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SUMMARY

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Department of Defense Counter Unmanned Aircraft Systems: Background and Issues for Congress

U.S. policymakers have expressed growing concern over the military threats posed by unmanned aircraft systems (UAS, commonly known as drones). The size, speed, and altitude at which many drones fly, as well as the increasing ubiquity, flexibility, affordability, and sophistication of these aircraft, are widely seen as creating significant technical and operational challenges for the U.S. Department of Defense (DOD, or the Deparment).

DOD is investing in defending U.S. forces and facilities against drones, as well as making changes to doctrine, organization, and training. These efforts include the development and deployment of a variety of defensive weapons, ranging from air defense systems to handheld jammers. Within DOD, the Army has been assigned primary responsibility for coordinating counter-UAS strategy, capabilities, and related requirements across the services.

Congress may play an important role in this area, including by authorizing and appropriating funds for counter-UAS activities; maintaining or changing relevant authorities, policies, and organizations; and exercising oversight of DOD's execution of its counter-UAS role. Some of the issues Congress may consider include

- DOD's strategic direction for countering UAS;
- the type and severity of UAS threats;
- the level of coordination within the Department;
- DOD's authorities to protect military installations within the United States;
- the establishment and organization of military forces for countering UAS;
- the costs of conducting counter-UAS operations;
- DOD's ability to test and evaluate counter-UAS systems; and
- the technical maturity of proposed counter-UAS solutions.

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Introduction

On January 28, 2024, a drone strike on a U.S. base in Jordan killed three U.S. servicemembers and injured more than 40.[1] Department of Defense (DOD, or the Department) officials attributed the attack to Iran-backed militia groups in Iraq and Syria, which in the preceding months had escalated drone and rocket attacks on U.S. forces and allies in the region.[2] In Iraq, U.S. military forces have recovered parts of Iranian-origin Shahed series of one-way attack drones—including the Shahed-101, Shahed-131, and Shahed-136—the largest of which DOD officials have said could be equipped with as much as 50 kilograms (101 pounds) of explosives.[3] Similar drones have been used by the Houthi group in its attacks on commercial shipping in the Red Sea, and by Russia in its strikes on Ukrainian cities and energy infrastructure. Both Russia and Ukraine have reportedly produced growing numbers of drones for battlefield use and equipped front-line forces with first-person view (FPV) one-way attack drones armed with explosives to supplement artillery munitions and conventional missiles.[4]

DOD has identified unmanned air, ground, and sea systems as an "urgent and enduring threat to U.S. personnel, facilities, and assets overseas" and said that drones "pose the most significant threat at this time and increasingly in the U.S. homeland."[5] (Unless otherwise specified, CRS uses the terms *unmanned aircraft*, *uncrewed aircraft*, and *drone* interchangeably.) In response, U.S. policymakers and DOD officials have said that the Department should accelerate its investments in defensive counter-unmanned aircraft system (counter-UAS) capabilities.[6] This report reviews DOD's counter-UAS programs and recent legislative activity by Congress to address UAS threats. The first section provides background information on DOD policies, organization, and systems for countering UAS. The second section examines recent legislative activity concerning counter-UAS programs. The final section includes possible issues Congress may consider. This report does not address issues concerning domestic law enforcement.

Background[7]

In 2019, then-Secretary of Defense Mark T. Esper assigned responsibility to the Army for coordinating the activities of the Department and the military services as they related to

[1] C. Todd Lopez, "3 U.S. Service Members Killed, Others Injured in Jordan Following Drone Attack," DOD News, January 29, 2024.

[2] Jim Garamone, "Strikes Against Iran-backed Militias Had 'Good Effects,' Pentagon Spokesman Says," DOD News, February 5, 2024; and Eric Schmitt, "Mix-Up Preceded Deadly Drone Strike in Jordan, U.S. Officials Say," *The New York Times*, January 29, 2024.

[3] U.S. Defense Intelligence Agency, "DIA releases updated report on Russia's use of lethal Iranian unmanned aerial vehicles (UAVs) in Ukraine; UAV display to continue," press release, August 25, 2023; and U.S. Defense Intelligence Agency, *Iran: Enabling Houthi Attacks Across the Middle East*, Washington, DC, February 2024, pp. 5-9.

[4] Economist staff, "How cheap drones are transforming warfare in Ukraine," *The Economist*, February 5, 2024; and Ian Lovett and Nikita Nikolaienko, "It's Russian Men Against Ukrainian Machines on the Battlefields in Ukraine," *The Wall Street Journal*, February 7, 2025.

[5] U.S. Department of Defense, "DoD Announces Strategy for Countering Unmanned Systems," press release, December 5, 2024.

[6] For example, see Statement by Senator Roger Wicker, CQ Congressional Transcripts, *Senate Armed Services Committee Holds Hearing on Pending Nominations*, January 30, 2025; and Ashley Roque, "Secretary Wormuth's advice to next administration: 'Stay on the path' on Army programs," *Breaking Defense*, October 30, 2024.

[7] For additional background, see **Appendix A**.

countering threats posed by small UAS,[8] which DOD defined as unmanned aircraft in Groups 1, 2, and 3, according to the Department's categories of UAS.[9] As DOD's executive agent—a DOD Component head designated by the Secretary of Defense as having the authority to act on behalf of the Secretary[10]—for counter-small UAS, the Army is responsible for leading and directing counter-small UAS "doctrine, requirements, materiel, and training standards and capabilities to establish joint solutions with a common architecture to address current and future emerging Small UAS threats." The Secretary also tasked the Army with responsibility for developing common requirements for counter-UAS systems and conducting oversight of service-developed unique requirements; planning, programming, and budgeting for research into counter-UAS capabilities; and formulating counter-small UAS doctrine, training programs, and curricula, among other tasks.[11]

DOD Counter-UAS Policies and Organizations

DOD Counter-UAS Policies

DOD Strategy

DOD published its *Strategy for Countering Unmanned Systems* in December 2024,[12] superseding two earlier strategies for countering UAS published by the Army and the Department in 2016 and 2020, respectively.[13] The unclassified fact sheet that accompanied the release of the 2024 strategy acknowledges that the "rapid development and proliferation of unmanned systems is changing the

[8] U.S. Department of Defense, *Counter-Small Unmanned Aircraft Systems (C-sUAS) for Unmanned Aircraft Groups 1, 2 and 3*, Washington, DC, November 18, 2019; and Aaron Mehta, "Pentagon wants to streamline its counterdrone focus," *C4ISRNet*, December 11, 2019.

[9] Aaron Mehta, "Pentagon wants to streamline its counterdrone focus," *C4ISRNet*, December 11, 2019. DOD classifies uncrewed aircraft into groups according to aircraft's maximum gross takeoff weight, operating altitude, and speed (see **Appendix C**). The Department's "UAS Categorization Chart" comprises five categories ranging from the smallest aircraft, Group 1, to Group 5, the largest aircraft. For the purpose of countering UAS, DOD has made a distinction between what it refers to as *small UAS*—which DOD has typically identified as those in Groups in 1, 2, and 3—and the larger aircraft in Groups 4 and 5. (The term *small UAS* may be defined or applied differently in other DOD and U.S. government contexts.) DOD expects that defensive operations involving "small" UAS are likely to require the development of unique counter-UAS equipment and systems, as well as the promulgation of counter-UAS policies, training programs, doctrine, and other specific requirements, while larger UAS in Groups 4 and 5 are likely to remain the responsibility of conventional air and missile defense systems and units. See Office of the Chairman of the Joint Chiefs of Staff, *Joint Air Operations*, Joint Publication 3-30, Washington, DC, July 25, 2019, p. III-31; and CRS In Focus IF12797, *Defense Primer: Categories of Uncrewed Aircraft Systems*, by Daniel M. Gettinger.

[10] According to DOD Directive 5101.01, the Secretary of Defense or Congress may designate a DOD Component head as an executive agent when "there is no existing management arrangement to accomplish the identified DoD objectives," "DoD resources, policy, or common service or support need to focus on a specific area or areas of responsibility to minimize duplication or redundancy," or as required by law, executive order or government-wide regulation. See Office of the Director of Administration and Management, *DOD Executive Agent*, DOD Directive 5101.01, Washington, DC, February 7, 2022, p. 3; and U.S. Department of Defense, *DoD Dictionary of Military and Associated Terms*, July 2024, p. 68.

[11] U.S. Department of Defense, *Counter-Small Unmanned Aircraft Systems (C-sUAS) for Unmanned Aircraft Groups 1, 2 and 3*, Washington, DC, November 18, 2019.

[12] U.S. Department of Defense, *Fact Sheet: Department of Defense Strategy for Countering Unmanned Systems*, Washington, DC, December 5, 2024.

[13] Jen Judson, "Army Debuts Strategy to Counter Drone Threats," *Defense News*, November 2, 2016; and Department of Defense, *Counter-Small Unmanned Aircraft Systems Strategy*, 2021. Additionally, the Joint Unmanned Aircraft Systems Center of Excellence (JUAS COE) reportedly published a counter-UAS concept of operations (CONOPS) in 2010-2011, before DOD disestablished the Center in 2012. See Maj. F. Patrick Filbert (Ret.) and Maj. Darryl Johnson (Ret.), "Joint Counter Low, Slow, Small Unmanned Aircraft Systems Test," *Fires*, May/June 2014, p. 22.

character of conflict."[14] In the fact sheet, DOD describes the 2024 strategy as an effort to "unify the Department's approach" to mitigating UAS threats and identified five "strategic ways" by which DOD plans to seek to implement its vision.[15] In the near-term, DOD has stated that it intends to focus on defensive countermeasures "with an emphasis on detection as well as active and passive defense."[16] DOD also has stated that it intends to endeavor to make countering uncrewed systems a "key element of warfighting" and a "key element of our thinking of future force development and design" according to the unclassified fact sheet.[17]

Congress has urged DOD to develop a strategy for countering UAS threats. In an item of special interest accompanying its markup of the National Defense Authorization Act for Fiscal Year 2017 (FY2017 NDAA), the House Armed Services Committee (HASC) directed the Secretary of Defense to develop a roadmap for addressing gaps in DOD's counter-UAS capabilities.[18] Then, in Section 1074 of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (P.L. 116-283), Congress directed DOD to submit to Congress a classified strategy to counter small UAS, as well as reports on the threats posed by small UAS, the activities of DOD's executive agent for counter small UAS, and an independent assessment of DOD counter-UAS programs.[19] In Section 1090 of the National Defense Authorization Act for Fiscal Year 2025 (P.L. 118-159), Congress directed the Defense Secretary to develop a "strategy for countering unmanned aircraft systems ... and the threats such technology poses to the facilities, personnel, and assets" of the Department in the United States.[20]

DOD's Domestic Counter-UAS Authorities

In DOD's 2024 *Strategy for Countering Unmanned Systems*, the Department committed to "mitigating the potential negative effects of unmanned systems on U.S. forces, assets, and installations – at home and abroad," according to the unclassified fact sheet that accompanied its release.[21] One DOD official, citing reports of drone detections around military bases, described drones as an "increasing threat" to domestic military installations,[22] and the Department has worked with federal aviation regulators and law enforcement to identify and respond to reported drone sightings and incursions.[23] However, in addition to the technical challenges associated with safely conducting defensive operations against drones in a domestic setting, there are a number of

[14] U.S. Department of Defense, *Fact Sheet: Department of Defense Strategy for Countering Unmanned Systems*, p. 1.

[15] U.S. Department of Defense, *Fact Sheet: Department of Defense Strategy for Countering Unmanned Systems*, p. 2.

[16] U.S. Department of Defense, *Fact Sheet: Department of Defense Strategy for Countering Unmanned Systems*, p. 1.

[17] U.S. Department of Defense, *Fact Sheet: Department of Defense Strategy for Countering Unmanned Systems*, p. 2.

[18] U.S. Congress, House Armed Services Committee, *Report of the Committee on Armed Services House of Representatives on* H.R. 4909 *together with Additional Views*, report to accompany H.R. 4909, 114th Cong., 2nd sess., May 4, 2016, 114-537 (Washington: GPO, 2016), pp. 80-81.

[19] P.L. 116-283, §1074.

[20] P.L. 118-159, §1090.

[21] U.S. Department of Defense, *Fact Sheet: Department of Defense Strategy for Countering Unmanned Systems*, Washington, DC, December 5, 2024, p. 1.

[22] In congressional testimony in March 2024, Air Force General Gregory M. Guillot, commander of U.S. Northern Command, described drones as an "increasing threat" and said that DOD installations were reporting an average of "two to five" drone sightings each week. See Remarks by General Gregory M. Guillot, U.S. Congress, Senate Armed Services Committee, *To receive testimony on posture of United States Northern Command and United States Southern Command in review of the Defense Authorization Request for Fiscal Year 2025 and the Future Years Defense Program*, 118th Congress, 2nd sess., March 14, 2024, accessed at plus.CQ.com.

[23] U.S. Department of Defense, "Reports of Drone Incursions Taken Seriously, DOD Spokesman Says," press release, December 17, 2024. For additional details, see CRS Insight IN12476, *Drone Encounters Prompt Calls for Restrictions and Other Protections*, by Bart Elias.

applicable federal laws that might prohibit DOD from operating certain equipment for detecting and mitigating UAS within the United States, including statutes prohibiting interference with the signal spectrum, computer hacking, wiretap, and tampering with or damaging an aircraft.[24]

In Section 1697 of the FY2017 NDAA (P.L. 114-328), codified as 10 *United States Code* (U.S.C.) Section 130i, Congress granted DOD the authority to detect, track, and mitigate UAS threats to certain covered facilities and assets, which Congress limited to facilities and assets identified by the Secretary of Defense that are located in the United States and are related to certain DOD missions. Initially, the qualifying DOD missions were those of nuclear deterrence, missile defense, and national security space. Following a request by DOD to expand the Department's counter-UAS authority for specific mission areas,[25] in Section 1692 of the National Defense Authorization Act for Fiscal Year 2018 (P.L. 115-91), Congress revised DOD's authority by amending the definition of covered facilities and assets.[26] Under the expanded definition and in addition to those mission areas already specified in Section 1697 of the FY2017 NDAA, a "covered facility or asset" is one that "directly relates to the missions of the [DOD] pertaining to" protection of the President or Vice President; air defense of the United States; combat support agencies such as the Defense Logistics Agency and National Geospatial Agency; special operations activities; the production, storage, and transportation, or decommission of high-yield explosives; or a Major Test Range and Test Facility Base.[27] At the same time as it added qualifying missions to the definitions in Section 130i, Congress, in Section 1692 of the FY2018 NDAA, limited DOD's authority by introducing a "partial termination" date, at which time the Department's authority as it related to the additional mission areas specified in Section 1692 would expire without intervention by the President or Congress.[28] In Section 1681 of the National Defense Authorization Act for Fiscal Year 2024 (P.L. 118-31), Congress extended the date at which parts of DOD's authority are set to expire to December 31, 2026.[29]

Section 130i of 10 U.S.C. identifies a series of actions DOD may take that it considers "necessary to mitigate the threat" posed by drones, including by disrupting or seizing control of the aircraft or by using "reasonable force" to disable, damage, or destroy the aircraft. In the development and implementation of such actions, Congress directed the Secretary of Defense to coordinate with the Secretary of Transportation and the U.S. Federal Aviation Administration (FAA) before issuing any "guidance or otherwise implementing this section if such guidance or implementation might affect aviation safety, civilian aviation and aerospace operations, aircraft airworthiness, or the use of airspace." According to statements to Congress by an FAA official in 2018, the agency worked with DOD to develop and implement notification and reporting requirements.[30] The FAA reportedly also conducted "specific, data intensive analyses of each potential location of or situation for use of C-UAS technologies" to ensure airspace safety.[31] Certain counter-UAS

[24] U.S. Department of Justice, *Advisory on the Application of Federal Laws to the Acquisition and Use of Technology to Detect and Mitigate Unmanned Aircraft Systems*, 9.95.300-UAS, Washington, DC, August 2020.

[25] U.S. Congress, House, *National Defense Authorization Act for Fiscal Year 2018*, conference report to accompany H.R. 2810, 115th Cong., 1st sess., November 9, 2017, 115-404, pp. 1040-1041.

[26] P.L. 115-91, §1692.

[27] P.L. 115-91, §1692.

[28] The President may request a 180-day extension of DOD's counter-UAS authority if the "President certifies to Congress that such extension is in the national security interests of the United States."

[29] P.L. 118-31, §1681.

[30] U.S. Congress, Senate Homeland Security and Governmental Affairs Committee, S. 2836, *The Preventing Emerging Threats Act Of 2018: Countering Malicious Drones*, 115th Cong., 2nd sess., June 6, 2018, 115-479 (Washington: GPO, 2019), p. 154-155.

[31] U.S. Congress, Senate Homeland Security and Governmental Affairs Committee, S. 2836, *The Preventing Emerging Threats Act Of 2018: Countering Malicious Drones*, p. 155.

detection and mitigation capabilities that involve the use of radio waves (e.g., radar, electronic jammers) are also required to be evaluated by the Federal Communications Commission (FCC) to ensure that they are in compliance with authorized uses of the radiofrequency spectrum.[32]

DOD and federal aviation regulators have identified potential risks to public safety and to the privacy of U.S. citizens associated with using counter-UAS equipment in a domestic environment—particularly those systems that are designed for combat—and the Department has sought to identify potential solutions.[33] In September 2024, then-Secretary of Defense Lloyd Austin announced that counter-UAS would be a focus of the second round of DOD's Replicator Initiative ("Replicator 2"), which seeks to rapidly acquire and field technologies to fill perceived gaps in DOD's capabilities.[34] DOD officials have since said that Replicator 2 will seek to identify solutions for countering UAS threats at DOD installations, particularly those located in the United States, and will be led by the Defense Innovation Unit.[35] Additionally, U.S. Northern Command (NORTHCOM) will serve as the "lead synchronizer for Homeland Counter small Unmanned Aircraft Systems."[36] DOD tasked NORTHCOM with responsibility to "conduct counter-sUAS operations, establishing and maintaining a response plan, and tracking and responding to sUAS incidents," as well as coordinating with other federal agencies.[37]

DOD is one of four federal agencies—the others are the Department of Energy (DOE), Department of Homeland Security (DHS), and Department of Justice (DOJ)—granted limited authority by Congress to take actions against drones.[38] DOD and the Biden Administration argued for an expansion of the Department's authority to protect domestic military installations from UAS. In a legislative proposal submitted by DOD's Office of the General Counsel to Congress on April 5, 2024, DOD recommended that Congress amend Section 130i of 10 U.S.C. in several ways, such as by adding new mission areas and allowing DOD to share information with other federal agencies.[39] Doing so, argued DOD, would align DOD's authorities with those granted by Congress to the DHS and DOJ.[40] In a June 2024 Statement of Administration Policy on H.R. 8070 (118th Congress), the House-passed version of the FY2025 NDAA, the Biden Administration

[32] U.S. Department of Justice, *Advisory on the Application of Federal Laws to the Acquisition and Use of Technology to Detect and Mitigate Unmanned Aircraft Systems*, 9.95.300-UAS, Washington, DC, August 2020, p. 7.

[33] Michael Marrow, "'It's not a war zone': Pentagon ponders policy shifts to protect homeland bases from drones," *Breaking Defense*, December 3, 2024. For the potential advantages and disadvantages of certain counter-UAS systems, see U.S. Government Accountability Office, *Science & Technology Spotlight: Counter-Drone Technologies*, March 2022; and Arthur Holland Michel, *Counter-Drone Systems*, Center for the Study of the Drone at Bard College, Annandale-on-Hudson, NY, February 2018, pp. 6-9.

[34] Lloyd Austin, *Memorandum for Senior Pentagon Leadership Commanders of the Combatant Commands Defense Agency and DOD Field Activity Directors*, Office of the Secretary of Defense, Replicator 2 Direction and Execution, Washington, DC, September 27, 2024. For background on the Replicator initiative, see CRS In Focus IF12611, *DOD Replicator Initiative: Background and Issues for Congress*, by Kelley M. Sayler.

[35] Theresa Maher, "DIU deputy says 'biggest challenge' for Replicator 2 will be homeland defense," *Inside Defense*, December 12, 2024.

[36] U.S. Northern Command Public Affairs, "United States Northern Command Assigned as DOD's Lead Synchronizer for Counter Small Unmanned Aircraft Systems Operations in the Continental United States and Alaska," press release, December 5.

[37] U.S. Northern Command Public Affairs, "United States Northern Command Assigned as DOD's Lead Synchronizer for Counter Small Unmanned Aircraft Systems Operations in the Continental United States and Alaska."

[38] The Department of Transportation's Federal Aviation Administration also has limited authority to test and evaluate drone detection systems at airports. See CRS In Focus IF11550, *Protecting Against Rogue Drones*, by Bart Elias.

[39] DOD Office of the Deputy General Counsel, *Third Package of Legislative Proposals Sent to Congress for Inclusion in the National Defense Authorization Act for Fiscal Year 2025*, Washington, DC, April 5, 2024, pp. 94-102.

[40] DOD Office of the Deputy General Counsel, *Third Package of Legislative Proposals Sent to Congress for Inclusion in the National Defense Authorization Act for Fiscal Year 2025*, p. 97.

urged Congress to "pass a durable, multi-year authorization and expansion" of DOD's counter-drone authority.[41] DOD officials in statements to Congress and congressional testimony echoed the Biden Administration's position.[42] Congress, meanwhile, has directed DOD to undertake several activities designed to enable the Department to respond to UAS incursions over domestic DOD installations, including most recently in the enacted FY2025 NDAA (P.L. 118-159).[43]

DOD Counter-UAS Organizations

Joint Counter-Small UAS Office (JCO)

The Joint Counter-Small UAS Office (JCO) is the lead Army organization for counter-UAS and is tasked with directing DOD's counter-UAS "doctrine, requirements, material, and training" efforts and establishing "joint solutions within a common architecture" to address current and future UAS threats.[44] The Secretary of Defense established the JCO in 2020 under DOD Directive 3800.01E *Counter-Small Unmanned Aircraft Systems (C-sUAS) for Unmanned Aircraft Groups 1, 2, and 3*, to implement its responsibilities as DOD's executive agent for counter-small UAS, including the evaluation and oversight of material requirements for the services, the coordination of policy and strategy, and the development of training curricula and courses.[45] One of the JCO's immediate tasks following its establishment was to evaluate the suitability of the interim counter-UAS products fielded by military services in the preceding years. In 2020, the JCO evaluated 40 interim counter-UAS systems, of which it selected and endorsed eight for potential acquisition by the military services.[46]

Since then, the JCO, in collaboration with the Army Rapid Capabilities and Critical Technologies Office (RCCTO), has hosted semi-annual, themed exercises to demonstrate and validate material solutions for countering UAS.[47] Based on these demonstrations, the JCO may determine that a given product is not suitable or that it may require more investment to mature, or the military services may select a product for further development or for immediate purchase and fielding.[48] While the JCO's operating statute does not extend to acquiring equipment for the services, using the series of themed exercises, the JCO has expanded its lists of equipment that it recommends to

[41] Office of Management and Budget, Executive Office of the President, *Statement of Administration Policy on* H.R. 8070 – *Servicemember Quality of Life Improvement and National Defense Authorization Act*, Washington, DC, June 11, 2024, p. 6.

[42] For example, in a September 2024 letter to the chairs of the House and Senate Armed Services Committees, Secretary of Defense Lloyd Austin reiterated the Administration's request for a multiyear counter-drone authority and argued that Congress should provide counter-drone authorities to other federal agencies and to state, local, tribal, and territorial law enforcement agencies. See Letter from Lloyd D. Austin, Secretary of Defense, to Mike Rogers, Chairman, Committee on Armed Services, September 26, 2024.

[43] See "Legislative Activity" for more information.

[44] Headquarters, Department of the Army, "Joint Counter-small Unmanned Aircraft Systems Office," last updated August 27, 2021.

[45] Major General David Stewart and Lieutenant Colonel Paul Lushenko, "Countering Small Drones: Office Works Toward Joint Solutions to Growing Threat," *Army Magazine*, January 2, 2025.

[46] Nathan Strout, "Army selects eight counter-drone systems for the joint force," *C4ISRNet*, June 26, 2020.

[47] In FY2024, the JCO hosted an industry demonstration at the U.S. Army Yuma Proving Ground in Yuma, AZ, focused on systems capable of detecting and defeating swarms of drones, and in FY2025, the JCO intends to hold a demonstration—its sixth overall—focusing on electronic warfare countermeasures for Group 3 UAS. See Mark Schauer, "C-sUAS demo returns to U.S. Army Yuma Proving Ground," U.S. Army, July 5, 2024; and Dan Schere, "DOD counter drone office releases request for white papers related to next demonstration," *Inside Defense*, September 26, 2024.

[48] Colonel Mike Parent, "Media Roundtable on JCO Industry Day Demo #5," U.S. Army Public Affairs, July 25, 2024.

the military services.[49] Additionally, in partnership with the Army Fires Center of Excellence at Fort Sill, the JCO has developed training materials and courses that are made available to members of the joint force. Congress, in Section 353 of the FY2025 NDAA, further directed the Army, through the JCO, to "establish and maintain a threat library, or expand and maintain an existing threat library" of UAS threats, to include suspected threats, proposed counter-UAS solutions, and a "comprehensive list of global incursions" by UAS at DOD installations.[50]

Besides the Army, each of the military services appears to be participating in the JCO in some capacity. Then-Commandant of the Marine Corps David H. Berger said in congressional testimony in 2023 that the Marine Corps is "actively engaged with the JCO" and that it "takes lessons learned after actions from the JCO to inform decision about air defense."[51] The Navy, said then-Chief of Naval Operations Admiral Michael Gilday in 2023, views the JCO's role as imperative "to reduce wasted resourcing and time in pursuit of material solutions and procedural changes" and considers the organization an opportunity to "eventually establish a truly Joint solution that can benefit all Services."[52] Meanwhile, in congressional testimony in 2023, then-Secretary of the Air Force Frank Kendall said that the Air Force works with the JCO, including on the development of high-energy laser and high-powered microwave technology and by leading the JCO's "low collateral effects kinetic interceptor evaluations."[53] None of the military services other than the Army appear to have allocated personnel to fill positions at the JCO.

The congressional defense committees have expressed concerns about the level of coordination within the Department. The House Armed Services Committee, in its markup of the FY2024 NDAA (H.Rept. 118-125), questioned the degree to which systems evaluated by the JCO had been adopted by the military services.[54] Likewise, the Senate Armed Services Committee, in its report on the FY2024 NDAA (S.Rept. 118-58), directed the Secretary of the Army to submit a report to the congressional defense committees on the JCO's efforts to transition technologies from development to fielding.[55] HASC has further expressed concern about the pace at which some of services appear to be addressing UAS threats; in its report on the FY2024 NDAA, the

[49] For example, in May 2023, the JCO expanded its list of recommended electronic warfare (EW) systems from eight to 11 following an evaluation it conducted the prior year. See Office of the Deputy Chief of Staff, Department of the Army, *Memorandum for Record: Joint Counter-small Unmanned Aircraft Systems (C-sUAS) Office (JCO) Recommendation of C-sUAS Detection and Defeat Systems*, Washington, DC, May 25, 2023.

[50] Major General Sean Gainey, "Joint C-sUAS Office (JCO) Overview," remarks at the SMD Symposium, Huntsville, AL, August 10, 2022, p. 3.

[51] Testimony by Commandant of the Marine Corps David H. Berger, U.S. Congress, House Armed Services Committee, *Department of the Navy Fiscal Year 2024 Budget Request*, 118th Cong., 1st sess., April 28, 2023, 118-35 (Washington: GPO, 2024), p. 207.

[52] Testimony by Commandant of the Admiral Michael Gilday, U.S. Congress, House Armed Services Committee, *Department of the Navy Fiscal Year 2024 Budget Request*, 118th Cong., 1st sess., April 28, 2023, 118-35 (Washington: GPO, 2024), pp. 189-190.

[53] Testimony by Secretary of the Air Force Frank Kendall, U.S. Congress, House Armed Services Committee, *Department of the Air Force Fiscal Year 2024 Budget Request*, 118th Cong., 1st sess., April 27, 2023, 118-33, p. 131.

[54] "The committee is concerned that the military services, in particular the Army, have neither transitioned proven systems, specifically systems currently operating in combat environments with [U.S. Special Operations Command] nor systems that have been recommended by the JCO, to production at scale, nor acquired them for wider deployment across the joint force." The HASC directed the Secretary of the Army to brief the Committee by December 1, 2023, on "opportunities for greater integration of JCO equities into the planning, programming, budgeting, and execution process and the Future Years Defense Program, consistent with JCO strategy and DOD Directive 3800.01E" and on whether another structure other than the JCO would be better suited transitioning validated counter-UAS technologies. U.S. Congress, House Armed Services Committee, *National Defense Authorization Act for Fiscal Year 2024*, report to accompany H.R. 2670, 118th Cong., 1st sess., June 30, 2023, 118-125 (Washington: GPO, 2023), pp. 39-40.

[55] U.S. Congress, Senate Armed Services Committee, *National Defense Authorization Act*, report to accompany S. 2226, 118th Cong., 1st sess., July 12, 2023, S.Rept. 118-58 (Washington: GPO, 2023), pp. 19-21.

committee said that it was "concerned by the lack of structure and cohesion amongst stakeholders in the Navy to address this already pervasive problem."[56]

DOD Counter-UAS Personnel and Force Structure

Career air defense and electronic warfare personnel in the Army and Marine Corps are responsible for operating certain counter-UAS systems and short-range air defense systems that conduct counter-UAS. The Army's Air Defense Artillery (ADA) branch operates the Army's air defense systems, including short-range air defense (SHORAD) and high to medium air defense (HIMAD) systems and counter-rocket, artillery, and mortars (C-RAM) systems. ADA personnel are further responsible for operating certain counter-UAS systems, such as the Low, Slow, Small Integrated Defense System (LIDS). Likewise, the Marine Corps personnel responsible for operating the Marine Air Defense Integrated System (MADIS) counter-UAS platform belong to the Low Altitude Air Defense occupational specialty.[57] The Army has focused on acquiring systems that are specific to a military occupational specialty (MOS), such as air defense, and systems that are MOS-agnostic, as in systems that allow a broader range of soldiers to employ counter-UAS capabilities regardless of their specialized career field.

Under the "Force Structure Transformation" initiative, announced in February 2024, the Army intends to create new units dedicated to countering short-range air threats, including UAS.[58] These units include four additional battalions dedicated to operating the Integrated Fire Protection Capability (IFPC) system, the successor to the Army's counter-RAM system, as well as four additional SHORAD battalions. The Army also intends to create nine counter-UAS batteries located within IFPC and divisional air defense battalions.[59] The Army expects to activate the first of the nine planned counter-UAS batteries in FY2029, according to congressional testimony in 2024 by then-Secretary of the Army Christine Wormuth.[60]

None of the military services have a designated an MOS for counter-UAS. Instead, Army and Marine Corps officials have expressed the view that the responsibility for countering UAS, especially small drones in Groups 1 and 2, is a task shared by all military personnel.[61] In the introduction to Army Techniques Publication (ATP) 3-01.81 *Counter-Unmanned Aircraft System (C-UAS)*, the Army's published doctrine on counter-UAS, the Army describes counter-UAS as "not a stand-alone effort or the sole responsibility of any warfighting function or branch"; rather, counter-UAS is "part of local security and counter reconnaissance missions that is the responsibility of every Soldier and unit."[62] Both the Army and Marine Corps are acquiring

[56] U.S. Congress, House Armed Services Committee, *National Defense Authorization Act for Fiscal Year 2024*, report to accompany H.R. 2670, 118th Cong., 1st sess., June 30, 2023, 118-125 (Washington: GPO, 2023), p. 54.

[57] 1st Lt. Isis Coty, "1st LAAD Bn Activates Firing Battery Alpha," U.S. Marine Corps/DVIDS, August 29, 2024.

[58] U.S. Army, "Army changes force structure for future warfighting operations," press release, February 27, 2024. For background, see CRS Report R47985, *The 2024 Army Force Structure Transformation Initiative*, by Andrew Feickert; and **Appendix A**.

[59] U.S. Army, "Army changes force structure for future warfighting operations," press release, February 27, 2024.

[60] Testimony by Secretary of the Army Christine Wormuth, U.S. Congress, Senate Appropriations Committee, Department of Defense Subcommittee, *Senate Appropriations Defense: A Review of the President's FY2025 Budget Request for the Army*, 118th Cong., 2nd sess., May 21, 2024.

[61] Hope Hodge Seck, "Every Marine A Drone Defender Under Three Part Counter-UAS Plan," *The Warzone*, May 13, 2024. According to another DOD official, defensive operations against UAS in Groups 1-2 is "a protection task that every soldier has to have a role in.... We'll know we're successful when it's just considered fieldcraft." Colonel Glenn A. Henke, "Dominating the Unmanned Aircraft Systems (UAS) Space," remarks at AUSA Hot Topic 2024 - Army Aviation, Arlington, VA, September 16, 2024.

[62] Headquarters, Department of the Army, *Counter-Unmanned Aircraft System (C-UAS)*, ATP 3-01.81, Washington, DC, August 11, 2023, p. v.

counter-UAS equipment suitable to personnel independent their occupational specialization,[63] and have encouraged through doctrine and training the development of passive air defense tactics such as dispersing forces, hardening equipment and shelters, and applying camouflage.[64]

Some commentators have argued that the military services could go further to integrate units specialized in counter-UAS equipment and tactics, perhaps by creating new organizational constructs and communities for countering UAS threats. One commentator has argued that the absence of a dedicated counter-UAS community in the Navy has resulted in an insufficient number of trained personnel to protect domestic military installations and the lack of training opportunities for operationally relevant personnel.[65] Another commentator has argued that "entry-level training for all Marines should incorporate basic C-UAS considerations," in the same way that Marines were trained to counter improvised explosive devices (IEDs) during the Iraq and Afghanistan wars.[66] Yet another commentator has argued that the Army should explore decentralizing counter-UAS batteries so that they are embedded within a greater number of lower-echelon units.[67]

These concerns appear to be reflected to some extent in recent congressional activity and proposed legislation. The House Armed Services Committee, in a report accompany its version of the FY2025 NDAA (H.Rept. 118-529; H.R. 8070), expressed concern that the Army had not developed integrated counter-UAS capabilities for echelons at or below that of Brigade Combat Teams with the same urgency as it had for those at the division-level and above.[68] Meanwhile, a provision of the House-passed version of H.R. 8070 would have established the "Drone Corps" as a basic branch of the U.S. Army, one responsible for small and medium UAS and defensive counter-UAS.[69] Army officials and the Biden Administration opposed the creation of the Drone Corps, arguing that doing so would create additional bureaucracy and that sufficient specialization already existed within the Army.[70] The provision was not adopted in the enacted version of the FY2025 NDAA (P.L. 118-159).

DOD Counter-UAS Training

The Joint Counter-Small UAS University (JCU), part of the Army's Fires Center of Excellence and located at Fort Sill, OK, offers training in counter-UAS equipment and operations to Army, Navy, and Air Force personnel, among others. The Army established the JCU to centralize and institutionalize the Department's training in an effort to ensure a "shared understanding of current

[63] See "Various Counter-UAS Equipment" for more information.

[64] For example, see Headquarters, Department of the Army, *Counter-Unmanned Aircraft System (C-UAS)*, ATP 3-01.81, Washington, DC, August 11, 2023, p. 3-1.

[65] Lieutenant Commander Charles Johnson, "Countering the Drones of War—in the United States," *Proceedings*, vol. 150, no. 7 (July 2024), p. 30.

[66] Captain Karl Flynn, "Make Every Marine a Drone Killer," *Proceedings*, vol. 149, no. 11 (November 2023).

[67] Captain Josef "Polo" Danczuk, "Bayraktars and Grenade-Dropping Quadcopters: How Ukraine and Nagorno-Karabakh Highlight Present Air and Missile Defense Shortcomings and the Necessity of Unmanned Aircraft Systems," *Military Review*, vol. 104 (March 2024), pp. 32-44.

[68] U.S. Congress, House Armed Services Committee, *Servicemember Quality of Life Improvement and National Defense Authorization Act for Fiscal Year 2025*, report to accompany H.R. 8070, 118th Cong., 2nd sess., May 31, 2024, H.Rept. 118-529 (Washington: GPO, 2024), p. 14.

[69] For additional background information, see CRS Insight IN12382, *Proposal to Create a U.S. Army Drone Corps*, by Daniel M. Gettinger and Andrew Feickert.

[70] Jon Harper, "Senior Army leader throws cold water on lawmakers' Drone Corps proposal," *Defense Scoop*, May 17, 2024; and Executive Office of the President, Office of Management and Budget, Statement of Administration Policy, H.R. 8070 – Servicemember Quality of Life Improvement and National Defense Authorization Act for FY 2025, 2024.

and evolving threats among all military services, federal agencies, allied, and partner nations," according to JCU Director Lt. Col. Moseph Sauda.[71] The JCU held its inaugural two-week C-sUAS Operators Course in October 2023.[72] The JCU also offers courses on protecting installations from UAS and contingency planning, all of which appear to be available to military personnel from any career field.[73]

Several efforts are underway to introduce counter-UAS tactics, techniques, and procedures to a wider audience. For instance, the JCU has integrated counter-UAS training into the Basic Combat Training course for new soldiers at Fort Sill, one of the Army's four basic training sites.[74] In addition to the training at Fort Sill, the JCU offers virtual courses through the Joint Knowledge Online (JKO) platform and manages counter-small UAS Mobile Training Teams.[75] In the Marine Corps, the 1st Marine Division offers a course on integrating small UAS and counter-UAS tactics, techniques, and procedures at and below the company level.[76]

Military personnel also gain proficiency with counter-UAS systems and tactics during military exercises, including those that focus specifically on counter-UAS. For example, in an effort to incorporate lessons learned from counter-UAS operations in the Middle East, the Army established in 2023 the Green Sands training initiative at the Army Central Command (ARCENT) Training and Readiness Center.[77] In August 2024, the Army held the Operation Hard Kill to demonstrate various counter-UAS weapons in a live-fire environment.[78] Meanwhile, in October 2024, NORTHCOM conducted the Falcon Peak exercise that, for the first time, sought to evaluate counter-UAS solutions for DOD installations within the United States.[79] Counter-UAS has also been the focus of joint training exercises conducted by the United States and its allies and partners, such as the U.S.-Saudi Arabia Red Sands exercise.[80]

The enacted FY2025 NDAA contained multiple provisions related to DOD's counter-UAS training activities. In Section 925 of the act, Congress directed the Secretary of Defense to submit a report to the congressional defense committees on the training efforts of the Department as they relate to countering UAS threats, and to provide a summary of training curricula provided to

[71] Christopher Wilson, "Fort Sill's Joint C-sUAS University: Spearheading the charge against drone threats," U.S. Army, November 6, 2023; and Kelsey Reichmann, "C-UAS Training Academy Coming to Fort Sill," *Defense Daily*, October 30, 2020.

[72] Amber Osei, "Joint C-sUAS University holds first class," U.S. Army Air Defense Artillery School/DVIDS, October 19, 2023.

[73] Army personnel that complete the C-sUAS Operators Course are issued an "Additional Skill Identifier" signifying the completion of formal skills training.

[74] Donald Herrick, "Fort Sill integrates counter-drone training into Basic Combat Training," U.S. Army, October 21, 2024.

[75] Jen Judson, "Pentagon's counter-drone boss tackles rising threat," *Defense News*, March 10, 2023; and Maj. Gen. Sean Gainey, "Joint C-sUAS Office (JCO) Overview," SMD Symposium, August 10, 2022, p. 6.

[76] U.S. Marine Corps, "SUAS/CSUAS Integration Course," 1st Marine Division, accessed March 20, 2025, https://www.1stmardiv.marines.mil/Units/division-schools/suas-c-suas-ic/.

[77] The Army conducted the inaugural Green Sands training event in July 2023. See Captain Richard Moore, "USARCENT Traings Deploying Soldiers in counter-UAS," U.S. Army Central, July 25, 2023; and Sergeant Raquel Brik, "Green Sands: The Evolution of Counter-UAS Training," U.S. Army, March 8, 2024.

[78] Sam Skove, "Anti-drone 'shoot-out' lets experienced soldiers wring out latest gear," *Defense One*, August 8, 2024.

[79] Michael Marrow, "Nets, jamming and 'cyber scalpels': Pentagon weighs homeland counter-drone tech in mountain tests," *Breaking Defense*, November 20, 2024.

[80] Tyler Rogoway, "AH-64 Apaches Practice Shooting Down Drones with Hellfire Missiles In Saudi Arabia," *The War Zone*, October 3, 2024.

DOD's installation commanders and deployed forces.[81] In Section 1073 of the FY2025 NDAA, Congress directed the Secretary of Defense to execute a "large-scale exercise in the special use airspace of the [DOD]" to test the Department's ability to respond to UAS threats.[82]

DOD Systems for Countering UAS[83]

Following its establishment in 2020, the JCO endorsed eight interim counter-UAS systems for potential acquisition and use by the military services, some of which have since progressed to programs of record.[84] The selected systems included kinetic and nonkinetic effectors, command-and-control systems, and sensors. In the years since 2020, the JCO has expanded its list of systems it recommends to the military services based on product evaluations it has conducted with the Rapid Capabilities and Critical Technologies Office and the Army's Program Executive Office (PEO) Missiles and Space. Army officials have said that the service expects to continually evaluate and field new counter-UAS systems in order to maintain pace with technological developments.[85] Collectively, with these systems and others, DOD seeks to provide what Army doctrine describes as a "layered" defensive capability against UAS threats.[86] Army officials[87] and some commentators[88] have identified layered defenses against UAS as an imperative for military forces. This section describes a selection of some of the weapon systems fielded or under consideration by the military services for countering UAS threats.

[81] P.L. 118-159, §925. For additional information, see CRS Insight IN12418, *FY2025 NDAA: Countering Uncrewed Aircraft Systems*, by Daniel M. Gettinger.

[82] P.L. 118-159, §1073.

[83] Given the multiplicity of counter-UAS currently under consideration or fielded by DOD—and given that DOD does not appear to have publicly released a comprehensive list of its weapon systems for countering UAS threats—the following selection of systems is derived from a CRS analysis of DOD's FY2025 congressional budget submission. It does not represent all the weapon systems DOD considers to be potentially relevant to countering UAS, nor all the systems under consideration or fielded by the military services for counter-UAS to date. DOD's FY2025 Defense Budget Materials are available, via the Under Secretary of Defense (Comptroller), at https://comptroller.defense.gov/Budget-Materials/Budget2025/.

[84] Army Public Affairs, "Army announces selection of interim C-sUAS systems," press release, June 25, 2020.

[85] In a panel discussion in September 2024, one Army official commented, "Every two years we're going to go find what is the best product out there to meet those requirements and that's what we're going to buy. That is a very different way than what we've done, but that's the only way we're going to be able to keep up; because the things we decided to buy three years ago, some of those are being outclassed, and they're just not going to keep up with the threat that is evolving this fast." Colonel Glenn A. Henke, "Dominating the Unmanned Aircraft Systems (UAS) Space," remarks at AUSA Hot Topic 2024 - Army Aviation, Arlington, VA, September 16, 2024.

[86] According to the Army's counter-UAS doctrine, a "layered defense" is one that "provides multiple engagement opportunities, ideally beginning at the maximum range from friendly forces and areas, and before any attacking UAS can release their weapons." See Headquarters, Department of the Army, *Counter-Unmanned Aircraft System (C-UAS)*, ATP 3-01.81, Washington, DC, August 11, 2023, p. 2-1.

[87] In October 2024, Army Major General David F. Stewart described countering UAS as a "layered defense, and no one single bullet is going to solve this problem." See U.S. Army Professional Forum, "Warrior's Corner: Outpacing the Small Unmanned Aircraft Systems (UAS) Threat," remarks at AUSA 2024, Washington, DC, 2024; and Brett Davis, "For Counter UAS, Layered Defense is the Best Option," *Inside Unmanned Systems*, June 15, 2023. Writing in *Air Defense Artillery Journal* in 2023, then-Army Chief of Staff General James C. McConville said of the Army's counter-UAS, "Our capability development efforts focus on providing a networked, scalable, and tailored suite of capabilities to the force commander (for mounted, dismounted, fixed, and semi-fixed operations) that support a layered defense and incorporate active, passive, and deep sensing." General James C. McConville, "Ensuring War-Winning Future Readiness for AMD Forces," *Air Defense Artillery Journal*, no. 1 (2023), p. 5.

[88] "Effective, layered and efficient C-UAS capabilities are not a luxury…. They are basic elements of a land force that is suitable for operations today." See Jack Watling and Justin Bronk, *Protecting the Force from Uncrewed Aerial Systems*, Royal United Services Institute, Occasional Paper, London, October 2024, p. 35.

Various Counter-UAS Equipment

Each of the military services has acquired different types of man-portable, handheld, and soldier-worn equipment for countering UAS. Typically, this equipment is intended to be used by personnel regardless of their occupational specialty, independently or in conjunction with integrated counter-UAS systems and with minimal ancillary support equipment, and against low-flying aerial threats.

The Stinger and Its Successors

The conventional example of man-portable and handheld equipment for countering UAS is the Stinger surface-to-air missile, which the Army fielded both as a component of Cold War-era short-range air defense (SHORAD) systems like the Avenger and Linebacker. Today, the Stinger is a key element of the Army's LIDS and Marine Corps's MADIS counter-UAS systems. In the mid-2010s, the launched the Stinger Service-Life Extension Program (SLEP) to improve the missile's ability to intercept drones,[89] which the Army described as designed to provide an organic air defense capability to soldiers outside of the Air and Missile Defense (AMD) community.[90] The United States has also provided Stingers to Ukraine in an effort to boost that country's air defenses against attacks by Russian aircraft, cruise missiles, and drones.[91]

The Army has launched at least two projects—the Next-Generation Short-Range Interceptor (NGSRI) and the eXtended Range Counter-sUAS Missile (XRC)—that aim to replace the Stinger missile. The NGSRI is a conceptual surface-to-air missile for the Maneuver Short Range Air Defense (M-SHORAD) Increment 3 platform.[92] In 2023, the Army reportedly selected Lockheed Martin and Raytheon Technologies to develop prototypes of the NGSRI.[93] The Army expects to select a vendor and begin production of the NGSRI by FY2028; eventually, as many as 10,000 FM-92 Stinger missiles equipped on M-SHORAD platforms could be replaced by the NGSRI.[94] The XRC is a conceptual surface-to-air missile for defeating Group 2-3 UAS threats. In a request for information issued in September 2024, the Army said it was seeking a missile that would be compatible with the Stinger launcher and that would have greater range than the Stinger.[95] It expects to begin prototype demonstrations before FY2030.[96]

The military services have also sought to repurpose older-generation air-to-air and air-to-ground missiles as counter-UAS interceptors, an option that some experts have said could provide a

[89] Kevin Jackson, "Stinger maintenance work to increase service life, reliability," U.S. Army, May 17, 2017; Cruise Missile Defense Systems Project Office, "Missile defense system upgrade meets Soldier's urgent need," press release, September 19, 2018; and Gary Sheftick, "Army rebuilding short-range air defense," Army News Service, July 3, 2019.

[90] Staff Sgt. Kathleen Polanco, "Short-range air defense training at 7ATC," *DVIDS*, September 9, 2017.

[91] See CRS Report R48182, *Defense Production for Ukraine: Background and Issues for Congress*, coordinated by Luke A. Nicastro.

[92] See "Maneuver Short-Range Air Defense (M-SHORAD)" for more details.

[93] Jason Sherman, "Lockheed, Raytheon advance in multibillion-dollar contest to develop Stinger replacement," *Inside Defense*, March 28, 2023.

[94] Jason Sherman, "Lockheed, Raytheon advance in multibillion-dollar contest to develop Stinger replacement"; and U.S. Government Accountability Office, *Weapon Systems Annual Assessment*, GAO-24-106831, June 2024, pp. 115-116.

[95] Dan Schere, "Army wants to start development of extended-range Stinger in FY-25," *Inside Defense*, September 16, 2024.

[96] Dan Schere, "Army wants to start development of extended-range Stinger in FY-25."

lower-cost cost option than conventional surface-to-air air defense missiles.[97] For example, counter-UAS systems like the Navy's VAMPIRE and the Army's EAGLS and Containerized Weapon System (CWS) each feature the Advanced Precision Kill Weapon System (APKWS),[98] a modified, precision-guided version of the Cold War-era Hydra-70 rocket.[99] The Army has also reportedly explored using the Hellfire Longbow air-to-ground anti-tank missile in a counter-UAS role,[100] and the Navy has reportedly begun fielding repurposed Hellfire missiles as counter-UAS interceptors on its Littoral Combat Ships.[101] This approach has also been adopted by U.S. allies, including the United Kingdom, which has sent air-to-air missiles to Ukraine for use as surface-launched interceptors against drones.[102]

Electronic Warfare Countermeasures

In addition to kinetic countermeasures, each of the services have fielded nonkinetic counter-UAS equipment, some of which have been adapted from technology developed to counter improvised explosive devices (IEDs) in Iraq and Afghanistan. For example, the Navy derived its Drone Restricted Access using Known Electromagnetic Warfare (DRAKE) system from the Joint Counter Radio-Controlled Improvised Explosive Device Electronic Warfare (JCREW) system, one of the projects of the Joint IED Defeat Organization (JIEDDO) in the 2000s.[103] The DRAKE is designed to be carried as a backpack and to jam the communication links between the operator of the adversary drone and the aircraft.[104] Meanwhile, the Air Force Research Laboratory's Negation of Improvised Non-State Joint Aerial Threats (NINJA), an Air Force program of record, is designed to detect, track, locate, identify, and defeat UAS threats using the radio frequency communications between the drone and the operator.[105] In congressional testimony in 2023, then-Secretary of the Air Force Frank Kendall said that 99 Air Force locations had installed the NINJA system.[106]

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[97] Some commentators have argued in favor of repurposing existing short-range missiles as kinetic counter-UAS interceptors, and that doing so could offer the "prospect of reduced cost per munition due to commonality across the services, and the potential to use weapons in a ground role that have run out of airframe carriage hours but are otherwise still fully functional." Jack Watling and Justin Bronk, *Protecting the Force from Uncrewed Aerial Systems*, Royal United Services Institute, Occasional Paper, London, October 2024, p. 23.

[98] Foe the Navy's VAMPIRE, see NAVAIR, "Navy to complete rapid delivery of new counter-UAS system to Ukraine," press release, December 6, 2023. For the Army's systems, see MSI Defense Solutions, "MSI Defense Solutions Delivers 6 EAGLS™ Counter-UAS Systems to U.S. Army," press release, July 22, 2024; and Joseph Trevithick, "Army Counter Drone System Pops Out of a Shipping Container," *The War Zone*, November 15, 2023.

[99] The Hydra-70 is a Cold War-era 2.75-inch rocket that was originally developed as an air-to-ground weapon and later adapted for surface-to-air roles. In 2021, BAE Systems announced that it had begun testing a ground-launched version of the APKWS as a counter-drone interceptor. See BAE Systems, "BAE Systems successfully tests APKWS laser-guided rockets against unmanned aerial systems," press release, October 11, 2021.

[100] Tyler Rogoway, "AH-64 Apaches Practice Shooting Down Drones with Hellfire Missiles in Saudi Arabia," *The War Zone*, October 3, 2024.

[101] Aaron-Matthew Lariosa, "U.S. Navy LCS Receive Upgraded C-UAS Hellfire Missiles," *Naval News*, January 17, 2025.

[102] Joseph Trevithick, "British Air-To-Air Missiles Turned SAMs Seen Scoring Kill in Ukraine," *The Warzone*, October 4, 2024.

[103] Joint Improvised Explosive Device Defeat Organization, *Joint Improvised Explosive Device Defeat Organization - Annual Report FY 2008*, Washington, DC, 2008, p. 11; and Capt. Dan Malatesta, "PMS Expeditionary Missions," presentation at Sea Air Space 2021, National Harbor, MD, 2021, pp. 8-9.

[104] Mallory Shelbourne, "Navy Arming Surface Ships with Drone Repellent System," *USNI News*, September 7, 2021.

[105] Billy Mitchell, "DDS to transfer counter-drone capabilities to Air Force," *Defense Scoop*, September 10, 2021.

[106] Testimony by Secretary of the Air Force Frank Kendall, U.S. Congress, House Armed Services Committee, (continued...)

Handheld and Soldier-Worn Equipment

Other examples of counter-UAS equipment fielded or considered by the military services include handheld and soldier-worn devices (sometimes referred to as "dismounted" solutions). This equipment is designed to be ultra-portable and for use against small drones at short ranges, and in some cases as a last resort in the event that other solutions have failed or are unavailable. Possible examples of such equipment include the "Dronebuster," a handheld device first acquired by the Army and Air Force in 2017, that uses jamming to disrupt the communication signals of drones.[107] The Army and Marine Corps have also acquired equipment that is designed to improve the accuracy of rifle fire—known as "SmartShooter"—potentially enhancing the ability of ground-based troops to shoot down small drones.[108] In 2024, the Marine Corps issued solicitations for a "buckshot-like" counter-drone solution that could be fielded with small units, such as squads and platoons.[109]

Requested Funding for Various C-UAS Equipment

In its FY2025 congressional budget submission, the Army requested funds for at least two research, development, test and evaluation (RDT&E) programs that seek to develop, test, and evaluate various possible counter-UAS solutions. According to the Army's budget justification documents, the Counter-Small Unmanned Aircraft Systems Development and Demonstration program supports the work of the Army as DOD's executive agent for counter-small UAS in identifying and evaluating potential counter-UAS solutions for the military services.[110] In its FY2025 budget submission, the Army requested $59.6 million in RDT&E funding for work on various projects, including for the APKWS munition, the Forward Area Air Defense Command and Control (FAADC2) system, and a common data repository. The Counter-Small Unmanned Aircraft Systems Advanced Development project, located within the Air Defense Command, Control and Intelligence – Engineering Development program, also conducts research into counter-small UAS solutions for the military services and DOD agencies.[111] Examples of the proposed projects in FY2025 include an "advanced kinetic defeat" capability and high-energy laser system, as well as joint demonstration and assessment initiatives. In its FY2025 budget submission, the Army requested $49.7 million for the project.[112]

The Navy and Air Force also requested investment funding for various counter-UAS projects. The Navy requested $14.2 million in RDT&E funding for the Counter Unmanned Aircraft Systems program, which supports work on the DRAKE system, among other C-UAS

Department of the Air Force Fiscal Year 2024 Budget Request, 118th Cong., 1st sess., April 27, 2023, 118-33 (Washington: GPO, 2024), pp. 130-131.

[107] Todd South, "The Army is adding the 'Dronebuster' to its set of anti-drone tools," *Army Times*, April 23, 2017; and Charlsy Panzino, "Air Force buys 100 Dronebuster devices for security forces," *Air Force Times*, June 15, 2017.

[108] Seth J. Frantzman, "Israel's Smart Shooter wins US Army contract for anti-drone optics," *C4ISRNet*, October 12, 2022; and Joseph Trevithick, "Marines Testing Counter-Drone Rifle Aiming System with Automatically Moving Stock," *The War Zone*, October 25, 2024.

[109] SAM.gov, "M67854-24-I-0134 Dismounted Counter small Unmanned Aircraft System (CsUAS)," last updated September 18, 2024, https://sam.gov/opp/7583df85be8e43049feef904fa50ad55/view.

[110] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Army, Volume 3d of 3, Research, Development, Test & Evaluation, Army, Volume II, Budget Activity 5d,* March 2024, p. 179.

[111] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Army, Volume 3a of 3, Research, Development, Test & Evaluation, Army, Volume II, Budget Activity 5a,* March 2024, p. 317.

[112] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Army, Volume 3a of 3, Research, Development, Test & Evaluation, Army, Volume II, Budget Activity 5a*, p. 317.

capabilities.[113] The Air Force requested $12.2 million in RDT&E funding, respectively, for the Air Base Air Defense program, which includes requested funding for the NINJA RF detect and defeat system and supports work on counter-UAS solutions for the National Capital Region and for Presidential aviation assets.[114]

Low, Slow, Small UAS Integrated Defeat System (LIDS)

The Army's Low, Slow, Small Unmanned Aircraft System Integrated Defeat System, or LIDS, is a family of systems composed of the Fixed Site LIDS (FS-LIDS) and Mobile LIDS (M-LIDS), both of which are designed to defend against drones in Groups 1-3, as well as other low-flying threats. The core elements of the fixed and mobile versions of LIDS are similar and include a radar system and electro-optical/infrared (EO/IR) cameras, radar, a command-and-control system, and kinetic and electronic means of engaging and debilitating or destroying the perceived aerial threat. The Army reportedly developed the requirements for the M-LIDS in 2017-2018.[115] Both the Army and Air Force have deployed the LIDS systems.[116]

In M-LIDS Increment 2.1, initiated by the Army in 2022, the Army consolidated the M-LIDS sensors and weapons on a single Stryker vehicle, instead of the two Mine Resistant Armored Platform All-Terrain Vehicles (M-ATVs)—one vehicle for electronic warfare and another for kinetic defeat capabilities—on which the M-LIDS relied previously.[117] The M-LIDS has incorporated products from multiple companies, including the Moog, Inc. Reconfigurable Integrated weapons Platform (RIwP) turret; Raytheon's Coyote interceptors and eXpeditionary Battlefield active electronically-scanned array External Unit (XBAEU) radar; and the Counter-small Unmanned Aircraft Electronic Warfare System (CUAEWS) from SRC.[118] However, the individual products on the M-LIDS could change as the Army continues to evaluate and test new capabilities.[119]

The FS-LIDS, an immobile system that provides a counter-UAS capability to a fixed military installation, features many of the same core elements as its mobile counterpart, with a few differences. The FS-LIDS lacks the weapons turret on the M-LIDS; instead, Coyote interceptors (see "Coyote" below for more details) feature prominently in the FS-LIDS. The detect and track capability on the FS-LIDS is provided by Raytheon Ku Band Radio Frequency System (KuRFS) radars and electro-optical and infrared cameras. In addition to Coyote interceptors, the FS-LIDS is equipped with an electronic warfare system for mitigating drones. Both the FS-LIDS and M-LIDS use the Army's Forward Area Air Defense Command and Control (FAADC2) system.

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[113] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Navy, Volume 2 of 5, Research, Development, Test & Evaluation, Navy, Budget Activity 4*, March 2024, p. 1129.

[114] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Air Force, Volume 2 of 4, Research, Development, Test & Evaluation, Air Force*, March 2024, p. 483.

[115] Lieutenant Colonel Paul Santamaria and Maj. Jake LaGue, "Need for Speed," *Army AL&T*, Summer 2024, pp. 50.

[116] Major Forrest Craven, "AFCENT CUAS," Presentation at the Counter-UAS Summit, Arlington, VA, August 28, 2024.

[117] Laura Heckmann, "Army Counter-Drone System Gets Stryking Makeover," *National Defense Magazine*, April 23, 2024.

[118] Integrated Fires/Rapid Capabilities Office, *Low, Slow, Small UAS Integrated Defeat System (LIDS) Family of Systems*, https://www.srcinc.com/pdf/LIDS-Family-of-Systems-Brochure.pdf; Raytheon, "RTX's Raytheon demos KuRFS and Coyote performance against complex UAS threats," press release, October 14, 2024; Leonardo, "U.S. Army taps Leonardo DRS to provide additional M-LIDS Counter-UAS Platforms," press release, January 5, 2023.

[119] For example, see Meredith Roaten, "US Army seeks new M-LIDS production, future capability support," *Janes*, January 13, 2025; and Laura Heckmann, "Army Counter-Drone System Gets Stryking Makeover," *National Defense*, April 23, 2024.

In its FY2025 congressional budget submission, the Army requested $280.1 million in procurement funding to procure the FS-LIDS and M-LIDS systems, as well as various dismounted solutions such as the Modi, SmartShooter, Bal Chatri 2, and Dronebuster.[120] The requested procurement funding included five M-LIDS systems based on the single-vehicle Stryker configuration, representing the third division set of M-LIDS systems, as well as the first set since the Army migrated from the two- to one-vehicle configuration.[121] The Army's requested procurement funding also includes six FS-LIDS, as well as funding for a variety of handheld counter-UAS systems like the Dronebuster and SmartShooter. Separately, the Army requested $117.4 million in procurement funding to purchase Coyote interceptors for the LIDS.[122]

Figure 1. Mobile Low, Slow, Small Integrated Defeat System (M-LIDS)

Source: Sgt. Brandon Hernandez, U.S. Army, Defense Visual Information Distribution Service.

Notes: This November 2024 photo shows the original configuration of M-LIDS consisting of two M-ATV vehicles.

Coyote

The Raytheon Coyote is a counter-UAS interceptor selected by the Army for the LIDS family of mobile and fixed site counter-UAS systems. The Coyote is a one-way, ground-launched, radar-guided interceptor drone available in both kinetic and nonkinetic versions. Unlike conventional ground-to-air missiles, the Coyote is reported to have the ability to loiter in the air and reattack targets if necessary. Advanced Ceramics Research, an Arizona-based company, first developed the Coyote in the early 2000s, before Raytheon—now a subsidiary of RTX Corporation—

[120] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Other Procurement, Army, Volume 2 of 3, Communications and Electronics Equipment, Budget Activity 2*, March 2024, p. 449.

[121] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Other Procurement, Army, Volume 2 of 3, Communications and Electronics Equipment, Budget Activity 2*, p. 449.

[122] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Missile Procurement, Army, Volume 1 of 1, Budget Activity 2*, March 2024, p. 76.

purchased the company in 2015.[123] In 2019, the Army fielded prototypes of the Coyote-equipped Howler counter-UAS system, a predecessor to LIDS.[124] As of 2024, the Coyote had achieved 170 successful interceptions during deployments in the Middle East, Africa, and Europe, according to Army officials.[125]

The Army estimates that between FY2025 and FY2029, it will require the production of 6,000 Coyote kinetic interceptors, as well as hundreds of nonkinetic interceptors.[126] Army officials have described the Coyote as an effective interceptor against UAS, although not one that is necessarily cost-effective against cheap drones.[127] In Section 113 of the FY2025 National Defense Authorization Act, Congress directed the Secretary of the Army to develop and implement a "plan for the procurement and fielding" of additional kinetic effectors for the Army's LIDS and to brief the congressional defense committees on the plan by September 30, 2025.[128]

Ground-Based Air Defense

The Marine Corps' Ground-Based Air Defense (GBAD) portfolio includes the development and acquisition of fixed and mobile air defense and counter-UAS systems. These systems include the Marine Air Defense Integrated System (MADIS) and the Light MADIS (L-MADIS), as well as the Installations-Counter Small Unmanned Air Systems (I-CsUAS) and the Medium Range Intercept Capability (MRIC). In its FY2025 congressional budget submission, the Navy requested $369.3 million and $74.1 million in procurement and RDT&E funding, respectively, for the Marine Corps GBAD program.[129] The requested procurement funding included approximately $204.7 million for the MADIS program—for 13 MADIS Increment 1 and five L-MADIS systems; $53.2 million in procurement funding for the I-CsUAS program; and $111.4 million in procurement funding for the MRIC program.

Marine Air Defense Integrated System (MADIS)

The Marine Air Defense Integrated System (MADIS) family of systems is designed to "protect maneuver forces, installations, and other designated critical assets" from fixed- and rotary-wing aircraft and Group 1-3 UAS, according to the Navy's FY2025 congressional budget justification documents.[130] The Marine Corps has identified the MADIS family of systems as a priority of its

[123] Department of Defense, "Calm Before the Swarm," January 19, 2023, https://media.defense.gov/2023/jan/19/2003146808/-1/-1/0/sensintel_story.pdf; and David Wichner, "Tucson Tech: Raytheon advancing drone 'swarm' technology for Navy," *Tuscon.com,* June 29, 2018.

[124] Raytheon, "US Army Deploys Howler Counter-UAS Capability into the Battlefield," press release, June 18, 2019.

[125] Joseph Trevithick and Howard Altman, "Army Coyote Drone Hunting Drones Have Scored 170 Combat Kills," *The Warzone*, November 1, 2024.

[126] Jon Harper, "Army awards big contract for Coyote interceptors amid growing demand for counter-drone weapons," *Defense Scoop*, September 27, 2024.

[127] CRS conversation with Army officials, 2024. According to Army congressional budget justification documents, the unit cost of the Coyote us approximately $129,538, though costs may vary year-to-year depending on the specific variant of the Coyote, procurement quantity, and other production-related considerations. See DOD, *Fiscal Year (FY) 2025 Budget Estimates, Army, Justification Book Volume 1 of 1, Missile Procurement, Army*, March 2024, p. 79.

[128] H.R. 5009, §113.

[129] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Navy, Volume 1 of 1, Procurement, Marine Corps,* March 2024, p. 79; and DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Navy, Volume 5 of 5, Research, Development, Test & Evaluation, Navy, Budget Activity 7-8*, March 2024, p. 169.

[130] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Navy, Procurement Marine Corps, Volume 1 of 1*, March 2024, p. 79.

Force Design 2030 modernization program.[131] The approved acquisition objectives for the MADIS and L-MADIS are 190 systems and 21 systems, respectively, according to the 2025 *Marine Aviation Plan*.[132]

The MADIS Increment 1 Block 1 system is composed of two Joint Light Tactical Vehicles (JLTVs): Mk1 and Mk2.[133] The Mk1 vehicle is equipped with the XM914E1 30mm cannon, Stinger missiles, and a nonkinetic electronic warfare system; the Mk2 vehicle is equipped with radar and kinetic and nonkinetic counter-UAS capabilities.[134] The Marine Corps is in the process of testing, acquiring, and integrating MADIS Increment 1 Block 2 hardware, which will reportedly feature improved kinetic and nonkinetic defeat capabilities for targeting one-way attack drones.[135] The service is also participating in the Army's programs to develop a replacement for the Stinger missile.[136] In December 2023, the Marine Corps conducted the first live-fire test of the production version of the MADIS Increment 1.[137]

The L-MADIS is intended to support expeditionary forces with nonkinetic counter-UAS capability. The system is composed of two Ultra-Light Tactical Vehicles (ULTV), currently the Polaris MRZR all-terrain vehicle. It is designed to be transportable on a Bell-Boeing MV-22 Osprey or by the Sikorsky H-53 helicopter. To detect drones, the L-MADIS currently features the RPS-42 radar and the CACI AVT CM262, an electro-optical and infrared system. To defeat drones, the L-MADIS includes the SNC Modi 2, an electronic warfare system designed to disrupt the communications of drones and improvised explosive devices (IEDs) and that can be mounted on a vehicle or carried in a backpack. The Marine Corps deployed the L-MADIS for the first time in 2019, when the system reportedly downed an Iranian drone in the Persian Gulf.[138]

[131] U.S. Marine Corps, Force Design 2030 Annual Update, June 2023, p. 11. For background on Force Design 2030, see CRS Report R47614, *U.S. Marine Corps Force Design Initiative: Background and Issues for Congress*, by Andrew Feickert.

[132] U.S. Marine Corps, *2025 Marine Aviation Plan*, Washington, DC, January 2025, p. 30.

[133] The Joint Light Tactical Vehicle is an Army-led modernization program to replace the Army's and Marine Corps' fleets of High Mobility Multi-purpose Wheeled Vehicles (HMMWVs). The JLTV is produced by Oshkosh Corporation.

[134] Testimony by Commandant of the Marine Corps General David H. Berger, in Congress, Senate Committee on the Armed Services, hearings, 118th Congress, 1st sess., April 18, 2023; and Kongsberg Defense US, "USMC Preparing for Full Rate Production of MADIS RWS," press release, July 10, 2023.

[135] Jon Harper, "With RFP on the way, Marines are eyeing a variety of 'non-kinetic' counter-drone weapons," *DefenseScoop*, July 10, 2023.

[136] U.S. Marine Corps, *2025 Marine Aviation Plan*, Washington, DC, January 2025, p. 30.

[137] Morgan Blackstock, "New Air Defense System Advances Corps' Air Dominance," Office of Public Affairs and Communications, PEO Land Systems, January 17, 2024.

[138] Sam LaGrone, "Marines Took Out Iranian Drone for the Cost of a Tank of Gas," *USNI News*, July 19, 2019.

Figure 2. Marine Air Defense Integrated System (MADIS)

Source: Photo by Cpl. Malia Sparks/U.S. Marine Corps, Defense Visual Information Distribution Service.

Installation-Counter Small UAS (I-CsUAS)

According to the Navy and Marine Corps congressional budget submission, the Installation-Counter Small UAS (I-CsUAS) program is meant to provide fixed-site counter-UAS capabilities to permanent and temporary Marine Corps installations for detecting, identifying, tracking, and defeating drones in Groups 1-3. The Marine Corps issued a request for proposals for the I-CsUAS program in February 2024.[139] According to the Marine Corps, the requested funding for FY2025 will go toward establishing a program of record and replacing and expanding the leased counter-UAS capabilities that the Marine Corps fielded at six locations under an urgent statement of need. In March 2025, the Marine Corps awarded Anduril a $640 million contract for the I-CsUAS program.[140]

Medium-Range Intercept Capability (MRIC)

The Medium-Range Intercept Capability (MRIC) is a short- to medium-range, ground-based air defense system derived from Israel's Iron Dome system and designed to be fielded with the Marine Corps' LAAD battalions. Its primary mission is to defend fixed sites against cruise missile threats, as well as those posed by UAS and other low-flying aircraft. The MRIC features the Raytheon SkyHunter interceptor, a variant of the Rafael Tamir missile; the AN/TPS-80 Ground/Air Task-Oriented Radar; and the Common Aviation Command and Control System. The MRIC is a distant successor to the HAWK surface-to-air missile, which the Marine Corps retired in the late 1990s.[141] In August 2024, the Marine Corps awarded Raytheon a $25 million contract for 80 SkyHunter interceptor missiles and associated equipment to support an initial platoon-level

[139] Jon Harper, "Army, Marine Corps ping industry for more counter-drone tech," *Defense Scoop*, March 1, 2024.

[140] Nick Wilson, "Anduril wins $640 million contract for counter-drone base protection systems," *Inside Defense*, March 10, 2025.

[141] Johannes Schmidt, "Back to the Future: MRIC and the rebirth of the Corps' air defense capability," Marine Corps PEO Land Systems, July 27, 2023.

MRIC capability.[142] The following October, the Marine Corps announced that it intended to award contracts that will support the deployment of three MRIC batteries; long-term, the Marine Corps is seeking to field a total of 12 MRIC platoons.[143]

Figure 3. Maneuver Short-Range Air Defense (M-SHORAD)

Source: Photo by Spc. Andrew Simeri/U.S. Army, Defense Visual Information Distribution Service.

Maneuver Short-Range Air Defense (M-SHORAD)[144]

The Army's Maneuver Short-Range Air Defense (M-SHORAD) system is designed to provide maneuver forces at the brigade level the ability to counter aerial threats from fixed- and rotary-wing aircraft and UAS. The Army issued a solicitation for M-SHORAD in 2017, before awarding General Dynamics Land Systems and Leonardo DRS contracts in 2020 for M-SHORAD Increment 1. The Increment 1 package includes a weapons package configured by Leonardo and consisting of AGM-114L Longbow Hellfire missiles for ground targets; FIM-92 Stinger missiles for aerial targets; and XM914 30mm cannon, M-240 machine gun, and a multi-mission radar for ground and air targets. The weapons package is mounted on a General Dynamics Stryker vehicle.

[142] Nick Wilson, "RTX awarded $25 million MRIC contract covering production of 80 missiles," *Inside Defense*, August 30, 2024.

[143] Nick Wilson, "Marine Corps advances MRIC fielding plan with awards to Raytheon," *Inside Defense*, October 7, 2024.

[144] For background on the M-SHORAD system, see CRS In Focus IF12397, *U.S. Army's Maneuver Short-Range Air Defense (M-SHORAD) System*, by Andrew Feickert.

In June 2024, the Army renamed the M-SHORAD the SGT STOUT after Medal of Honor recipient Sgt. Mitchell W. Stout.[145]

Some analysts have argued that given that the Stinger missile is the primary anti-aircraft armament of the M-SHORAD Increment 1, the vehicle is not a cost-effective solution to defend against drones.[146] In subsequent increments of the system, the Army is planning on integrating other weapon systems that could potentially improve M-SHORAD's effectiveness against drones and lessen the costs of such engagements.

- In Increment 2, the Army is adding a 50-kilowatt laser for countering UAS in Groups 1-3.[147] Also known as Directed Energy (DE) M-SHORAD, according to the *Army Air and Missile Defense 2028* strategic plan, by 2028 "M-SHORAD battalions will field a mix of DE and missile-based systems, with an increasing ratio of DE as the objective force for 2034 is fielded."[148] The Army's RCCTO evaluated the capabilities of Increment 2 prototypes in 2021.[149] In February 2024, the Army deployed four DE M-SHORAD prototypes to the U.S. Central Command theater for further evaluation. According to media reporting, the Army is evaluating other prototypes of the DE M-SHORAD after the initial prototypes failed to meet certain expectations during this deployment.[150] Additionally, DOD's Director of Operational Test and Evaluation (DOT&E), in its report on FY2024 programs, said that the deployment "prevented RCCTO from starting the scientific and technical testing planned for [FY2024]."[151]
- Increment 3 is expected to include the Army's Next Generation Short-Range Interceptor (NGSRI), one of several conceptual successors to the Stinger missile.[152] Increment 3 is also expected to include XM1223 Multi-Mission Proximity Airburst (MMPA) ammunition, a 30-mm multipurpose cartridge for engaging small drones, armored ground vehicles, and personnel that is currently under development.[153]

[145] U.S. Army Public Affairs, "Army names the M-SHORAD after Vietnam War Medal of Honor recipient," press release, June 15, 2024.

[146] 2LT Benjamin Phocas and Maj. Peter Mitchell, "Return of Tactical AAA," *Air Defense Artillery Journal,* no. 1 (2024), p. 32.

[147] For detail on DOD's directed energy program, see CRS Report R46925, *Department of Defense Directed Energy Weapons: Background and Issues for Congress*, coordinated by Kelley M. Sayler.

[148] U.S. Army, *Army Air and Missile Defense 2028*, Huntsville, AL, March 2019, p. 11, https://www.smdc.army.mil/Portals/38/Documents/Publications/Publications/SMDC_0120_AMD-BOOK_Finalv2.pdf

[149] Nancy Jones-Bonbrest, "Army advances first laser weapon through Combat Shoot-Off," Army Rapid Capabilities and Critical Technologies Office, August 10, 2021.

[150] Jen Judson, "US Army refreshes competition for short-range laser," *Defense News*, March 29, 2024; and Ashley Roque, "Army soldiers not impressed with Strykers outfitted with 50-kilowatt lasers, service official says," *Breaking Defense*, May 16, 2024.

[151] Director, Operational Test & Evaluation, *FY 2024 Annual Report*, Washington, DC, January 2025, p. 103.

[152] See "Various Counter-UAS Equipment" for more information.

[153] The XM1223, as currently conceived, could be programmed in multiple detonation modes depending on the type of target, according to the Army. See Meredith Roaten, "US Army developing new smart munition for M-SHORAD chain gun," *Janes*, April 18, 2023; Jared Keller, "The Army is eying a new all-in-one proximity round for its 30mm chain guns," *Task and Purpose,* May 23, 2023; and Kaitlyn Tani and Anthony Amoroso, "Incremental Advances," *Army AL&T Magazine,* Fall 2021, pp. 49-53.

In its FY2025 budget submission to Congress, the Army requested $69.1 million in procurement funding for the M-SHORAD.[154] It also sought $315 million in RDT&E funding for the M-SHORAD, of which the Army intends to spend the majority—$204.9 million—on work on Increment 3, according to Army budget justification documents.[155]

Command-and-Control for Counter-UAS

Command and control (C2) systems are used to locate, identify, and track aerial threats and to coordinate the selection and deployment of countermeasures that are best suited to the type of threat. The Army introduced the Forward Air Defense Command and Control (FAADC2) system in the 1990s, providing a C2 capability to SHORAD systems for the first time. In 2020, the JCO endorsed three command and control systems for the military services: the Army FAADC2, the Marine Corps and Air Force Multi-Environmental Domain Unmanned Systems Application Command and Control (MEDUSA), and the Air Force's Air Defense System Integrator (ADSI).[156] The LIDS and M-SHORAD systems use FAADC2.

Military officials have described command and control capabilities as a perennial challenge facing the Department's efforts to counter UAS threats.[157] Some commentators have cast doubt about the capacity of currently fielded C2 systems to counter UAS threats. Two commentators have written that the FAADC2 software requires an operator to manually select and engage individual UAS targets, which they argue "distracts operator focus on critical air track identification and further exacerbates human error and inefficiency to defeat UAS."[158] Others have observed that DOD lacks a common command and control software for counter-UAS systems and that some counter-UAS hardware may be compatible only with certain command and control systems, such as FAADC2 and MEDUSA.[159]

DOD officials have noted that a lack of compatibility between counter-UAS hardware and software could hinder the Department's ability to integrate new capabilities.[160] In 2025, the Army intends to evaluate alternative command and control systems to FAADC2 and to identify a solution that is designed for mobile counter-UAS operations.[161] The Defense Innovation Unit (DIU), the DOD office charged with leading the Replicator 2 C-UAS initiative, has said that investigating the issue of command and control is a central focus of its efforts.[162] In December 2024, DIU released a request for proposals for a "Forward Counter Unmanned Aircraft Systems Command and Control (FCUAS C2) System" that could potentially replace the legacy FAADC2 system.[163]

[154] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Army, Volume 1 of 1, Missile Procurement, Army,* March 2024, p. 13.

[155] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Army, Volume 2b of 2, Research, Development, Test & Evaluation, Budget Activity 4B,* March 2024, p. 140.

[156] Nathan Strout, "Army selects eight counter-drone systems for the joint force," *C4ISRNet,* June 26, 2020.

[157] Speaking on the topic of counter-UAS in 2023, Lt. Col. Gabriela Arraiz, then the deputy chief technology officer at Joint Special Operations Command, said: "What we discovered was that the most challenging part of this problem actually has nothing to do with the final step, and everything to do with the steps that precede it. And the steps that precede it are largely dependent on software and data." See Mikayla Easley, "SOCOM encountering challenges connecting counter-drone systems with software and data," *Defense Scoop,* August 30, 2023.

[158] Joel B. Vowell and Anthony R. Padalino, "Advancing the U.S. Army's Counter-UAS Mission Command Systems to Keep Pace with Modern Warfare," *Military Review,* vol. 104, no. 3 (May/June 2024), pp. 104-106.

[159] Major Forrest Craven, "AFCENT CUAS," Presentation at the Counter-UAS Summit, Arlington, VA, August 28, 2024.

[160] CRS conversation with DOD official, 2024.

[161] Jen Judson, "US Army to hold new counter-drone battle command system competition," *Defense News,* August 7, 2024.

[162] According to Deputy Director Aditi Kumar, DIU intends to "start early on the hardest problems, which in many cases are the software problems. Jon Harper, "DIU confronting C2 challenge for counter-drone phase of Replicator," *Defense Scoop,* December 12, 2024.

[163] Jon Harper, "DIU confronting C2 challenge for counter-drone phase of Replicator."

Indirect Fire Protection Capability (IFPC)[164]

The Army's Indirect Fire Protection Capability (IFPC) is a ground-based system for defending high-value installations against rocket, mortar, and artillery (RAM) threats, as well as UAS and cruise missiles. The Centurion C-RAM system was the first iteration of what is today known as IFPC Increment 1 (IFPC Inc 1), development and fielding of which reportedly occurred in 2004 and 2006, respectively.[165] The Army currently conceives of as many as three IFPC variants eventually replacing Increment 1—the IPFC Increment 2 (IFPC Inc 2), the IFPC High Energy Laser (IFPC-HEL), and IFPC High-Powered Microwave (IFPC-HPM)—all of which appear to remain in some stage of development or testing.[166] The Army has described the IFPC family of systems as having a role in defending fixed sites against UAS, one complementary to the M-SHORAD system for maneuver forces.[167] IFPC Inc 2, the primary armament of which is a surface-to-air missile interceptor, is said to be designed to provide a long-range defensive capability for UAS in Groups 2-3, while IFPC-HEL and IFPC-HPM are intended as a short-range defense against small UAS in Groups 1-2. The Marine Corps is also reportedly exploring the acquisition of a smaller, more mobile version of the IFPC-HPM for counter-UAS operations.[168]

In its FY2025 budget submission to Congress, the Army requested $657.6 million in procurement funding for the IFPC Increment 2-1 program.[169] According to its budget justification, the Army intends to use the funds for low-rate initial production of the IFPC Increment 2 and to purchase additional IFPC interceptors (the AIM-9X missile) and launchers.[170] The Army requested $167.9 million in RDT&E funding for the Indirect Fire Protection Increment 2 Block 1 program.[171] Additionally, in the Expanded Mission Area and Missile (EMAM) program, the Army requested $35.7 million in RDT&E funding for projects to develop the high-energy laser and a high-powered microwave variants of the IFPC system.[172] However, in its FY2025 budget request, the Army recalibrated its plan for IFPC-HEL, reducing the amount it planned to spend on the system over the next several years.[173]

[164] For background on IFPC, see CRS In Focus IF12421, *The U.S. Army's Indirect Fire Protection Capability (IFPC) System*, by Andrew Feickert.

[165] Inside Defense staff, "EAPS is Developed to be Future Interceptor in C-Ram Program of Record," *Inside Defense*, September 15, 2008; and Maj. Daniel G. Corbett, "10 years of C-RAM History," *Fires*, March/April 2016, p. 42.

[166] Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASA(ALT)), *U.S. Army Acquisition Program Portfolio 2024*, Washington, DC, 2024, pp. 56-58.

[167] U.S. Army, *Army Air and Missile Defense 2028*, p. 11.

[168] Jon Harper, "Marines to get new drone-killing microwave weapon designed for expeditionary ops," *Defense Scoop*, September 23, 2024.

[169] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Army, Justification Book Volume 1 of 1, Missile Procurement, Army*, March 2024, p. 49.

[170] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Army, Justification Book Volume 1 of 1, Missile Procurement, Army*, pp. 51-52.

[171] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Army, Justification Book Volume 3c of 3, Research, Development, Test & Evaluation, Army, Volume II, Budget Activity 5C*, March 2024, p. 311.

[172] DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Army, Justification Book Volume 2a of 2, Research, Development, Test & Evaluation, Army, Volume II, Budget Activity 4A*, March 2024, p. 318.

[173] Jason Sherman, "Army guts $4.8 billion from IFPC-HEL in new five-year plan, focuses on 'try' before 'buy,'" *Inside Defense*, April 19, 2024.

Legislative Activity

FY2025 National Defense Authorization Act

Legislative Provisions

During consideration of the FY2025 National Defense Authorization Act (NDAA), Congress evaluated policy provisions relating to DOD's counter-UAS authorities and capabilities, and whether to authorize more, the same, or less funding than the President requested for such activities.[174] The enacted version of the legislation (P.L. 118-159), a House amendment to a Senate amendment to H.R. 5009, included multiple oversight provisions related to countering UAS threats:

- Section 113 directs the Secretary of the Army to "develop and implement a plan for the procurement and fielding of additional kinetic effectors" for the Army's LIDS counter-UAS system, and to brief the congressional defense committees on such a plan not later than September 30, 2025.
- Section 353 directs the JCO to "establish and maintain a threat library, or expand and maintain an existing threat library" that includes known or suspected UAS threats, proposed counter-UAS solutions, and a "comprehensive listing of global incursions" from UAS, and to do so not later than 180 days after enactment.
- Section 925 directs the Secretary of Defense to establish a "C-UAS Task Force" to "review and, if necessary, consolidate and update all [DOD] memoranda and directives" related to countering UAS in the United States and to provide clarity and "an expedited decision-making process" for installation commanders. The provision also directs DOD to issue and disseminate new directives and requires a report on existing training efforts within 120 days of enactment.
- Section 1073 directs the Secretary of Defense to "execute a large-scale exercise in the special use airspace" of the Department to test DOD's ability to respond to UAS incursions at installations in the United States.[175]
- Section 1089 directs the Director of the DOD's All-Domain Anomaly Resolution Office to designate a liaison to serve on the C-UAS Task Force required by Section 925.
- Section 1090 directs the Secretary of Defense to "develop a strategy for countering unmanned aircraft systems" and the threats such technology poses to "facilities, personnel, and assets of the [DOD] in the United States." The provision further directs the Secretary of Defense to conduct an assessment of counter-UAS technology and the threats such technology poses, and of the existing counter UAS enterprise of the Department. The provision directs the

[174] For additional information, see CRS Insight IN12418, *FY2025 NDAA: Countering Uncrewed Aircraft Systems*, by Daniel M. Gettinger. For background on the FY2025 NDAA, see CRS Insight IN12404, *FY2025 NDAA: Summary of Funding Authorizations*, by Brendan W. McGarry.

[175] In congressional testimony in February 2025, General Gregory Guillot, Commander of U.S. Northern Command and North American Aerospace Command, said that NORTHCOM would hold an exercise in August 2025—known as Falcon Peak 25.2, a successor to the October 2024 Falcon Peak exercise—which will "include a larger slate of vendors, participants, and systems ... meeting FY25 National Defense Authorization Act direction." See Testimony by General Gregory Guillot, U.S. Congress, Senate Armed Services Committee, *U.S. Northern/Southern Command Posture*, 119th Congress, 1st sess., February 13, 2025, accessed on plus.cq.com.

> Secretary to submit a report to include the findings of the assessment, recommended changes to counter-UAS technology and policy, and recommendations for responding to incursions at other federal departments and agencies by June 1, 2025.

In addition to enacted provisions in the FY2025 NDAA, in the explanatory statement that accompanied the negotiated version of the legislation, conferees directed the Secretary of Defense to submit a briefing by not later than March 1, 2025, to the congressional defense committees on cooperative efforts by the United States and Israel to counter threats from the Government of Iran, specifically those involving one-way attack drones.[176]

Funding Authorizations

In the enacted version of the FY2025 NDAA, Congress authorized procurement and RDT&E funding above that requested by DOD for certain programs for countering UAS, and below that requested for other C-UAS programs.[177]

The changes Congress authorized to DOD's requested funding for counter-UAS programs included the authorization of $184.8 million more than requested in Army procurement funding for counter-UAS interceptors for the LIDS systems, which the Army had identified as an unfunded priority in a letter to Congress in March.[178] The enacted NDAA authorized $79.983 million—$20 million more than requested—for the Army's Counter-Small Unmanned Aircraft Systems Advanced Development program to accelerate work on the Next Generation Counter-UAS Missile (NGCM).[179]

For the Air Force, the enacted NDAA authorized $50 million more than requested for the Air Force Physical Security System for "counter uncrewed systems for Africa Command."[180] Additionally, in the Air Force's Operation and Maintenance account, Congress authorized $36 million more than requested for "C-UAS Electronic Support,"[181] one of U.S. Central Command's

[176] U.S. Congress, House, *Joint Explanatory Statement to Accompany the Servicemember Quality of Life Improvement and National Defense Authorization Act for Fiscal Year 2025*, 118th Cong., 2nd sess., December 7, 2024, p. 333. Directive ISIs, often referred to as directive report language, direct an individual (such as a senior DOD official) to take a specified action by a date certain. Although directive report language is not legally binding, agency officials generally regard it as a congressional mandate and respond accordingly. See CRS In Focus IF10516, *Defense Primer: Navigating the NDAA*, by Brendan W. McGarry and Valerie Heitshusen.

[177] See **Appendix B**. Unlike an appropriations bill, the NDAA does not provide budget authority for defense-related activities.

[178] U.S. Congress, House Rules Committee, *Text of the House Amendment to the Senate Amendment to* H.R. 5009, committee print, 118th Cong., 2nd sess., December 7, 2024, 118-52, p. 1329; and Ashley Roque and Valerie Insinna, "Army, CENTCOM ask Congress for spending jump for counter-drone mission," *Breaking Defense*, March 22, 2024.

[179] U.S. Congress, House Rules Committee, *Text of the House Amendment to the Senate Amendment to* H.R. 5009, p. 1347. The Next Generation C-UAS Missile (NCGM) is a conceptual interceptor under development by the Army for countering Group 3 UAS threats. The Army's Combat Capabilities Development Command Aviation & Missile Center plans to evaluate proposed solutions—including the BlueHalo FE-1 and the Raytheon Coyote—for the missile in FY2025. BG Frank Lozano, "PEO Missiles and Space Update," Presentation at the Space and Missile Defense Symposium, August 2024, p. 9; and Ashley Roque, "Army setting sights on 4 C-UAS competitions in '25, including next-gen missile," *Breaking Defense*, August 7, 2024.

[180] U.S. Congress, House Rules Committee, *Text of the House Amendment to the Senate Amendment to* H.R. 5009, committee print, 118th Cong., 2nd sess., December 7, 2024, 118-52, p. 562.

[181] U.S. Congress, House Rules Committee, *Text of the House Amendment to the Senate Amendment to* H.R. 5009, p. 600.

unfunded requirements.[182] For the Navy, the enacted NDAA authorized $14.4 million more than requested for the Marine Corps Air Defense Weapon Systems program to accelerate work on a counter-UAS high-powered microwave.[183]

FY2025 Defense Appropriations Bill

In the House-passed and Senate Appropriations Committee-reported versions of the Department of Defense Appropriations Bill for FY2025 (H.R. 8774 and S. 4921, respectively, 118th Congress), Congress considered funding certain programs for countering UAS at levels different from that requested.[184]

The House-passed version of the bill proposed appropriating funding for certain procurement and RDT&E programs for countering UAS at or below the level requested in the President's budget submission to Congress. For instance, the House-passed version would have appropriated $191.8 million less than requested for the Army's procurement of the IFPC Increment 2-1. The Senate's committee-reported version of the bill would have appropriated more funding for certain programs than requested. For instance, the committee-passed bill would have appropriated $184.8 million more than requested for the Army's Counter Small Unmanned Aerial Intercept program. Both versions of the bill would have appropriated more funding than requested—an estimated $44.5 million and $34.6 million in procurement and RDT&E funding, respectively—for counter-UAS systems for U.S. Special Operations Command.

In addition to the proposed changes to funding appropriations, the Senate Appropriations Committee, in its report accompanying its version of the FY2025 defense appropriations bill (S.Rept. 118-204), expressed concerns that "through its internal requirements development and budget review processes, the Army has inadvertently self-imposed restrictions on the counter-UAS systems it can procure."[185] The committee directed the Assistant Secretary of the Army for Acquisition, Logistics, and Technology to brief the congressional defense committees on the Army's ability to acquire the counter-UAS systems it needs.

Potential Issues and Considerations for Congress

DOD's Strategic Direction

DOD's December 2024 *Strategy for Countering Unmanned Systems* suggested that the Department is transitioning from focusing on countering uncrewed aircraft—especially small drones—to uncrewed systems in general, in what the Department described in a press release as

[182] In a letter Congress detailing its unfunded priorities, U.S. Central Command said that it would use the funding to acquire "15 SIGINT-enabled sensors equipped with upgraded CRESTONE, placed on [MQ-9 Reapers] to increase air domain awareness, aircraft survivability, and force protection." See Inside Defense staff, "Breakdown of CENTCOM's FY-25 UPL," *Inside Defense*, March 27, 2024.

[183] U.S. Congress, House Rules Committee, *Text of the House Amendment to the Senate Amendment to* H.R. 5009, committee print, 118th Cong., 2nd sess., December 7, 2024, 118-52, p. 576.

[184] See **Appendix B** for more details. Title IV of the Full-Year Continuing Appropriations and Extensions Act, 2025 (P.L. 119-4), funded the Department for FY2025; it did not include an accompanying explanatory statement specifying the level of budget authority for specific DOD programs, projects, or activities. Consequently, the final appropriation for the programs described in this section has yet to be determined.

[185] U.S. Congress, Senate Appropriations Committee, *Department of Defense Appropriations Bill, 2025*, report to accompany S. 4921, 118th Cong., 2nd sess., August 1, 2024, S.Rept. 118-204, p. 91.

an effort to "gaze beyond the 'five-meter target' to threats we may see in the future."[186] Some DOD officials have made remarks that appear to support this approach; in October 2024, for instance, JCO Director Major General David F. Stewart observed that "the Department is moving to a counter-UxS, so that's counter air, sea, and land, not just the air part."[187] DOD has not offered public details on what such a shift could entail for current programs.[188] Congress may consider the implications of such a reorientation in DOD strategy, both in definitional terms and in terms of the role and function of existing DOD organizations, personnel, and equipment for countering UAS. For example, what role will the JCO—and the Army writ large—have in coordinating the Department's efforts to counter uncrewed systems? To what extent are the systems currently being developed for countering different types of UAS relevant to defending against ground and sea threats? How will the Department measure and evaluate progress in its efforts to counter unmanned systems? In Section 1090 of the enacted FY2025 NDAA, Congress directed DOD to conduct an assessment of its counter-UAS enterprise and submit recommended changes to technology, policy, and authorities.[189] Based on such an assessment and as part of its oversight function, Congress may consider whether it has sufficient information to evaluate DOD's plans, or whether it requires more details as to the Department's strategic direction.

Type and Severity of UAS Threats

Army officials have acknowledged that the focus of the service's counter-UAS efforts has shifted over the years from commercially available drones (e.g., the Group 1 and 2 drones used by the self-proclaimed Islamic State in around 2016-2017) to larger—and potentially more lethal—UAS, including those sourced from state actors like Iran and used in attacks on commercial shipping in the Red Sea and against Ukraine and Israel.[190] In its 2024 *Strategy for Countering Unmanned Systems*, DOD identified several technological trends that could influence the types of UAS threats U.S. military forces may face in the future, including drones that are "able to loiter for longer timespans, to communicate better with other systems, move and act as swarms, and to carry larger payloads."[191] Congress has sought information from DOD on the nature of UAS threats, as well as reassurance that the Department is tracking this issue.[192] Most recently, as discussed above, Congress, in Section 353 of the FY2025 NDAA, directed the JCO to "establish and maintain ... or expand and maintain" a UAS threat library as a means of coordinating action

[186] U.S. Department of Defense, "DoD Announces Strategy for Countering Unmanned Systems," press release, December 5, 2024.

[187] U.S. Army Professional Forum, "Warrior's Corner: Outpacing the Small Unmanned Aircraft Systems (UAS) Threat," remarks at AUSA 2024, Washington, DC, 2024; and Major General David Stewart and Lt. Col. Paul Lushenko, "Countering Small Drones: Office Works Toward Joint Solutions to Growing Threat," *Army Magazine,* January 2, 2025.

[188] A 2024 study of DOD publications by the Department's Air Land Sea Space Application (ALSSA) Center found that "although certain domains of unmanned systems are addressed in various Service or joint publications, no all-encompassing doctrinal source exists to define the various types of unmanned systems or address how to counter this unique threat to operations across the spectrum of conflict." ALSSA suggested that DOD adopt common doctrinal terms and definitions, while also concluding that DOD did not need a new, comprehensive doctrine for countering unmanned systems. ALSSA, *Counter-Unmanned Systems Study*, September 1, 2024, pp. 2-5.

[189] See "Legislative Activity" for more information.

[190] General Sean Gainey, *Countering Uncrewed Aerial Systems: A Conversation with General Sean Gainey*, Center for Strategic and International Studies, Washington, DC, November 14, 2023; Linda Hersey, "UAS platforms can travel farther, faster and with bigger payloads," *Inside Defense*, August 29, 2023; and Walker D. Mills, Andrew Tenbusch, and Trevor Phillips-Levine, "The Coming Wave of Wartime Drone Expertise," *War on the Rocks*, February 4, 2025.

[191] U.S. Department of Defense, *Fact Sheet: Department of Defense Strategy for Countering Unmanned Systems*, Washington, DC, December 5, 2024, p. 1.

[192] P.L. 116-283, §1074; P.L. 117-263, §162 and §6513; and P.L. 118-159, §1090.

across the Department.[193] JCO officials have previously said that maintaining such a library is part of the JCO's mission.[194] As part of its oversight function, Congress may seek to understand the effectiveness of such a library in tracking UAS threats, and whether and to what extent such a library does already or should encompass threats from sea and land domains, as well as those posed by adversary counter-UAS solutions.

Coordination Within DOD

Although DOD publicly maintains that the JCO mission has the full participation and support of the military services, both the extent of non-Army involvement and the precise delineation of roles and responsibilities remains unclear.[195] Some commentators have suggested that Congress could empower the JCO with more authorities, specifically, "with an authority requirement recognized by the Joint Capabilities Integration Development System (JCIDS) that is broad enough to be effective for immediate [counter-small UAS] needs."[196] Some DOD officials, however, have cited a lack of coordination within DOD on certain counter-UAS issues.[197] The congressional defense committees, as discussed above, have expressed concerns about the level of coordination within the Department.[198] Congress, in evaluating the role of the JCO through its oversight and authorization functions, has several potential options to explore this issue. Congress may, for example, consider passing legislation seeking an independent assessment of the JCO's remit and performance.

Protection of Domestic Military Installations

Reports of potentially illegal or unauthorized drone activity near or around DOD installations have prompted congressional inquiries[199] and expressions of concern by some Members of Congress.[200] In November 2024, DOD's Office of Inspector General announced it would evaluate DOD actions to address UAS incursions over military installations.[201] As discussed above, DOD has designated U.S. Northern Command to coordinate domestic counter-UAS activities; the Department has also announced that technological solutions for the defense of military

[193] P.L. 118-159, §353. See "Legislative Activity" for more information.

[194] Major General Sean Gainey, "Joint C-sUAS Office (JCO) Overview," remarks at the SMD Symposium, Huntsville, AL, August 10, 2022, p. 3.

[195] According to DOD officials, while the JCO has liaisons with all of the military services and combatant commands, none of the military services have assigned personnel to the JCO.

[196] Shaan Shaikh, Tom Karako, and Michelle McLoughlin, *Countering Small Uncrewed Aerial Systems: Air Defense by and for the Joint Force*, Center for Strategic and International Studies, Washington, DC, November 2023, p. 36.

[197] John Tirpak, "US Needs Better Coordination, Cheaper Ways to Counter Drones: Pentagon Officials," *Air and Space Forces Magazine*, May 2, 2024; and CRS conversation with DOD officials, 2024.

[198] See "Joint Counter-Small UAS Office (JCO)" for more information.

[199] U.S. Congress, Senate Armed Services Committee, *National Defense Authorization Act for Fiscal Year 2025*, report to accompany S. 4638, 118th Cong., 2nd sess., July 8, 2024, 118-188 (Washington: GPO, 2024), p. 219.

[200] For example, see Office of Representative Mikie Sherrill, "Sherrill Demands Answers for Drone Activity Over Northern New Jersey," press release, December 12, 2024; Office of Representative Donald Norcross, "Rep. Norcross Releases Statement on Suspicious Drone Activity in New Jersey," press release, December 19, 2024; Office of Mark E. Green, MD (R-TN), "ICYMI: Chairman Green Demands Answers on Unexplained Aerial Sightings, Leads on Legislative Solutions for Counter-Drone Response," press release, December 16, 2024; and Office of Senator Tim Kaine, "Warner, Kaine, Youngkin Receive Classified Briefing Regarding Unexplained Drone Sightings in Virginia," press release, December 19, 2024.

[201] DOD Office of Inspector General, *Evaluation of DOD Actions to Address Unmanned Aircraft Systems at Military Installations in the United States and its Territories*, Project No. D2025-DEV0SR-0038.000, Alexandria, VA, November 20, 2024.

installations, including for those located in the United States, is a focus of DOD's Replicator 2 initiative.[202] DOD has proposed expanding its authorities to conduct counter-UAS operations in the United States in what the Department has described as an effort to align its authorities with those granted by Congress to other federal agencies. As part of its oversight function, Congress has several options to consider. Congress may consider whether to provide DOD with additional authorities to conduct counter-UAS operations in the United States, and whether to extend DOD's existing authorities beyond December 31, 2026 (the date at which DOD's existing authorities are currently set to expire). Congress may also consider requesting a briefing from DOD's Office of Inspector General on its findings.

Force Structure

The challenges posed by UAS proliferation have exposed long-running historical debates over the size, composition, and mission of the Army's air and missile defense forces, specifically those forces for short-range air defense. The Army is in the process of reversing the downsizing of its SHORAD capabilities it undertook in the early 2000s[203] and plans on reintroducing SHORAD battalions to Army divisions and adding units specialized in conducting counter-UAS.[204] As a result, according to Colonel Glenn Henke, commandant of the Air Defense Artillery (ADA) school at Fort Sill, "the ADA branch is undergoing our most significant modernization and growth in arguably the last 40 years."[205] Yet, the total cost and schedule of the Army's plans remains unclear, as is whether the Army will have sufficient personnel to meet its goals.[206] To enhance its oversight of the Force Structure Transformation initiative, Congress may seek more information about the Army's plans and timeline for the counter-UAS batteries, as well as about the equipment and training that the Army envisions will enable non-ADA forces to protect themselves against small UAS.

Program Funding

DOD officials have argued that the Department requires greater flexibility in the way Congress authorizes and appropriates funding, especially for UAS and counter-UAS capabilities.[207] In testimony before the Senate Appropriations Committee's Subcommittee on Defense, then-Undersecretary of Defense for Acquisition and Sustainment William LaPlante said that "having funding aligned with the prosecution of capability areas as opposed to specific, by-name systems would better enable procurement to outpace adversarial advancements and mitigate the risk posed by UAS."[208] Army officials have also said that greater flexibility to pursue capabilities rather than named programs would allow it to keep pace with the evolving threats.[209] In preparation for the

[202] See "DOD's Domestic Counter-UAS Authorities" for more information.

[203] See **Appendix A**.

[204] See "DOD Counter-UAS Personnel and Force Structure" for more information.

[205] Colonel Glenn A. Henke, "Dominating the Unmanned Aircraft Systems (UAS) Space," remarks at AUSA Hot Topic 2024 - Army Aviation, Arlington, VA, September 16, 2024.

[206] For a discussion of considerations regarding the Army's 2024 Army Force Structure Transformation initiative, see CRS Report R47985, *The 2024 Army Force Structure Transformation Initiative*, by Andrew Feickert.

[207] For example, see Lisbeth Perez, "Army Secretary Stresses Agile Funding Need for Advanced Tech," *MeriTalk*, September 5, 2024; and Lauren C. Williams, "Don't call it a slush fund: Pentagon's top buyer says looser pursestrings will foster innovation," *Defense One*, February 12, 2024.

[208] U.S. Congress, Senate Appropriations Committee, Subcommittee on Defense, *A Review of Select Department of Defense Acquisition Programs*, 118th Cong., 2nd sess., May 15, 2024.

[209] Dan Schere, "Camarillo outlines Army budget challenges for FY-26 as new administration gets ready," *Inside Defense*, January 13, 2025.

FY2026 defense budget proposal, DOD officials have said that the Department is working with Congress to consolidate UAS, counter-UAS, and electronic warfare funding lines, and to fund these weapons by category rather than by specific, named programs.[210] However, some commentators and industry leaders have warned of the possibility that the Army could abuse such flexibility and said that guidelines should be in place.[211] Others argue that the granting the Army greater flexibility could introduce uncertainty in industry, and that the usefulness of a flexible funding mechanism would depend in large part on the type of systems to which it was applied.[212]

Cost

Some Members of Congress have expressed concerns about the costs associated with using conventional air and missile defense interceptors against UAS threats.[213] Media reports suggest that the U.S. military's inventory of air defense interceptors and platforms has dwindled amid operational demands for the weapons.[214] Cost concerns have been particularly pronounced as far as the Navy is concerned given the pace of drone and cruise missile attacks on global shipping by the Houthi group in the Red Sea.[215] In congressional testimony in April 2024, then-Secretary of the Navy Carlos Del Toro said that the service had expended approximately $1 billion in munitions during operations in the Middle East.[216] That month, Congress enacted appropriations (H.R. 815; P.L. 118-50) that included $2.4 billion in supplemental funding for U.S. military operations in the U.S. Central Command region.[217]

Some commentators have resisted framing the issue of the cost of countering drones around the relative costs of the attacker's drone and the defender's interceptor. One commentator argued that the gap between a Houthi drone and a U.S. Navy Standard Missile-2 interceptor is a "simplistic comparison [that] can be misleading."[218] Another commentator has argued that when the costs of

[210] Dan Schere, "Camarillo outlines Army budget challenges for FY-26 as new administration gets ready."

[211] Ashley Roque and Valerie Insinna, "Army working with appropriators to iron out flexible spending plan," *Breaking Defense*, October 17, 2024; and Sam Skove, "Army announces plan to help spread commercial drones across infantry units," *Defense One*, May 27, 2024.

[212] In a statement to *Breaking Defense*, Lockheed Martin executive Tim Cahill said, "You wouldn't try and apply that to the big munitions programs, for example, because that would put a level of uncertainty that I think would be detrimental to us continuing to drive investment." Ashley Roque and Valerie Insinna, "Army working with appropriators to iron out flexible spending plan," *Breaking Defense*, October 17, 2024.

[213] For example, see Senator Mitch McConnell, "Legislative Session," remarks in the Senate, *Congressional Record*, vol. 170 (January 16, 2024), p. S107; and U.S. Congress, House Armed Services Committee, *House Armed Services Subcommittee on Tactical Air and Land Forces Holds Hearing on Fiscal Year 2025 Department of Defense Fixed-Wing Tactical and Training Aircraft Programs Budget Request*, 118th Cong., April 16, 2024.

[214] Helene Cooper and Eric Schmitt, "U.S. Wrestles with Aiding Allies and Maintaining Its Own Weapons Supply," *New York Times*, October 17, 2024; and Nancy A. Youssef and Gordon Lubold, "Pentagon Runs Low on Air-Defense Missiles as Demand Surges," *Wall Street Journal*, October 29, 2024.

[215] Lara Seligman and Matt Berg, "A $2M missile vs. a $2,000 drone: Pentagon worried over cost of Houthi attacks," *Politico*, December 30, 2023. For background on the Houthi attacks, see CRS Insight IN12301, *Houthi Attacks in the Red Sea: Issues for Congress*, by Christopher M. Blanchard.

[216] Justin Katz, "Navy is down $1B in munitions from ops in Red Sea, says SECNAV," *Breaking Defense*, April 16, 2024.

[217] For additional information, see CRS Insight IN12274, *FY2024 National Security Supplemental Funding: Defense Appropriations*, by Cameron M. Keys and Luke A. Nicastro.

[218] Wes Rumbaugh, *Cost and Value in Air and Missile Defense Intercepts*, Center for Strategic and International Studies, Washington, DC, February 24, 2024.

defended assets, such as that of cargo ships in the Gulf of Aden and the associated economic disruptions should such defensive operations fail, should be part of the equation.[219]

Nevertheless, Army and DOD officials have recognized that cost presents key a challenge to the Department's capacity to conduct counter-UAS operations.[220] The fact sheet accompanying DOD's 2024 strategy states as one of its objectives "reducing the cost imbalance between unmanned systems and countermeasures."[221] DOD is pursuing a variety of drone mitigation technologies, including new, potentially lower-cost surface-to-air interceptors, gun-based solutions, electronic warfare systems, and directed energy and high-powered microwave systems. In addition to identifying alternative options for intercepting drones, Army officials have cited the high cost of drone detection technologies, such as radar, as another challenge facing the service.[222]

The congressional defense committees, in reports on their respective versions of the FY2025 NDAA, included directive report language concerning the cost of drone countermeasures. In the HASC's report (H.Rept. 118-529), the committee directed the Secretary of Defense to submit a report on DOD's expenditure of munitions to counter air and missile threats in the Middle East, as well as on the cost and effectiveness of the munitions expended.[223] Meanwhile, in its report (S.Rept. 118-188), SASC directed the Secretary of Defense to brief the congressional defense committees by February 1, 2025, on an assessment of current low-cost countermeasures, a plan for the "potential expedited adoption and deployment of these technologies," and an analysis of projected budgetary requirements.[224]

Test and Evaluation

One potential issue for Congress concerns DOD's ability to test and evaluate counter-UAS systems against realistic representations of aerial threats, including relatively low-end threats such as commercial drones and more sophisticated threats such as noncooperative and cooperative swarming drones. While the Army has a long-standing program to acquire UAS targets for air defense artillery, the targets acquired under this program, known as the Remotely Piloted Vehicle Target (RPVT), are larger and more expensive than most commercially available Group 1-2 drones.[225] Some experts argue that live-fire tests of certain counter-UAS systems using nonrealistic aerial targets resulted in an overestimation of their effectiveness.[226] DOD officials have likewise questioned whether the Department's counter-UAS systems are evaluated using

[219] Commander Aaron Shiffer, *Calculating the True Value of Air Defense*, Joint Air Power Competence Centre, December 2024.

[220] Colin Demarest, "Drone-killing costs must come down, says Pentagon's chief weapons buyer," *C4ISRNet*, April 15, 2024.

[221] U.S. Department of Defense, *Fact Sheet: Department of Defense Strategy for Countering Unmanned Systems*, Washington, DC, December 5, 2024.

[222] CRS conversation with Army officials, 2024. For estimates of radar costs, see DOD, *Department of Defense Fiscal Year (FY) 2025 Budget Estimates, Other Procurement, Army, Volume 2 of 3, Communications and Electronics Equipment, Budget Activity 2*, March 2024, p. 453.

[223] U.S. Congress, House Armed Services Committee, *Servicemember Quality of Life Improvement and National Defense Authorization Act for Fiscal Year 2025*, report to accompany H.R. 8070, 118th Cong., 2nd sess., May 21, 2024, H.Rept. 118-529, pp. 283-284.

[224] U.S. Congress, Senate Armed Services Committee, *National Defense Authorization Act for Fiscal Year 2025*, report to accompany S. 4638, 118th Cong., 2nd sess., July 8, 2024, 118-188 (Washington: GPO, 2024), pp. 87-88.

[225] See CRS In Focus IF12738, *Aerial Targets*, by Daniel M. Gettinger.

[226] D. Max Ferguson and Russell Lemler, "Understanding the Counterdrone Fight: Insights from Combat in Iraq and Syria," Modern War Institute at West Point, May 14, 2024.

operationally relevant data and conditions, and have argued that DOD should invest in infrastructure that would allow the Department to conduct such tests.[227] Additionally, the House Armed Services Committee has questioned whether the JCO has sufficient resources and direction to address evolving UAS threats such as drone swarms.[228] As part of its oversight function, Congress has several options to address this issue. Congress may consider passing legislation seeking an assessment of the target drones and test infrastructure available to the Department to conduct counter-UAS training and testing, the accessibility of such systems, and the capacity of DOD's test ranges when it comes to testing various types of counter-UAS systems. For example, the Senate Armed Services Committee, in its report accompanying its version of the FY2025 NDAA, directed the Secretary of Defense to submit a briefing to the congressional defense committees by March 31, 2025, on DOD's efforts to "test DE systems [for countering UAS threats] and plans to increase that capability."[229]

Technical Maturity of Certain C-UAS

Directed energy (DE) and high-powered microwave (HPM) systems could, some DOD officials say, potentially offer lower-cost alternatives for counter-UAS to conventional air and missile defense interceptors.[230] Some Members of Congress have expressed support for directed energy programs as a low-cost alternative to conventional air and missile defense interceptors.[231] However, the Army's development of a directed energy capability for the M-SHORAD platform has reportedly faced delays[232] and, during a combat deployment in 2024, middling user reviews.[233] And while the cost-per-shot of a DE or HPM system may be less than that of conventional missile interceptor, the up-front cost of producing DE and HPM systems at scale could balance or negate such potential cost advantages. In light of these reports and as part of its oversight of these programs, Congress has several potential options it may consider, including

[227] In remarks in August 2024, DOT&E Director Dr. Douglas Schmidt observed that the Department is not yet at the point where DOD's counter-UAS systems are being tested against the threats U.S. forces are likely to encounter. Dr. Douglas Schmidt, "Counter UAS (C-UAS): Emerging Technologies, Testing, & Evaluation," Presentation at the Counter-UAS Summit, Arlington, VA, August 28, 2024.

[228] In the report accompany its version of the FY2025 NDAA, the House Armed Services Committee observed that "while the [JCO] leads and directs Joint C-UAS doctrine, material, and training, there is no agency or directorate focused on evaluating the capabilities of existing and emerging C-UAS in a joint, integrated virtual environment against known UAS and UAS swarm threats." U.S. Congress, House Armed Services Committee, *Report of the Committee on Armed Services on the Servicemember Quality of Life Improvement and National Defense Authorization Act for Fiscal Year 2025*, report to accompany H.R. 8070, 118th Cong., 2nd sess., May 31, 2024, 118-529 (Washington: GPO, 2024), p. 13.

[229] U.S. Congress, Senate Armed Services Committee, *National Defense Authorization Act for Fiscal Year 2025*, report to accompany S. 4638, 118th Cong., 2nd sess., July 8, 2024, 118-188 (Washington: GPO, 2024), p. 25.

[230] For example, see Testimony by Secretary of the Air Force Frank Kendall, U.S. Congress, House Armed Services Committee, *Department of the Air Force Fiscal Year 2024 Budget Request*, 118th Cong., 1st sess., April 27, 2023, 118-33, p. 131; Jon Harper, "Navy SWO boss frustrated by shortage of directed energy weapons," *Defense Scoop*, January 9, 2024, and Major General Sean Gainey, "Countering Uncrewed Aerial Systems: A Conversation with General Sean Gainey," remarks at the Center for Strategic and International Studies, November 14, 2023. For additional background, see CRS Report R46925, *Department of Defense Directed Energy Weapons: Background and Issues for Congress*, coordinated by Kelley M. Sayler.

[231] Ashley Roque, "Army soldiers not impressed with Strykers outfitted with 50-kilowatt lasers, service official says," *Breaking Defense*, May 16, 2024.

[232] Jen Judson, "SHORAD laser weapon will stay in development phase longer than planned," *Defense News*, October 14, 2022.

[233] Ashley Roque, "Army soldiers not impressed with Strykers outfitted with 50-kilowatt lasers, service official says," *Breaking Defense*, May 16, 2024.

passing legislation seeking an assessment by DOD of the viability and maturity of directed energy systems, as well as other proposed lower-cost alternatives to conventional interceptors.

CRS Reports on Specific Issues Related to Countering UAS

Other CRS reports may provide additional background information on specific technologies and weapon systems for countering UAS and on potentially relevant policy issues:

UAS and Counter-UAS

- CRS Insight IN12476, *Drone Encounters Prompt Calls for Restrictions and Other Protections*, by Bart Elias
- CRS Insight IN12418, *FY2025 NDAA: Countering Uncrewed Aircraft Systems*, by Daniel M. Gettinger
- CRS Insight IN12382, *Proposal to Create a U.S. Army Drone Corps*, by Daniel M. Gettinger and Andrew Feickert
- CRS Report R47188, *Unmanned Aircraft Systems: Roles, Missions, and Future Concepts*, by Kelley M. Sayler and Michael E. DeVine

Air Defense

- CRS In Focus IF12397, *U.S. Army's Maneuver Short-Range Air Defense (M-SHORAD) System*, by Andrew Feickert
- CRS In Focus IF12421, *The U.S. Army's Indirect Fire Protection Capability (IFPC) System*, by Andrew Feickert
- CRS Report R47985, *The 2024 Army Force Structure Transformation Initiative*, by Andrew Feickert

Technology

- CRS Report R46925, *Department of Defense Directed Energy Weapons: Background and Issues for Congress*, coordinated by Kelley M. Sayler
- CRS Report R44175, *Navy Shipboard Lasers: Background and Issues for Congress*, by Ronald O'Rourke
- CRS In Focus IF11882, *Defense Primer: Directed-Energy Weapons*, by Kelley M. Sayler

Appendix A. Historical Development

In the 1990s, the U.S. Army warned that a panoply of emerging low-altitude aerial threats—including lethal and reconnaissance unmanned aircraft systems (UAS) and cruise missiles—would make it difficult for the service to defend forward-deployed ground forces and fixed sites.[234] U.S. military and intelligence analysts expected that drones, which the U.S. Air Force fielded in the Vietnam War and U.S. ground and maritime forces adopted in the 1980s,[235] were primed to proliferate to other militaries and non-state actors.[236] In anticipation of the aerial threats it expected it could face in the 21st century, the Army sought to modernize its short-range air defense (SHORAD) capabilities. These programs, detailed in the 1995 and 1998 Army modernization plans, included the introduction of the Forward Area Air Defense Command and Control (FAADC2) system and Sentinel radar, as well as the fielding of a new SHORAD platform known as the Bradley Linebacker.[237] The Army also launched a "Block II" upgrade to the Cold War-era Stinger surface-to-air missile[238] to improve the missile's performance against cruise missiles and UAS.[239]

From 1999 to 2000, under an initiative known as Army Transformation, the Army divested the Stinger Block II program as a cost-cutting measure.[240] Three years later, the Army began reorganizing its air defense artillery capabilities by deactivating four divisional SHORAD battalions and removing the Bradley Linebacker from service.[241] The restructuring assigned most SHORAD battalions from the Active Component to the Army National Guard and ended the decades-long practice of allocating an anti-aircraft battalion to each Army division.[242] Some advocates of the move to downsize the Army's SHORAD forces in the mid-2000s argued that the Army's transition to more modular units would makes these units better equipped to deal with a

[234] For example, in the 1995 *Army Modernization Plan*, the Army reported that "significant shortfalls exist in the ability to counter cruise missiles and UAVs." Additionally, in the Army's FY1997 *Air and Missile Defense Master Plan*, the Army concluded that the service had "limited capability in the forward areas" to protect against short-range threats, including UAVs. See Department of the Army, *The United States Army 1995 Modernization Plan*, Washington, DC, 1995, pp. J-19, https://apps.dtic.mil/sti/tr/pdf/ADA286744.pdf; and Inside Defense staff, "Army Air, Missile Defense Master Plan Paints Bleak Picture of Future Capabilities," *Inside Defense*, November 5, 1997.

[235] CRS Report 93-686, *Intelligence Technology in the Post-Cold War Era: The Role of Unmanned Aerial Vehicles (UAVs)* (available to congressional clients upon request).

[236] In the 1998 *Army Modernization Plan*, the Army warned that "the threats with increased proliferation trends in the 21st Century are tactical ballistic missiles (TBM), cruise missiles (CM), unmanned aerial vehicles (UAV), and rockets." Office of The Deputy Chief of Staff for Operations and Plans, *The 1998 United States Army Modernization Plan*, Washington, DC, April 1998, pp. F1. See also Directorate of Intelligence, U.S. Central Intelligence Agency, *Remotely Piloted Vehicles in the Third World: A New Military Capability*, GI 86-10060, August 1986, p. 7,10.

[237] The Bradley Linebacker was based on the Bradley Fighting Vehicle. Inside Defense staff, "Army Successfully Tests System to Shoot Down Cruise Missiles, UAVs," *Inside Defense*, July 16, 1996.

[238] The Stinger was the Army's primary SHORAD missile interceptor and the main armament of both the Linebacker and the Avenger. The Avenger is a SHORAD platform first deployed in 1988 and based on the High Mobility Multipurpose Wheeled Vehicle (HMMWV). See Missile Defense Advocacy Alliance, *Avenger Air Defense System*, July 2, 2020.

[239] U.S. Army, *Weapon Systems United States Army 1997*, Washington, DC, 1997, p. 81.

[240] Department of the Army, *Army Posture Statement Fiscal Year 2001*, 2000, p. 30.

[241] Divisional SHORAD units were equipped with the Linebacker and Avenger and responsible for providing mobile SHORAD capabilities to forward-deployed units. See Inside Defense staff, "Army Instating New Strategy to Rebalance Active, Reserve Force Mix," *Inside Defense*, November 10, 2003; and John A. Hamilton, *Blazing Skies: Air Defense Artillery on Fort Bliss, Texas, 1940-2009* (Department of the Army, 2009), p. 345. For more on the Army's restructuring, see CRS Report RL32476, *U.S. Army's Modular Redesign: Issues for Congress*, by Andrew Feickert.

[242] Major Jonathan M. Cohen, "Divisional Air Defense 1945-Present," *Military Review*, vol. 89, no. 6 (November-December 1999), pp. 40-54.

broader variety of threats, including the growing number of rocket, artillery, and mortar (RAM) attacks on U.S. military installations in Iraq and Afghanistan.[243] One detractor claimed that the reductions in force would exacerbate the burden on the Army's high and medium air defense (HIMAD) systems—Patriot and Terminal High Altitude Area Defense (THAAD)—and leave ground forces unduly exposed.[244]

In its 2016 report, the congressionally mandated National Commission on the Future of the Army (NCFA) concluded that the post-Cold War diminution of Army defenses against short-range aerial threats constituted one of several "unacceptable modernization shortfalls."[245] Some Members of Congress reacted to the NCFA study by expressing concern about the state of short-range air defenses.[246] Additionally, during the markup of the FY2017 National Defense Authorization Act (NDAA), the House Armed Services Committee further expressed some concern about the effects of accelerating drone proliferation on DOD's air defense capabilities.[247] One Member of Congress argued that the diffusion of drones to non-state groups had eroded the U.S. military's technological advantage.[248] DOD officials also expressed concerns about the increasing proliferation of drones, and viewed the ability of non-state groups like the self-proclaimed Islamic State to use drones in increasingly sophisticated ways with growing alarm.[249]

Army leaders argued that the service needed to address what they perceived as gaps in its air defense capabilities.[250] In an October 2017 memorandum, then-Chief of Staff of the Army

[243] Defense Daily staff, "Army Air Defense Artillery Moves to Composite, Modular Units," *Defense Daily*, vol. 225, no. 38 (March 1, 2005).

[244] Colonel Charles A. Anderson, "Short-Range Air Defense in Army Divisions: Do We Really Need It?," *Military Review*, July/August 2001, pp. 98-103.

[245] National Commission on the Future of the Army, *National Commission on the Future of the Army report to the President and the Congress of the United States, January 28, 2016*, January 28, 2016, p. 50. For detail on the NFCA report, see CRS Report R44366, *National Commission on the Future of the Army (NCFA): Background and Issues for Congress*, by Andrew Feickert.

[246] U.S. Congress, House Armed Services Committee, Tactical Air and Land Forces Subcommittee, *Recommendations from the National Commission on the Future of the Army*, 114th Cong., 2nd sess., February 10, 2016, 98–916 (Washington: GPO, 2016), pp. 20-21

[247] In its markup of the FY2017 NDAA, the House Armed Services Committee (HASC) observed that UAS proliferation posed "a significant challenge to the Department of Defense's capabilities to detect, track, and neutralize such threats," and in an item of special interest, HASC directed the Secretary of Defense to develop a roadmap for addressing gaps in DOD's counter-UAS capabilities. See U.S. Congress, House Armed Services Committee, *Report of the Committee on Armed Services House of Representatives on* H.R. 4909 *together with Additional Views*, report to accompany H.R. 4909, 114th Cong., 2nd sess., May 4, 2016, 114-537 (Washington: GPO, 2016), pp. 80-81.

[248] In a Senate Armed Services Committee hearing in 2015, Senator Jack Reed said, "This diffusion of technology has even impacted our advantages over non-state groups like ISIL [Islamic State of Iraq and the Levant] and Al Qaida, who are increasingly able to acquire and employ tools, including drones and satellite communications equipment, which would have been unthinkable only a few years ago." See U.S. Congress, Senate Armed Services Committee, *Future of Warfare*, 114th Cong., 1st sess., November 3, 2015, 114-211 (Washington: GPO, 2016), p. 3.

[249] For example, see David B. Larter, "SOCOM commander: Armed ISIS drones were 2016's 'most daunting problem,'" *Defense News*, May 16, 2017; and Aaron Mehta, "STRATCOM issues guidance for anti-drone measures near nuclear sites," *Defense News*, April 4, 2017. For detail on the Islamic State, see CRS In Focus IF10328, *The Islamic State: Background, Current Status, and U.S. Policy*, by Clayton Thomas. For additional information on the Islamic State's use of drones, see Conflict Armament Research, *Islamic State's Weaponised Drones*, London, 2016; and Don Rassler, *The Islamic State and Drones: Supply, Scale, and Future Threats*, Combating Terrorism Center at West Point, July 11, 2018.

[250] See Justin Doubleday, "Update Underway For Army's 2012 Air And Missile Defense Strategy," *Inside Defense*, December 26, 2015; Carrie E. David, "CDID director discusses state of integrated air and missile defense during SMD Symposium," U.S. Army, August 17, 2016; Sydney J. Freedberg Jr., "Army Races To Rebuild Short-Range Air Defense: New Lasers, Vehicles, Units," *Breaking Defense*, February 21, 2017; and Brigadier General Randall McIntire, "The return of Army short-range air defense in a changing environment," *Fires*, November/December 2017, pp. 5-8.

General Mark A. Milley outlined six modernization priorities for the Army, one of which was air and missile defense capabilities to protect combat formations from "air and missile delivered fires, including drones."[251] The Army revisited requirements the service had discounted a decade prior. The Army launched the Stinger Service-Life Extension Program (SLEP) to improve the missile's ability to intercept drones.[252] In 2017, the Army's Project Manager for Short and Intermediate Effectors for Layered Defense (PM SHIELD) released a solicitation for the Maneuver SHORAD (M-SHORAD) platform, a planned successor to the Avenger and Linebacker.[253] Under the *Army Air and Missile Defense 2028* strategy, published in 2019, the Army announced plans to reintroduce short-range air defense capabilities to each Army division by creating new SHORAD battalions.[254]

Yet, Army officials acknowledged that reanimating the service's SHORAD capabilities may be insufficient to deal with proliferating and evolving UAS threats.[255] Army officials further worried that the cost of using conventional SHORAD interceptors such as the Stinger to shoot down drones could prove prohibitive.[256] At a time when the market for novel counter-UAS solutions was expanding,[257] the Army and DOD moved to identify potential solutions for the military services. In the late 2010s, the military services fielded dozens of types of interim counter-UAS systems; according to one estimate, by 2017, U.S. Central Command had deployed more than 100 experimental counter-UAS systems in the theater,[258] while other reports cite a far higher figure for the number of interim systems deployed.[259] In 2019, the Department assigned responsibility to the Army for coordinating the counter-UAS activities of the Department and the military services in what then-Undersecretary of Defense for Acquisition and Sustainment Ellen Lord described at the time as an effort to concentrate on a select number of counter-UAS systems.[260]

[251] General Mark A. Milley and Ryan D. McCarthy, *Modernization Priorities for the United States Army*, U.S. Army, Washington, DC, October 3, 2017, p. 2.

[252] Kevin Jackson, "Stinger maintenance work to increase service life, reliability," U.S. Army, May 17, 2017; Cruise Missile Defense Systems Project Office, "Missile defense system upgrade meets Soldier's urgent need," press release, September 19, 2018; and Gary Sheftick, "Army rebuilding short-range air defense," Army News Service, July 3, 2019.

[253] Courtney McBride, "Army Issues Solicitation for Maneuver-Shorad," *Inside the Pentagon's Inside the Army*, vol. 29, no. 7 (February 20, 2017). For details on M-SHORAD, see CRS Insight IN10931, *U.S. Army's Initial Maneuver, Short-Range Air Defense (IM-SHORAD) System*, by Andrew Feickert.

[254] U.S. Army, *Army Air and Missile Defense 2028*, Huntsville, AL, March 2019, pp. 12-13.; and Jen Judson, "Short-Range Air Defense battalions will grow in both Army's active force and National Guard," *Defense News*, April 2, 2018.

[255] Sydney J. Freedberg Jr., "Army Vice Says Yes on Anti-Drone Tech; Maybe on Missiles; No On Iron Man," *Breaking Defense*, June 21, 2016.

[256] Monica Wood, "Shoffner talks Army modernization with industry leaders," *Fires*, March/April 2018, p. 63.

[257] Arthur Holland Michel, *Counter-Drone Systems*, Center for the Study of the Drone at Bard College, Annandale-on-Hudson, NY, February 2018, p. 2.

[258] Mark D. Newell, "Moore's Law and the Challenge of Counter-sUAS Doctrine," *Joint Forces Quarterly*, no. 89 (2nd Quarter 2018), p. 25.

[259] Shaan Shaikh, Tom Karako, and Michelle McLoughlin, *Countering Small Uncrewed Aerial Systems: Air Defense by and for the Joint Force*, Center for Strategic and International Studies, Washington, DC, November 2023, p. 30.

[260] Aaron Mehta, "Pentagon wants to streamline its counterdrone focus," *C4ISRNet*, December 11, 2019.

Appendix B. FY2025 Funding Authorizations and Appropriations for Selected Counter-UAS Programs

Table B-1. Proposed and Enacted Funding Authorizations and Appropriations for Selected Programs for Countering UAS for Fiscal Year 2025

(in millions of dollars of discretionary budget authority, rounded to the nearest tenth)

			Authorizations			Appropriations		
Line Item Title	Line[a]	FY2025 Request	House-passed (H.R. 8070)	SASC-reported (S. 4638)	Enacted (P.L. 118-159)	House-Passed (H.R. 8774)	SAC-Reported (S. 4921)	Enacted (P.L. 119-4)[b]
Missile Procurement, Army								
M-SHORAD – Procurement	03	$69.1	$69.1	$69.1	$69.1	$69.1	$69.1	—
Indirect Fire Protection Capability INC 2-I	08	$657.6	$657.6	$657.6	$603.5	$465.8	$574.8	—
Counter Small Unmanned Aerial System Intercept	10	$117.4	$314.8	$202.2	$302.3	$117.4	$302.3	—
Other Procurement, Army								
Indirect Fire Protection Family of Systems	74	$63.1	$63.1	$63.1	$63.1	$63.1	$63.1	—
Counter Small Unmanned Aerial System (C-sUAS)	78	$280.1	$445.5	$345.6	$280.1	$291.3	$452.5	—
Research, Development, Test & Evaluation, Army								
Maneuver – Short Range Air Defense (M-SHORAD)	78	$315.8	$253.2	$315.8	$284.5	$315.8	$284.5	—
Counter - Small Unmanned Aircraft Systems Advanced Development	88	$60	$64.5	$80	$80	$80	$60	—
Air Defense Command, Control, and Intelligence – Eng Dev[c]	105	$49.7[c]	$49.7[c]	$79.7[c]	$49.7[c]	$49.7[c]	$49.7[c]	—
Indirect Fire Projection Capability Inc 2 – Block 1	133	$167.9	$167.9	$167.9	$150.9	$143.4	$150.9	—
Counter – Small Unmanned Aircraft Systems Sys Dev & Demonstration	155	$59.6	$59.6	$64.1	$64.1	$59.6	$64.1	—
Procurement Marine Corps, Navy								

			Authorizations			Appropriations		
Line Item Title	Line[a]	FY2025 Request	House-passed (H.R. 8070)	SASC-reported (S. 4638)	Enacted (P.L. 118-159)	House-Passed (H.R. 8774)	SAC-Reported (S. 4921)	Enacted (P.L. 119-4)[b]
Ground Based Air Defense	10	$369.3	$333.3	$369.3	$364.3	$362.6	$369.3	—
Research, Development, Test & Evaluation, Navy								
Counter Unmanned Aircraft Systems	90	$14.2	$14.2	$14.2	$14.2	$29	$14.2	—
Marine Corps Air Defense Weapons Sys	205	$74.1	$88.5	$74.1	$88.5	$88.5	$78.2	—
Procurement, Air Force								
Air Force Physical Security System[d]	32	$74.2[d]	$74.2[d]	$174.2[d]	$124.2[d]	$74.2[d]	84.4[d]	—
Research, Development, Test & Evaluation, Air Force								
Airbase Air Defense Systems (ABADS)	70	$17.3	$17.3	$17.3	$17.3	$17.3	$17.3	—
Procurement, Defense-Wide								
Warrior Systems <$5M[e]	68	$52.1[e]	$52.1[e]	$96.6[e]	$96.6[e]	$96.6[e]	$96.6[e]	—
Research, Development, Test & Evaluation, Defense-Wide								
Warrior Systems <$5M[f]	284	$17.8[f]	$17.8[f]	$52.4[f]	$52.4[f]	$52.4[f]	$52.4[f]	—

Source: CRS analysis of DOD Comptroller, FY2025 *Procurement Programs (P-1)* and *Research Development, Test & Evaluation Programs (R-1)* spreadsheets; FY2025 military department budget justification books; U.S. Congress, House Committee on Armed Services, *Servicemember Quality of Life Improvement and National Defense Authorization Act for Fiscal Year 2025*, legislative text and joint explanatory statement to accompany H.R. 5009/P.L. 118-159, 119th Cong., 1st sess., H.Prt. 119-2, January 2025; U.S. Congress, House Appropriations Committee, *Department of Defense Appropriations Bill, 2025*, report to accompany H.R. 8774, 118th Cong., 2nd sess., June 17, 2024, H.Rept. 118-557 (Washington: GPO, 2024); and U.S. Congress, Senate Appropriations Committee, *Department of Defense Appropriations Bill, 2025*, report to accompany S. 4921, 118th Cong., 2nd sess., August 1, 2024, S.Rept. 118-204 (Washington: GPO, 2024).

a. As it appears in P.L. 118-159, the enacted FY2025 NDAA.

b. The enacted legislation, a full-year continuing resolution, did not include an accompanying explanatory statement specifying the level of budget authority for individual DOD programs, projects, or activities. Consequently, the final appropriation for the programs cited has yet to be determined.

c. The figures cited refer only in project FG5, "Counter Unmanned Aerial Systems (UAS)," in the military department budget justification books or as similar described in the congressional funding tables.

d. The figures cited refer only to those in the project "Airbase Air Defense Systems (ABADS)" in the military department budget justification books or as similarly described in the congressional funding tables.

e. The figures cited refer only to those in project number 6, "Counter Uncrewed System (CUxS)," in the military department budget justification books or as similar described in the congressional funding tables.

f. The figures cited refer only to those in project number 717, "Counter Uncrewed System (CUxS)," in the military department budget justification books or as similar described in the congressional funding tables.

Appendix C. DOD's UAS Categorization Chart

Figure C-1. DOD's Chart for the Categorization of Unmanned Aircraft

Unmanned Aircraft Systems Categorization Chart

UA Category	Maximum Gross Takeoff Weight (lbs)	Normal Operating Altitude (ft)	Speed (KIAS)	Representative UAS
Group 1	0-20	< 1200 AGL	100 kts	WASP III, TACMAV RQ-14A/B, Buster, Nighthawk, RQ-11B, FPASS, RQ16A, Pointer, Aqua/Terra Puma
Group 2	21-55	< 3500 AGL	< 250	ScanEagle, Silver Fox, Aerosonde
Group 3	< 1320	< 18,000 MSL	< 250	RQ-7B Shadow, RQ-15 Neptune, XPV-1 Tern, XPV-2 Mako
Group 4	> 1320		Any Airspeed	MQ-5B Hunter, MQ-8B Fire Scout, MQ-1C Gray Eagle, MQ-1A/B/C Predator
Group 5	> 1320	> 18,000 MSL	Any Airspeed	MQ-9 Reaper, RQ-4 Global Hawk, RQ-4N Triton

Legend

AGL	above ground level	lbs	pounds
FPASS	force protection aerial surveillance system	MSL	mean sea level
ft	feet	TACMAV	tactical micro air vehicle
KIAS	knots indicated airspeed	UA	unmanned aircraft
kts	knots	UAS	unmanned aircraft system

Source: Office of the Chairman of the Joint Chiefs of Staff, *Joint Air Operations*, Joint Publication 3-30, Washington, DC, July 25, 2019, p. III-31.

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