Strategy Research Project

Joint Interoperability - The First Casualty of the Drone Takeover

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Over the past three decades, the Department of Defense (DOD) has developed and fielded a fleet of unmanned drones without a Joint coordinated strategy. Contrary to service interoperability encouraged by the Goldwater-Nichols Act, the military deferred unifying drone programs and development in 1988. This has resulted in years of wasteful duplication and a drone fleet in which interoperability is an afterthought. Conflicts in Iraq and Afghanistan created significant demand for drone capabilities, and nearly unconstrained military budgets fueled service-specific drone development. Drones are the largest growth market in the aerospace industry, and the DOD is predicted to spend $93 billion on them in the next decade. Attempting to coordinate service-specific drone development, the DOD has published many unmanned vehicle roadmaps and established several advisory task forces. However, without a truly Joint strategy to consolidate efforts and resources, as well as an organization with the authority to enforce it, little change has occurred. The wasted effort and resources of service-specific drone capability development weakens the U.S. military and is not sustainable in a fiscally constrained environment.

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Joint Interoperability - The First Casualty of the Drone Takeover

> …without resource constraints, strategy would be unnecessary. Limited resources thus create the need for strategy, and as resources become more constrained, strategy becomes more important.
>
> —Todd Harrison, Defense Strategist[1]

Throughout history, the development of weapons has been driven by the goal of striking the enemy while remaining at a safe distance. Unmanned drones are thus a predictable step in the evolution of warfare. Without a comprehensive joint strategy, the U.S. development of drones has impaired joint interoperability. Fueled by nearly unlimited budgets, our armed forces have acquired a large fleet of drones during the conflicts in Iraq and Afghanistan. Combatant commanders on the battlefield requested urgent and haphazard unmanned capabilities, and the industrial complex quickly complied. The resulting drone fleet was developed and fielded without a coordinated joint strategy. Additionally, pressure from individual services and industry to maintain separate service-specific lines of effort, resulting in costly duplication, has hindered efforts to craft a joint strategy. As the conflicts in Iraq and Afghanistan are drawing down, the Department of Defense (DOD) is now in a position to look back at the last three decades to consider lessons to be learned, to assess the current service-specific policies, and to develop a viable Joint Unmanned Aerial Systems (UAS) strategy. A joint strategy, in accord with the Goldwater-Nichols Act, will enable our military to maintain and enhance its unmanned capabilities during the emerging era of fiscal austerity.

The Goldwater-Nichols Reorganization Act of 1986 realigned the Defense Department under increasing organizational and fiscal pressure to improve its management and administration. Several key provisions of the Act increased attention to the formulation of strategy and directed joint interoperability to enhance the

effectiveness of military operations. The Act also directed more efficient uses of resources, improved acquisition processes, and focused on providing capabilities to the combatant commanders through a joint system.[2]

The Defense Department defines unmanned aerial systems as powered aircraft that do not carry a human operator; they are also referred to as drones and unmanned aerial vehicles (UAVs). The vehicles can be land-, air-, or ship-launched; they use aerodynamic forces to provide lift; they can be autonomously or remotely piloted; they may be expendable or recoverable; and they can carry lethal or non-lethal payloads. The entire system consists of the aerial vehicle, a flight control station, information retrieval or processing stations, and sometimes platforms required for launch and recovery. In addition, the system requires adequate intra- or inter-theatre communications capabilities to enable operators to maintain control of some vehicles and to enable the drones to transmit information obtained by onboard sensors to a commander and other users.[3]

Because drones arrived so swiftly on the battlefield, their acquisition has not been supported by doctrine or well-crafted strategy. Though development of unmanned systems continues across all domains, the development of ground and maritime systems has not been nearly as rapid as the development of aerial systems. Many issues discussed and conclusions in this paper may apply to future coordination in developing capability within those domains – specifically to maximizing coordination between the Army and Marines for unmanned ground systems, as well as the Navy and Coast Guard for unmanned maritime systems.

Because the evolution of unmanned systems has outpaced the development and implementation of strategic concepts, short-term, service-specific strategies have been designed to exploit drone capabilities. The urgent, need-based procurement during the Iraq and Afghanistan conflicts shortened timelines. In fact, some systems were sent directly from the factory floors to the battlefield to meet immediate operational requirements. Individual services often designed and procured nearly identical platforms with similar capabilities. Supporting service-specific procurement were conflict-fueled large defense budgets augmented by Overseas Contingency Operations (OCO) funds. The combination of conflict-driven demand and seemingly unlimited funding fueled the explosion of UAS onto the battlefield. As early as 2006, Representative Weldon (R-PA) lamented at a Congressional hearing, "There are so many unmanned aerial systems in various development programs in each of the services and various agencies within the services that I am confident in saying that all of us here could not collectively name them all. I don't think that this is the way that we should go about our business."[4] The rapid emergence of UAS into all services has outpaced strategic planning. The Defense Department is still trying to recover.

Wasteful Spending Through Uncoordinated Duplication

Responding to fiscal pressures, the Goldwater-Nichols Act was designed to improve interoperability and efficient use of defense resources by reducing wasteful spending, especially for redundant equipment. As of July 2013, nearly 11,000 drones were included in the U.S. military inventory, and that number was expected to increase in the near future.[5] Nearly all of these unmanned systems were designed to perform intelligence, surveillance, and reconnaissance missions. While there are many differences among the individual vehicles' they all have similar capabilities. In the Fiscal

Year (FY) 2016 budget, the Pentagon is expected to spend over $7 billion on the

research, development, and procurement of various unmanned systems; that

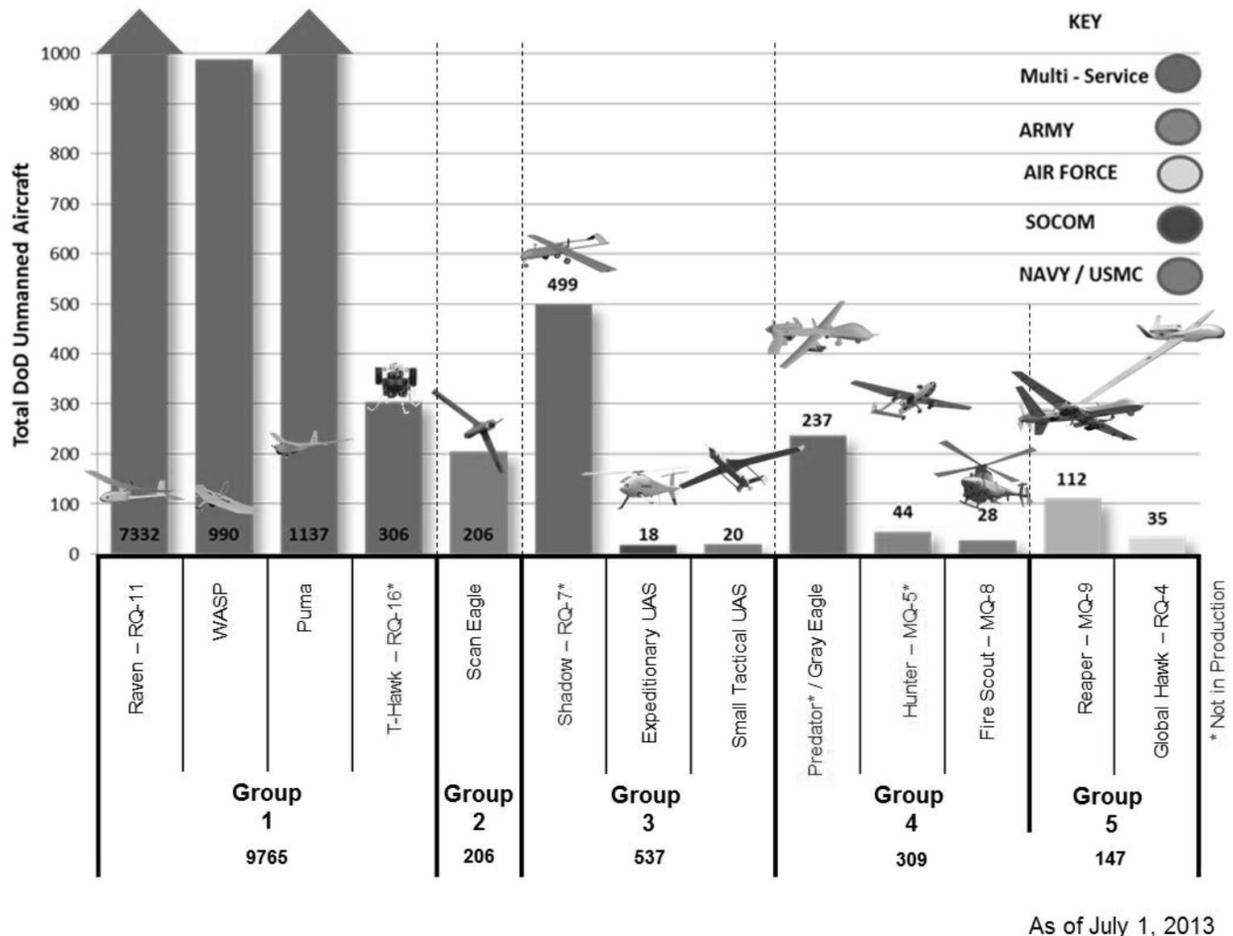expenditure is expected to increase to over $12 billion in FY 2025.[6]

Figure 1. Inventory of DOD Unmanned Aerial Systems[7]

In the FY 2016 budget, service-specific unmanned system requests reveal areas

of duplication. The Air Force is buying 29 General Atomics Reaper drones for $821

million, while also dedicating $82.5 million of OCO funds to modify these new aircraft –

specifically $69 million to increase the drones' range.[8] Likewise, the Army is spending

$383 million for 17 General Atomics Gray Eagle drones, two of which are being

purchased with OCO funds.[9] General Atomics builds both unmanned systems for

identical purposes: armed intelligence, surveillance, and reconnaissance missions. They have nearly identical endurance capabilities, and both are armed with four Hellfire missiles. However, the Air Force Reapers can carry additional weapons.[10] These similar drones have different logistical requirements; they are powered by different engines; they are supported by different ground stations; and they carry different sensor payloads. However, Raytheon builds the sensor and targeting payloads for both drones, which are similar in capability, though acquired through separate programs. The services have generally been reluctant to adopt common mission management systems or other interoperability approaches with similar unmanned systems. Instead, each service has tended to initiate its own development programs, specifically tailored to its own requirements, rather than accepting an existing capability from another service.[11]

Additionally, the Navy is purchasing three Triton unmanned vehicles for nearly $549 million, which is built on the Air Force's Global Hawk platform.[12] Although Triton was developed from the Global Hawk and although Northrop Grumman builds both, the Navy and Air Force invested in different levels of research and development for the original platform, sometimes addressing the same issues. This Fiscal Year, the Air Force is delaying purchase of additional Global Hawks, opting instead to invest over $208 million in additional research and development to resolve airframe reliability issues, one of which is development and testing of an ice protection system.[13] Yet, the Navy has already invested in developing an anti/de-icing capability for the Triton vehicle.[14] Congress has justifiably questioned Defense Department's wasteful duplication in acquiring different drones with similar performance capabilities. Further, the Triton/Global Hawk example shows that, without a joint unified strategy, the armed

services will wastefully duplicate acquisitions even when they use the same platform. Eliminating this unnecessary duplication through a comprehensive joint strategy would generate savings not only in defense resources but also in research and development efforts.

A comprehensive joint strategy would also facilitate consolidation of drone inventories, which would save much more than removing wasteful duplication in research, development, and procurement. Consolidation would generate cost savings efforts in training programs; it would facilitate all services' reliance on consolidated joint training facilities. Additionally, training and qualifying the personnel from any service to operate a consolidated joint inventory would provide flexible joint service manning of the fleet. Consolidated inventories would also produce significant financial savings in maintenance and logistics lines. Utilizing repair parts across the services would increase efficiency and optimize operational readiness.

Table 1. Selected Unmanned Aerial System Comparison[15]

	Service	Wing Span (ft)	Length (ft)	Altitude (ft)	Endurance (hrs)	Weapons	Engine
Textron Shadow	Army Marine	20.4	11.3	15,000	6-9		Wankel UAV Engine 741
Boeing Blackjack	Navy Marine	16	8.2	19,500	16		EFI Piston Engine
Northrop Grumman Hunter	Army	34.25	23	18,000	21		NWUAV heavy-fuel turboprop
General Atomics Predator	Air Force	48.7	27	25,000	35	3 Hellfire missiles	Modified Rotax 914 turboprop
General Atomics Grey Eagle	Army	56	28	25,000	27	4 Hellfire missiles	Thielert heavy-fuel turboprop
General Atomics Reaper	Air Force	66	36	50,000	27	4 Hellfire missiles or laser-guided bombs / JDAM	Honeywell TPE331-10 turboprop
Northrop Grumman Triton	Navy	130.9	47.6	56,500	24	3,200 lb payload (internal) 2,400 lb payload (external)	Rolls Royce AE3007H turbofan
Northrop Grumman Global Hawk	Air Force	130.9	47.6	60,000	32+	3,000 lb payload	Rolls Royce AE3007H turbofan

The question must be asked: how has the U.S. military operating in a Joint environment under the Goldwater-Nichols Act allowed an inter-service rift to develop around the common unmanned system capability. The answer reveals the key issues that need to be resolved before the U.S. military can convert the current array of unmanned systems into a synchronized interoperable asset. To improve effectiveness, Goldwater-Nichols requires the Joint Chief of Staff to report to the Secretary of Defense evaluations of unnecessary duplications of effort among the armed services.[16] As previously discussed, one contributing factor was that combatant commanders' demands for unmanned system capabilities far exceeded the supply. Additionally, the abundant defense funds during decades of conflict enabled, perhaps encouraged, individual services to procure service-specific drones. The ensuing rapid evolution of capabilities outpaced the development and implementation of strategic concepts. Without a synchronized strategy, the U.S. military was unprepared for this great demand. Until a strategic unmanned systems plan is developed, current inter-service acquisitions will continue.

Costliness of Deferring Joint Opportunities

In 1986, the Goldwater-Nichols Act implemented improvements in the efficient uses of defense resources by focusing on providing capabilities to the combatant commanders through joint acquisition processes. Also during the 1986 budget proceedings, the Senate Appropriations Committee noted that the military services had launched too many drone programs, so it encouraged the Defense Department to strive to identify commonalities in its programs. However, no progress towards commonality occurred over the next two years. Therefore, in 1988 the House and Senate Armed Services Committee and the Senate Appropriations Committee again called into

question the effectiveness of each service maintaining its own unmanned system program. This concern was so great that Congress transferred the funds from each service's drone program into a joint program managed by the Secretary of Defense. The House Armed Services Committee requested that DOD report how it planned to minimize the waste within unmanned aerial vehicle development. The House Armed Services Committee was concerned that each service appeared to be proceeding on its own with development and procurement of systems with similar mission and payload requirements.[17]

In response to these congressional concerns, the Defense Department published the first of what would become an annual Master Plan for drone development. Significantly, it was the first official Defense Department policy statement regarding drone development. However, the Defense Department did not propose funding any joint drone programs for at least two years; instead, it requested that the funds continue to go to service-specific programs.[18] Its justification was that individual service development would eventually provide the foundation for a joint program.[19] The UAV Master Plan then included sections written by each service, reflecting their disconnected needs and polices. However, under Goldwater-Nichols joint implementation of new technology also allowed for joint development of supporting doctrine. Then DOD's Joint Doctrine would later declare that, "A key to successful interoperability is to ensure that planning processes are joint from their inception. The development and fielding process must provide material that is fully compatible with and complementary to systems of all services."[20]

The General Accounting Office (GAO) assessment of the Joint UAV Master Plan was critical of the decision to delay elimination of individual service unmanned vehicle programs and not to immediately fund joint programs. They also reported that the UAV Master Plan did not address issues of payload commonality. They recognized that "since a large portion of the cost of an unmanned aerial system was a result of the payload, more attention needs to be given to this aspect of Defense Department programs."[21] The payload issue has remained unresolved since the GAO's first assessment in 1988. As recently as 2013, a DOD assessment concluded that upgrading existing proprietary components may be both expensive and logistically unfeasible because whole platforms may need to be taken out of service. The service-centric development approach has resulted in a number of unfavorable characteristics that impede applications of technical progress and the adoption of new capabilities that would lead to improved interoperability.[22]

A pattern has developed over the past two decades: various organizations have been created within the Defense Department to attempt to unify the service-specific unmanned aerial programs. However, they have made little progress because there is no comprehensive joint strategy and authority to enforce that strategy. Beginning in 2001, a Joint UAV Planning Task Force was established in the Office of the Secretary of Defense; it published the UAV Roadmap the following year. The UAV Roadmap described current programs and potential missions along with guidance on emerging technologies. The GAO then found that neither the Roadmap nor other key documents represented a comprehensive strategic plan to ensure that services and agencies would develop complementary systems, perform all required missions, and avoid duplication.[23]

The GAO recognized that the Defense Department risked fielding a poorly integrated unmanned system force structure. In turn, this would increase development, procurement, and logistics costs. Further, it would delay interoperability efforts. Additionally, since the Joint UAV Planning Task Force served only in an advisory capacity, it had no authority to enforce the direction of programs.[24]

In 2003, Congress directed the formation of joint program offices to ensure commonality among the services' drone programs. Congress expressed concern that the Defense Department's "growing enthusiasm may well lead to a situation in which there is no clear path toward the future of unmanned aerial systems."[25] Congress noted that the 2003 Roadmap lacked the key components of an actual joint strategy that could significantly influence service-specific programs. So Congress directed the Defense Department to submit another Roadmap. However, Roadmaps have been submitted for decades – without a favorable joint outcome.

In 2004, the GAO's concern over the Defense Department's management of their unmanned aerial vehicle programs led to two recommendations. First, the Secretary of Defense should establish a strategic plan by either modifying the UAV Roadmap or developing another document to guide unmanned system development and fielding. Second, the UAV Planning Task Force or another organization should oversee implementation of the strategic plan. It should have sufficient authority to effectively enforce the plan's direction and promote joint interoperability to ensure efficient use of funds.[26]

Although the Roadmap contains some elements of a strategic plan, the DOD still lacks a comprehensive plan to guide the development and fielding of unmanned aerial

systems that complement each other, perform the needed missions, and avoid duplication.[27] While the Defense Department has repeatedly acknowledged the need to improve interoperability of unmanned aerial systems, little progress has been made to achieve a genuine unity of effort. Until the DOD and the services take steps to ensure that every opportunity for joint efforts and interoperable unmanned system payloads are developed and enforced, these problems are likely to continue. They may become more widespread as the Defense Department continues to deploy these systems to meet commanders' demands for them.[28]

In 2007, the Secretary of Defense created the UAS Task Force to pursue the goals of coordinating unmanned system requirements between the services, of promoting the development and fielding of interoperable systems, and of shaping unmanned acquisition programs to prioritize joint solutions.[29] However, this organization again had no authority to terminate or consolidate redundant programs. Without a strategic plan and an organization with authority providing oversight, service officials indicated that their service-specific planning documents were developed to meet their own needs and operational concepts without considering those of other services.[30] Congressman Abercrombie (D-HI) complained in a Congressional hearing later that year, "There is concern as to whether an organization exists within the DOD with sufficient information across the spectrum of [unmanned aerial system] programs and with the authority to properly direct resources and avoid wasteful, uncoordinated expenditure of resources."[31]

The Joint Requirements Oversight Council (JROC), established in compliance with the Goldwater-Nichols Act in 1986, had developed an analytical process to guide

the development of capabilities from a joint perspective. However, they review only major acquisition programs, and the majority of unmanned system programs have not met the criteria for JROC review. In 2009, the House Armed Service Committee established a panel on defense acquisition reform because the current system was not rigorous enough to protect taxpayers, not responsive enough to meet defense needs, and not disciplined enough to acquire weapon systems for future wars. The panel received testimony indicating the Joint Staff lacked the analytical expertise needed to ensure that the proposed requirements would be rigorously reviewed. The GAO acknowledged that the process should result in measurable progress in allocating resources in order to eliminate redundancies, gain efficiencies, and achieve a balanced mix of executable programs. The services use their unmanned systems to fight together on the battlefields as a joint force; however, they do not identify their warfighting needs or investments in weapons systems in the same integrated manner.[32]

In 2011, officials from the Defense Department's operational commands also expressed concern that the acquisition process focused more on long-term service-centric capability gaps than on more immediate and largely joint gaps. The commanders questioned the JROC's process, which is influential, but advisory. They admitted that acquisition and budget processes remain driven by the individual services' priorities.[33] The GAO reported that the JROC's fragmented decision-making process did not always consider trade-offs among cost, schedule, and performance objectives; did not prioritize requirements; did not consider redundancies across proposed programs; and did not prioritize and analyze capability gaps in a consistent manner.[34]

Some interoperability has been achieved, such as the Navy and Air Force joint program for the Unmanned Combat Aerial Vehicle. But no significant progress has been made in achieving better interoperability among service unmanned vehicles and payloads. Considering the fact that costly payloads and sensors have been an identified concern since before 1988, the seriousness of the Defense Department's attempts to build interoperability can be questioned. As more and more billions are being allocated for a growing number of unmanned system programs, the DOD still needs to create an organization with the authority to achieve cost-effective development of drones.

The most recent DOD Unmanned Systems Integrated Roadmap declared, "Given today's highly constrained fiscal environment, it is imperative that Defense Department look at areas where efficiencies can be gained to create unmanned systems that are both effective and affordable. The Defense Department will look at capitalizing on commonality, standardization, and joint acquisition strategies, among other strategies."[35] However, the DOD Roadmap has had a poor track record; it has not impacted the services' varied agendas. Additionally, this has been an identified issue for nearly three decades. Only a few sentences of the Roadmap acknowledge the problem and no resolution is in sight.

<center>Politicizing Congressional Support for Drones</center>

Drone systems are politically engineered. Multiple components are subcontracted and built in many different states and political districts. Politicians voting against an unmanned system program could also be voting against jobs in their districts, which would mean political suicide. If Congressional members had repeated the 1988 action of halting funding due to concern over service-specific drone programs, some employment in their districts, fueled by the large base-line Defense Department

<center>13</center>

budget and the OCO funds, would have been lost. Politicians would be criticized if they appeared to be reducing the largest growth sector of the decade, especially during a recession.

Additionally, as U.S. troops engaged in conflict in Iraq and Afghanistan, Congress approved their requests for additional support in the form of rapidly procured unmanned aerial systems. The large base-line Defense Department budget augmented by the OCO funds included significant spending for unmanned systems. Had Congress questioned the effectiveness of each service maintaining their own drone program, as in 1988, and halted each service's unmanned system program funds, this would also have been political suicide. Any politician questioning the service-specific requests for drones or withholding Defense Department requested funds would be judged as not supporting the troops engaged in conflict.

Drones in Iraq and Afghanistan

The Kuwait invasion occurred only two years after the 1988 Congressional unmanned system fund intervention. Since that invasion in 1990, the United States has been engaged nearly continuously in conflict in Iraq, as well as periods of conflict in Afghanistan. In the beginning of those conflicts, all services operated unmanned aerial systems, though the Air Force had the most mature programs. When these conflicts commenced, demand for the capabilities of these systems far exceeded the available assets. The missions that these systems were called to perform quickly evolved. They expanded from intelligence, surveillance, and reconnaissance to include strike missions, close air support, as well as many others. These additional capabilities increased the already high demand for drones. But the Air Force programs were unable to meet the growing demand, so the other services sought to procure their own unmanned systems.

The urgent needs in theatre and the ensuing rapid acquisition approach in recent years have produced the current fleet of unmanned systems that generally do not operate with each other or with external systems.[36] Many other issues have been identified during this significant rise in unmanned systems, not only by the individual services but also by the GOA. However, instead of resolving these issues early through a comprehensive joint strategy, it has been simply easier for each service to develop and procure its own organic unmanned systems.

Demand for unmanned capabilities became essentially unconstrained, since drones directly supported the troops. Throughout the conflicts, unmanned aerial system procurement exploded. Procurements were funded by the large Defense Department budgets and by OCO funds. The Defense Department acknowledges that it did not foresee the rapid technological development of unmanned aircraft, of their sensor or communication payloads, and of their ground stations. So it has expedited rapid delivery of unmanned aircraft and payloads to deployed forces to meet forces' demand for them. Unfortunately, the Defense Department has not always adopted standards that might have prevented or mitigated some of the interoperability problems.[37] As technology and capabilities have emerged, the availability of OCO funding has enabled commanders to bring the latest technologies into the theatre without lengthy procurement processes. So instead of traditional competitions in which the systems may be tested against each other in advance of operations, new unmanned vehicles have been deployed directly into the field, where U.S. forces can experiment with and exploit their capabilities.[38]

As the evolution of unmanned systems has outpaced the development and implementation of appropriate strategic concepts, short-term strategies have been

designed to exploit the capabilities of unmanned systems. In 2001 Secretary of Defense Donald Rumsfeld boasted that, "We put aside the threat-based model of the past and adopted a capabilities-based approach; one that focuses less on who might threaten us or where, and more on how we might be threatened and what capabilities we will need to deter and defend against those threats."[39] Without a joint strategic unmanned system plan to guide the development of capabilities and force structure, commanders have been given drones with capabilities around which they develop their operational and tactical strategies. This asset-based capability strategy is not aligned with the Defense Department's requirement-based capability strategy. The capabilities based strategic approach is built on the capabilities that we need, not on the capabilities that we have. Without a strategic plan to guide unmanned system investment decisions, the Defense Department will not be in a position to validate requirements, make sound programmatic decisions, or establish funding priorities.[40]

In the last decade, the capabilities provided by unmanned systems has been a significant driver of the strategies in both Iraq and Afghanistan. The GAO recognized that the DOD Roadmap identifies service-specific guidance and priority goals for drone development. However, there is no comprehensive strategic plan to ensure that the services develop systems that complement each other, perform all required missions, and avoid redundancy. The GAO also recognized that in addition to a strategy, the Defense Department must have an oversight body with sufficient authority to enforce program direction.[41] The acquisition community has not been capable of ensuring the services are using resources efficiently and are best aligned for joint operations. This raises additional questions about the ability of the current acquisition processes to meet

the Defense Department's interoperability requirements in this rapidly changing technological environment with fiscal constraints.

Without a comprehensive strategic plan, the Defense Department has increased the risk of fielding a poorly integrated unmanned force structure, which could increase cost and risk future interoperability issues.[42] A unified strategy would guide the development and fielding of drones that complement each other, perform the range of capabilities required, and avoid costly duplication. The interoperability issues that the Defense Department is now trying to address affirm that the individual services have not fully embraced the Goldwater-Nichols Act. The Iraq and Afghanistan conflicts should have brought the services together by encouraging joint interoperability. Yet the services have gone in separate directions. Individual services have defaulted to incorporating unmanned systems into their base service capabilities, citing a need for the organic capability.

For example, the Army's Future Combat System (FCS) was designed during this period of high demand for organic unmanned system capability. The FCS program initially included four classes of organic unmanned aerial vehicles, each designed according to Army-specific capability requirements. Each class was determined by size and provided information to different levels of the command structure. Class I drones were small and provided information to the individual soldier, while Class II drones were slightly larger with twice the range; they provided information to the infantry commander. Class III drones were to replace Shadow drones; they had increased range and better sensors to support battalion commanders. Class IV drones were to be nearly identical to the Air Force's Predator vehicles; two Class IV versions were designed to support

brigade commanders.[43] In this way, the Army's FCS organic capability avoided the requirement to rely upon another service's capability and thus created no need for joint interoperability. The Army was not the only service that designed programs with this philosophy in mind; each service was procuring unmanned systems so that they would have no need to rely on joint capabilities. They wanted enough to take care of themselves.

<div align="center">Influence by the Military-Industrial Complex</div>

The large amount of defense dollars available for service-specific unmanned system during these past three decades of conflict has supported this service-centric acquisition of drones. However, in the current highly constrained fiscal environment, the Defense Department must identify areas where efficiencies can be gained to create unmanned systems that are both effective and affordable.[44] President Eisenhower warned in his Farewell Address, "In the councils of government, we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military industrial complex. The potential for the disastrous rise of misplaced power exists and will persist."[45]

The Teal Group stated that the unmanned aerial system market would continue as "the most dynamic growth sector of the world aerospace industry this decade." Industry analysts estimate that U.S. production will continue to soar from $7.2 billion annually in FY 2016 to $12 billion in FY 2025. The U.S. is expected to spend over $93 billion on drones during the next decade.[46] The Association for Unmanned Vehicle Systems International, an advocacy organization that promotes unmanned and robotic systems, had more than 500 corporate members in 2011. A significant number of U.S. companies had a stake in unmanned aerial system manufacturing activities. The military

industrial complex has enjoyed a lucrative period of supplying the individual military services with often nearly identical systems with similar capabilities.

General Atomics entered the unmanned system market by producing the Predator drone for the Defense Department and other agencies. First used for reconnaissance, these systems eventually deployed with Hellfire missiles to execute strike and close-air support missions. In 2010 they were awarded a $195 million to build drones for the Army. Then only a few months later, they were awarded a $148.2 million to provide similar drones to the Air Force. General Atomics is not the only company benefitting from the lack of joint coordination among the services. AeroVironment is building tactical drones for the Army and Air Force. As both services are seeking small drones for surveillance, AeroVironment has produced several small aerial vehicles with similar capabilities for them separately. In September 2011 they were awarded multiple contracts totaling over $30 million for backpack-sized drones for both the Army and Air Force.[47]

Under the Goldwater-Nichols Act, the Secretary of Defense is responsible for reviewing the services and capabilities supplied by every agency and activity, rather than by a military department. This is to ensure that those capabilities common to more than one department are supplied in the most effective, economical, and efficient manner to meet the requirements for combat readiness of the armed forces.[48] Adding to the complexity of reviewing the unmanned system programs are the differences in the individual service's budgeting conventions. The Air Force's drone programs are identified as "Aircraft Procurement, Air Force" in their budget request paperwork. But the Army's funding requests are classified as "Other Procurement, Army", which includes a

broad range of items. Further, because many unmanned systems conduct intelligence, surveillance, and reconnaissance, some of their costs, especially those of the payloads, are also included in the Intelligence budgets, rather than Defense Department budgets.[49] Without a uniform convention to determine accurately the costs of individual drone programs, meaningful comparisons of similar unmanned systems are difficult to make. A joint strategy would create commonality among the services' procurement funding requests, facilitating proper oversight.

The military-industrial complex has increased pressures against a joint strategy to prevent acquisition of consolidated drone inventories. The large number of companies advocating unmanned systems are benefiting from the unmanned system market growth fueled by Defense Department budgets augmented by OCO funds. The duplication in drone programs resulting from each service exploring its individual unmanned system strategies benefits the military-industrial complex. The magnitude of the growing market has prompted the large military-industrial complex to enter the political arena and influence the Defense Department procurement process to maintain service-specific lines of effort.

The influence that these companies exert in the political arena comes in the form of lobbying. With such large contracts available in this growing market, every company is trying to benefit from pressuring the political arena. For example, General Atomics spent more than $29 million lobbying public officials from 1998-2014. During the same time period, Northrop-Grumman exceeded $213 million in lobbying, while Lockheed Martin exceeded $186 million. Both companies sell their military equipment, including unmanned systems, to the U.S. military. However, in 2014 alone total defense

aerospace lobbying, which includes drones, exceeded $69 million, according the Center for Responsive Politics.[50] This lobbying gives industry tremendous power and significant influence over the political arena and over decision-makers supervising the unmanned system programs, just as President Eisenhower warned.

As the unmanned system market continues to grow, lobbying by the military-industrial complex will also increase to maintain influence over the political arena. The Defense Department has little ability to counter the influence from the military-industrial complex. As huge contracts increase with the market, lobbying will continue to encourage service-specific drone development and procurement. In a fiscally constrained environment, the Defense Department must build a joint strategy, must consolidate inventories, and must embrace interoperability. But these achievements would reduce the number of contracts available to the military-industrial complex.

Recommendations

The Defense Department must develop a truly joint strategy that encourages joint interoperability from concept-inception to end-user operations. Over the past three decades, difficult issues from joint operations have arisen among the services that have contributed to the growing rift. Some issues are technical in nature, such as open/common architecture software, intra- and inter-platform payload modularity, and levels of autonomy. Other issues are non-technical, such as acquisition strategies and training/qualification requirements. To achieve service interoperability, these issues must be resolved. Without a comprehensive joint strategy the issues will remain unresolved, and the inter-service rifts will widen with time.

The Defense Department must establish a joint oversight organization with authority to implement and enforce the developed strategy. Additionally, the oversight

organization must have the authority to cancel or consolidate existing programs. More rigorous oversight will require the services to improve transparency by adopting a unified procurement process and language. The Defense Department must establish a common way to classify the unmanned system programs in budget documentation. Some are identified as aircraft programs; others are intelligence, surveillance, and reconnaissance programs; and not all programs include all components, such as ground stations and sensor payloads. Commonality of language will allow the Defense Department and Congress to understand the complete costs of capabilities for comparison and oversight.

The Defense Department must conduct an internal process review to assure that unmanned system acquisitions comply with the Goldwater-Nichols Reorganization Act. This review must be broad, expanding beyond the letter of the law and into the law's intent. This is a critical time to conduct a review; current increasing organizational and fiscal pressures are very similar to the original factors that led to the Act. The key features of Goldwater-Nichols are just as important in the current environment. The review should identify areas for increased efficiency within the department, specifically with defense resources provided through improved acquisition processes.

Conclusion

Drones are changing the character of conflict, and are blurring the lines between the services. Capabilities that unmanned systems bring to the fighting force are not uniquely Navy, Army, Marines, or Air Force. However, during the past three decades the Defense Department has treated them as such. This enormous wasted effort and resources in service-specific capability development is not sustainable in the current fiscally constrained environment. Moreover, this waste is not only financial: time and

effort expended by individual services would be greatly reduced if they were not developing systems in isolation. The lessons from unmanned aerial system development apply across the Defense Department, including the other unmanned domains where early coordination will reveal areas to increase efficiency.

The most significant lesson that the Defense Department must learn from the last three decades of drone development is that they must actively seek out and seize any opportunities for joint interoperability. There will always be circumstances that allow laws such as the Goldwater-Nichols Act to be circumvented. However, the Defense Department must not only refrain from situations designed to drive the services apart, but must truly embrace the spirit of joint interoperability. The additional effort required to create the joint service Goldwater-Nichols intended will result in a more efficient and capable warfighting force – the U.S. military.

Endnotes

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