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Scaling the Swarm DoD and Army Strategies to Enable Rapid and Sustained sUAS Procurement

December 2025

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ABSTRACT

The rapid rise of small unmanned aircraft systems (sUAS) has transformed warfare, as seen in the Russia–Ukraine conflict, where mass-produced, low-cost sUAS provided decisive effects. In harnessing this new technology, the U.S. faces critical gaps: limited domestic production capacity, fragile supply chains, and slow acquisition processes. This thesis analyzes how the Department of Defense can overcome these barriers to ensure affordable and adaptable sUAS are available at scale. Using a review of defense policy, contracting practices, and program management tools, the study identifies systemic obstacles, including rigid processes, fragmented training standards, and cultural reliance on legacy systems. Analysis across Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities, and Policy highlights reforms needed to normalize drone use across the force. Findings show that innovative contracting mechanisms such as Other Transaction Authority and Commercial Solutions Openings, combined with dual-use and modular open system designs, can stimulate private investment, reduce costs, and strengthen domestic supply chains. The research recommends immediate bulk procurement of commercial drones to signal demand, paired with a long-term Program of Record supported by sustained appropriations. Ultimately, U.S. military success in future conflicts will depend not only on advanced technology but also on the ability to rapidly field vast numbers of sUAS.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAF	Adaptive Acquisition Framework
ASIs	additional skills identifier
CCP	Chinese Communist Party
CDD	capabilities decision document
COTS	commercial off the shelf
CSO	commercial solutions opening
C-sUAS	counter small unmanned aircraft system
DCRs	defense change recommendations
DFARS	Defense Federal Acquisition Regulation Supplement
DIB	Defense Industrial Base
DIU	Defense Institute University
DJI	Da Jiang Innovations
DoD	Department of Defense
DOTMLPF-P	doctrine, operations, training, materiel, leadership and education, personnel, facilities, policy
FAA	Federal Aviation Agency
FAR	Federal Acquisition Regulation
FY	fiscal year
GAO	Government Accountability Office
GWOT	Global War on Terror
ICD	initial capabilities document
ID/IQ	indefinite delivery/indefinite quantity contracts
JCIDS	Joint Capabilities Integration and Development System
KO	contracting officer
MCA	major capability acquisition
MCOE	Maneuver Center of Excellence
MDAP	Major Defense Acquisition Program
MOS	military occupation specialty
MTA	middle tier acquisition
MTTs	Mobile Training Teams
NDAA	National Defense Authority Act

OSC	Office of Strategic Capital
OTA	other transaction authority
PME	professional military instruction
POI	program of instruction
POR	program of record
PPBE	planning, programming, budget, execution
RDT&E	research, development, testing & evaluation
REE	rare earth elements
RPG	rocket propelled grenade
SAP	simplified acquisition procedures
sUAS	small unmanned aircraft system
TTPs	tactic training procedures
UAV	unmanned aerial vehicle
UCA	urgent capability acquisition

I. INTRODUCTION

It is said that the nature of war does not change. Some of man's greatest scholars have studied war, determining that if differences in opinion exist, so too will conflict. Indeed, Carl von Clausewitz (2008) famously described war as an "extension of policy by other means" (p. 87). What does change, however, is the nature of warfare: the tools and weapons used by humanity to inflict harm upon others and erode their will to fight in pursuit of a policy objective. Russia's latest invasion of Ukraine in February 2022 has demonstrated the effectiveness of the next tool of warfare: small unmanned aircraft system (sUAS; Zafra et al., 2024). sUASs, and the broader category of unmanned autonomous vehicles (UAVs), are not new inventions, nor are they unique to the defense environment. What has evolved is how drones are used. The United States made drones famous in the Global War on Terrorism (GWOT). Massive airframes such as the Grey Eagle and Reaper could provide aerial surveillance for hours on end and then execute a missile strike to destroy a target, all directed by operators at home thousands of miles away (Gaub, 2011). The contemporary Russo–Ukraine war has proven the viability of smaller first-person drones with a far more limited range, in some cases, only 100 meters (Zafra et al., 2024). These drones can be used to spot artillery missions or drop small munitions, such as hand grenades or RPG warheads, into troop formations, vehicles, and tanks. Larger drones, such as the Shahed-136, can autonomously pilot themselves to their target independent of human control, further changing the dynamic of drones in warfare (Zafra et al., 2024).

The Russo–Ukraine war has forced Ukraine to develop its own sUAS doctrine, tactics, and performance parameters of drones to counter the Russian invasion and broader proliferation of drones on the battlefield. Prior to the conflict and the reckoning of the value of sUAS on the battlefield, Ukraine had few domestic manufacturing capabilities and largely relied on importing drones and related hardware, only producing about 5,000 drones domestically a year (Macalpine, 2025). A focus on electronics recycling and modular parts and an emphasis on grassroots manufacturing and developing has resulted in a surge of platforms and equipment (Nixon, 2025). Relying on initiatives such as providing instruction on how to build drones at home and ordering the production of millions more drones from domestic suppliers for purposes ranging from attack to reconnaissance, Ukraine is playing catch-up against an enemy well-versed in drone warfare (Nixon, 2025). Now capable of producing 2 million drones a year, Ukraine is learning a hard lesson at the worst time (Macalpine, 2025; Skove, 2024). Ukraine's desperation and fight for survival is stimulating immense growth in drone production spurred on by changes to warfighting doctrine. The United States would greatly benefit from recognizing that the nature of warfare has changed. Small drones deployed in vast numbers produced at cheap prices, rendering them readily disposable, can be combat multipliers on the battlefield of the 21st century.

A. PROBLEM STATEMENT

Globalization of the world economy has led to intricately connected economies relying on raw materials from many countries around the world. In the event of a disruptive global conflict, maritime shipping of goods and resources is likely to be negatively affected, resulting in possible supply chain collapse or cessation of manufactured goods arriving to the United States (Hust & Kavall, 2021). Given lessons learned from the Russo–Ukraine war, the United States will need to be able to produce disposable drones on a massive scale to successfully engage in a conflict with a peer adversary in the context of trade disruption. Existing legislation, such as the Defense Production Act, gives power to the federal government in times of national emergency or war to redirect efforts toward manufacturing for the purpose of the public good (Neenan & Nicastro, 2023). However, the U.S. defense industrial base faces challenges in meeting the expected demands of the Department of Defense (DoD) given the current limited production of drones both for private consumers and civil and military applications. The potential fragility of the global supply chain and the constraints of the defense acquisition system may negatively impact the agility and scalability of production during disruptions.

Domestic U.S. production of drones currently lags far behind foreign competitors such as Da Jiang Innovations (DJI) and Autel, with the United States relying heavily on parts or materials from foreign countries (Robbins, 2023). Complicating matters is that should the defense base even solve its material issue, it still lacks the capacity to match Ukraine's wartime production, with some estimates putting maximum U.S. production at only 100,000 drones a year (Somerville, 2025). The lost industrial capacity in the United States due to investment in cheaper locations abroad has resulted in dependence on overseas imports for commercial goods. China, by contrast, dominates the drone market, with companies such as DJI commanding a vast majority of the global market share of drone sales (Kroenig & Bayoumi, 2024). The barrier to entry for U.S. companies is often prohibitively high given China's control of the market and monopoly of the supply chains necessary for sustained production of high quantities of drones (McBride & Chatzky, 2019). Recognizing that industrial manufacturing and supply chain dependence has had a negative impact on national security, the United States has started to secure its own supply chains and encourage domestic manufacturing growth. Time remains a key consideration in restoring industrial capacity to enable mass production of drones, with experts opining about potential Chinese military action against Taiwan (Amonson & Egli, 2023). The DoD has a vital role to play in rapidly increasing private sector investment in drone production. As potentially the largest and wealthiest drone customer, the DoD must act quickly to spur private development of industry to facilitate an industrial base healthy enough to meet the very high demands of military drones on a scale like what is being seen in the Russo–Ukraine conflict.

Given these challenges, this project aims to analyze existing policy and identify where improvements can be made for sustained combat operations. This research presents recommendations on how to incentivize industry through capitalization of the dual-use market to build industrial capacity and capability to meet future sUAS demands. Key capabilities of DoD drones are identified to improve the acquisition of sUASs that are effective on the modern battlefield but equally lucrative to private consumers. In seeking to realize these objectives, this project seeks to answer the following research questions:

What current policy, contracting, and program management arrangements pose problems for the acquisition of large quantities of military sUAS?

What policy, contracting, and program management changes should the DoD make to facilitate a successful program for the acquisition of very large quantities of military sUAS in support of military operations?

What financial investments can the DoD make to buy down risks to a program for the acquisition of very large quantities of military sUAS at short notice?

B. METHODOLOGY

Research methods consist of a comprehensive literature review of academic, governmental, agency (DoD), and private sector data, research, and policies. An examination of the laws, policies derived from the laws, legal execution of those policies, and their success rates inform the analysis and recommendations made. These recommendations are based on an aggregate of analysis of the organizations examined. Following evaluation of the existing sUAS military landscape, doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF-P) Change Recommendations (DCRs) are leveraged to indicate to industry the DoD's intent to purchase large amounts of drones and encourage industry growth to meet the rising demand. After recommending relevant DCRs, a playbook of options is developed for the materiel solutions that force planners and acquisitions officers can immediately apply. Contracting options are used to bridge the materiel capability gap in the immediate term to enable unit and individual training supplemented by sustained program management options for peace and wartime. Having presented demand signals to industry, a program of record (POR) that offers sUAS platforms that can meet military needs while being sold to private consumers is proposed. A dual-use sUAS system that has characteristics this research finds most vital to military operations and is also commercially available may ultimately reduce costs per unit and boost domestic supply chains to meet sustained production of the system for the foreseeable future. Figure 1 illustrates the direction this project aims to follow.

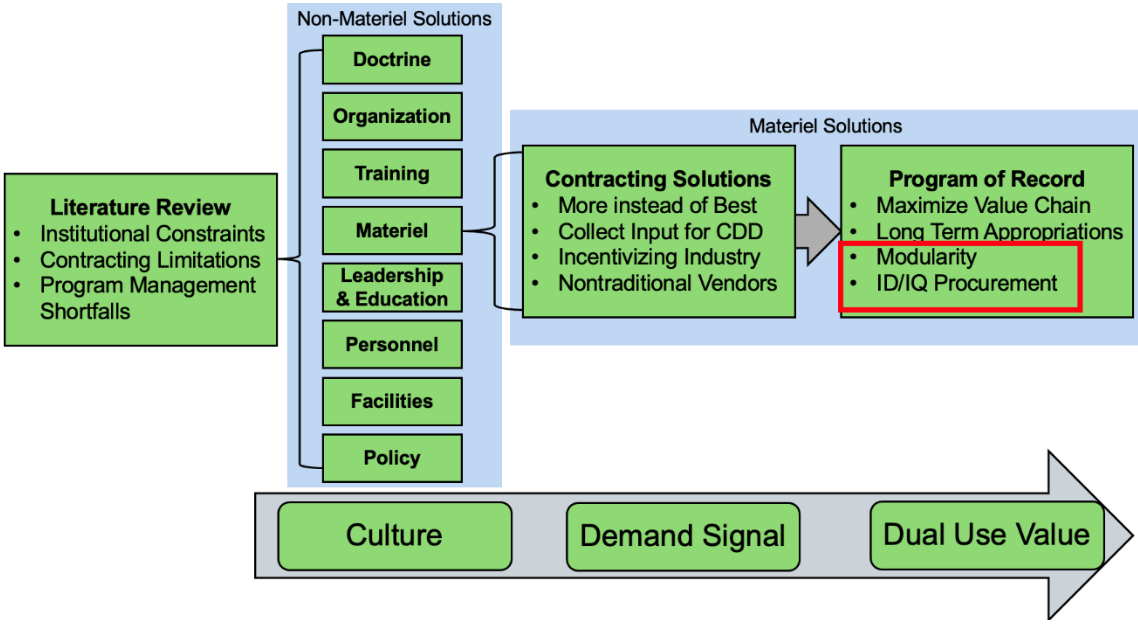

Figure 1. Project Goals

C. LIMITATIONS AND SCOPE

As the incumbent presidential administration is shaping policy in line with new priorities, there is a great deal of alterations being made to existing policy and new policies that are being challenged in the court system. The legality, stability, and impact of new executive actions are under constant assessment. Additionally, the vacillation of policy with the aim of exercising national power creates situations in which policy enactment, adjustment, or abatement are in constant flux. This has significant negative impact on the ability to conduct research in a timely and organized manner. Lastly, the new administration's decisions that do remain constant and stable will not have had time to fully mature and enable this project to assess the consequences and implications thereof. For this reason, our research may reference material or data newer than January 20, 2025, but assessments of public policy and the instruments and apparatus are only be made on those that existed prior to January 19, 2025. The lessons learned from the Russo–Ukraine war have demonstrated the widespread proliferation and use of smaller, commercially available sUAS. Focus is placed on the DoD's ability to influence development, procurement, and employment of sUAS in the land domain. Therefore, research and analysis are focused on aerial sUAS popular on the commercial market. The Federal Aviation Administration (FAA) categorizes drones according to weight, normal operating altitude, and speed. These rules are derived from the U.S. Code of Federal Regulations (C.F.R.), where a "small unmanned aircraft" is defined as weighing 55 pounds or less on takeoff (Small Unmanned Aircraft Systems, 2016). Figure 2 shows the different types of classification of unmanned aircraft systems (UASs) according to the FAA. Group 1 and 2 drones are those we refer to as sUAS. Group 1 and group 2 drones, based on the C.F.R.'s definitions, are those most likely to have widespread success and popularity on the civil and private market; these drones also have proven military applications despite potential regulation (Clossman & Long, 2015). Given their size and performance limitations relative to other groups, these drones are least likely to require that operators obtain specialized training, permits, or licenses prior to operation, increasing their popularity and availability among amateur operators.

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

Figure 2. UAS Categorization Chart. Source: FAA (2025).

D. ORGANIZATION OF PROJECT AND GENERAL OVERVIEW

This project first examines the broader use of drones in 21st century warfare. Summarization of lessons learned come primarily from the protracted Russo–Ukraine conflict but also the brief and asymmetrical Nagorno–Karabakh conflict. Use cases of drones in contemporary conflicts should shape the direction the U.S. Army may pursue in preparing for the next conflict. Considerations are made toward Chinese dominance of and interference in the sUAS market and the influence this has on the United States' ability to develop, manufacture, and innovate in drone technology. Concerns regarding supply chain independence and the impact this can have on U.S. manufacturing during times of war are also addressed. The background concludes with a brief synopsis of the relationship the DoD has with the defense industrial base, most specifically those companies at the cutting edge of innovation, and how the DoD can repair and develop relationships with the private sector.

The literature review begins with an assessment of the constraints in which the DoD must operate regarding drone operation, use by Army units, and density of drones within unit formations. Legal constraints that apply within and beyond the DoD that govern drone use are examined together, as they collectively impact the ability for prospective drones to acquire a compelling dual-use consideration that becomes important during sustained sUAS procurement. A subsequent analysis of the existing contracting practices relating to sUAS is made to introduce problems and issues current contracting practices have on meeting the immediate needs of the Army. The literature review concludes with an examination of the Army's program management practices and the impact these have on the service branch's prolonged sUAS procurement to meet near-term goals.

The goal of the analysis is to illustrate non-materiel solutions that can drive DOTMLPF-P revisions to then enable sustained, large-scale acquisition of sUAS. Changes to the culture of military services, chiefly the Army, form the foundation of DOTMLPF-P revision which is further driven from the lessons learned from contemporary conflict. Manufacturing a need in Army formations for sUAS resulting from DOTMLPF-P changes is recommended, with the resulting competition among the private sector fueling improved design and development among private industry. Simultaneously with DOTMLPF-P changes, creative contracting methods are recommended to purchase sUAS in the immediate and near-term to facilitate training and collect valuable use data. Demand signals to industry in the form of bulk commercial off the shelf (COTS) purchasing via contracts can further encourage growth among domestic manufacturers. With the contracting methods serving as a type of competitive prototyping, development of a long term and dedicated Program of Record (POR) based on the lessons learned from bulk COTS purchasing can ensure the Army equips its force with the most effective sUAS platforms. Key to the programs of record are characteristics encouraging dual-use sales among the private market. Characteristics of the programs of record include features such as modular components, right-to-repair provisions and artificial intelligence capabilities.

The study concludes with a summarization of findings and areas for future potential research. In addition, a brief summary of relevant actions taken by the newly inaugurated presidential administration is included.

II. BACKGROUND

This chapter provides background information on the implementation of drones in modern warfare, starting with an examination of their use in 21st century conflicts such as the GWOT, the Nagorno–Karabakh conflict and the Russo–Ukraine war. These modern examples highlight the importance of sUAS in the DoD's contemporary arsenal. Additionally, the chapter presents an examination of the economic and strategic impacts of Chinese market behavior in the global drone market and the impacts of U.S. dependence on foreign supply chains for items critical to production of sUAS. Focusing on both the operational evolution of sUAS on the battlefield and the supply chain vulnerabilities sets the stage for future solution approaches to the current U.S. need for sUAS defense capabilities.

A. DRONES IN THE 21ST CENTURY

The advent of unmanned systems in the 21st century has changed the use of aircraft in armed and unarmed conflicts throughout the world. As technology has developed and matured, UAS have become more prevalent on the battlefield. According to Stamp (2013), drones were first developed in the early 20th century for use in World War I; however, their development did not mature adequately, and thus they never saw use on the battlefield. Stamp also highlighted that drone development continued, and the DoD began using them in the 1950s as simple targeting assets to identify enemy locations for artillery. Their evolution to today's advanced technology has enabled their use in every aspect of warfare, from targeting to kinetic strikes and intelligence-gathering to electronic warfare engagements. As artificial intelligence and additional advanced technologies continuously mature, the use of drones in warfare will likely increase.

1. UAS Utilization During the Global War on Terrorism

The United States' use of large UAS became standard practice within the multiple conflicts encompassed by the GWOT that spanned the first two decades of the 21st century. According to Gaub (2011), drone employment first centered around intelligence, surveillance, and reconnaissance in the Iraq and Afghanistan theaters created a longlasting impact on the battlefield. Gaub suggested the long loiter times and high-quality sensor technology enabled the near real-time feed of intelligence to decision-makers and warfighters. As the wars progressed, the evolution of UAS to deliver munitions for lethal effects on enemy targets was the next major change to impact the battlefield. This transition occurred in the fall of 2001, striking known al-Qaeda commander Mohammed Atef with a Hellfire missile launched from an MQ-1 Predator (Kaplan, 2016). The MQ-1 Predator can be seen in Figure 3 on an operation flight. Now, a physically disconnected combatant could deliver precise, real-time, deadly impacts with nearly no risk to force.

Figure 3. MQ-1 Predator in Flight. Source: Lopez (2012).

The remarkable use of drones over the two-decade GWOT was a basis for the future use of automation and unmanned systems in warfare. As Romaniuk and Webb (2015) emphasize, “the drone program has undoubtedly given the U.S. political and military leadership the mindset of having the strategic initiative—the ability to choose where and when to attack without constraint” (p. 238). While the drones used in the GWOT were much larger than modern drones, their advantages and effectiveness can still be translated to sUAS in the modern fight. Much like their larger predecessors, modern sUAS can provide the ability for small units to attack with little or no constraints.

There is no doubt that the employment of drones changed the landscape of the GWOT. This mass employment forever changed how militaries will fight in the future. The use of large drones to linger for hours or even days over a target then strike at a chosen moment is the perfect demonstration of unmanned systems' advantage on the battlefield. As demonstrated in the Nagorno–Karabakh conflict and Russia–Ukraine war, the use of smaller, cheaper drones amplifies lessons learned in the GWOT.

2. Nagorno–Karabakh Conflict

In a short lived but extremely important example of drone effectiveness on the battlefield, the Nagorno–Karabakh conflict between Azerbaijan and Armenia exemplifies the quick impact of drones. In a matter of weeks, Azerbaijan was able to make significant progress on the disputed territory, using almost exclusively drones to target Armenian formations, logistic sites, and armored vehicles (Detsch, 2021). Figure 4 displays the conflict area of the Nagorno-Karabakh conflict, as well as borders of the involved nations and surrounding area. Azerbaijan's use of a variety of drone types created at low cost with the intention of being expendable and mass-deployed overwhelmed the Armenian forces, creating a nearly zero-risk operation for Azerbaijan. While there was no official concession, Azerbaijan's progress exemplified the successful utilization of drones (Postma, 2021).

Figure 4. Nagorno-Karabakh Conflict Area Map. Source: Cerillo (2023).

This nearly one-sided conflict will influence future conflicts in the utility of UAS on the battlefield. While small states can benefit from UAS' low cost and low barriers to entry, this will not be the only increased-use area. The United States should expect to see future adversaries, including peers and near-peers, fully leverage UAS capabilities (Andrews, 2021, p. 5). As adversaries around the world prepare to use this low-cost standoff weapon, the United States must find a way to integrate and produce large volumes of sUAS to deliver effects on the battlefield.

3. Russia–Ukraine War

Since the start of the Russia–Ukraine war in 2022, the use of UAS has grown to dominate the battlefield and the headlines. Both sides' use of a variety of drone capabilities continues to highlight the high impact of UAS in armed conflict. Unlike their larger siblings used in the GWOT, sUAS leveraged on the battlefield of the Russia–Ukraine war have been smaller, less costly systems employed by small units to gain advantages through intelligence, surveillance and reconnaissance (ISR), kinetic strikes, and electronic warfare (Macalpine, 2025; Zafra et al., 2024).

Much like the challenge the United States currently faces with its industrial base, Ukraine lacked domestic manufacturing capacity of sUAS at the start of the conflict. Ukraine's pre-war drone manufacturing was almost non-existent, with some Ukrainian news sources alluding to pre-war capacity at less than 10% of its 2024 capacity (Halstian, 2025; Ukrainska Pravda, 2024). However, through innovation and the threat of an invading enemy, there was a spur in homegrown manufacturing of sUAS. In fact, Ukraine's sUAS production is expected to double in 2025 from the previous year, from 2.2 million to 4.5 million (Axe, 2025). This substantial increase in domestic manufacturing has enabled major battlefield effects by getting sUAS into the hands of Ukrainian warfighters in high quantities and quickly. According to Watling and Reynolds (2015), "tactical UAVs currently account for 60–70% of damaged and destroyed Russian systems" (p. 10).

While mass production is a critical component of the sUAS capability, there is also a need to produce the drones inexpensively to create an environment that permits their loss on the battlefield. This attrition should be considered in all situations, whether from losses to kinetic strikes, enemy interdiction, or mishaps. This is an area Ukraine and Russia have excelled in during their current conflict, producing sUAS at a much lower cost than other kinetic options such as missiles. Specifically, Russia's Shahed drone, a group 3 drone with a cost-per-target-struck of approximately $350,000, is significantly more cost-effective than its $1,000,000-plus Kh-22 missile (Hollenbeck et al., 2025). Translate the same effectiveness to a group 1 drone, which can be produced far cheaper at approximately $1,000, and the cost per target can plummet to less than $10,000 per strike (*The Economist*, 2024). Ultimately, Russia has lost over 5,000 combat vehicles and Ukraine has lost 2,000 combat vehicles because of sUAS employment (Mittal & Goetz, 2025, p. 6). With the combination of low cost, minimal risk to force, and diversity of employment capabilities, sUAS employment in the Russia–Ukraine war has taken center stage. This has led to Russian and Ukrainian forces being both able and willing to use UAS and sUAS for strikes without the concern of high costs associated with other strike options.

As the evolution and effects of drone use in the 21st century have demonstrated, the modern battlefield is almost certain to involve drone use. As drones have decreased in size while still maintaining consequential capability, their impacts have continued to grow. Going forward, the United States and its allies must acknowledge this and begin to develop a roster of low-cost, high-capability sUAS for warfighter use.

B. MARKETS AND SUPPLY CHAINS

The relationship between Chinese market behavior and the supply chain and their dynamic, pivotal role to the production of large quantities of sUAS cannot be understated. This section explores the evolution of China's manufacturing capabilities and market practices in the global drone market. Specifically, examining the major market control they have established through their influence and subsidizing of DJI. At the same time, the United States faces significant challenges due to reliance on foreign markets for both raw materials, particularly rare earth elements (REE), and manufacturing of components critical to production of sUAS.

1. Chinese Market Behavior

The advent of sUAS as combat multipliers on the battlefield reflects a broader trend of cheap, mass-produced weaponry being used to erode advantages from expensive and powerful systems. China has slowly but steadily become a manufacturing powerhouse by capitalizing on economy of scale to produce inexpensive group 1 and 2 sUAS to meet worldwide demand. China's state-subsidized DJI holds 90% of the American drone market and 80% of the global market (Pusztaszeri, 2024; Robbins, 2023). DJI's vertical integration of supply chains has afforded the company significant control over all aspects of its sUAS designs (Kroenig & Bayoumi, 2024). As a result, DJI can not only manufacture and assemble drones far cheaper than competitors but also sell individual drone components such as batteries and motors to other companies (Pusztaszeri, 2024). The dependence other companies have on DJI components can become a national security concern when the Chinese Communist Party (CCP) manipulates DJI's market participation. For instance, DJI (under direction from the CCP) has ceased sales of drone batteries to U.S. manufacturer Skydio (Tang, 2024). This limits Skydio's production capacity as they depend on some components being manufactured by China, forcing a rationing of batteries and other components that drives Skydio's costs up. The results of such actions by DJI and the CCP are that domestic drones become far more expensive and consumers increasingly demand the cheaper Chinese alternative.

China's market manipulation extends beyond simply banning the export of drone components that other companies depend on. The "Made in China 2025" initiative has served to insulate China's market from competition and enable weaponization of its own economy against competing states (McBride & Chatzky, 2019). DJI's dominance of the U.S. drone market means the CCP can flood the market (and has done so) with significantly cheaper sUAS if it believes that U.S. companies are infringing upon China's market share (Robbins, 2023). Intellectual property theft through forced transfer agreements and foreign investment further grants China an edge in sUAS manufacturing by keeping competing companies at a disadvantage in market access (McBride & Chatzky, 2019). Predatory sUAS market practices result in stymied domestic production, especially within the lucrative hobby industry. These practices, coupled with broader manufacturing and industrial atrophy because of Chinese anticompetitive practices, have led to a steep decline in domestic sUAS production capacity. What remains disproportionately depends on Chinese parts and resources (Ferreira & Critelli, 2022; Kroenig & Bayoumi, 2024).

The value that a robust manufacturing capacity has in national security goals compounds China's dominance of the sUAS market. Investigators have explored Chinese manipulation of industry products such as steel and aluminum, revealing that when China restricts such resources on the global marketplace, the U.S. industrial capacity suffers (Weaver, 2019). China extends this practice to its manufactured goods (such as sUAS), which increases the barrier to entry for new U.S. market enterprises and reduces profit margins for those that remain (Robbins, 2023). Efforts to shield American industry and curb Chinese market manipulation through duties and tariffs have been ongoing for some time (Weaver, 2019). The U.S. government, through the American Security Drone Act of 2023, has made concerted efforts to encourage private and public entities to specifically avoid purchasing Chinese drones in favor of domestically manufactured offerings (National Defense Authorization Act [NDAA 2023). The market for sUAS is dominated by China's DJI, which controls both the sales of drones across the globe and the supply chains that support the ability to manufacture sUAS and sUAS components.

2. Supply Chain Considerations

The United States' inability to domestically sustain its need for rare earth elements and component manufacturing greatly complicates the country's ability to procure large quantities of sUAS to field in military applications. The need for rare earth elements to produce critical components such as batteries and motors, combined with the ability to produce only limited amounts of domestic microprocessors and printed circuit boards are all major supply chain constraints(Reynolds, 2024; Tang, 2024). Consideration must also be given to the fact that sUAS are not exclusive consumers of REE in manufacturing. Various other vital systems and platforms also require REE and present a compelling need to develop supply chain resilience and independence (Harshberger et al., 2025).

3. Rare Earth Elements

sUAS manufacturing requires a substantial amount of REEs to support both the system's technology of the system and its weight limitations (Government Accountability Office [GAO], 2024). Critical REEs include aluminum, cobalt, copper, dysprosium, electrical steel, fluorine, gallium, iridium, lithium, magnesium, natural graphite, neodymium, nickel, platinum, praseodymium, silicon, silicon carbide and terbium (U.S. Department of Energy, n.d.). These elements—especially lithium, cobalt, and nickel—are critical to battery and brushless motor manufacturing. However, this market is overwhelmingly dominated by China at all steps of the process, from mining and refining the raw elements to manufacturing the final components (Defense Innovation Board [DIB], 2025a).

When considering this need for rare earth elements to produce high volumes of sUAS, it is assumed that the U.S. defense industrial base lacks the domestic capacity to mine and refine rare earth elements. Specifically, according to the U.S. Government Accountability Office, "between 2019 and 2022, the U.S. imported more than 95% of the total rare earths it consumed" (Russell, 2024, para. 6). This reliance on foreign supply has not gone unnoticed by the DoD or the federal government at large, with the United States investing over $400 million to increase domestic capacity (Lopez, 2024). While the federal government has begun significant investment in rare earth element production domestically, there is still a sizeable gap between current investment and the scale the United States needs to reach to become independent of foreign supply chains. For example, according to the U.S. Geological Survey (2025, p. 110), there is only a single facility in Nevada that produces battery-grade lithium within the United States. As time continues to pass, the increasing demand and reliance on foreign supply chains' REEs will only become more critical. Figure 5 depicts the move of lithium from near critical in the short-term to critical in the medium-term. It also illustrates the same criticality shift of many other notable REEs, such as silicon carbide, cobalt, aluminum, neodymium, and others.

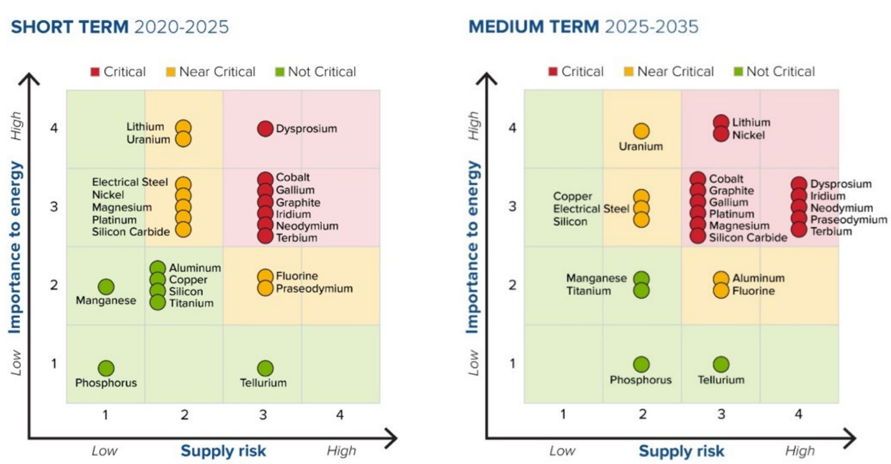

Figure 5. REEs in Relation to Time and Criticality. Source: U.S. Department of Energy (n.d.).

The United States' heavy reliance on Chinese production and processing of rare earth elements is further exacerbated by China's December 2023 ban on the export of rare earth extraction and separation technologies (Baskaran, 2024). This delays U.S. development of technologies to efficiently and effectively extract REEs and ultimately creates a void that must be filled by continued importing. Merge this with the competition across multiple defense systems, and the challenges of the United States' limited domestic REE production is only amplified (Leal Filho et al., 2023, p. 8). When considering the whole picture of REEs, their challenges, and their critical need in the manufacturing of sUAS, there must be action to address the fragile supply chain.

4. Components and Final Assembly

In addition to REE limitations, the U.S. manufacturing base also currently lacks the capacity to manufacture sUAS components and the ability to assemble sUAS domestically in large quantities. The inability to convert raw materials into usable parts, pieces, and components further compounds U.S. supply chain constraints around domestic drone production. Specifically, a single Chinese company is credited with control of 90% of the U.S. drone market and 80% of the global market (Pusztaszeri, 2024). Again, the reliance on foreign markets, specifically China, for critical defense materials has created a fragile supply chain hindering the ability to mass produce sUAS in quantities that would likely be needed in the event of a large-scale conflict with direct U.S. involvement.

The vulnerability created by U.S. reliance on foreign component suppliers to produce large quantities of sUAS domestically for military use cannot be understated. Kapustina et al. (2021) say, "the main manufacturers of both unmanned aerial vehicles and their components are China, France and, to a lesser extent, America, while the software and service development industry is developed in Europe" (p. 4). Within this market, as previously mentioned, China controls most of the manufacturing capacity. In fact, the two largest sUAS manufacturers, DJI and Autel, are both Chinese-based companies (Kroenig & Bayoumi, 2024).

C. CONCLUSION

The implementation of drones on the battlefield, from primitive reconnaissance tools to the more sophisticated and diverse systems used today, has transformed modern warfare. As demonstrated in the GWOT, Nagorno–Karabakh conflict, and Russia–Ukraine war, drone advancements and impacts are becoming ever more prevalent. These advancements have enabled cost-effective, risk-reducing actions that greatly disrupt opposing forces' operations. However, the increasing need to incorporate sUAS into tactical operations also exposes a major vulnerability in the U.S. supply chain, as there is a great reliance on foreign producers, predominantly China, for sUAS critical materials, components, and manufacturing. It is imperative that the United States begins maximizing operations capabilities of sUAS and urgently strengthens its domestic manufacturing capabilities and capacity to support the production of large quantities of drones.

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III. LITERATURE REVIEW

This chapter provides an assessment of the institutional, contracting, and program management frameworks that may present potential bureaucratic barriers and hinder the DoD and the Army from effective sUAS procurement. Research identified common problems and themes across the body of knowledge that included a wide variety of literature, from governmental publications to academic research. These themes are outlined as subsections under the most relevant framework to which they apply. Future chapters present analyses of how these themes affect Army sUAS procurement and provide informed recommendations for solutions.

A. INSTITUTIONAL CONSTRAINTS ON DRONE OPERATIONS

This section offers an exploration of the misalignment between current training standards and emerging operational needs, the friction imposed by multi-layered compliance requirements, and the downstream effects on force readiness and private sector engagement. Collectively, the combination of statutes, regulations, and cultural inertia limit the Army's ability to scale drone usage in line with modern battlefield demands.

1. Fragmented Certification Standards and Training Bottlenecks

Broadly speaking, Army drone operator training has not undergone significant changes despite the proliferation of new sUAS capabilities, types, and technologies. Within the DoD, minimum drone operator certification is governed by Service-specific licensing and training, initially derived from applicable U.S. law for any group 1 or 2 operator (Small Unmanned Aircraft Systems, 2016). For the Army, these requirements are formally outlined in Appendix D of *Flight Regulations* (AR 95-1); (Headquarters Department of the Army [HQDA], 2018). These Service-issued certifications and licenses can sometimes have additional requirements imposed on them to varying degrees by organization, installation, or state and local laws (Phillips et al., 2025). However, little attention has been paid to the reclassification of drones within the wider Army equipment portfolio. This is especially true with the Army's *Small Unmanned Aircraft System*

Aircrew Training Program (TC 3–04.62; HQDA, 2013) that governs the training program, which has not been updated to incorporate the proliferation of newer drones designed for a market full of operators lacking any formal operational knowledge. With sUAS being a relatively new platform, in many cases, the military operating certification training is the same for Group 1 drones as it is for larger Group 3 drones, such as the RQ-7B Shadow. Figure 6 shows the different types of drones that TC 3–04.62 can certify operators to fly. Clockwise from top left are the Parrot USA MIL, a group 1 sUAS; Skydio X2D, a group 1 sUAS; MQ-1C Gray Eagle, a Group 4 drone; RQ-7B Shadow, a group 3 drone, and the Flightwave Aero Edge 130, a group 1 sUAS.

Figure 6. Different Types of Drones TC 3–04.62 Certifies Operators to Fly. Source: Department of War (2011), Red Cat (n.d.), Manuel (2024), Potter (2013), Skydio (2023).

More advanced drones, such as first-person view (FPV) drones, do demand greater skill on the part of the operator, but these types of drones do not encompass the total sUAS inventory, and the skill gap is increasingly diminishing with the rise of AI piloting assistance (Bondar, 2025).

The Army training program's lack of adjustment has resulted in significant training bottlenecks for Soldiers. Consequentially, the Army does not certify large enough numbers of Soldiers to support contemporary sUAS operations in training or combat situations. The sUAS master trainer course operated at the Maneuver Center of

Excellence (MCOE) produced only 90 certified Soldiers in Fiscal Year (FY) 2022 against a need of 112 across the force in subsequent years (Phillips et al., 2025). The number of operators needed can be expected to increase in the event of a conflict with a peer adversary if the lessons learned from the Russo–Ukraine war are applied. While Soldiers may leave the course having earned a highly sought after license to operate increasingly complicated unmanned drones, their job may only require minimal licensing. The training administered by the Army complicates the retention of trained personnel in two ways: by awarding them certification and training sought after by the private sector and by failing to appropriately manage and retain this talent through efficient talent coding. Graduates are awarded a personnel development skill identifier instead of the centrally managed and career-advancing additional skill identifier (Phillips et al., 2025).

Following the completion of the certification course, licensed Soldiers are, in most cases, only capable of operating a drone with reduced oversight, not employing it tactically in military operations. Further, despite their master trainer title, they cannot then certify further operators at echelon with an equal qualification of master trainer, leading to overreliance on a singular certification program operated at the MCOE (Phillips et al., 2025). Master trainers can "certify" operators, but only if the master trainers achieve and maintain stringent mission-qualified standards in the specific sUAS on which they want to certify operators, limiting the effectiveness of this practice in cases where drones available to units may change quickly to meet the Army's needs (HQDA, 2018). The density of master trainer sUAS operators at the division level is insufficiently matched to the required billets at echelon, and operators certified by master trainers lag far behind the "anticipated density of sUAS in combat where maneuver units will want many more trained operators" (Phillips et al., 2025, p. 26). Figure 7 illustrates the quantity of one group 1 drone variant, the RQ-11 Raven, per Army division as well as the number of operators required and certified to fly the drone.

Unit	SUAS			SUAS OPERATORS	
	TYPE	AUTH	ON HAND	REQUIRED	CERTIFIED
3 Inf Div	RAVEN	38	38	76	104
10 Mtn Div	RAVEN	63	63	126	128
82d Abn Div	RAVEN	63	63	126	128
101 Abn Div	RAVEN	65	64	116	39
18 FA BDE	RAVEN	7	6	14	0
20 EN BDE	RAVEN	8	7	16	6
16 MP BDE	RAVEN	34	34	68	5
Total		278	275	512	410

SOURCE: Data provided by XVIII Airborne Corps, July 28, 2023.

Figure 7. Quantities of RQ-11 Ravens per Army Division. Source: Phillips et al. (2025).

Using the 82nd Airborne Division as an example, the 128 certified operators translate to 1% of the total end strength of about 11,000 Soldiers (Skovlund, 2024). After factoring in casualty loss, rest requirements, and increased quantities and different types of drones, the current density of certified operators presents significant challenges to units seeking to operate the drones as they anticipate they would in combat.

It is essential to clarify that drone operation by any military member requires basic certification. For civilian operators, the C.F.R. only requires certification for group 3 and higher drones or if a group 1 or 2 drone operates at an altitude higher than 400 feet above ground level (AGL) or under other unique circumstances (FAA, 2021). Figure 8 illustrates the various classifications of airspace to which civilian drone certification levels correspond.

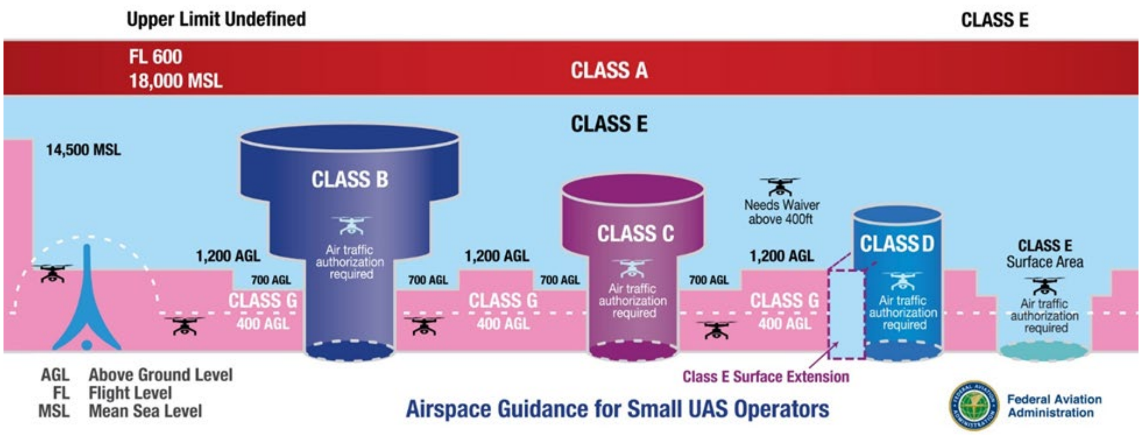

Figure 8. Classifications of Airspace in Relation to Civilian Drone Certification Levels. Source: FAA (2021).

It is noteworthy that Class G airspace, or anything under 400 feet AGL, requires no certification. Other classes of airspace correspond to operations within or near controlled airspace. Combined with the capabilities of typical group 1 and 2 sUAS, where maximum altitudes do not exceed 3,500 feet, unqualified operators training in Class G airspace should not pose undue burdens on military units through additional operator certification requirements. While the Army has considered establishing a dedicated Military Occupational Specialty (MOS), or "drone corps," to mitigate the certification density issue, present discussion surrounding the topic has stalled given the "unwarranted degree of specialization" this would demand in Army formations as opposed to wider adoption and use of drones by ordinary and minimally trained Soldiers (Feickert & Gettinger, 2024, p. 2). Ordinary citizens can operate most drones available for purchase on the commercial market, yet military operators are subject to significantly more obstacles.

2. Regulatory Overhead and Operational Inflexibility

Further coordination to enable drone operation in general typically requires the direct or indirect involvement of other certified personnel. For instance, a drone operator may have to coordinate with a spectrum management representative (HQDA, 2020) to ensure that the necessary frequencies to control the drone are available for exclusive use or an airspace manager (HQDA, 2016, 2018) to ensure that other air assets, such as helicopters, are aware of drone operations in the area to prevent collisions. In combat situations, spectrum and airspace management are both vital functions at the brigade and above echelon; however, they pose obstacles to sUAS familiarization training at junior levels. The training value for these other certified personnel is primarily in tracking and coordinating requests to mitigate self-inflicted interference. SUAS training, in this context, requires hands-on experience in real-time and cannot be replicated or simulated, unlike spectrum and airspace management training. This time requirement is far outside the traditional company eight-week training cycle. For instance, spectrum requests, by regulation, must be submitted 45 days prior to the requested use date (HQDA, 2020). New or unique airspace reservations can require 90 days, though use requirements under specified and restrictive conditions are possible without request (HQDA, 2016). It is essential to note that these are lead times required by regulation; installations and local governments or organizations may also add their own coordination timelines on top of these regulatory requirements. In training situations, installations also typically add further coordination requirements with entities such as range control, a requirement unique to peacetime situations. This is further challenged by a degree of variation between installations with differing or additional requirements and timelines and more restrictive operating guidance such as capping the amount of simultaneous drone operation or nighttime prohibitions (Phillips et al., 2025). While many of these deconfliction requirements are a result of lessons learned from accidents, the lead times required to ensure deconfliction impose undue planning timelines on units that sometimes may wish to conduct ad hoc or "sergeants' time training" because of previously unavailable spare time.

3. Property Accountability and Risk Aversion at the Tactical Level

Property accountability procedures and regulations discourage the use of expensive and/or highly pilferable equipment. *Force Development and Documentation Consolidation Procedures* (AR 71-32) outlines the broad Tables of Organization and Equipment that standardize the equipment assigned to each unit, and *Property Accountability Procedures* (AR 735-5) governs the financial liability and property accountability procedures in the event of damage or loss of said equipment (HQDA, 2019, 2024). With much of the property accountability chains beginning at the company grade officer level and below, financial liability requirements are a lower-unit echelon consideration. Junior officers (O-1/O-2) and NCOs (E-5/E-7) typically hold supervisory or direct accountability of the equipment used in training. In the event of damage or loss, should they be found negligent or culpable, they are financially responsible for restitution to the Army from their paycheck. This degree of personal and direct risk to one's own paycheck, while necessary to prevent fraud, waste, and abuse, results in reluctance or outright refusal to train on expensive but crucial warfighting equipment (Roque, 2025). As the drones themselves, not the controllers necessary to operate the drones, are typically considered end items, any damage or loss of the drone parts results in an AR 15-6 investigation and financial liability proceedings (Phillips et al., 2025; Roque, 2025). Reluctance to use drones not only hinders units' ability to conduct complex and realistic training but also sends unintended signals to private industry regarding the military's consumption rates for properly employed drones. This consideration is explored further in the contracting and program management challenges.

4. Public Perception, Autonomy, and Legitimacy Gap

Another unique complication regarding drone use by the military is the ambiguous definition and clarification surrounding the employment of autonomous systems in combat. Challenging bureaucratic hurdles to processes such as contracting also contribute to the private sector's reluctance to work with the DoD. The lack of transparency and unclear rules or laws surrounding autonomous drones leads to the general public and private industry delegitimizing drone use. Business between the DoD and broader private industry beyond the major defense companies has stymied in part due to the questionable use of drones in past conflicts (Wakabayashi & Shane, 2018). The role of artificial intelligence to further the effectiveness of autonomous operation is also met with resistance from the public sector. Companies whose profits depend more on private consumers than government entities are often unwilling to jeopardize the loyalty of their customer base. "The public combines moral norms to cast judgment about drone strikes and that these moral considerations are shaped by shifts in why drones are used and how they are constrained" (Lushenko, 2023, para. 1). As autonomous systems and artificial intelligence increasingly combine to achieve maximum effects on the battlefield, the DoD must be diligent to remain transparent with the public regarding its intentions to reduce unintended or unethical loss of human life.

5. Legislative Gaps and the National Defense Authorization Act's Limitations

Culture issues extend to the annual passing of NDAAs. When developing each year's NDAA, members of Congress do focus on sUAS platforms. However, drone production is still far behind the scale needed, based on lessons learned from the Russo–Ukraine war, partially due to an absence of earnest demand from the DoD. NDAA authorizations continue to emphasize traditional platforms of warfare and less on newer technologies such as sUAS. Recent Army plans aim to "equip each of its combat divisions with around 1,000 drones … using them for surveillance, to move supplies, and to carry out attacks" (Gordon, 2025, para. 3). Should the Army's 10 active duty divisions receive 1,000 drones each, the 10,000 total drones would only be just enough to meet the number of drones expended by Ukraine every month in 2023 (Kirichenko, 2024). While increasing the number of sUAS by any amount is progress, 1,000 per division is likely insufficient to fully bridge the current capability gap. Increasing the number of sUAS would require a corresponding increase in certified operators and ideally result in an overall increase in capability density. However, this alone is still unlikely to drive robust production and commitment from the private sector and the DoD for sustained procurement. Until lines of funding are requested and codified in subsequent NDAAs, this is likely to remain the case.

B. CONTRACTING BARRIERS AND INDUSTRIAL BASE MISALIGNMENT

This section presents an analysis of how the DoD's acquisition regulations, contracting timelines, and risk-averse practices obstruct rapid procurement and deter small businesses from entering the defense sUAS market. The impact that bureaucratic and regulatory requirements have on efforts to buy more drones in the near term is closely examined. Special attention is given to the Federal Acquisition Regulation (FAR), the role of Other Transaction Authority (OTA), and the protectionist policies that are intended to secure the supply chain but may narrow competition within the supplier base.

The lack of clear demand signals, coupled with slow and cumbersome processes, erodes trust and participation across the defense industrial contracting ecosystem.

1. Systemic Frictions in FAR-Based Contracting

Timelines regarding contracts for goods and services provided to the federal government can sometimes result in technology becoming obsolete before it is delivered to the government. Figure 9 illustrates the approximate amount of time for contracts as they correlate to dollar value based on a 2017 Government Accountability Office (GAO) study.

Dollar value	Procurement action lead time (in days)	
	Competitive contracts	Non-competitive contracts
<$25,000	55	55
>$25,000 to <$1 million	75	100
$1 million to < $50 million	180	250
$50 million to $250 million	600	520
$250 million to $500 million	630	550
>$500 million to <$1 billion	630	610
>$1 billion	700	610

Figure 9. Amount of Time for Contracts to Be Awarded in Relation to Their Dollar Values. Source: Sullivan (2017).

Increasingly expensive contracts are often associated with increasingly longer award timelines. According to a 2018 report published by the GAO, "time intervals from solicitation to award [for selected contracts] ranged from less than a month to more than four years, with a median of about nine months" (Woods, 2018, p. 12). Woods found that contracts valued at less than $50 million are often awarded within 12 months, but the fact remains that the process can become unintentionally longer in some cases, and the general rule is that more lucrative contracts require more time to award. Figure 10 outlines the key steps involved in the contracting process.

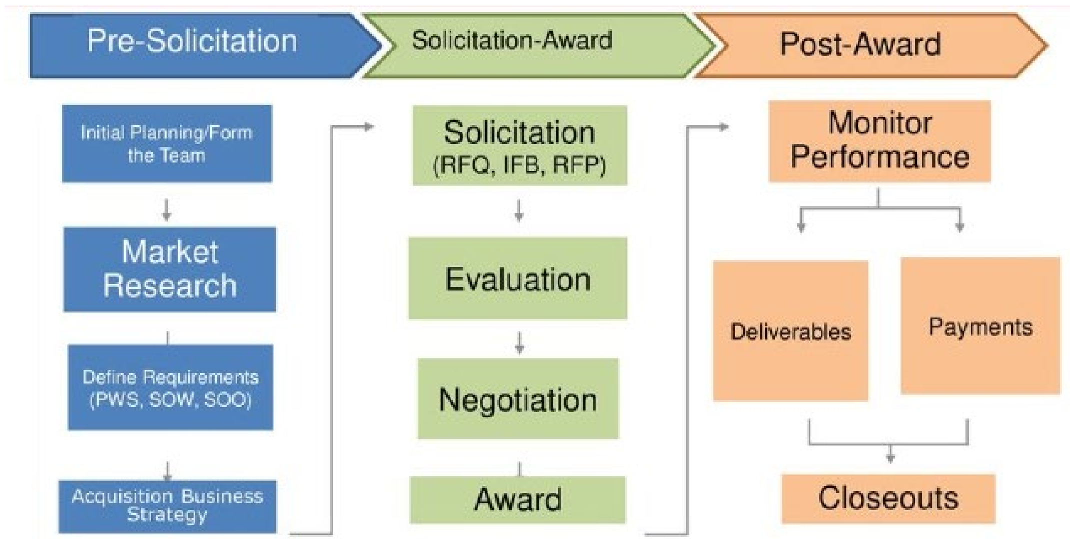

Figure 10. Key Steps of the Contracting Process. Source: Defense Acquisition University (n.d.-c).

Omitted from this graph is the potential for an award protest. Companies that submit bids on requests for proposals from the government but are not awarded the final contract can file a grievance with the GAO for redress. Such action postpones all progress on the contract, as deliverables cannot be accepted and paid for until the protest action is resolved. While protest serves to encourage competition and award contracts to the best vendor, the delay between protest and award resolution can negatively impact the government's ability to procure the goods and services it needs quickly. Figure 11 illustrates the broad timelines associated with the bid process.

Event	Normal Time Frames	Express Time Frames
Filing of protest with GAO	Prior to the bid opening or the time set for receipt of initial proposals, in the case of pre-award protests; no more than 10 calendar days after the protested conduct, in the case of post-award protests	Prior to the bid opening or the time set for receipt of initial proposals, in the case of pre-award protests; no more than 10 calendar days after the protested conduct, in the case of post-award protests
Notice of the protest sent from GAO to the agency	Within 1 working day of the protest's being filed	Within 1 working day of the protest's being filed
Agency's report on the protested procurement sent to GAO	Within 30 calendar days of the agency's receiving notice of the protest	Within 20 calendar days of the agency's receiving notice of the protest
Protester's reply to the agency's report	Within 10 calendar days of the filing of the agency report	Within 5 calendar days of the filing of the agency report
GAO's decision on the protest	Within 100 calendar days of the protest's being filed	Within 65 calendar days of the protest's being filed

Figure 11. Broad Timelines Associated with the Bidding Process. Source: Manual and Schwartz (2016).

Notably, decisions regarding bid protests can take up to 65 calendar days. However, Figure 12 represents the GAO's typical timeline for protests, which can take up to 100 days.

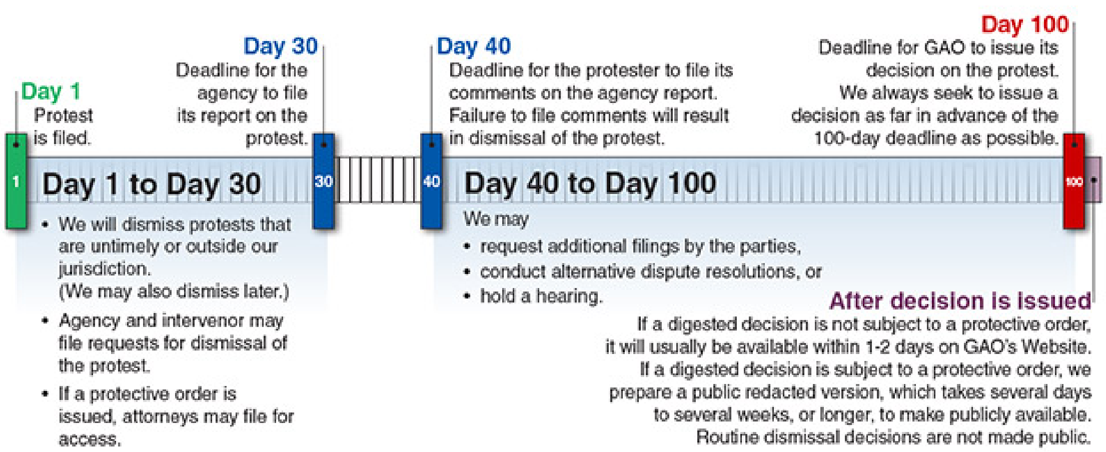

Figure 12. GAO's Typical Timeline for Protests. Source: GAO (n.d.).

According to Perley (2025), "For an innovation organization trying to bring smaller companies into defense, speed to capital is critical. Few of these companies can afford to wait one or two years from the time they reach an agreement to the time they are paid" (para. 28). Larger companies can absorb the time lost during the solicitation process with other products in their portfolios. Smaller companies that may only have one primary product are far more vulnerable to longer solicitation processes and are, therefore, more likely to seek business elsewhere. Because of the lengthy review and selection timelines that the DoD must comply with, the organization fails to adequately solicit broad market participation in an environment where fast-paced competition fuels growth.

2. The Blue UAS Bottleneck and Supply Chain Overregulation

The laws governing FAR provisions can further delay acquisition through excessive bureaucratic requirements. Issues that prompt the development of laws such as the American Security Drone Act stem from genuine national security concerns. Federal entities are barred from purchasing complete sUAS or components, such as controllers, radios, transmission systems, and cameras, that originate from “covered” entities, including China and Russia (NDAA, 2023). Individual companies, such as DJI, are also explicitly prohibited from receiving federal funds. Laws that specifically prohibit the procurement of drones or drone components originating from foreign covered entities are designed to favor domestic companies and interests over time. However, Chinese products are so endemic in the market today that it is tough to execute contracts that are fully compliant with existing legislation without continuing to lose ground in getting drones in the hands of warfighters. The Defense Innovation Unit (DIU, 2025) aims with its Blue UAS initiative to reduce the oversight burden on DoD contracting agencies by conducting market research to ensure compliance with laws and regulations. The result is that an exceptionally narrow number of systems that meet DoD needs are being approved. A RAND study concluded that of the 16 sUAS vetted by Blue UAS for DoD procurement, only nine could “likely” be acquired in the near term, of which only eight meet the defined use case criteria (Putney & Ellinger, 2025, p. 13). Figure 13 lists the relevant sUAS and their corresponding use cases, based on the criteria outlined in the report. Skydio’s X2D is absent from this list, despite being awarded a $21 million contract, as it did not precisely meet the use criteria for platoon or company-level operations, according to this RAND report.

sUAS Company and Name	Echelon of Use (According to Putney & Ellinger 2025)
Flightwave Aero Edge 130	PLT, CO, BN
Harris Aerial Carrier H6 HE+	BDE
Harris Aerial Carrier H6 Hydrone	BN, BDE
Parrot USA GOV	PLT
Parrot USA MIL	PLT
Sensefly eBee TAC	CO, BN
Teal Golden Eagle	PLT
Vantage Robotivs Vesper	PLT

Figure 13. Relevant sUAS and Corresponding Use Cases. Source: Putney and Ellinger (2025).

The researchers revisited the DIU's Blue UAS list (June 2025) two months after Putney and Ellinger published their findings and found that of the eight systems listed in Figure 11, only two (Flightwave Aero Edge 130 and Parrot USA) have maintained their Blue UAS certification. These systems have prices "mostly in the $10,000 to $25,000 range, with at least one outlier at the low end and several on the higher end. The consumer market for sUAS, which typically will not be compliant with the NDAA requirements, among other needs for the Army, can range from several hundred dollars to over $10,000" (Putney & Ellinger, 2025, p. 17).

This is exacerbated in cases of subcontracting executed on behalf of the prime contractor, where "no mechanism currently exists to systematically and consistently collect timely information on lower-tier defense suppliers and supply relationships" (Harshberger et al., 2025, p. 7). While FAR 52.204-10 (2020) governs reporting by the prime contractor on first-tier subcontract awards, it does not address the potential for further subcontracting award by subsequent contractors. If the DoD and its contracting agents do not have practical tools or methods to fully measure down-stream subcontractors and the origins of parts and components, associated FAR requirements do nothing but present obstacles to procurement. The protectionist spirit behind laws such as the American Security Drone Act and the FAR hinders the DoD's ability to convey clear demand signals to domestic industry by requiring compliance with regulations.

3. The Role and Limitations of Other Transaction Authority and Simplified Acquisition Procedures Mechanisms

The intricacies plaguing government contracting have not gone unnoticed, and multiple tools exist to assist contracting officers (KOs) in navigating bureaucracy. However, the use of tools such as Simplified Acquisition Procedures (SAP) or OTA are not without their issues. While SAP can significantly reduce solicitation time, the threshold for approval to use SAP for commercial items, such as sUAS, is capped at $7.5 million (DAU, n.d.-e). To procure significant amounts of sUAS at their current prices, such a threshold would necessitate continued small-batch ordering if pursued. SAP is also not exempt from complying with FAR Part 8, Required Sources of Supplies and Services (FAR, 2025), as the DIU's Blue UAS program already has equitable offerings available through the General Services Administration schedule of supplies.

OTA offers KOs far greater independence in procuring large quantities of sUAS at the cutting edge of technology. OTA's exemption from FAR-based contracting enables KOs to adhere to industry standards when negotiating contracts with non-traditional businesses. OTAs afford "greater flexibility and customization in designing a contract approach that can incentivize and attract nontraditional defense contractors, better manage risk and uncertainties, and increase efficiency" (McCormick, 2020, p. 1). In its FY2023 performance report, the DIU (2024) claimed to have "awarded 450 prototype OT contracts to commercial companies" between June 2016 and September 2023, "with a total value of $1.7 billion" (p. 17). The DIU combines investments in the form of OTA with private capital, ostensibly to build industrial capacity; however, the long-term effectiveness of this approach is difficult to determine. Figure 14 represents the growing appeal of OTAs to nontraditional vendors, while the difference between prototypes awarded and transitioned awards suggests no compromises have been made to the level of scrutiny placed on platforms seeking status as permanent defense fixtures.

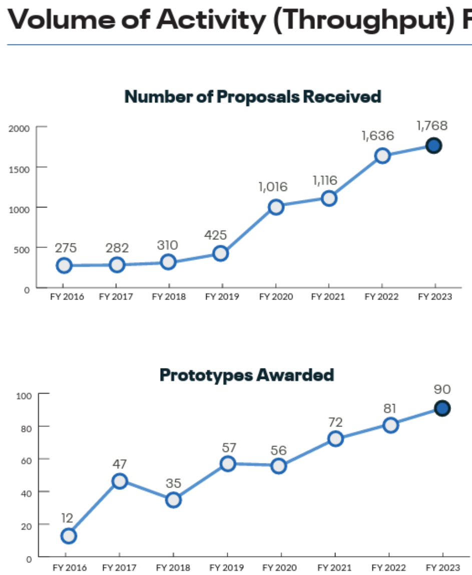

Figure 14. Appeal of OTAs to Nontraditional Vendors. Source: DIU (2024).

Figure 15 is representative of where the total FY2023 investment of $502.2 million was spent, indicating that the Army and Air Force were the most active OTA users.

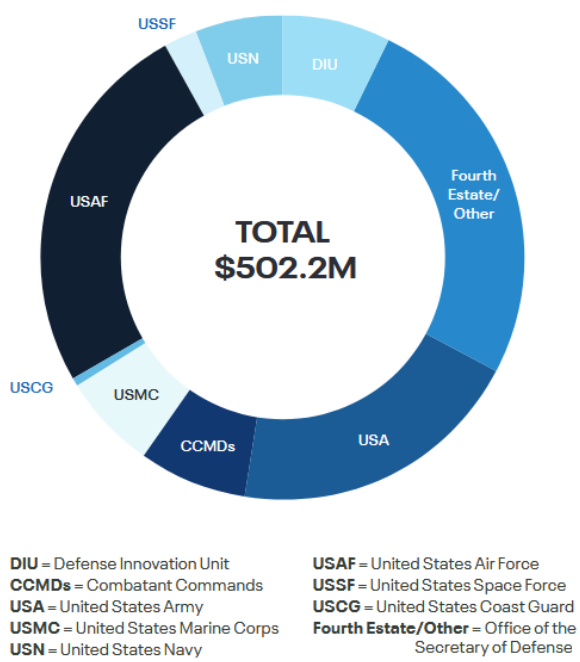

Figure 15. Obligated Prototype Funding Breakdown for FY2023. Source: DIU (2024).

The growing use of OTA among defense entities reflects mounting interest in easing bureaucratic burdens in contracting. "While OTAs are not inherently free from oversight compared to contracts, their greater flexibility is part of a broader signal pushing for less oversight in pursuit of accelerated technology acquisition" (McCormick, 2020, p. 9).

OTAs can reduce the barrier to entry for nontraditional businesses to work with the DoD, but they are not a permanent solution. Due to the nature of the law used in pursuing OTA contracts, 10 U.S.C. § 4022, these types of contracts are largely limited to prototyping and research and development–type work (McCormick, 2020). Transitioning prototypes to production can build inertia for prospective sUAS designs, but the new designs ultimately still demand heavy investments to effectively scale sustained production (DIB, 2025a). Additionally, OTA agreements cannot exceed $500 million without express approval from the Under Secretary of Defense for Acquisition and Sustainment (OUSD[A&S]). The senior procurement executive holds authority for contracts from $100–$500 million, while heads of contracting activities can approve OTA contracts below $100 million (OUSD[A&S], 2023). The lack of oversight surrounding the awarding of OTA also raises concerns, in that contracts are increasingly awarded to consortia groups instead of individual nontraditional vendors (McCormick, 2020). OTA contracts can often fail to account for operation and sustainment costs should a project transition, which can force the DoD to budget more money for the equipment than would normally occur (McCormick, 2020). OTA contracts add value to sUAS procurement but are insufficient in filling warfighters' significant capability gap.

4. Structural Bias Favoring Defense Primes

Engaging with nontraditional companies that offer products of potential value to defense applications remains a core challenge for the DoD. The five major U.S. defense contractors—Lockheed Martin, RTX, Northrop Grumman, General Dynamics, and Boeing—command the widest margin of defense spending, which for FY2023 was valued at 22% of all federal contracts, for a total value of $34 billion (System for Award Management, 2025). These companies also typically serve as prime contractors and maintain "direct contractual relationships with the government" (Neenan, 2024, p. 1). The deep connection between major traditional defense contractors and the government has afforded these contractors significant expertise in navigating the intricacies of government contracting bureaucracy, which is enabled through their hiring of key former government contracting personnel (DiNapoli, 2021b). A 2021 GAO study found that the hiring of former government employees by defense giants erodes public confidence in the government concerning bias in contract awarding due to conflicts of interest (DiNapoli, 2021b). While federal laws are in place to restrict the participation of former DoD employees in private company government contracts, there is no official "means of ensuring that DoD does not do business with companies whose employees violate the lobbying restriction with their employers' knowledge" (DiNapoli, 2021b, p. 21). Figure 16 illustrates the companies researched in the GAO report, listing the number of former DoD personnel hired by each in relation to the value of DoD contract obligations in 2019.

Contractor	Is contractor a weapons developer?[c]	Number of former senior and acquisition officials employed as of 2019 and hired after 2016	Value of DOD contract obligations in fiscal year 2019 (dollars in millions)
Raytheon Technologies[a]	Yes	315	7,536
Northrop Grumman Corporation	Yes	289	4,792
General Dynamics Corporation	Yes	287	4,396
Lockheed Martin Corporation	Yes	253	13,422
L3 Harris Corporation[b]	Yes	168	4,032
The Boeing Company	Yes	160	6,523
BAE Systems, Inc.	Yes	108	3,125
Federal Express Corporation	No	48	1,225
General Atomics	Yes	38	1,512
General Electric Company	Yes	31	2,032
Atlantic Diving Supply, Inc.	No	10 or fewer	3,084
McKesson Corporation	No	10 or fewer	2,721
AmerisourceBergen Corporation	No	10 or fewer	2,361
Bechtel Corporation	No	10 or fewer	1,342
Total	—	**1,718**	**58,103**

Figure 16. Former DoD Personnel Hired in Relation to Value of DoD Contract Obligations in 2019. Source: DiNapoli (2021b).

This advantage in obtaining government contracts is unmatched, especially with companies that may have never worked with the government before in any capacity. The steep learning curve associated with tasks seemingly as simple as negotiating FAR-based contracts can turn off many small businesses (DIB, 2025b).

The close working relationship that the DoD enjoys with larger defense contractors is important but may be detrimental to encouraging participation by smaller market entrants, especially those with lucrative sUAS technology, who may find quicker success in the private sector. Figure 17 illustrates the contracting cone, which encompasses the full spectrum of available FAR and non-FAR contract strategies, all of which have unique requirements that are typically not found in the private sector.

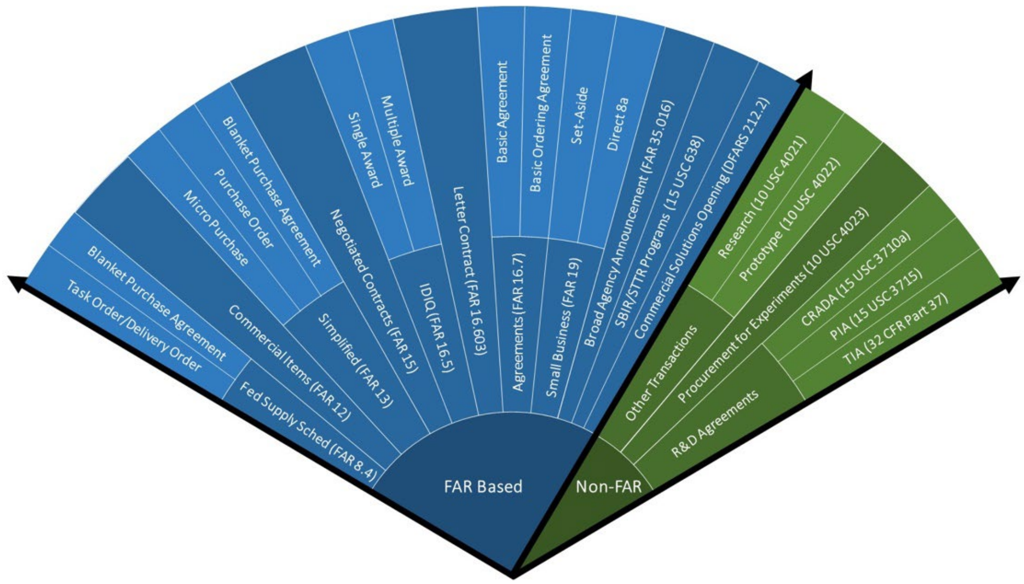

Figure 17. Full Spectrum of Available FAR and Non-FAR Contract Strategies. Source: DAU (n.d.-c).

The complexity smaller companies face in navigating the different procurement vehicles of the federal government can place financial burdens on them. "DoD contracting practices have evolved so far away from commercial norms that non-defense businesses have to create separate accounting, audit, and compliance systems if they want to do business [with the DoD] … the cost and hassle are simply not worth it" (Shah & Kirchhoff, 2024, p. 39). Additional hassle in the form of demands written into contracts concerning intellectual property turns away startup companies unwilling to sign away rights to their proprietary software (Wong et al., 2022). Hardware may not change radically across platforms, but the software powering advanced sUAS can—and frequently does—change. The DoD may believe it is protecting itself by obtaining rights to the software. However, this unintentionally discourages new companies from doing business out of fear of losing their market edge. Competing against giants in the defense industry, who are experts at navigating government bureaucracy, is often a challenge that smaller businesses choose not to undertake.

5. Market Confusion and Demand Signal Ambiguity

As previously mentioned, private industry may continue to believe that the DoD is not heavily invested in acquiring vast quantities of sUAS due to its lack of a clear demand signal. Many of the sUAS on the market today have been designed and developed entirely independent of DoD involvement or funding. The very nature of government contracting involves the procurement of readily available commercial goods and services. Nevertheless, the DoD does not capitalize on the commercial availability of sUAS to generate sustained market interest. But "Given the urgent need to integrate sUAS into Army formations, the Army should use the commercial market, treating sUAS as commercial items, if these commercial items have the capabilities that the Army needs immediately" (Camm et al., 2025, p. 11). The DoD may be reluctant to purchase commercial sUAS because doing so would require the DoD to accept that it must tailor purchased items to be more effective in operating environments. Camm et al. (2025) argue that the DoD must overcome this reluctance: "[The] DoD must be prepared to surrender much of the control emphasized in [traditional] defense acquisition and adapt its acquisition to the opportunities that arise in commercial markets" (p. 12). Industry leaders may perceive a capability gap that the DoD needs to fill and believe their product can help, but the DoD fails to validate such assumptions due to erratic sUAS purchasing patterns. Such ambiguity leads to the marginalization of innovative businesses that may otherwise be willing to design a product that meets published goals and purchasing objectives (DIB, 2025a).

C. PROGRAM MANAGEMENT, ACQUISITION PATHWAYS, AND CULTURAL RESISTANCE

This section provides an examination of the broader programmatic limitations within the defense acquisition enterprise. It presents a critique of the inflexibility of the Planning, Programming, Budgeting, and Execution (PPBE) process, the lack of scalable investment in sUAS procurement, and the cultural inertia of programs of record favoring legacy systems over emerging technologies. It also offers assessment of alternative acquisition pathways, such as Middle Tier of Acquisition (MTA) and Urgent Capability Acquisition (UCA), as well as the uneven focus on counter-drone systems. The cumulative effect of these limitations is a misalignment between innovation potential and institutional execution.

1. The Promise and Pitfalls of the Adaptive Acquisition Framework

DoD program management practices present obstacles to the procurement of sUAS for defense applications. The wider DoD, for its part, recognized that with the advent of new technologies, there also comes the inception of new program management techniques. As technology develops at a rapid pace, the ability to adjust projects and programs already in motion must remain flexible. The AAF, introduced in 2019, was specifically designed to blend industry best practices with the DoD's unique program management needs (OUSD[A&S], 2022). The MTA, UCA, and Major Capability Acquisition (MCA) pathways are products of the AAF that aim to address capability gaps with materiel solutions within different timelines and with varying considerations.

MCA typically includes a development life cycle that is not conducive to innovative technology development, as drone development is outpacing MCA development programs' development cycles. However, most MCA programs are also categorized as Major Defense Acquisition programs, which typically command the largest budgets, with figures around $2.79 billion (in FY2014 constant dollars) for the total procurement of the program (OUSD [Comptroller]/Chief Financial Officer, 2024). For these reasons, MCA is not the research focus of this project.

Focus is instead placed on MTA programs with 5-year timelines and UCA programs with timelines of less than 2 years. Figure 18 shows the different timelines and approximate milestones in each.

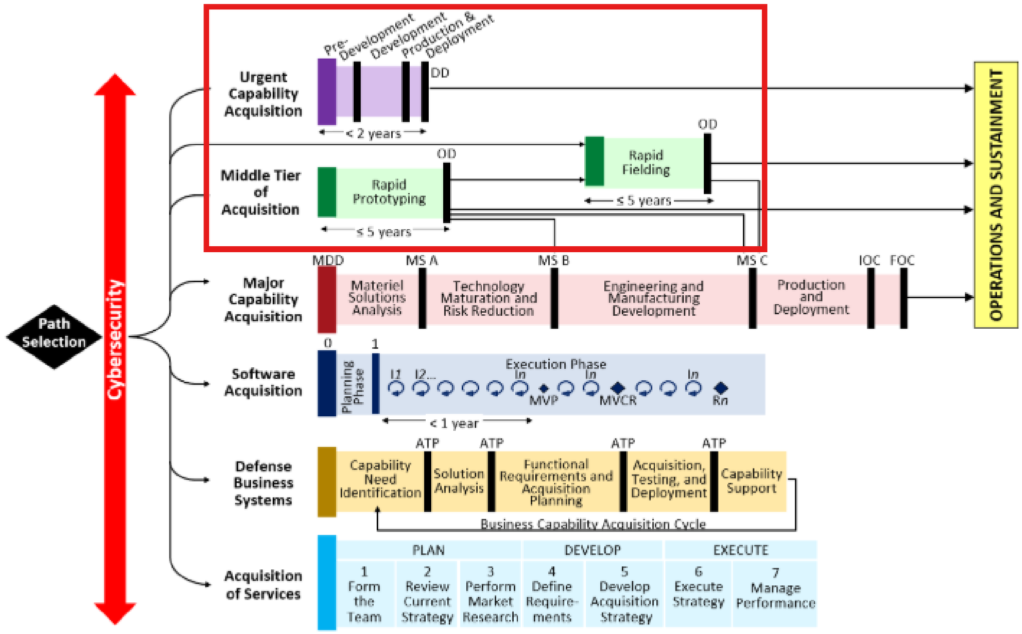

Figure 18. Timelines and Milestones of Each AAF Pathway. Source: DAU (n.d.-b).

The performance of programs operating under MTA and UCA has varied. Recent studies of MTA's performance within the DoD indicate general success, with approximately 59% of projects meeting 5-year schedule requirements, but the precise factors enabling this success are unclear and therefore not well positioned to be replicated across the MTA portfolio (Bub, 2023; Perdue & Teissonniere-Almodovar, 2024). Data concerning UCA's specific performance has been more challenging to locate. Still, the opportunity for rapid and iterative user feedback is characteristic of industry standards in designing and delivering a minimum viable product. Within the DoD, there have been observations that collecting and applying user feedback to inform design development could be improved (Oakley, 2024).

2. The Skew Toward Counter-sUAS Investment

The DoD, through organizations such as the DIU, has made attempts to encourage growth in the sUAS sector through initiatives such as Replicator. Combined with the DIU's Blue UAS program, Replicator is intended to procure large amounts of attritable and disposable sUAS for the DoD that meet regulatory requirements to fill capability gaps for the warfighter. However, critics of the Replicator initiative have argued that the DoD's approach is "very disorganized and confusing" (Sayler, 2024, p. 2). Compounding the problem is that Replicator 2 (the next batch of sUAS-related investment) focuses almost exclusively on Counter-sUAS (C-sUAS) technology. Companies interested in meeting the sUAS capability gap for the DoD may be deterred from investing heavily in their drone programs if they perceive that their investment may have to compete with completely different technology (Shah & Kirchhoff, 2024). The vacillation between matching adversarial capabilities and eliminating them with different equipment does not fuel competitive innovation in either case. "The core challenge for domestic unmanned systems manufacturers scaling their operations with the DoD lies in the lack of a clear and consistent demand signal" (DIB, 2025a, p. 9).

There is a disproportionate amount of attention placed on C-sUAS systems and platforms with regard to program management investments, specifically funds for programs in their engineering and manufacturing development, production and deployment, or operations and support phases, and research, development, test, and evaluation (RDT&E) funds for programs in their technology maturation and risk reduction phases. This reflects the fact that C-sUAS applications have a uniquely military-centric market and demand funding from the same but also sends signals to the private industry that the military is willing to spend far more money on a capability the private market is unwilling or unable to buy legally. The dual-use limitations of C-sUAS minimize the market that defense contractors can sell to if their product is not chosen for procurement by the military, while sUAS drones still have a lucrative value. For instance, in the Army's FY2025 budget request concerning UAS, approximately $46.1 million was requested for procurement and $26.8 million for RDT&E, but $397.5 million was requested for C-sUAS procurement and $435.4 million for C-sUAS RDT&E (Gettinger, 2024, 2025). The money spent on procurement for sUAS products is further complicated in that it is typically allocated in small-batch orders which leads to suboptimal manufacturing (DIB, 2025a). Small-batch ordering across different manufacturers does not enable cost reduction because it fails to fully capitalize on the cost experience curve in manufacturing (Office of the Secretary of Defense, 2020). Figure 19 demonstrates that even in cases where costs exceed predictions, as seen with the much-maligned F-35, sustained production of the same platform by the same manufacturer still leads to savings over time.

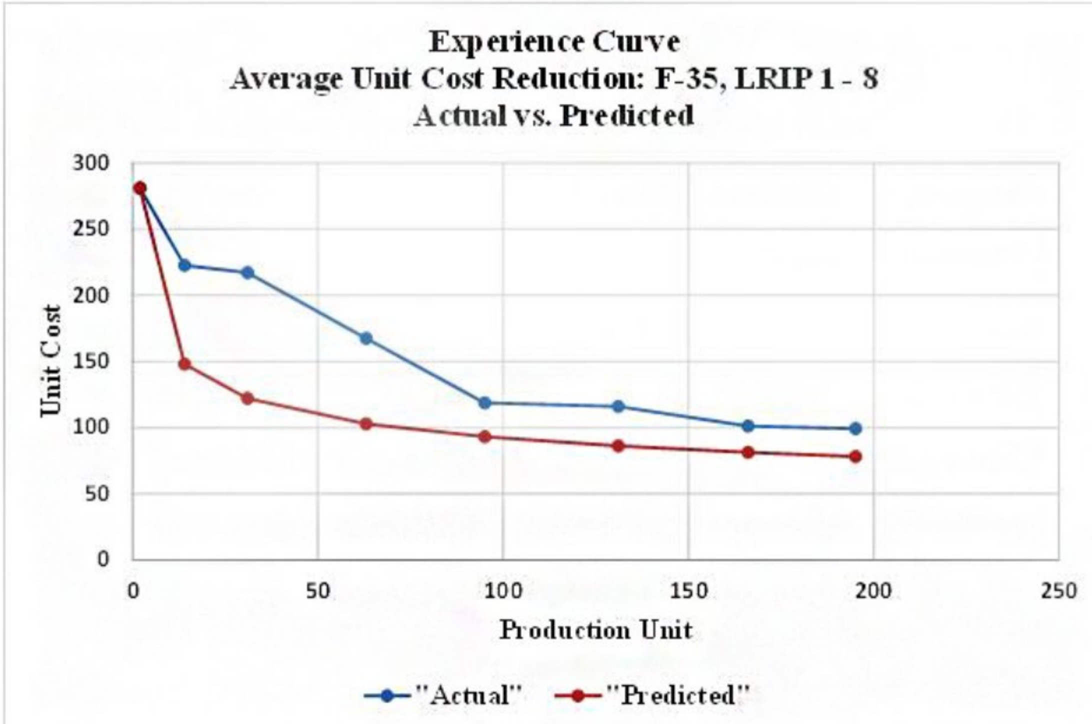

Figure 19. F-35 Average Unit Cost Production. Source: Arepally (2017).

Figure 20 expands upon the experience curve across a broader industry, illustrating that cost savings can range from 5%–30% over sustained manufacturing.

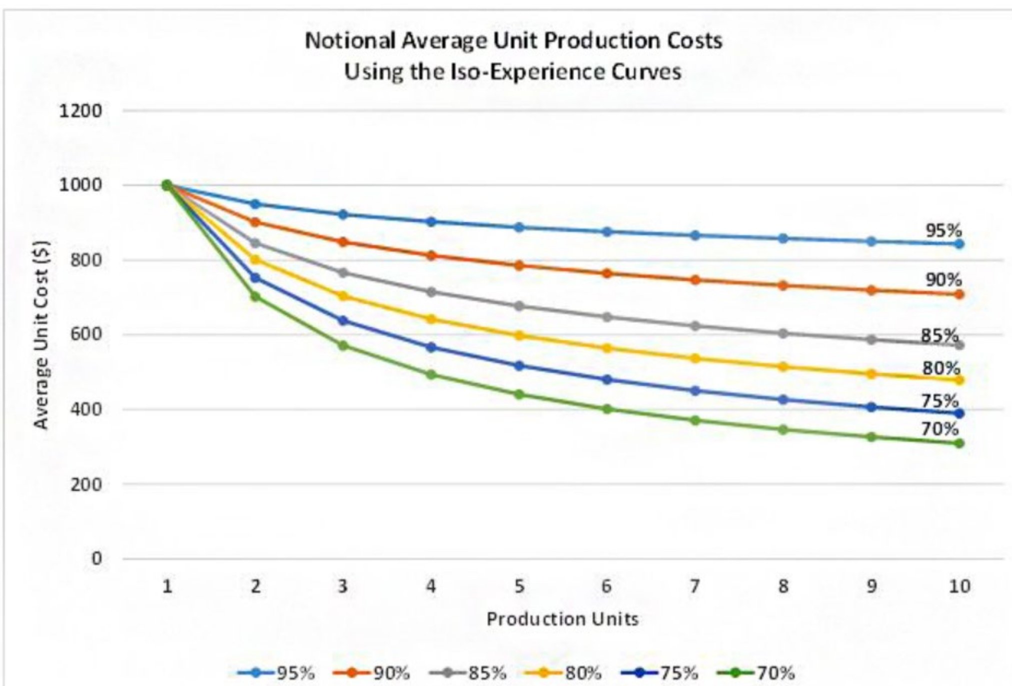

Figure 20. Experience Curve Across a Broader Industry, Source: Arepally (2017).

3. Economies of Scale and the Cost of Penalty of Militarization

The Army awarded Skydio a contract to build the RQ-28A, a militarized version of the X2D, and requested $21.1 million from Congress to acquire only 270 systems in FY2026 at an expected cost of $65,000 per unit (Gettinger, 2024). Based on the experience curve, a larger order could have resulted in a cheaper per-unit cost, which may, in turn, have led to the Army purchasing more units leading to cost savings over time. Compared with Ukraine's expected and actual consumption and replacement rates, this small-batch ordering is not only insufficient to field drones across the Army, but it also does nothing to compel the industrial base to increase its manufacturing capacity to anticipate future Army demands. It also does nothing to reduce the price per unit using the rules of economies of scale.

Considering the price from a program management aspect, the cost of the militarized versions of drones is almost always significantly higher than that of the commercial versions. Using the previously mentioned example, Skydio's X2D retailed at $11,000 at the time of the report but is being sold to the Army at a cost of approximately $65,000 (Gettinger, 2024). While military requirements often demand unique and niche technologies, not every drone needs to have specialized sensors, payload-carrying capabilities, or encryption if the trade-off is fewer drones at the company level and below. The cost per unit of commercial offerings increases disproportionately following the militarization of an already acceptable solution, preventing more drones across a wider force (Carberry, 2024). More expensive drones mean fewer drones in the hands of the Soldiers who need them for core tasks such as simple reconnaissance or dropping a grenade on an enemy forward observer. Excessively complicated or non-modular drones also introduce modernization challenges as technology improves, further driving up program life-cycle costs.

4. Institutional Inertia and Cultural Barriers to Innovation

Among the broader program management landscape, many of the largest programs with budgets to match are seen as representative of the services to which they belong. As a result, these programs of record are unlikely to have decreased priority or budgeting in favor of equipment that may challenge the identity of how a service fights

(Shah & Kirchhoff, 2024). For example, in FY2025, the DoD is expected to spend $13.5 billion on the F-35, $10.8 billion on the Virginia-class submarine, and $896 million on modifications to the M1 Abrams (OUSD [Comptroller]/Chief Financial Officer, 2024). These figures dwarf the $21.1 million to acquire new sUAS through the RA-28A program. While these signature platforms do much to enhance combat power for the DoD, they do little to address the capability gap that sUAS can fill at a significantly lower cost. The changing nature of warfare continues to favor cheaper and more numerous solutions over traditional power projection combat platforms (Chávez & Swed, 2024; Saunders, 2024).

The U.S. Marine Corps has radically reorganized its force in response to these changes in warfighting technology and the shift in focus to the Pacific theater with its Force Design 2030 initiative. The Marine Corps' divestiture of 450 tanks to focus instead on emerging and expected threats indicates that the Services are capable of moving away from dated culture and legacy platforms toward refreshed doctrine and new capabilities (Gonzales, 2021). The Army's culture, by contrast, is resistant to change despite similar commitments to force-redesign by 2040. "The Army's largest funding request in NDAA FY24 was still for more tanks," despite lessons learned from the Russo–Ukraine war and assumptions regarding a littoral conflict with China (Saunders, 2024, p. 40). While many programs still have utility on the modern battlefield, some have seen their value diminished given changes in warfighting. Program management practices still tend to favor legacy programs such as M1 Abrams Modernization over drone procurement.

5. The Planning, Programming, Budgeting, and Execution Process and Budgetary Constraints on Agility

The PPBE process within the DoD is risk-averse, time-prohibitive, and nonadaptive (Hale et al., 2024). The DoD uses PPBE to develop its budgetary requests that it submits to Congress. Congress retains the ultimate authority to approve funding appropriations, regardless of what the DoD requests. "Characterized by long-term planning, with a planning phase that can begin more than two years before the expected year of budget execution," the PPBE process is inherently prohibitive to procuring the most cutting-edge drone technology (McGarry, 2022, p. 11). Figure 21 illustrates the long-term nature of the PPBE process against a calendar year, with planning for FY2025 beginning as early as February 2022.

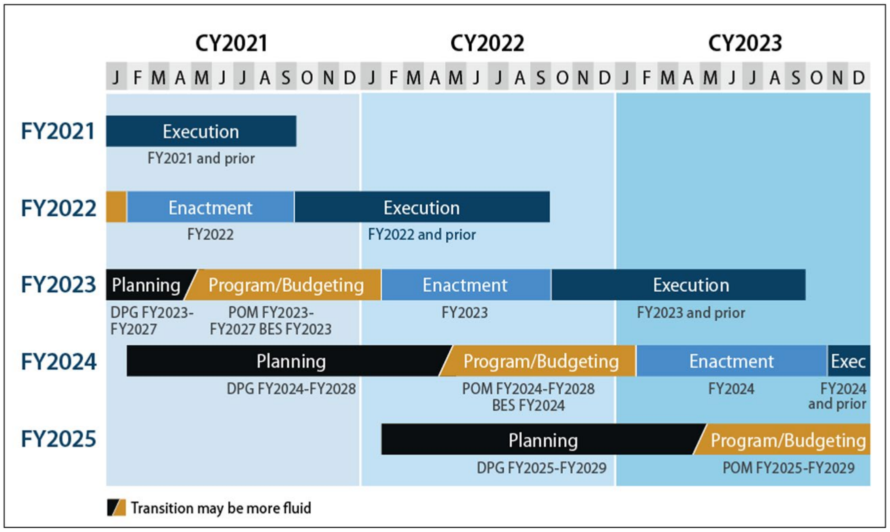

Figure 21. Long-Term Nature of the PPBE Process. Source: McGarry (2022).

To put this in perspective, had Ukraine been using the PPBE process at the time of the Russian Federation’s February 24, 2022 invasion, it would have been spending funds allocated during planning at the height of the COVID-19 pandemic or been forced to assume how the conflict would look in October 2024 to inform planning post-invasion. The dynamic nature of the Russo–Ukraine war has led to significant developments in sUAS technology development that would have been impossible to harness or improve under timeline requirements such as those imposed by PPBE. While “emergency” funds such as overseas contingency operations dollars can make up deficits in planned budgets, these are best applied for situations that are difficult to predict or genuinely unanticipated. With the knowledge the DoD has about the role of sUAS and other emerging technologies on the modern battlefield, funds can be appropriated ahead of conflicts to mitigate future risk to warfighters.

Compounding the issue is the lack of authority to reprogram funds appropriated to specific functions but within the same program (McGarry, 2022). Should a program mature from the RDT&E phase, funds dedicated to RDT&E cannot then be repurposed as procurement or operations and maintenance (O&M) resources without Congressional approval in most cases. Congressional oversight of reprogramming funds most often takes the form of caps on the amounts that the DoD can transfer without approval. As an example, according to McGarry (2021), this amount was $10 million for FY2021. Not allowing remaining RDT&E funds to be used for immediate procurement of production-ready equipment prevents robust upscaling of manufacturing. For sUAS systems experiencing rapid development timelines, this further impedes adaptiveness to changing warfighter needs. Long planning timelines and oversight regarding reprogramming of funds within a program introduce obsolescence risk.

6. The Strategic Cost of Continuing Resolutions

Additional obstacles to program funding exist in the form of continuing resolutions when defense appropriation budgets expire or lapse. As federal funds may not be spent until they have been appropriated by FY, delays in passing budgets present obvious challenges to procurement. Continuing resolutions serve as a compromise during deliberations on formal appropriation budgets for other DoD matters by enabling temporary funding, but they do little to sustain acquisition capability. "The value of strategic planning is diluted when acquisition personnel are uncertain how much money will eventually be made available. Vendors have greater leverage over the government when they know that funds must be obligated on a more urgent timeframe" (Section 809 Panel, 2019, p. 233). Figure 22 illustrates the number of days the DoD has operated under a continuing resolution since FY1988.

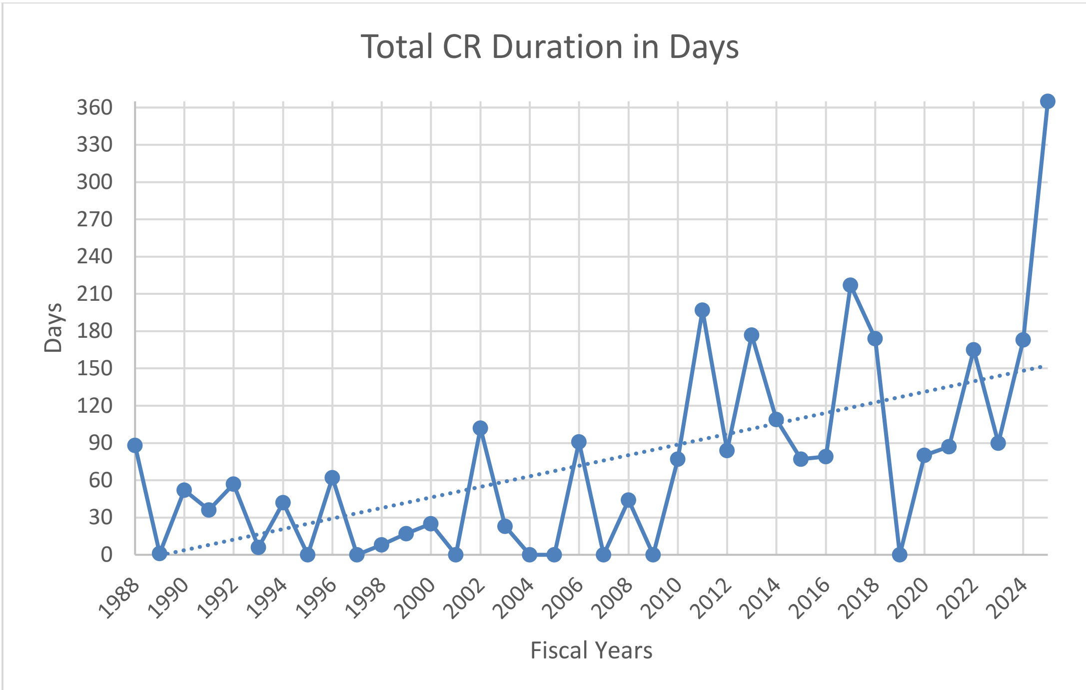

Figure 22. Number of Days the DoD Operated Under a Continuing Resolution. Source: Daniels (2025), Section 809 Panel (2019).

Recent trends indicate an increase in uncertainty and deliberation regarding defense appropriations by Congress, as evidenced by the growing number of days under continuing resolutions. For the first time in history, in FY2025, the DoD will operate for an entire FY under a continuing resolution due to the government's failure to pass an independent appropriation bill (Goss, 2025). During a continuing resolution, fund estimates to perform ongoing work are usually performed using an extrapolation of the previous FY's obligations. This inherently prevents "new starts" from occurring, as the priority is funding work in progress. While the FY2025 continuing resolution includes provisions to enable limited new starts, Figure 23 shows that procurement and RDT&E funding suffer, a common theme among all similar actions.

Defense Appropriations (051) Analysis			
$BA in billions			
	FY24	FY25	FY24 v FY25
Military Personnel	165.7	171.4	5.7
Operation and Maintenance	325.4	330.0	4.6
Procurement	170.6	167.3	-3.3
RDT&E	151.6	143.1	-8.5
Revolving Funds	1.8	1.8	0.1
General Provisions (excluding rescissions)	-1.8	8.1	9.9
Total* (051)	**813.3**	**821.7**	**8.4**

Figure 23. Procurement and RTD&E Analysis During Continuing Resolution. Source: Goss (2025).

The implications of continuing resolutions create perceptions of uncertainty and politicization of the federal government's budget. As a result, companies are less willing to pursue government programs that may lose funding in future years despite excellent performance. "The threat of government shutdowns, and restrictions related to continuing resolutions and DoD processes that slow its ability to commit funding are a major impediment" to government procurement and program management (DIB, 2025a, p. 6). "To the vendors and manufacturers, the Government becomes a less reliable, higher risk customer … we offer vendors less stability and predictability, and pay [more] accordingly" (Office of the Secretary of Defense, 2017, p. 4). Research conducted by RAND suggests that "information [is] lacking that would permit analysts to be able to derive defensible estimates of [continuing resolution costs] to draw general conclusions" surrounding continuing resolution's' damaging effects, but the perception among industry is overwhelmingly negative (Young & Gilmore, 2019, p. IX). Therefore, DoD programs are disadvantaged in attracting competitive vendors due to the volatility in federally managed public funds and are perceived as riskier investment opportunities.

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IV. DOTMLPF-P CHANGE TO FACILITATE MATERIEL ACQUISITION

In intensifying the acquisition of very large quantities of sUAS, the DoD should immediately focus on cultural and institutional DOTMLPF-P changes. This is necessary to encourage private sector manufacturing growth to sustain the Army's demand and set the conditions for prolonged procurement, as discussed in subsequent chapters. According to the October 2021 Joint Capabilities Integration and Development System (JCIDS) manual, DOTMLPF-P change can take place in the form of a Joint Urgent Operational Need, Joint Emergent Operational Need, or Joint DOTMLPF-P Change Recommendation (DCR; Office of the Joint Chiefs of Staff, 2021). Figure 24 outlines the broad application of the different documents along with general timelines.

JCIDS Lanes	Operational Timeline	JCIDS Documents	JCIDS Staffing Timeline
Ongoing Contingency Lane	Urgent Need (<2 Years)	JUON	15 days
Anticipated Contingency Lane	Emergent Need (<2 Years)	JEON	31 days
Deliberate Lane	Future Need (>2 Years)	ICD CDD DCR	67 days 103 days

Figure 24. JCIDS Process. Source: Office of the Joint Chiefs of Staff (2021).

It is important to note that while the DCR is the only document that specifically addresses potential DOTMLPF-P changes, all options include provisions for institutional changes. Redefining the role of sUAS within the Service may create initial frustration and deficiencies in standardization or readiness reporting, but it is an important step to demonstrate commitment to new warfare technologies. The recommendations made within this thesis must be conducted with potential future uses in Large-Scale Combat Operations foremost in mind. The Army has recognized the value of sUAS in its formations but efforts to close the sUAS capability gap with adversaries are not reflective of how truly essential sUAS may be in the next conflict. Instead, current actions appear more focused on simply exposing units and Soldiers to sUAS in small increments. If contemporary production numbers and supply chains for domestic sUAS manufacturers are known to be insufficient to meet expected wartime consumption rates, the Army must demand the defense base scale up its production rates prior to the start of any hostilities. It can best accomplish this through institutional DOTMLPF-P change that enables a genuine commitment to buy mass quantities of sUAS.

The different DOTMLPF-P domains are defined in the JCIDS Manual (2021) and illustrated in Table 1.

Table 1. DOTMLPF-P Domains. Source: Office of the Joint Chiefs of Staff (2021).

Doctrine	The fundamental principles that guide the employment of U.S. military forces in coordinated action toward a common objective, or how we fight.
Organization	A unit or element with varied functions enabled by a structure through which individuals cooperate systematically to accomplish a common mission, or how we set up to fight. The number and quantity of personnel applies here.
Training	The training of individuals, units, and staffs to prepare forces to respond to strategic, operational, or tactical requirements and execute their assigned or anticipated missions, or how we prepare to fight.
Materiel	The use of existing equipment (in increased quantity, alternate application, or with modification) to bridge capability gaps. Everything necessary to equip forces to operate effectively.
Leadership & Education	The professional development of leaders that is the product of a learning continuum comprising training, experience, education, and self-improvement, or how we prepare our leaders to lead.
Personnel	Ensuring that qualified personnel exist where needed to implement proposed solutions to capability gaps. The quality, type, and skills of personnel most applies here.
Facilities	The "real" property consisting of one or more of the following: buildings, structures, ranges, utility systems, roads, and land.
Policy	Any DoD, interagency, or international policy that may impact effective implementation of changes in other DOTMLPF-P domains.

A. DOCTRINE

The proliferation of sUAS on the modern battlefield demands a comprehensive reassessment of many Army manuals at every echelon, from Department of the Army publications to company-level tactics, techniques, and procedures (TTPs). Incorporation of sUAS into Service doctrine as combat platforms and force multipliers continues to evolve within the militaries of other countries, and the U.S. Army would vastly benefit from doing the same (Chávez & Swed, 2024; Davis, 2023). While doctrinal literature is improving, there remains a "wide variability in integrating sUAS into combined arms operations [because] sUAS integration proficiency is not linked to METLs [Mission-Essential Task Lists]" (Phillips et al., 2025, p. 34). This quote points to a problem of sUAS platform standardization that is explored later in this thesis but also addresses the lack of a mechanism for commanders to hold subordinate leaders accountable in improving proficiency. Those units that most excel at sUAS employment in advanced Combat Training Center rotations do so as a result of "persistent commander attention, intense training regimens, and self-created SOPs [Standard Operating Procedures]" (Phillips et al., 2025, p. 34). Individual passion must not be relied upon when establishing a doctrinal foundation for employing new technologies.

Precise TTPs will prove difficult to develop given the lack of a standardized sUAS platform in the Army's inventory, but revisions are nevertheless required to improve operator proficiency in concert with their assigned unit's efforts to accomplish a variety of missions. However, this doctrinal deficiency in sUAS incorporation cannot be solved with a singular revision across the Army's literature. Iterative and constant revisions are required to stay current with battlefield developments. Considering the rapid pace of conflict and armies working to achieve advantage, "Ukrainian military UAS operators noted that it often takes less than a week for both sides to find ways to trick [sUAS guidance software]" (Bondar, 2024, para. 3). Lessons learned from contemporary conflicts highlight the importance of consistently evaluating current TTPs to inform the improvement of sUAS development as well as training curriculums.

In changing sUAS doctrine, it is important to consider the total value that sUAS can provide to commanders on the battlefield and not limit application to strictly combat-centric roles when considering development of key tasks for sUAS. To that end, tailoring revisions to all six warfighting functions (Command and Control, Movement and Maneuver, Intelligence, Fires, Sustainment, Protection) and associated publications will likely prove more valuable to future sUAS employment. Understanding the limitations of sUAS is equally important and doctrinal change "must address the unique challenges of operating unmanned systems at extended ranges and in contested environments" when executing any warfighting function (Sauser, 2025, p. 59).

B. ORGANIZATIONAL

Changes in sUAS doctrine would be better applied by a requisite increase in trained personnel at echelon. As referenced in Figure 5, the number of sUAS master trainers is likely insufficient to maximize sUAS effectiveness at all of the levels at which they are likely to be employed (Phillips et al., 2025). Previous quantities of personnel were based on legacy UAS more frequently employed at higher echelons, but contemporary evidence continually demonstrates that sUAS use at every echelon is a necessity in modern battlefields. More expertise is required at every level and therefore demands a re-evaluation of unit organization to determine if dedicated sUAS cells afford leaders more tactical options (Phillips et al., 2025).

Another consideration that can work in tandem with the previous recommendation is in the categorization of sUAS. While some sUAS can be employed as cheap and expendable sensors or munitions, other sUAS may not be as readily disposable yet still provide commanders significant utility (Chávez & Swed, 2024). Determining the appropriate amounts of each type of sUAS for every unit's Table of Organization and Equipment provides the Army numerous benefits. First, it helps inform how many experts are needed in each unit to operate the advanced sUAS. Second, it can expose the average Soldier to the types of sUAS they are most likely to operate on the battlefield, enabling them to understand how to maximize its combat effectiveness. Lastly, categorization can help ensure the right Soldier has the right tool at the right time.

C. TRAINING

Frequency of training remains vital in improving proficiency and mitigating decay of skill. Units most adept at employing sUAS can attribute their success to incorporating them into training exercises from the battalion level and below and maintaining a "battle rhythm of weekly crew-training flights in local training areas, including the training of micro-maneuver and other advanced flying techniques" (Phillips et al., 2025, p. 34). Changes to training are deeply connected to doctrinal changes in that further integration and training of sUAS into other battle staff functions, such as fire coordination and intelligence collection, are important to developing holistic sUAS proficiency. Integration of sUAS across unit functions in training environments is currently only completed at the behest of interested or innovative commanders to improve their own overall understanding of how to maximize sUAS effects (Phillips et al., 2025). Standardized and scenario-based training, combined with the consideration of sUAS in unit METLs, can encourage units to increase their home station training use.

Just as iterative revisions to Army literature are important to the improvement of doctrine, iterative evaluation of training programs of instruction (POIs) is equally important to verify Soldiers are learning the best TTPs in the best environments (Monas & Heard, 2024). Quickly adjusting POIs to keep pace with commercial off-the-shelf (COTS) procurement or balancing classroom and hands-on instruction for simpler platforms require consistent attention. After-action reviews and incorporation of lessons learned can maximize the feedback loop for sUAS trainers and schoolhouses to ensure the POI is as efficient as possible (Monas & Heard, 2024). Among other shortfalls, the Army's sUAS Aircrew Training Program (TC 3–04.62; HQDA, 2013) has not been updated in almost 12 years, which highlights the urgency to update POIs to match the latest battlefield sUAS use.

The training curriculum for master trainers may award the valuable FAA Part 107 certification but is assessed as neglecting tactical employment of sUAS in military situations (Phillips et al., 2025). In addition, master trainer certification is inherently narrow not only in the throughput of graduates but also in the body of instruction. Expansion of sUAS curriculum to award qualification at progressive levels can assist in increasing unit sUAS operation and ease the burden on training pipelines to improve access to training. The Army's aviation branch is already employing a similar concept but still places an undue burden on master trainers, as they must be present for subordinate certification holders to operate basic sUAS (Monas & Heard, 2024). Any certifications obtained should be adjusted to produce operators to train their peers at echelon and give commanders greater flexibility in developing unit sUAS proficiency.

D. MATERIEL

Materiel, within the context of a DCR, focuses primarily on leveraging COTS solutions to change Army operations. There is little to no emphasis on the development of a POR. Within the context of this project, materiel change recommendations follow in the next chapter.

E. LEADERSHIP AND EDUCATION

Leaders at every level are likely to be closer to sUAS operations than they were in previous eras of the Army. Fire teams and squads could potentially have numerous drones at their disposal, and leaders at the platoon level and higher can expect not only to have more drones than ever before but also systems far more capable than legacy platforms. Tactical decision-makers must be informed about sUAS capabilities in their arsenal so they may maximize their combat effectiveness (Sauser, 2025). Educating leaders is difficult outside of training environments, especially when they are executing their duties as leaders. This does not diminish the importance of keeping them informed, and the Army must explore creative solutions in reaching every tactical leader to ensure they understand how sUAS fits into their missions. Army-wide distribution of professional development literature paired with mandatory briefings is a dated yet potentially effective means of increasing awareness as a baseline effort.

Within dedicated training environments, such as Professional Military Education (PME), evolution is necessary to develop leaders with an sUAS focus. If tactical leaders must understand the technical application of sUAS, operational and strategic leaders must be experts in integrating the different capabilities that sUAS can provide (Sauser, 2025). PME is also an excellent environment in which to educate leaders on the concepts behind ethical sUAS use. Preventing sUAS misuse or misapplication during combat starts with informing leaders about suggested rules of engagement for the new platforms (Enemark, 2023). The time that leaders spend within PME is often short, and the Army must take full advantage of what time is available to ensure that newer concepts are being taught as an institutionally standardized foundation.

F. PERSONNEL

Currently, the Army places a great deal of emphasis on the centralized training of UAS operators. As explored in the previous chapter, master trainer courses conducted at the Army's Maneuver Center of Excellence (MCOE) in Fort Benning, GA, fail to adequately prepare sUAS operators for the drones they are most likely to operate in a dynamic battlefield setting (Phillips et al., 2025). Additionally, the throughput of personnel through this course is grossly inadequate to meet the demands for sUAS expertise at every level of the Army (Phillips et al., 2025). Establishing specific curriculum for and associated certification to the sUAS graduates are most likely to operate can increase throughput. For instance, man-hours should not be wasted instructing operators on how to secure airspace coordination for a group 4 drone when they are obtaining certification to fly a group 1 drone. Refining instruction to more effectively meet unit needs affords more personnel the opportunity to achieve proficiency.

While Soldiers can achieve master trainer certification at other locations, such as at Fort Huachuca, they must be a specific Military Occupational Specialty in order to do so (Monas & Heard, 2024). The general Army population is only able to achieve certification at select locations. Expanding training beyond the MCOE program in the form of Mobile Training Teams (MTTs) can help the Army reach more Soldiers in more locations across its footprint. An added benefit to this approach is the ability to focus training to the sUAS platforms the units the MTTs visit have on hand. This can be synergized through local hiring of civilian contractors who are experts in the COTS solutions the Army is likely to procure in the near term (Phillips et al., 2025).

Operator training can also leverage autonomous mode of operation or artificial intelligence to focus instruction on key concepts of sUAS employment. Coordination with other warfighting functions remains a core task requiring human thought, but responsibility to ensure the sUAS does not crash due to a sudden gust of wind or because communication is briefly lost due to terrain can be transferred to onboard autonomous software. Automating more advanced flying techniques reduces training time to "only a few hours, enabling a wider pool of Soldiers to develop the necessary skills with minimal specialized expertise” (Bondar, 2025, p. 3). A lack of standardization of sUAS presents challenges to this recommendation but does not detract from its utility if feasible.

Once Soldiers are trained and certified, it is vital to retain them in the Army. Retention and centralized management of personnel with vital sUAS talents and skills is best accomplished through the award of Additional Skill Identifiers (ASIs) (Phillips et al., 2025). ASIs are important to career advancement and provide Army personnel managers greater visibility of Soldiers with specialized training. This can encourage Soldiers to pursue the advanced certification and provide the Army with greater opportunities to ensure needed skill levels are met across the force. The creation of a specific MOS in the form of a drone corps follows a similar idea (Feickert & Gettinger, 2024). However, this risks insulating the wider Army from a skill that every Soldier may be expected to demonstrate in wartime environments. Restricting sUAS operation to specific personnel is a parochial approach to a new piece of equipment that should be more ubiquitous to the Army as a whole.

G. FACILITIES

Dedicated training space to allow for expedited use of sUAS is key to giving units greater opportunity to train on the systems. While traditional range control procedures serve to govern the use of scarce training space, a dedicated zone in which sUAS can be used without requiring lengthy coordination across and beyond the installation should be considered (Phillips et al., 2025). This can be in the form of a permanent Restricted Operations Zone to communicate to other people, military and civilian alike, that sUAS are permitted to freely operate in the area. Additionally, providing range control entities the ability to monitor airspace for both sUAS and manned aircraft may assist them in deconflicting airspace and mitigate the chance of accidents (Phillips et al., 2025).

H. POLICY

Regulations pertaining to the accountability of Army equipment are essential to mitigating and preventing fraud, waste, and abuse. However, these policies place undue obstacles on platforms designed to be expendable in future battlefields. The Army must “tolerate higher levels of loss and damage of its sUAS to motivate full-spectrum unit training … [and] recognize the high value to the Army of such training relative to the cost of loss or damage" (Camm et al., 2025, p. 26). This does not mean the complete deletion of property accountability regulations for sUAS. Instead, meeting the intent behind employing mass quantities of disposable sUAS could require the reclassification of certain components of the system as Class 2, 5, 7, or 9 parts (Camm et al., 2025).

Figure 25 outlines the different DoD classes of supply.

Figure 25. Classes of Supply. Source: Office of the Joint Chiefs of Staff (2010).

Delineation of the sUAS controller, instead of the drone itself, as the end item is equally acceptable. Alternatively, simply exempting some or all Group 1 or 2 sUAS from AR 735-5 could achieve the same goal in the near term (Roque, 2024). Removing operators' concern that training accidents could impact their take-home pay is important to encourage greater use among units and improve force-wide proficiency.

Getting more sUAS in the hands of Soldiers across the force means buying many sUAS in the near term. Greater variety in the types of drones the Army employs can also inform future capability development requirements, which is explored later. The DIU's Blue UAS program is well intentioned and grounded in meeting statutory requirements but unfortunately forces units into narrow procurement opportunities by dramatically reducing the amount of systems available for rapid purchase (Putney & Ellinger, 2025). For instance, secure supply chains are important to the defense base but not to warfighters; restricting units from purchasing sUAS on these grounds keeps important capabilities beyond the warfighter's reach. Reevaluating the policies surrounding Blue UAS, such as potentially refocusing the program solely on preventing the acquisition of drones or related parts from adversarial states, may increase the amount of sUAS in the Army.

The Army must also work to reduce the bureaucracy units must navigate to execute sUAS training. While dedicated facilities and training space can mitigate this issue, units are still bound by regulatory requirements to coordinate sUAS use (Phillips et al., 2025). Specifically, the time horizons to receive operating approval are often very restrictive. This can be mitigated through dedicated and protected frequencies for sUAS operation, no-fly zones for manned aircraft, or ensuring units have a means to notify base-wide entities of unplanned training (Phillips et al., 2025). For instance, units can be provided a phone number to notify both range control and air traffic control authorities of drone operation under a certain ceiling. If neither entity has any immediate reason to contest the training, then sUAS operation can proceed in a fraction of the time a normal paper request would require. Revising such policies to be less restrictive on unplanned training can encourage units to make better use of free time.

Policies surrounding certification awarding and what authority certified operators have can enhance the effectiveness of MTTs and unit-specific training. As master trainers represent the pinnacle of sUAS operation within the Army, current policy should be evaluated to determine what level of certification these individuals can award to other Soldiers outside of dedicated training environments (Monas & Heard, 2024; Phillips et al., 2025). Ad hoc certification, at a minimum, can enable units to quickly build proficient operators of basic sUAS tactics and techniques in situations where personnel turnover is high. Scaling up the density of sUAS within units must be matched with a similar increase in trained personnel, and reducing policy obstacles to certifying Soldiers for basic Army operating needs can dramatically speed up this process.

I. CONCLUSION

In summary, these suggested DOTMLPF-P changes are likely to heavily contribute to expanded sUAS use. With the rise of sUAS in training exercises, an increase in loss frequency will occur and lead to a sharp increase in consumption of systems. Increasing demand first is important to encourage the increase of a more diverse and competitive supply. Deliberately approaching institutional obstacles to sUAS use first is essential to ensure that the materiel solutions pursued from the private market offer the best return on the Army's investment.

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V. CONTRACTING STRATEGIES FOR MATERIEL SOLUTIONS

In this chapter, potential short and midterm solutions are explored in acquiring sUAS and buying-down risk for immediate integration into warfighting capabilities. In alignment with the previously explored DOTMLPF-P changes, warfighters need not only time but also volume to improve sUAS proficiency. Significant and radical upscaling of near-term procurement of all available sUAS demonstrates to private industry a genuine commitment to a new warfare platform. This DoD financial commitment would encourage private industry to meet acquisition demand requirements with a more competitive market and resilient supply. The strategies presented in this chapter should enable the DoD to better support a full sUAS POR in the long term, as outlined in the next chapter. The key characteristic of this stage of sUAS procurement is the Army simply buying everything it can to present the demand signal and enable the Army to grow and develop sUAS employment TTPs.

Complete abandonment of diligent yet time-consuming tasks such as market research and requests for proposals is not the intent behind the following recommendations. Tasks such as these are important for conducting thoughtful and informed procurement decisions. However, if the goal is to get sUAS into the hands of more troops as rapidly as possible, some of these supplementary tasks can be minimized in the interest of supplying the warfighter. The Army's focus, time, and effort should go to the development of a deliberate POR using the lessons learned from rapid procurement and fielding of COTS systems. To best execute an effective POR that achieves cost and performance goals, time constraints must be sacrificed in the near term and combined with aggressive contracting to allow for better future production of the most effective platform.

A. "MORE OVER BEST" TO DRIVE CDD FEEDBACK

With precise sUAS capability requirements yet to be clearly defined by U.S. warfighters, widespread procurement of a variety of different drones signals to companies across the industry that a growing and lucrative opportunity exists in the DoD (DIB, 2025a). By definition, attritable and low-cost sUAS drones are designed to be expendable: "The number one thing Soldiers are asking for is large quantities of first-person view drones … or low-cost drones that they could fly without being afraid of losing or breaking … [to make] Soldiers feel comfortable employing [them] in the way they think they would in combat" (Carberry, 2024, para. 9). To support the concept that these systems are expendable, the Army must procure quantities to the order of perhaps hundreds of thousands of drones. The drones must be bought and fielded quickly, likely without advanced testing, operations and support funding, or the best features only seen in "top of the line" equipment. Doing this comes at the direct and immediate sacrifice of configuration control over the final design of the platforms but with the benefits of little to no funds being spent on RDT&E and without significant risk (Camm et al., 2025). This approach would create a significant upfront cost but is important in nurturing industrial growth and closing the capability gap for warfighters.

Further complicating the matter, as previously discussed and recommended for DOTMLPF-P change, is the narrow amount of systems the Army is permitted to purchase without additional oversight. Blue UAS's criteria excludes systems that have value but for one reason or another fail to gain certification (Ecelbarger, 2025). Removing superfluous and difficult-to-verify restrictions, such as supply chain resilience and security, can enable the Army to procure greater quantities of equipment. Provided that federal funds do not go to covered entities (NDAA, 2023) and do not introduce cyber vulnerabilities into networks, there should not be any further obstacles to units buying systems in which they see value. Every opportunity to put sUAS into Army formations can improve proficiency and provide exceptionally valuable feedback into what capabilities provide the greatest utility to commanders for future development. In the long term, ensuring that manufacturers have resilient and secure supply chains remains important, but this should not be a critical factor in the immediate goal of buying more sUAS now.

The greater diversity of sUAS in the Army in the near term would help provide invaluable feedback for use in developing solid concepts of employment and operations laying a solid foundation for the requirements supporting a follow-on dedicated POR. Flying many different designs in different environments and with different missions or units offers the opportunity to collect information for the ultimate development of a Capability Development Document (CDD) for future POR development (Goncharuk, 2025). In some ways, the Army is already doing this, albeit on a far smaller scale. An example of this in action is "the bitter cold caused ice to form on some of the aircraft's rotor blades and sapped the batteries, a glitch that hadn't arisen in earlier exercises in Hawaii and Louisiana" (Gordon, 2025. para. 8). Incorporating direct user input to reduce the uncertainty surrounding what the Army wants a system to accomplish gives the Army an opportunity to maximize its investment. Understanding what works and what doesn't, what is operationally suitable and effective and what is not, can help reduce program risk and shorten overall fielding timelines. This can be accomplished through greater numbers of fewer drone designs but at the cost of receiving possibly redundant lessons learned (DIB, 2025a). The greater diversity of design allows data analysts to draw more profound conclusions from initial contracted procurements and fielding.

B. ENHANCED FAR-BASED CONTRACTING

FAR-based contracts remain the general standard for most purchases made by the federal government. Thus, they remain "the quickest way to acquire additional sUAS … to identify existing systems that meet DoD needs and … procure them" (Camm et al., 2025, p. 11). However, contracting officers must be cognizant that these types of contracts consume significant amounts of valuable time. Explicitly leveraging negotiated contracts through FAR Part 15 (2024) can contribute heavily to this delay, and understanding how to minimize instances of contract protest is another vital aspect of speeding acquisition. Additionally, assuming risk on time-consuming processes such as market research can further reduce the time horizon, especially when purchasing a wide variety of products with proven success from across the market. But this must be balanced in such a way as to not create an increase of protests resulting from perceived lack of transparency or fairness (DIB, 2025b). Commercial Solutions Opening (CSO) purchases offer a workaround to previously time-consuming contract negotiations and procurement.

Authorized in FAR 12.1 (2024) and specifically supplemented in Defense Federal Acquisition Regulation Supplement (DFARS) 212.70 (2025), CSO "gives DoD power to advance successful OTA prototypes directly to production contracts without requiring companies to go through more competition" (Shah & Kirchhoff, 2024, p. 41). There is currently no limit to the value of a CSO contract, but those exceeding $100 million do require congressional notification and approval of "senior procurement executive [s]" prior to award (DFARS, 2025). The DIU and its Blue UAS program do utilize CSO to procure sUAS, though not at the true quantities of which it is capable. Dramatically upscaling the use of CSO is an immediate way to demonstrate to industry that the DoD is serious about unleashing American drone dominance.

Moving prototypes into production using the CSO model represents transition and is a metric the DIU uses to gauge its success (DIU, 2024). While a high transition rate may indicate acceptance of only modest technological breakthrough instead of totally original innovation, the use of CSO to immediately field sUAS to warfighters is more than enough to bridge the capability gap in the near term (Perley, 2025). The Russia–Ukraine conflict has shown that having even the most rudimentary, low-tech versions of sUAS has more impact than waiting for the most advanced version to be developed and manufactured does (Bondar, 2024). Continued yet modest technological developments are perhaps sufficient, and sustaining these small advancements can occur through FAR-based procurement as well as through an MTA or UCA POR executed via the Rapid Capabilities and Critical Technologies Office (Camm et al., 2025). Maximizing the funding available now through CSO can reduce the lead time for production of more efficient sUAS in the future.

Engaging with private industry means understanding that "the leading American small UAS companies consider themselves software companies – not hardware producers. As an autonomous and software enabled technology, small UAS software is constantly evolving with new updates to expand capabilities" (Saunders, 2024, p. 55). As software is a continuously developed product without a defined end date for development, procurement of sUAS could be treated "as a service" (Saunders, 2024, p. 55). Autonomous drones are increasingly used on the battlefield and are largely software-driven. The procurement and sustained maintenance and updating of sUAS could be classified as service contracts and controlled under different appropriations, enabling the Army to better manage funds already appropriated by Congress.

C. SEEKING NONTRADITIONAL VENDORS

Many of the most cutting-edge technologies are being developed completely independent of government involvement. The Army would benefit from capitalizing on some of the products being developed by these companies, but it has struggled to establish relationships with them. The Army and the military at large believe that their investment power and purchasing capacity are enough to generate interest among private industry to sell to the government. But the reality is that the companies with the most lucrative technologies seek investment and opportunity elsewhere; they do not visit sam.gov to see what the government is buying at that particular time (Camm et al., 2025). Established defense industry giants benefit from developing products with defense-focused applications in mind. The manufacturing capacity that the major defense primes have remains a vital component of supplying the U.S. military, but these companies should not be the only suppliers to the DoD. With dual-use applications of sUAS being a key factor in scaling up drone acquisition, the best products and businesses may be outside the traditional defense ecosystem and more involved in the private market. If the DoD and the Army want the latest and greatest drone technology, they must seek it out and meet these companies on their own terms.

There is no clear metric to assess how many vendors are not seeking contracts from the government, as it is difficult to measure missed opportunity. But it is no secret that the major defense primes do command a wide share of the market because of their mastery of governmental procurement processes. If the military wants to explore nontraditional sUAS vendors, it would benefit from expanding the DIU into an organization capable of assisting these vendors from start to finish in many of the burdensome and complicated requirements of doing business with the government (DIB, 2025b). Standardizing request for proposal formats to match industry standards, staffing DIU offices with industry experts, and providing dedicated services to guide companies through processes are some ways the DoD can tap into the private market (DIB, 2025b). Processes exist for a reason but should not stand in the way of innovation, and the DoD can mitigate this through proactive engagement with companies whose products it wants to purchase.

Developing relationships with private industry, specifically emerging companies, also means demonstrating to them a genuine concern for their well-being. Besides simply buying immense amounts of sUAS from companies, making efforts to protect their intellectual property is also important to many of these businesses (Camm et al., 2025). The military has struggled in the past with giving up control over intellectual property and suffered the financial consequences of being forced into extremely expensive support contracts (DiNapoli, 2021a). But the costs of demanding IP in contractual procurement can stymie innovative participation from private industry. Cooperative Research And Development Agreements can fuel innovation, enable companies to keep the rights to what is invented, and also give them exclusive rights to manufacture and sell the end product to the government (DAU, n.d.-d). Further, ensuring that contracts do not force companies to surrender their IP by instead explicitly guaranteeing trade secret protection may assuage companies that collaborating and selling to the DoD will not affect their competitive advantage (Morrison, 2021). Drones specifically designed to be attritable and disposable should not demand large O&S budget needs and should therefore be less reliant on government control of IP. Nontraditional companies may be more inclined to work with the government knowing that their product is secure.

The Office of Strategic Capital (OSC) is well positioned to invest in promising companies and technologies but does not consider sUAS an area of particular interest (Office of the Secretary of Defense, 2025). The OSC's mission to "identify and prioritize promising critical technologies and assets that require capital assistance and have the potential to benefit the DoD" is specifically targeted toward nontraditional defense vendors (Office of the Secretary of Defense, 2025, p. 2). Applying the lessons learned from contemporary conflicts and treating sUAS technology as one of particular interest is vital to harnessing the true potential of private industry. Some sUAS companies otherwise eager to work with the DoD may not survive the "valley of death" without sustained investment, something with which the OSC can directly assist (Saunders, 2024). Combined with venture capital investments specifically in companies with secure supply chains, OSC grants and loans could help invigorate domestic sUAS manufacturing and development.

Encouraging involvement in defense industry by atypical companies depends on those companies understanding that what they have is valuable to the DoD. To enable this, the DoD must be clearer about the fact that sUAS technology is becoming a more important facet of its organizational goals and more specific about what types of capabilities it finds most interesting. To the greatest extent possible, all aspects of sUAS procurement should be unclassified to ensure the widest possible dissemination to industry, especially those companies without existing access to classified material.

D. CONCLUSION

The DoD should first use all available funds to purchase as many sUAS from the Blue UAS list as possible. The quantities that could be procured in this way are unlikely to be large at first, but this is a vital first step in establishing the demand signal to industry and creating a need for the defense industry to fill. Depending on the capacity of individual Blue UAS–certified vendors, the Army could explore the feasibility of entering into short term indefinite delivery/indefinite quantity contracts for up to 5 years to fuel manufacturing growth.

The Army should then expand its efforts to those businesses that are not Blue UAS–certified. Instead of seeking to certify all commercially available sUAS for inclusion on the Blue UAS list, the Army may find it less resource-intensive to instead focus on developing a list that eliminates statutorily required covered entities (NDAA, 2023). The Blue UAS list can be used as a “preferred” business list, and a “Red UAS” list can be created that explicitly prohibits DoD organizations from buying from specific companies or countries. Units should be allowed to purchase anything that is not on either list. Making use of previously developed lists of sUAS, such as that in the 2025 RAND report, can speed market research and assist the DoD in consuming as much of the market as possible.

Simultaneous engagement with emerging companies should occur throughout both this contracting process and the subsequent POR development. Identifying companies with innovative and novel sUAS technologies should be combined with OSC investment, CRADA agreements, and OTA contracts. Once a company has reached R&D

maturation and successfully demonstrated a prototype, the Army should almost always transition the system into production through maximization of CSO.

As units provide feedback on the sUAS procured through the initial stages of the contracting process, the Army must use this knowledge to develop a better understanding of key system attributes and performance parameters. This information can be applied immediately to those systems qualified for CSO investment. After enough data has been collected, the Army can and should decide if the sUAS in question are good candidates for graduation to a POR through either formal procurement under UCA or MTA authorities. This action can be treated as a type of informal competitive prototyping and gives the Army flexibility in investing in the most promising (yet not perfect) platforms. In this way OTA funds can be maximized without subsequent Congressional approval, with remaining RDT&E money going towards procurement of the future POR. For those sUAS systems that have more niche capabilities or are at greater risk of rapid obsolescence, their procurement under "commercial goods as a service" can expand the available funding while providing a means to keep the drones in service to maximize the initial investment.

The near term has potential to be a logistical challenge in managing the many different types of sUAS within the Army portfolio, but the trade-off is in understanding what sUAS are most effective now and navigating the standardization issues during peacetime (Saunders, 2024). Ukraine's drone development model, while successful, has occurred out of necessity and during an existential struggle for survival (Goncharuk, 2025). The challenge in managing the many different sUAS models in Ukraine's arsenal has been unavoidable due to war. While at peace, the United States can shoulder the burden of a diverse sUAS portfolio if it helps to develop and procure the most effective and standardized solutions for a POR in the future.

VI. MATERIEL SOLUTIONS AND PROGRAM MANAGEMENT STRATEGIES

The sum of the effort behind DOTMLPF-P revision and contracting strategies as outlined in the previous chapters should ultimately help inform development of a dedicated POR for land-based sUAS. Establishing a common system capable of rapid and iterative updates to meet changes in the battlefield provides more resilient capabilities to the warfighter and best manages the Army's potential heavy investment in the system. That said, a vital aspect of the POR should be to leverage dual-use critical technologies and manufacturing processes to enable manufacturers to sell to the private consumer market in addition to the military. Maximization of the manufacturers' value chain in this way can provide the Army with many benefits, chiefly in the anticipated reduced cost per unit.

A. MAXIMIZING VALUE CHAINS

Businesses with lucrative products rarely turn down a customer seeking to buy them. With enough volume, an economy of scale can develop and result in overall cost savings for all customers. This has been proven successful for previous Army POR such as the M4, an arguably more dangerous system, and similar results can likely be achieved for less dangerous sUAS (Clossman & Long, 2015). Providing the Army with the ability to "bolt on" other pieces of equipment otherwise unavailable to the private sector, such as a grenade or electronic warfare suite, enables manufacturers to privately sell the drone without changing the design of the final product. Precise characteristics of the POR depend on feedback from warfighters but focus must be on ensuring the final product has dual use utility and can be sold on the private market to private consumers. C-sUAS investment from the Army has a military purpose but a narrow consumer market; sUAS markets have both, and the market value reflects that (Kang et al., 2020; Paulet, 2023). The DoD can take advantage of businesses investing far more heavily into research and development of commercial products by emphasizing sUAS platforms that are legal to be sold to private consumers (Modigliani, 2022). The cost penalty of militarizing the POR is in putting it beyond the legal or monetary reach of consumers on the private market and diminishing the power that economies of scale can have on procurement of a higher volume of systems for the Army.

B. MODULARITY

Key to the transition from MTA to a Major Defense Acquisition Program (MDAP) POR is maintaining requirements and prioritizing open and modular platform design (DIB, 2025a). Leveraging the full capability and capacity of value chains created by the manufacturing base, the requirements should lead to the development of a base sUAS that is a viable platform for applications outside of the DoD. Specifically, that base sUAS platforms should provide a U.S. manufacturer the means to effectively compete in the commercial market against giants such as DJI with DoD funding assistance. DoD investment in C-sUAS platforms lacks the inherent advantage sUAS platforms have in competing in wider markets. Expansion of sUAS by the DoD could kick start the U.S. drone manufacturing base in a way that C-sUAS platforms cannot. Dual-use technologies, manufacturing processes, and supply chains have a wider market between governmental and commercial entities and are more lucrative for businesses to pursue.

While a family of bolt-on attachments may be restricted to military application only, the ability to focus DoD investment in sUAS to weaken Chinese dominance in the sUAS market as discussed in the background chapter creates a multilayered benefit to the United States. By prioritizing a modular open system design, the long-term viability of the overall program can be maintained as technology, hardware, and warfighters' needs evolve. This could include additions to the family of attachments, improvements to the base sUAS platform, or the outright replacement of the base sUAS platform. Modularity in the design of the POR sUAS also gives the Army security from being "vendor-locked." Building up stores of spare parts and attachments unique to specific sUAS supports long-term success for a POR that meets cost, schedule, and performance acquisition program baseline requirements. These parts must be as interchangeable as possible to give the Army the best return on investment and flexibility in selecting POR vendors.

C. LONG TERM APPROPRIATIONS

Sponsoring development of a dual commercial/military use sUAS POR comes with additional protection in the form of appropriated funding from Congress. The restrictions on starting new projects or opening new projects, especially under continuing resolutions or government shutdowns, impedes the Army's ability to react to a changing commercial market. Continuing resolutions severely compromise the military's ability to rapidly procure commercial items, but this negative impact can be mitigated through sustained and long-term funding with designation as an MDAP. By transitioning to the POR with accompanied long-term appropriations commitments, this sUAS strategy can also avoid the valley of death other programs have seen (Landreth, 2022). Within the Services, MDAP programs do receive additional oversight given the dollar value of the programs. However, this comes with genuine commitment from policy-makers to ensure programs are funded appropriately and with financial security for the defense industry knowing their products will continue to have customers. As the Services regard their unique combat power platforms as integral to their identities and financially secure them as such, the same must be done with sUAS to achieve buy-in from industry.

Procuring sUAS may be unique in that they can be acquired almost exclusively from the private market. This should not prevent Army leaders from solidifying the utility sUAS have on the modern battlefield by way of sustained, large scale, and protected funding from Congress. An sUAS POR is likely to fall between ACAT II (spend limit of $3.064 billion) and ACAT I ($3.065 billion or more) status, based on FY 2026 requests and the recommended expansion of sUAS use across the force (ASA (FM&C), 2025; DAU, n.d.-a). An investment of this scale would require dedicated appropriations through the PPBE process. Since the PPBE process takes about 2 years before project work can be initiated, Army leaders should act now to secure POR status as soon as possible. Lines of funding can be allocated against capabilities while competitive prototyping occurs under contracting vehicles as previously discussed. Once vendors and particular sUAS platforms are identified as meeting Army needs, transitioning the best options to POR status and allocating the already available appropriated funds ensures no interruption or delay of capability delivery.

D. ID/IQ PROCUREMENT

Those sUAS platforms selected as POR should then be procured under ID/IQ terms to support the consumption rates expected of the Army in peace and war. Training expenditures will not match wartime rates but should provide enough demand for industry to justify expansion of manufacturing capacity. With modularity, a core requirement for any sUAS POR, ID/IQ procurement of a focused number of platforms can benefit more businesses and improve the health of the U.S. domestic sUAS market while also improving the products the DoD purchases.

E. TRANSITION FROM CSO AND MTA RAPID PROTOTYPING TO POR

To achieve long-term integration and impacts of sUAS capabilities within the DoD, there must be a system of suppliers to meet demand for the expendable assets (U.S. DoD, 2019). By transitioning the CSO and MTA rapid prototyping acquisitions discussed in the previous chapter to a full POR, likely with an entry to the MDAP at Milestone C, the warfighter can be supported for full-scale application of sUAS operations including the need for training, weapons system integration, and operation deployment. The POR should include a sUAS platform and a family of associated bolt on attachments. These attachments would be selected from the COTS procurement phase with emphasis on demonstrated capability, supply chain management, and manufacturing capacity. The successful transition to the POR is critical to deliver long-term capability and garner true return on investment of the CSO and MTA process used to meet the near-term, urgent need.

Baseline metrics for supply chain sources, manufacturing locations, and manufacturing capability/capacity should be identified and carried forward to the POR with identified incentives to continue increasing supply chain independence for DoD sUAS procurement. Leveraging strategies and appropriations outlined in the National Defense Industrial Strategy (OUSD A&S, 2025) to help inform development of resilient supply chains can foster healthy manufacturing capacity and long-term POR establishment. Making use of the Defense National Stockpile could also help secure sUAS manufacturing in the event of conflict but requires preparation, planning, and appropriation (Chappell et al., 2006). Doing so requires deliberate analysis of potential

POR vendors during the CSO and MTA process, application of incentives, and benefiting supply chain robustness when permitting. Program managers for the MTA and the future POR should regularly engage industry stakeholders to ensure supply chain requirements and incentives are achievable with the right amount of pressure and accountability to break free of the challenges identified in the background of this thesis.

F. CONCLUSION

The transition to a POR for sUAS is a phased strategy in place of a single decision within the acquisition framework. Beginning by fully leveraging CSO and MTA rapid prototyping discussed in the previous chapter and entering MDAP Milestone C for full-rate production for a sustained, long-term capability. The first step is defining and prioritizing a modular, dual-use platform that leverages commercial value chains while acknowledging the military specific bolt-on attachments. Pairing the transition with department and congressional commitments via long-term sustained appropriations afforded to fully established POR. This funding commitment provides the appropriate demand signal to the industrial base to garner continued investment for appropriate manufacturing and supply chain expansion. Procuring under the ID/IQ contracting approach creates a sustainment for both training and wartime consumption rates. Finally, program managers' continuous engagement with industry and maintaining open design allows for an evolution of warfighter needs and technology advancements. Together, these steps create a deliberate POR that ensures sUAS not only are not available at scale, but remain affordable, flexible, and advantageous to the warfighter.

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VII. CONCLUSION

A. SUMMARY OF FINDINGS

This project sought to determine how the DoD can rapidly acquire large quantities of sUAS over the long term by examining policy, contracting, and program management barriers within the existing defense acquisition framework. The research addressed three primary questions.

1. What current policy, contracting, and program management arrangements pose problems for the acquisition of large quantities of military sUAS?

Research found that overregulation and property accountability requirements that classify small, inexpensive drones as nonexpendable equipment can constrain training and use of sUAS by units. Fragmented certification and training doctrine inherited from legacy larger UAS programs also hindered rapid fielding and employment. These issues both contribute to a culture of aversion to smaller sUAS among Army servicemembers despite proven success on modern battlefields. Contracting rigidity under the FAR can also dissuade nontraditional vendors with promising sUAS platforms from working with the DoD due to delayed procurement timelines. Fragility of the industrial base and its reliance on Chinese-origin components and materials has contributed to limited domestic sUAS manufacturing capacity, frustrating efforts to procure large numbers of systems over the long term. Finally, program management inertia and resistance to smaller scale but dual use innovative technology is compounded by PPBE inflexibility and federal budget uncertainty, leading to delays of funding and overall acquisition.

2. What policy, cotracting, and program management changes should the DoD make to facilitate a successful program for acquiring very large quantities of military sUAS?

To establish conditions favorable to sustained procurement of sUAS, research indicated that the Army must make DOTMLPF-P changes to improve sUAS employment across the Service. While non-materiel changes are occurring in the Army to establish a foundation for effective employment, simultaneous procurement and development of materiel solutions can take place to equip the force in the near and long term. Use of CSO and OTA to rapidly purchase commercial drones for training and evaluation can expand the Army's ability to contract for sUAS in the immediate and near term (less than 2 years). In addition to decentralizing procurement authority to lower levels, near-term action can allow the Army to evaluate a myriad of available sUAS in a variety of different environments and by different units to develop clearer understanding of what characteristics of sUAS are most effective for military application. Long-term actions should focus on establishment of a POR with modularity in the design as a vital characteristic, allowing diverse payloads to be carried and developed independent of the sUAS platform. The POR should further feature a platform that can be adapted for both military and commercial use, encouraging the nascent domestic sUAS industry to steadily grow.

3. What financial investments can the DoD make to buy down risks to a program for the acquisition of very large quantities of military sUAS on short notice?

This research found that risk can be mitigated through agile funding mechanisms within the current AAF, targeted OSC investments in drone manufacturing, and contracting with industry using ID/IQ contracts to maintain production capacity. Long-term appropriations in the form of lines of funding against a POR are essential to further reduce impacts of disruptions in funds from irregular government budgetary cycles. Combined with strong but more importantly consistent demand signaling, the DIB can grow and attract private capital to the domestic sUAS sector, building manufacturing capacity in the United States to meet consumption rates in peace and war.

B. ACTIONS TAKEN BY THE CURRENT ADMINISTRATION

Since this project began, the second Trump administration has enacted multiple executive orders and departmental policies directed towards reforming the DAS and promoting domestic sUAS production. Executive orders such as "Restoring Common Sense to Federal Procurement" (Exec. Order No. 14267, 2025), "Modernizing Defense Acquisitions and Spurring Innovation in the Defense Industrial Base" (Exec. Order No. 14265, 2025), and "Unleashing American Drone Dominance" (Exec. Order No. 14307, 2025) collectively emphasize deregulation and innovation. Secretary of Defense Hegseth's (2025) companion memorandum, "Unleashing U.S. Military Drone Dominance," operationalizes these policies. The key objectives within Hegseth's memo are stimulating domestic drone manufacturing via mass DoD purchases of U.S.-made sUAS, reasserting technological dominance by arming warfighters with low-cost, advanced American systems, and reducing bureaucratic barriers to fielding and training with sUAS.

In support of these goals, the administration has initiated several key actions: delegating procurement authority to the first Flag Officer or SES-level equivalent leader within unit chains of command for sUAS acquisition; accelerating Blue UAS certification timelines to 14 days to speed procurement; directing the OSC to prioritize sUAS financing and incentivize private capital investment; and encourage DOTMLPF-P changes such as reclassification of sUAS as expendable property, easing range and spectrum restrictions, and expanding training opportunities. These initiatives are already reflected in the Army's FY26 budget request, with divestiture of the FTUAS program valued at approximately $147 million, coupled with investments of $360 million in RDT&E and $959 million in procurement of sUAS (ASA (FM&C), 2025). By contrast, C-UAS investments are $144 million for RDT&E and $693 million in procurement.

The Army has also already implemented some key DOTMLPF-P changes. Classification of Group 1 and 2 sUAS as items other than nonexpendable property has been addressed through recent messaging to the Army (Department of the Army, 2025). Revisions to CJCSI 3255.01 and associated service-specific training doctrine on sUAS to exempt Group 1 and 2 systems from training designed around legacy, larger systems will allow units to immediately expose more Soldiers to sUAS use (Office of the Secretary of Defense, 2025). The removal, following a review, of unnecessary range and spectrum restrictions at all installations and designating three national ranges for in-depth sUAS training will further set conditions for wider sUAS employment. While too early to fully assess the impacts these actions will have on sUAS procurement, they represent earnest efforts to improve acquisition to meet warfighter demands.

C. AREAS FOR FUTURE RESEARCH

The many changes to the Defense Acquisition System that the second Trump administration has brought will undoubtedly have ripple effects across the broader acquisition ecosystem. Whether these changes bring positive or negative consequences remains to be seen. With regards to sUAS procurement, it may take 1 to 3 years before effects are realized, especially considering the budget cycles of both the DoD and Congress. Potential areas for future research include:

1. Measure the effectiveness of policy changes through evaluating the impacts of Executive Orders 14265, 14267, 14307 and Secretary Hegseth's directive on domestic sUAS production and procurement over time. Analyzing whether these reforms meaningfully reduce acquisition lead times and increase participation from nontraditional vendors in the DAS will be noteworthy.
2. Evaluate the supply chain resilience of the domestic sUAS industrial base. Section 162 of the FY25 NDAA (Servicemember Quality of Life Improvement and National Defense Authorization Act for Fiscal Year 2025, 2024) directed the secretary of defense to take a variety of actions to increase supply chain resiliency for sUAS. A full taxonomy of the parts and materials of a DJI sUAS was required to be submitted to Congress by September 19, 2025, with an evaluation of the fragility and criticality of each component. Evaluating the impacts of these materials on sustained sUAS manufacturing is important to long-term procurement.
3. Determine whether the DoD has presented a clear enough demand signal to encourage private industry development of domestic sUAS manufacturing through a survey of the sUAS market compared to the RAND (2025) report. This can serve as a quantifiable metric of the success of administration actions toward encouraging domestic sUAS market growth and inform whether further action is required.

D. CONCLUSION

The proliferation of drones on the modern battlefield has revealed that industrial scale and adaptive acquisition are big contributors to the success or failure of warfighters. Technological dominance alone is not enough to win wars. To prevail in future conflicts, the United States must embrace not only new systems and platforms that directly close capability gaps on the battlefield, but also a procurement philosophy that capitalizes on quantity, agility, and dual-use innovation of the private market. The findings of this project, combined with ongoing administrative reforms, offer a viable pathway to building America's drone manufacturing base and ensuring the DoD can field capable, affordable, and abundant sUAS at the speed of relevance in the near and long term.

LIST OF REFERENCES

Amonson, K., & Egli, D. (2023). The ambitious dragon: Beijing's calculus for invading Taiwan by 2030. *Journal of Indo-Pacific Affairs*, *6*(3), 38–54.

Andrews, P. (2021, August). *Lessons from the Nagorno-Karabakh 2020 conflict* (Report No. 21–655). Center for Army Lessons Learned. https://api.army.mil/e2/c/downloads/2023/01/31/693ac148/21-655-nagorno-karabakh-2020-conflict-catalog-aug-21-public.pdf

Assistant Secretary of the Army for Financial Management & Comptroller. (2025, June). *Army FY 2026 Budget Overview*. Army Financial Management & Comptroller. https://www.asafm.army.mil/Budget-Materials/

Axe, D. (2025, March 12). 4.5 million drones is a lot of drones. It's Ukraine's new production target for 2025. *Forbes*. https://www.forbes.com/sites/davidaxe/2025/03/12/45-million-drones-is-a-lot-of-drones-its-ukraines-new-production-target-for-2025/

Baskaran, G. (2024). *What China's ban on rare earths processing technology exports means*. Center for Strategic & International Studies. https://www.csis.org/analysis/what-chinas-ban-rare-earths-processing-technology-exports-means

Bondar, K. (2024). *Closing the loop: Enhancing U.S. drone capabilities through real-world testing*. Center for Strategic & International Studies. https://www.csis.org/analysis/closing-loop-enhancing-us-drone-capabilities-through-real-world-testing

Bondar, K. (2025). *Ukraine's future vision and current capabilities for waging AI-enabled autonomous warfare*. Center for Strategic & International Studies. https://www.csis.org/analysis/ukraines-future-vision-and-current-capabilities-waging-ai-enabled-autonomous-warfare

Bub, K. R. (2023). *Analysis of rapid prototyping within the DoD* [Master's thesis, Naval Postgraduate School]. NPS Archive: Calhoun. https://hdl.handle.net/10945/72123

Camm, F., Girardini, K., & Kelly, T. K. (2025). *Small uncrewed aircraft systems (SUAS) in divisional brigades: Options to improve acquisition and accountability* (Report No. RR-A2642-3). RAND. https://doi.org/10.7249/RRA2642-3

Carberry, S. (2024, August 1). Army desperately seeking small, affordable drones. *National Defense Magazine*. https://www.nationaldefensemagazine.org/articles/2024/8/1/army-desperately-seeking-small-affordable-drones

Cerillo, C. (2023, October 25). *The Armenian and Azerbaijani conflict: Attacks in the Nagorno-Karabakh region*. UAB Institute for Human Rights Blog. https://sites.uab.edu/humanrights/2023/10/25/the-armenian-and-azerbaijani-conflict-attacks-in-the-nagorno-karabakh-region/

Chappell, C. G., Guss, K., & Gainer, R. (2006). *An Organizational History of the Defense National Stockpile Center: America's National Stockpile*. https://www.dla.mil/Portals/104/Documents/Strategic%20Materials/DNSC%20History.pdf

Chávez, K., & Swed, O. (2024, August 15). *Small drones for big militaries: The way ahead*. War Room. https://warroom.armywarcollege.edu/articles/small-drones/

Clossman, N., & Long, C. (2015). *A business case analysis of the M4/AR-15 market* [Master's thesis, Naval Postgraduate School]. Defense Technical Information Center. https://doi.org/10.21236/AD1008889

Defense Acquisition University. (n.d.-a). *Acquisition Category (ACAT)*. Retrieved July 23, 2025, https://www.dau.edu/acquipedia-article/acquisition-category-acat

Defense Acquisition University. (n.d.-b). *Adaptive acquisition framework pathways*. Retrieved June 4, 2025, https://aaf.dau.edu/aaf/aaf-pathways/

Defense Acquisition University. (n.d.-c). *Contracting for manufacturing and quality*. Retrieved October 6, 2025, https://www.dau.edu/cop/mq/resources/contracting-manufacturing-and-quality

Defense Acquisition University. (n.d.-d). *Cooperative research & development agreement (15 USC §3710a)*. Retrieved September 11, 2025, https://aaf.dau.edu/aaf/contracting-cone/rd-agreements/crada/

Defense Acquisition University. (n.d.-e). *Simplified acquisition procedures (SAP)*. Retrieved June 4, 2025, https://www.dau.edu/acquipedia-article/simplified-acquisition-procedures-sap

Davis, B. (2023, October 25). U.S. Army moving out with small UAS. *Inside Unmanned Systems*. https://insideunmannedsystems.com/u-s-army-moving-out-with-small-uas/

Defense Federal Acquisition Regulation Supplement 212.70, Defense Commercial Solutions Opening (2025). https://www.acquisition.gov/dfars/subpart-212.70-defense-commercial-solutions-opening

Detsch, J. (2021). The U.S. Army goes to school on Nagorno-Karabakh conflict. *Foreign Policy*. https://foreignpolicy.com/2021/03/30/army-pentagon-nagorno-karabakh-drones/

Defense Innovation Board. (2025a, January 3). *Defense Innovation Board: A pathway to scaling unmanned weapon systems*. Department of Defense. https://innovation.defense.gov/Portals/63/DIB%20A%20Pathway%20to%20Scaling%20Unmanned%20Weapon%20Systems_250113.pdf

Defense Innovation Board. (2025b, January 8). *Defense Innovation Board: Scaling nontraditional defense innovation*. Department of Defense. https://innovation.defense.gov/Portals/63/DIB%20Scaling%20Nontraditional%20Defense%20Innovation%20250113%20PUBLISHED.pdf

Defense Innovation Unit. (2024). *The Defense Innovation Unit FY 2023 annual report*. Department of Defense. https://downloads.ctfassets.net/3nanhbfkr0pc/57VfnQbajgWdONRicxv6nG/44f831e7a0e857bb8494508f8571fd71/DIU_Annual_Report_FY2023.pdf

Defense Innovation Unit. (2025). *UAS solutions for the U.S. DoD.* https://www.diu.mil/blue-uas

Department of the Army. (2025). *Unretrievable unmanned systems/equipment loss, damaged, destroyed, theft adjustments and property accountability requirements* (ALARACT 062/2025). https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN44001-ALARACT_0622025-000-WEB-1.pdf

Department of War. (2011, August 10). *Army soldiers mount a Shadow 200 unmanned aerial vehicle onto its launching catapult for a training flight on Fort Bragg, N.C., Aug. 10, 2011 The catapult launches the 400-poind UAV in fewer than 40 feet*. https://www.war.gov/Multimedia/Photos/igphoto/2001166389/

DiNapoli, T. J. (2021a). *Defense acquisitions: DoD should take additional actions to improve how it approaches intellectual property* (GAO-22-104752). Government Accountability Office. https://www.gao.gov/products/gao-22-104752

DiNapoli, T. J. (2021b). *Post-government employment restrictions: DoD could further enhance its compliance efforts related to former employees working for defense contractors* (GAO-21-104311). Government Accountability Office. https://www.gao.gov/products/gao-21-104311

Ecelbarger, N. (2025, April 28). *Realizing America's drone revolution*. War on the Rocks. https://warontherocks.com/2025/04/realizing-americas-drone-revolution/

The Economist. (2024, February 5). How cheap drones are transforming warfare in Ukraine. https://www.economist.com/interactive/science-and-technology/2024/02/05/cheap-racing-drones-offer-precision-warfare-at-scale

Enemark, C. (2023, November 18). *Enhanced ethics for military users of armed drones*. E-International Relations. https://www.e-ir.info/2023/11/18/enhanced-ethics-for-military-users-of-armed-drones/

Exec. Order No. 14265, Modernizing Defense Acquisitions and Spurring Innovation in the Defense Industrial Base, 90 FR 15621 (2025). https://www.federalregister.gov/documents/2025/04/15/2025-06461/modernizing-defense-acquisitions-and-spurring-innovation-in-the-defense-industrial-base

Exec. Order No. 14267, Reducing Anti-Competitive Regulatory Barriers, 90 FR 15629 (2025). https://www.federalregister.gov/documents/2025/04/15/2025-06463/reducing-anti-competitive-regulatory-barriers

Exec. Order No. 14307, Unleashing American Drone Dominance, 90 FR 24727 (2025). https://www.federalregister.gov/documents/2025/06/11/2025-10814/unleashing-american-drone-dominance

Federal Aviation Administration. (2021, August 30). *Airspace 101 – Rules of the sky*. https://www.faa.gov/uas/getting_started/where_can_i_fly/airspace_101

Federal Aviation Administration. (2025, February 20). *Aeronautical Information Manual (AIM)*. U.S. Department of Transportation. https://www.faa.gov/air_traffic/publications/atpubs/aim_html/chap11_section_3.html

FAR 8, Required Sources of Supplies and Services (2025). https://www.acquisition.gov/far/part-8

FAR 12.1, Acquisition of Commercial Products and Commercial Services (2024). https://www.acquisition.gov/far/subpart-12.1

FAR 52.204-10, Reporting Executive Compensation and First-Tier Subcontract Awards (2020). https://www.acquisition.gov/far/subpart-52.204-10

Feickert, A., & Gettinger, D. M. (2024). *Proposal to create a U.S. Army Drone Corps* (CRS Report No. IN12382). Congressional Research Service. https://www.congress.gov/crs-product/IN12382

Ferreira, G., & Critelli, J. (2022). China's global monopoly on rare-earth elements. *The U.S. Army War College Quarterly: Parameters*, *52*(1), 57–72. https://doi.org/10.55540/0031-1723.3129

Gaub, D. L. (2011). *The proliferation and threat of unmanned aerial vehicles in the twenty-first century*. United States Army Command and General Staff College.

Gettinger, D. M. (2024). *The U.S. Army's small uncrewed aircraft systems* (CRS Report No. IF12668). Congressional Research Service. https://sgp.fas.org/crs/weapons/IF12668.pdf

Gettinger, D. M. (2025). *FY2025 NDAA: Countering uncrewed aircraft systems* (CRS Report No. IN12418.6). Congressional Research Service. https://www.congress.gov/crs-product/IN12418

Goncharuk, V. (2025, August 12). *Ukraine isn't the model for winning the innovation war*. War on the Rocks. https://warontherocks.com/2025/08/ukraine-isnt-the-model-for-winning-the-innovation-war/

Gonzales, M. (2021, December 1). *Force design 2030: Divesting to meet the future threat*. U.S. Marine Corps. https://www.marines.mil/News/News-Display/Article/2857680/force-design-2030-divesting-to-meet-the-future-threat

Gordon, M. R. (2025, April 30). U.S. Army plans massive increase in its use of drones. *The Wall Street Journal*. https://www.wsj.com/politics/national-security/us-army-drones-shift-20cc5753

Goss, C. (2025, March 26). *DoD's first year-long CR*. Federal Budget IQ. https://federalbudgetiq.com/insights/dods-first-year-long-cr/

Government Accountability Office. (2024). *Critical materials: Action needed to implement requirements that reduce supply chain risks* (GAO-24-107176). U.S. Government Accountability Office. https://www.gao.gov/assets/880/871168.pdf

Government Accountability Office. (n.d.). *U.S. GAO – Timeline of bid protest process*. Retrieved June 7, 2025, https://www.gao.gov/infographic/timeline-bid-protest-process

Hale, R., Lord, E., Burks, J., Davis, S., Disbrow, L., Fanning, E. … Whitley, J. (2024). *Commission on Planning, Programming, Budgeting, and Execution Reform: Defense resourcing for the future* [Final Report]. Commission on PPBE Reform.

Halstian, M. (2025, May 15). A first point view: Examining Ukraine's drone industry. *Georgetown Security Studies Review*. https://gssr.georgetown.edu/the-forum/regions/eurasia/a-first-point-view-examining-ukraines-drone-industry/

Harshberger, T., Snyder, D., Lynch, K. F., & Peters, H. (2025). *A proactive, network-based approach to defense supply chain capacity* (Report No. PE-A2899-1). RAND. https://doi.org/10.7249/PEA2899-1

Headquarters Department of the Army. (2013). *Small unmanned aircraft system aircrew training program* (TC 3–04.62). https://downloads.regulations.gov/FAA-2015-4378-4810/attachment_1.pdf

Headquarters Department of the Army. (2016). *Air traffic control, airfield/heliport, and airspace operations* (AR 95-2). https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/r95_2.pdf

Headquarters Department of the Army. (2018). *Flight regulations* (AR 95-1). https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/ARN5966_AR_95-1_WEB_FINAL.pdf

Headquarters Department of the Army. (2019). *Force development and documentation consolidated policies* (AR 71-32). https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN43300-AR_71-32-001-WEB-3.pdf

Headquarters Department of the Army. (2020). *Army use of the electromagnetic spectrum* (AR 5-12). https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN37511-AR_5-12-001-WEB-3.pdf

Headquarters Department of the Army. (2024). *Relief of responsibility and accountability* (AR 735-5). https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN30843-AR_735-5-000-WEB-1.pdf

Hollenbeck, N., Altaf, M. H., Avila, F., Ramirez, J., Sharma, A., & Jensen, B. (2025). *Calculating the cost-effectiveness of Russia's drone strikes*. Center for Strategic & International Studies. https://www.csis.org/analysis/calculating-cost-effectiveness-russias-drone-strikes

Hust, C. R., & Kavall, A. P. (2021). *Analysis of rare earth element supply chain resilience during a major conflict* [Master's thesis, Naval Postgraduate School]. NPS Archive: Calhoun. https://hdl.handle.net/10945/67661

Office of the Joint Chiefs of Staff. (2010). *Distribution operations* (JP 4-09). Department of Defense. https://irp.fas.org/doddir/dod/jp4_09.pdf

Office of the Joint Chiefs of Staff. (2021, October 30). *Manual for the operation of the Joint Capabilities Integration and Development System*. Department of Defense. https://www.dau.edu/sites/default/files/2024-01/Manual%20-%20JCIDS%20Oct%202021.pdf

Kang, H., Joung, J., Kim, J., Kang, J., & Cho, Y. S. (2020). Protect Your Sky: A Survey of Counter Unmanned Aerial Vehicle Systems. *IEEE Access*, *8*, 168671–168710. https://doi.org/10.1109/access.2020.3023473

Kaplan, F. (2016, September 14). *The first drone strike*. Slate. https://slate.com/news-and-politics/2016/09/a-history-of-the-armed-drone.html

Kapustina, L., Izakova, N., Makovkina, E., & Khmelkov, M. (2021). The global drone market: Main development trends. *SHS Web of Conferences*, *129*, 1–8. https://doi.org/10.1051/shsconf/202112911004

Kirichenko, D. (2024, December 5). *The rush for AI-enabled drones on Ukrainian battlefields*. Lawfare. https://www.lawfaremedia.org/article/the-rush-for-ai-enabled-drones-on-ukrainian-battlefields

Kroenig, M., & Bayoumi, I. (2024, June 25). *A global strategy to secure UAS supply chains*. Atlantic Council. https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/a-global-strategy-to-secure-uas-supply-chains/

Landreth, J. (2022, February). Through DoD's valley of death—A data-intensive startup's journey. *Defense Acquisition Magazine*, *LI*(No. 1, DAU 284), 28–34.

Leal Filho, W. L., Kotter, R., Özuyar, P. G., Abubakar, I. R., Eustachio, J. H. P. P., & Matandirotya, N. R. (2023). Understanding rare earth elements as critical raw materials. *Sustainability*, *15*(3), 1–18. https://doi.org/10.3390/su15031919

Lopez, C. T. (2024, March 11). *DoD looks to establish 'mine-to-magnet' supply chain for rare earth materials*. Department of Defense. https://www.defense.gov/News/News-Stories/Article/Article/3700059/dod-looks-to-establish-mine-to-magnet-supply-chain-for-rare-earth-materials/

Lopez, E. (2012, January 7). *The MQ-1 Predator assigned to the 163rd Reconnaissance Wing in flight* [Photograph]. U.S. Air Force. https://www.af.mil/News/Photos/igphoto/2002864355/mediaid/5461033/

Lushenko, P. (2023). The moral legitimacy of drone strikes: How the public forms its judgments. *Texas National Security Review*, *6*(1), 11–34. http://dx.doi.org/10.26153/tsw/44438

Macalpine, A. (2025, February 28). *Ukraine's drone evolution, from Mavic scouts to long-range strike weapons*. UNITED24 Media. https://united24media.com/war-in-ukraine/ukraines-drone-evolution-from-mavic-scouts-to-long-range-strike-weapons-6232

Manuel, K. M., & Schwartz, M. (2016). *GAO bid protests: An overview of time frames and procedures* (No. CRS Report No. R40228). Congressional Research Service. https://www.everycrsreport.com/reports/R40228.html

Manuel, R. (2024, February 12). *Sweden Selects French Parrot Drone for Home Guard*. The Defense Post. https://thedefensepost.com/2024/02/12/sweden-parrot-drone-home-guard/

McBride, J., & Chatzky, A. (2019, May 13). *Is 'made in China 2025' a threat to global trade?* Council on Foreign Relations. https://www.cfr.org/backgrounder/made-china-2025-threat-global-trade

McCormick, R. (2020). *Department of Defense other transaction authority trends: A new R&D funding paradigm?* Center for Strategic & International Studies. https://www.csis.org/analysis/department-defense-other-transaction-authority-trends-new-rd-funding-paradigm

McGarry, B. W. (2021). *Defense primer: DoD transfer and reprogramming authorities* (No. CRS Report No. IF11243.6). Congressional Research Service. https://www.congress.gov/crs_external_products/IF/PDF/IF11243/IF11243.6.pdf

McGarry, B. W. (2022). *DoD planning, programming, budgeting, and execution (PPBE): Overview and selected issues for Congress* (CRS Report No. R47178). Congressional Research Service. https://www.congress.gov/crs-product/R47178

Mittal, V., & Goetz, J. (2025). A quantitative analysis of the effects of drone and counter-drone systems on the Russia-Ukraine battlefield. *Defense & Security Analysis*, *41*(3), 1–14. https://doi.org/10.1080/14751798.2025.2479973

Modigliani, P. (2022, February). *Pentagon: Buy commercial already.* MITRE. https://www.mitre.org/news-insights/publication/pentagon-buy-commercial-already

Monas, K. B., & Heard, C. G. (2024). Transforming the UAS generating force in contact: Company B, 2–13th Aviation Regiment. *Aviation Digest*, *12*(4), 15–18.

Morrison, J. (2021). Intellectual property & national security. *The University of Cincinnati Intellectual Property and Computer Law Journal*, *6*(1), 1–29.

National Defense Authorization Act for Fiscal Year 2024, Pub. L. No. 118–31, 137 Stat. 136 (2023). https://www.congress.gov/bill/118th-congress/house-bill/2670/text

Neenan, A. G. (2024). *Defense primer: Department of Defense contractors* (CRS Report No. IF 10600). Congressional Research Service. https://www.congress.gov/crs-product/IF10600

Neenan, A. G., & Nicastro, L. A. (2023). *The Defense Production Act of 1950: History, authorities, and considerations for Congress* (CRS Report No. R43767). Congressional Research Service. https://www.congress.gov/crs-product/R43767

Nixon, G. (2025, February 22). *Ukraine's homegrown drones have become increasingly lethal, critical tools in war with Russia*. CBC News. https://www.cbc.ca/amp/1.7465411

Oakley, S. S. (2024). *DoD acquisition reform: Military departments should take steps to facilitate speed and innovation* (GAO-25-107003). Government Accountability Office. https://www.gao.gov/products/gao-25-107003

Office of the Secretary of Defense. (2020, December). *DoD cost estimating guide*. Department of Defense. https://www.govinfo.gov/content/pkg/GOVPUB-D-PURL-gpo156710/pdf/GOVPUB-D-PURL-gpo156710.pdf

Office of the Secretary of Defense. (2017, September 8). *Impacts of a continuing resolution authority in fiscal year 2018*. Department of Defense. https://federalnewsnetwork.com/wp-content/uploads/2017/09/Mattis-Letter-to-McCain-on-CR-9-8-17.pdf

Office of the Secretary of Defense. (2025). *Unleashing U.S. military drone dominance* [Memorandum]. Department of Defense.

Office of the Under Secretary of Defense for Acquisition and Sustainment. (2022). *Operation of the adaptive acquisition framework* (DoDI 5000.02). Department of Defense. https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/500002p.PDF

Office of the Under Secretary of Defense for Acquisition and Sustainment. (2023, July). *Other transactions guide* (Version 2.0). Department of Defense. https://www.acq.osd.mil/asda/dpc/cp/policy/docs/guidebook/TAB%20A1%20-%20DoD%20OT%20Guide%20JUL%202023_final.pdf

Office of the Undersecretary of Defense for Acquisition and Sustainment. (2025). *National Defense Industrial Strategy*. https://www.businessdefense.gov/index.html

Office of the Under Secretary of Defense (Comptroller)/Chief Financial Officer. (2024, March). *Program acquisition cost by weapon system*. Department of Defense. https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2025/FY2025_Weapons.pdf

Paulet, A. (2023, July 18). *Unmanned Aerial Vehicle (UAV) Market Growth Dynamic Report 2023–2030*. Research Gate. https://www.researchgate.net/publication/372439486

Perdue, W. M., & Teissonniere-Almodovar, T. I. (2024). *Adaptive acquisition framework: Effectiveness of the middle tier of acquisition pathway* [Master's thesis, Naval Postgraduate School]. NPS Archive: Calhoun. https://hdl.handle.net/10945/73202

Perley, C. (2025, February 10). *How can we measure if defense innovation works?* War on the Rocks. https://warontherocks.com/2025/02/how-can-we-measure-if-defense-innovation-works/

Phillips, D., Duplessis, B. T., Stoll, H., Kelly, T. K., & Parker, T. (2025). *Small uncrewed aircraft systems (SUAS) in divisional brigades: Small UAS and counter-UAS training* (Report No. RR-A2642-5). RAND. https://doi.org/10.7249/RRA2642-5

Postma, J. (2021). Drones over Nagorno-Karabakh. *Atlantisch Perspectief*, *45*(2), 15–20. https://www.jstor.org/stable/48638213

Potter, E. (2013, December 8). *160th Special Operations Aviation E Company Soldiers equipped with MQ-1C Gray Eagle Unmanned Aircraft System; soon to be based at Fort Campbell*. Clarksville Online. https://www.clarksvilleonline.com/2013/12/08/160th-special-operations-aviation-e-company-soldiers-equipped-mq-1c-gray-eagle- unmanned-aircraft-system-soon-based-fort-campbell/

Pusztaszeri, A. (2024). *Why China's UAV supply chain restrictions weaken Ukraine's negotiating power*. Center for Strategic & International Studies. https://www.csis.org/analysis/why-chinas-uav-supply-chain-restrictions-weaken-ukraines-negotiating-power

Putney, A., & Ellinger, E. (2025). *Small uncrewed aircraft systems (SUAS) in divisional brigades: Survey of SUAS* (Report No. RR-A2642-2). RAND. https://doi.org/10.7249/RRA2642-2

Red Cat. (n.d.). *Red Cat.* Retrieved October 21, 2025, from https://redcat.red/

Reynolds, J. A. (2024). *Cost-effectiveness analysis of rare earth element supply chain policy* [Master's thesis, Naval Postgraduate School]. NPS Archive: Calhoun. https://hdl.handle.net/10945/73514

Robbins, M. (2023, September 20). *China's anticompetitive practices in the small drone market*. Association for Uncrewed Vehicle Systems International. https://downloads.regulations.gov/USTR-2023-0008-0013/attachment_1.pdf

Romaniuk, S. N., & Webb, S. T. (2015). Extraordinary measures: Drone warfare, securitization, and the "War on Terror." *Slovak Journal of Political Sciences*, *15*(3), 221–245. https://doi.org/10.1515/sjps-2015-0012

Roque, A. (2024, October 24). U.S. *Army takes on most effective counter-drone system yet: Red tape*. Breaking Defense. https://breakingdefense.com/2024/10/us-army-takes-on-most-effective-counter-drone-system-yet-red-tape/

Roque, A. (2025, March 7). *Army to Soldiers: Get small drones back in the air, don't worry about the red tape (as much)*. Breaking Defense. https://breakingdefense.com/2025/03/army-to-soldiers-get-small-drones-back-in-the-air-dont-worry-about-the-red-tape-as-much/

Russell, W. (2024, September 12). Critical materials are in high demand. What is DoD doing to secure the supply chain and stockpile these resources? *WatchBlog: Following the Federal Dollar*. https://www.gao.gov/blog/critical-materials-are-high-demand.-what-dod-doing-secure-supply-chain-and-stockpile-these-resources

Saunders, B. (2024). *Lift off: Scaling small unmanned aircraft systems and autonomous capabilities for the U.S. Department of Defense*. Belfer Center for Science and International Affairs, Harvard Kennedy School. https://www.belfercenter.org/publication/lift-scaling-small-unmanned-aircraft-systems-and-autonomous-capabilities-us-department

Sauser, M. M. K. (2025). Unmanned aircraft and the revolution in operational warfare: Preparing the U.S. Army for the age of unmanned systems. *Military Review*, *105*(4), 54–62.

Sayler, K. M. (2024). *DoD replicator initiative: Background and issues for Congress* (CRS Report No. IF12611). Congressional Research Service. https://www.congress.gov/crs-product/IF12611

Office of the Secretary of Defense. (2025, January 2). *Investment strategy for the Office of Strategic Capital*. Department of Defense.

Section 809 Panel. (2019). *Report of the Advisory Panel on Streamlining and Codifying Acquisition Regulations: Volume 3 of 3-part 1*. https://dair.nps.edu/handle/123456789/3579

Servicemember Quality of Life Improvement and National Defense Authorization Act for Fiscal Year 2025, Pub. L. 118–159, 138 Stat. 1773 (2024). https://www.congress.gov/bill/118th-congress/house-bill/5009

Shah, R. M., & Kirchhoff, C. (2024). *Unit X: How the Pentagon and Silicon Valley are transforming the future of war* (1st ed.). Scribner.

Skove, S. (2024, August 7). *Wartime need for drones would outstrip U.S. production. There's a way to fix that*. Defense One. https://www.defenseone.com/policy/2024/08/wartime-need-drones-would-outstrip-us-production-theres-way-fix/398642/

Skovlund, J. (2024, January 19). *How many soldiers are in a platoon? The U.S. Army by the numbers*. Task & Purpose. https://taskandpurpose.com/military-life/us-army-numbers/

Skydio. (2023, May 8). *Skydio Launches X2D Multiband Drone*. https://www.skydio.com/blog/x2d-multiband-drone/

Small Unmanned Aircraft Systems, 14 C.F.R. 107 (2016). https://www.ecfr.gov/current/title-14/part-107

Somerville, H. (2025, March 12). America turns to Ukraine to build better drones. *The Wall Street Journal*. https://www.wsj.com/world/ukraine-drones-american-defense-tech-startups-25f1fe92

Stamp, J. (2013, February 12). Unmanned drones have been around since World War I. *Smithsonian Magazine*. https://www.smithsonianmag.com/arts-culture/unmanned-drones-have-been-around-since-world-war-i-16055939/

Sullivan, M. (2017). *DoD is taking steps to address challenges faced by certain companies* (GAO-17-644). Government Accountability Office. https://www.gao.gov/products/gao-17-644

System for Award Management. (2025). *Top 100 contractors report for fiscal year 2023*. https://sam.gov/reports/awards/static;Report=

Tang, D. (2024, December 23). *Many Americans have come to rely on Chinese-made drones. Now lawmakers want to ban them*. The Associated Press. https://www.ap.org/news-highlights/spotlights/2024/many-americans-have-come-to-rely-on-chinese-made-drones-now-lawmakers-want-to-ban-them/

Ukrainska Pravda. (2024, February 5). *Ukraine's drone production capabilities have grown 100-fold since start of invasion*. https://www.pravda.com.ua/eng/news/2024/02/5/7440403/

U.S. Department of Defense. (2019). *DoD Instruction 5000.80: Operation of the Middle Tier of Acquisition (MTA) Programs* (No. DoDI 5000.80). Department of Defense. https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/500080p.PDF

U.S. Department of Defense. (2019). *Operation of the Middle Tier of Acquisition (MTA) programs* (DoDI 5000.80). https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/500080p.PDF

U.S. Department of Energy. (n.d.). *What Are critical materials and critical minerals?* Retrieved May 19, 2025, from https://www.energy.gov/cmm/what-are-critical-materials-and-critical-minerals

U.S. Geological Survey. (2025). *Mineral commodity summaries 2025*. https://doi.org/10.3133/mcs2025

von Clausewitz, C. (2008). *On war* (M. E. Howard & P. Paret, Eds.). Princeton University Press. https://doi.org/10.1515/9781400837403

Wakabayashi, D., & Shane, S. (2018, June 1). Google will not renew Pentagon contract that upset employees. *The New York Times*. https://www.nytimes.com/2018/06/01/technology/google-pentagon-project-maven.html

Watling, J., & Reynolds, N. (2025). *Tactical developments during the third year of the Russo–Ukrainian War*. Royal United Services Institute. https://static.rusi.org/tactical-developments-third-year-russo-ukrainian-war-february-2205.pdf

Weaver, M. (2019, May 23). *Section 232 and 301 trade actions in 2018*. U.S. International Trade Commission. https://www.usitc.gov/research_and_analysis/tradeshifts/2018/section_232_and_301_trade_actions_in_2018.pdf

Wong, J. P., Younossi, O., Lacoste, C. K., Anton, P. S., Vick, A. J. … Whitmore, T. C. (2022). *Improving defense acquisition: Insights from three decades of RAND research* (Report No. RR-A1670-1). RAND. https://doi.org/10.7249/RRA1670-1

Woods, W. T. (2018). *DoD should develop a strategy for assessing contract award time frames* (GAO-18-467). Government Accountability Office. https://www.gao.gov/products/gao-18-467

Young, S., & Gilmore, J. M. (2019). *Operating under a continuing resolution: A limited assessment of effects on defense procurement contract awards* (Report No. RR-2263-OSD). RAND. https://doi.org/10.7249/RR2263

Zafra, M., Hunder, M., Rao, A., & Kiyada, S. (2024, March 26). *How drone combat in Ukraine is changing warfare*. Reuters. https://www.reuters.com/graphics/UKRAINE-CRISIS/DRONES/dwpkeyjwkpm/

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