In 2014, the Navy fielded the first—and, to date, only—operational directed-energy weapon, the Laser Weapon System (LaWS), aboard the *USS Ponce* (LPD-15). LaWS is a 30-kilowatt laser prototype capable of performing a C-UAS mission. The Navy also plans to deploy ODIN, an optical dazzler that interferes with UAS sensors, and HELIOS, a 60-kilowatt laser, aboard the *USS Preble* (DDG-88) in 2021. Both systems are intended to protect U.S. assets from UAS attacks. In addition, in a March 28, 2019, memorandum, the Department of the Navy announced that it would be partnering with the Defense Digital Service to "rapidly develop new [cyber-enabled] C-UAS products to address the evolving UAS threats."

Marine Corps

The Marine Corps funds a number of C-UAS systems through its Ground Based Air Defense (GBAD) program office. For example, in 2019, the Corps completed overseas tests of the Marine Air Defense Integrated System (MADIS), which employs jamming and guns. The system can be mounted on MRZR all-terrain vehicles, Joint Light Tactical Vehicles, and other platforms (see **Figure 2**). In July 2019, Marines aboard the *USS Boxer* (LHD-4) used MADIS to neutralize an Iranian UAS that was deemed to be within "threatening range" of the ship. As part of GBAD, the Marine Corps is also procuring the Compact Laser Weapons System (CLaWS), the first DOD-approved ground-based laser. This system—which reportedly comes in variants of 2-, 5-, and 10-kilowatts—is also in use by the Army. Although the Marine Corps has experimented with man-portable C-UAS technologies, now-Commandant of the Marine Corps David Berger testified to Congress in

2019 that they "have not panned out" due to weight and power requirements.

Figure 2. Marine Air Defense Integrated System

Source: https://www.marcorsyscom.marines.mil/PEOs/-PEO-LS/PM-GBAD/.

Army

In July 2016, the Army published a C-UAS strategy to guide the development of its C-UAS capabilities (to date the only service to do so publicly). This was followed in April 2017 by Army Techniques Publication 3-01.81, *Counter-Unmanned Aircraft System Techniques*, which outlined "planning considerations for defending against low, slow, small [LSS] unmanned air threats during operations," as well as "how to plan for, and incorporate, C-UAS soldier tasks into unit training events." C-UAS is also part of the U.S. Army Combat Capabilities Development Command's six-layer air and missile defense concept, composed of (1) Ballistic, Low-Altitude Drone Engagement (BLADE), (2) Multi-Mission High-Energy Laser (MMHEL), (3) Next-Generation Fires Radar, (4) Maneuver Air Defense Technology (MADT), (5) High-Energy Laser Tactical Vehicle Demonstrator (HEL-TVD), and (6) Low-Cost Extended Range Air Defense (LOWER AD). Although these systems are still in development, the Army has fielded some man-portable, vehicle-mounted, and airborne C-UAS systems. In addition, like the Navy, it has partnered with the Defense Digital Service to develop computer-enabled C-UAS products.

DOD-Wide Developments

DOD is researching and developing a number of C-UAS technologies. For example, the Joint Staff and other DOD agencies have participated in C-UAS efforts such as Black Dart, an exercise intended to "[assess and validate] existing and emerging air and missile defense capabilities and concepts specific to the C-UAS mission set" and "[advocate] for soldiers' desired C-UAS capabilities." In addition, the Defense Advanced Research Projects Agency (DARPA) funds technology development programs for C-UAS such as CounterSwarmAI, which is to "develop systems for anticipating and defeating autonomous systems of the future," and the Multi-Azimuth Defense Fast Intercept Round Engagement System for ship-based point defense.

In December 2019, DOD streamlined the Department's various counter-small UAS (C-sUAS) programs, naming the Army as the *executive agent* tasked with overseeing all DOD C-sUAS development efforts. On January 6, 2020, the Secretary of Defense approved the implementation plan of the new office, known as the Joint C-sUAS Office (JCO). Working in consultation with the combatant commands and the Office of the Under Secretary of Defense for Acquisition and Sustainment, JCO assessed over 40 fielded C-sUAS systems. To date, it has selected 10 C-sUAS defensive systems and one standardized command and control system for further development.

JCO has produced a Joint Capability Development Document outlining operational requirements for future systems and, in January 2021, released a DOD C-sUAS strategy. JCO is to additionally produce a DOD Directive on C-sUAS and a threat assessment of C-sUAS capabilities. DOD also plans to establish a Joint C-sUAS academy at Fort Sill, Oklahoma by FY2024. The academy is to synchronize training on counter-drone tactics across the military services.

Finally, Section 1074 of the FY2021 National Defense Authorization Act (P.L. 116-283) requires a series of reports to Congress, including a report on and independent assessment of the JCO's C-sUAS activities and a report on the threat posed by UAS.

Potential Questions for Congress

- Is DOD funding of C-UAS systems appropriately balanced between research and development and procurement programs?
- To what extent, if at all, has the designation of a DOD executive agent for C-UAS reduced redundancies and increased efficiencies in C-UAS procurement?
- To what extent, if at all, is DOD coordinating with other departments and organizations, such as the Department of Homeland Security, the Department of Justice, and the Department of Energy, on C-UAS development and procurement?
- Are any changes to airspace management, operational concepts, rules of engagement, or tactics required in order to optimize the use of C-UAS systems and/or de-conflict with other U.S. military operations?
- To what extent, if at all, is DOD coordinating with the Federal Aviation Administration and international civil aviation authorities to identify and mitigate C-UAS operational risks to civil aircraft?

Related CRS Products

CRS In Focus IF11550, *Protecting Against Rogue Drones*, by Bart Elias.

Other Resources

U.S. Department of Defense, *Counter-Small Unmanned Aircraft Systems Strategy*, January 2021.

Arthur Holland Michel, *Counter-Drone Systems*, Center for the Study of the Drone at Bard College, December 2019.

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