

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

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1. REPORT DATE (DD-MM-YYYY) 13-02-2006		2. REPORT TYPE FINAL		3. DATES COVERED (From - To)	
4. TITLE AND SUBTITLE Persistent ISR from UAVs: Doctrinal Considerations for Operational Warfare				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) TODD C. KRUEGER, Maj, USAF Paper Advisor: Santiago R. Neville, CAPT, USN				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Joint Military Operations Department Naval War College 686 Cushing Road Newport, RI 02841-1207				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Distribution Statement A: Approved for public release; Distribution is unlimited.					
13. SUPPLEMENTARY NOTES A paper submitted to the faculty of the NWC in partial satisfaction of the requirements of the JMO Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC or the Department of the Navy.					
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15. SUBJECT TERMS Unmanned aerial vehicles (UAVs); persistent intelligence, surveillance, and reconnaissance (ISR); operational warfare; doctrine					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT UNCLASSIFIED	b. ABSTRACT UNCLASSIFIED	c. THIS PAGE UNCLASSIFIED			Chairman, JMO Dept
				28	19b. TELEPHONE NUMBER (include area code) 401-841-3556

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**PERSISTENT ISR FROM UAVs:
DOCTRINAL CONSIDERATIONS FOR OPERATIONAL WARFARE**

By

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A paper submitted to the faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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Abstract

Unmanned aerial vehicles (UAVs) of all varieties are saturating the battlespace, but little doctrine exists for their employment. At the operational level of war, UAVs are particularly valuable for providing persistent intelligence, surveillance and reconnaissance (ISR) – especially in the Global War on Terror (GWOT), where persistent ISR helps the commander overcome a small force-to-space ratio with time-sensitive targeting. The commander must balance the need for pre-planned collection missions with flexible coverage schemes. Tactical units are increasingly able to directly receive the data from such missions in raw format, but this must be balanced against the need for professional analysis of that data. At the operational level, significant command and control issues must be settled, such as the current trend toward overly centralized control enabled by “network-centric” continuous imagery feeds. This in turn mandates a need for tempering the desire for more information, as the intake can quickly become overwhelming. Additionally, commanders must avoid taking control of UAVs operated by tactical level units. Conversely, those tactical units should be allowed to have some degree of control over higher level UAVs, depending on the nature of the objectives they are pursuing. These issues point to the need for revisiting the doctrine guiding ISR and command/control principles.

Table of Contents

List of Acronyms	iii
Introduction	1
Thesis/Roadmap	2
Terms/Assumptions	2
Background: UAV Proliferation	3
Persistent ISR: The Principle Operational Advantage of UAVs	5
The Force-to-Space Ratio and Time-Sensitive Targeting	7
Timely Intelligence for the Warfighter	8
Centralization of Control	10
Operational vs. Tactical Platform Control	12
Conclusions	15
Recommendations	19
Notes	21
Bibliography	23

List of Acronyms

AIA	Advanced Information Architecture
AO	Area of Operations
AWST	Aviation Week and Space Technology
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
DoD	Department of Defense
GWOT	Global War On Terror
HALE	High Altitude/Long Endurance
HD/LD	High Demand/Low Density
JFACC	Joint Force Air Component Commander
JFC	Joint Force Commander
JFQ	Joint Force Quarterly
IED	Improvised Explosive Device
IMINT	Imagery Intelligence
ISR	Intelligence, Surveillance, and Reconnaissance
MALE	Medium Altitude/Long Endurance
NBC	Nuclear, Biological, and Chemical
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
QDR	Quadrennial Defense Review
TACON	Tactical Control
TST	Time-Sensitive Target
UAV	Unmanned Aerial Vehicle

INTRODUCTION

In an area of Afghanistan populated with villages, a highly sought-after terrorist leader prepares to host a meeting of his key lieutenants. U.S. intelligence sources have learned that this meeting will take place within the next twenty-four hours, and they have narrowed the location down to within a 40km x 40km map grid. The Joint Force Commander (JFC) has several strike options at his disposal, but first he needs to fix the target's location. Satellite coverage of the area is limited, so the Joint Force Air Component Commander (JFACC) has allocated a high altitude/long endurance (HALE) unmanned aerial vehicle (UAV) for conducting a persistent surveillance patrol over the area.

Sixteen hours into the mission, U.S. based imagery analysts identify the target with high confidence. They were seen entering an apartment building, which is unfortunately located very close to a valuable, historic temple. The UAV is sent back to that location to focus with higher resolution and confirm the target. To minimize the risk of collateral damage, the JFC decides to use a special forces strike team.

Meanwhile, members of the National Security Council have tabled a discussion in the White House in order to view a live imagery feed from the UAV. The Secretary of Defense tells the Chairman of the Joint Chiefs of Staff to make sure the JFC uses streaming video, as he would like to see the takedown of the target. When the Secretary sees the temple via the live feed, he decides that the mission is too risky and orders an abort, even though the JFC and his on-scene tactical commander are very confident of mission success.

Was the UAV employed correctly? Were principles of command and control violated? Although fictional, this scenario highlights the potential for both positive and negative results from using UAVs for persistent Intelligence, Surveillance, and Reconnaissance (ISR).

THESIS/ROADMAP

This paper considers the question of what UAV-specific doctrine should be written for the operational commander, regarding persistent ISR. Given the availability and utility of the current fleet of UAVs, operational doctrine should pertain mainly to persistent ISR, and the advantages and disadvantages of using UAVs in this role. While UAVs can help the commander reduce his force-to-space ratio and can provide critical time-sensitive-targeting, there are many issues that must be considered: dumping raw imagery directly to operational and tactical users; the trend toward overly centralized control of operations; the information overload experienced by operational staffs as a result of increased ISR output; and the required degree of operational control over the menagerie of battlefield UAVs. In fact, many of these issues should be addressed not with UAV doctrine, but by adherence to existing doctrine in the areas of command and control, intelligence, and information.

TERMS/ASSUMPTIONS

This paper is not a survey of UAVs and their capabilities; such information frequently changes and is widely available. Generally, platforms for tactical missions are small to medium-size, with a low ceiling and an endurance of a few hours or less. Medium altitude/long endurance (MALE) and HALE platforms typically operate at the operational level or higher. ISR UAVs are assumed to be capable of producing live still and video imagery intelligence (IMINT). Moreover, it is assumed that UAVs operate within a network-centric environment, meaning (1) they can be controlled from nearly anywhere, and (2) their ISR data can be sent nearly anywhere in near real-time. While that is currently not wholly accurate, it is a state that is rapidly being approached. Finally, the terms “surveillance” and “reconnaissance” are used per the definitions found in *Joint Publication 3-0*.¹

BACKGROUND: UAV PROLIFERATION

The fiscal 2007 Pentagon budget...proposes boosting spending on unmanned aircraft to \$1.7 billion next year. A separate long-term Pentagon blueprint calls for a quantum leap in drones, from hand-launched planes for battlefield surveillance and pilotless scout helicopters to long-range unmanned bombers that military planners expect to make up nearly half of the Air Force's future strike fleet.²

Wall Street Journal, February 7, 2006

Predator, Hunter, Raven, Dragon Eye, Shadow, and Global Hawk: these are just a few of the UAV systems employed in current U.S. military operations. In recent years, the military services have developed and fielded UAVs of all sizes and capabilities. Employed for high altitude, theater surveillance; real-time, over-the-horizon tactical reconnaissance; the search for improvised explosive devices (IEDs); and even armed strikes, UAVs have become “the most requested capability among combatant commanders in Southwest Asia.”³ General Michael Hagee, Marine Corps Commandant, agrees: “UAVs are really quite important. If you talk to the commanders over [in Iraq], they'd like to have more.”⁴ While the wisdom and utility of the various uses of UAVs is debatable, it is clear that they are here to stay.

Unfortunately, this rush to field UAVs has not been guided by an acquisition plan, let alone doctrine, as noted by General John Jumper, former Air Force Chief of Staff: “We've got a plethora of people out there selling their UAVs out of their back pocket to various entities over there.”⁵ Eager to use their new assets, those “various entities” are using current operations as a laboratory for experimentation. Brig. Gen. E.J. Sinclair, commander of the Army Aviation Center, concurs: “We quite honestly don't know where we're going with these UAVs...we're using Iraq as a battle lab for where we're going to go with UAVs.”⁶

A commander may or may not approve of this experimentation occurring in his area of operations (AO). Nevertheless, short of a nationally coordinated effort, there is little he can

do about it. The relevant question for the operational commander is: given that the services are bringing their UAVs to the fight, how should they best be operationally employed?

Many UAV roles have been considered, but this paper focuses on the one that has long been proven: the performance of ISR missions. The combat role of UAVs, although demonstrated spectacularly on a few occasions with Predator strikes, will also require doctrinal development when more test experience has accrued. Furthermore, the focus here is on issues relevant at the operational level of war, vice tactical. A significant body of tactical UAV techniques and procedures has been written, although certainly not jointly codified or even coordinated. Nevertheless, the operational commander must be aware of the capabilities of his tactical units. For example, if they have the ability to remotely see around a corner, or inside a building, this can be a tremendous asset. The comments of one Marine UAV operator typify the tactical viewpoint: “Without putting additional lives at risk, day or night, we provide a unique overhead view for tactical commanders with imagery intelligence to help them make battlefield decisions and save Marines' lives.”⁷

Finally, it should be noted that this paper does not directly address some of the technological issues that have arisen as a function of the relative immaturity of much of the UAV technology. For example, both airspace and communication frequency deconfliction issues have been exacerbated by UAV proliferation, as acknowledged by Gen. Jumper.⁸ In addition, UAVs require a great deal of bandwidth, both for the remote command link and the transmission of intelligence products. This in turn makes UAVs vulnerable to jamming.⁹ These problems are receiving a great deal of attention, since the services do not want anything to impede the accelerated fielding of their UAVs.

PERSISTENT ISR: THE PRINCIPAL OPERATIONAL ADVANTAGE OF UAVs

The on-going excitement over UAVs is an interesting phenomenon. After all, UAVs have been used in the reconnaissance role for decades, including extensive employment over Vietnam in the 1960s. The Israelis have long been acquainted with their use, and in 1982 persistent UAV surveillance of Syrian air force activity in the Bekaa Valley helped Israel achieve an aircraft kill ratio of 95:1.¹⁰ Yet in 2005, General Bryan Brown, Commander of U.S. Special Operations Command, stated that the warfighting community still needs to grasp how to optimize persistent ISR with UAVs.¹¹ The following observation from *Joint Force Quarterly (JFQ)* sheds light on the current UAV boom:

Unmanned aerial vehicles have demonstrated their increasing operational utility in the post-Cold War era, particularly when enabled by advances in satellite guidance and communications, computerized flight control systems, and sensor technology. Indeed, unmanned systems assumed new roles because of improvements in range, endurance, on-board sensors, and data transmission.¹²

Note that navigational, communications, and sensor technologies are not inherent to UAVs only. Advancements in these areas feed the concept of “network-centric warfare,” so prevalent in current military thinking. No doubt much doctrinal refinement of this subject must occur, but it would not be *UAV doctrine* per se. However, the combination of network-centric warfare and UAVs has given rise to several issues, some of which are discussed below. For the moment, it is necessary to isolate just exactly what unique advantages UAVs provide to an operational commander in performing persistent ISR missions.

The above quote highlights the endurance of UAVs, meaning the ability to dwell over chosen areas for long periods. This advantage, when combined with altitude, is a tremendous tool for the operational commander: “...the long endurance of UAVs is particularly important for surveillance when these operations could be conducted over days. In this

sense, UAVs could relieve manned platforms of the need to maintain the high operational tempo for the extended periods that are the norm in modern military contingencies.”¹³

Persistence as the principal operational advantage of surveillance UAVs is discussed below, but other critical features advertised by UAV advocates must be addressed here. The obvious feature, lack of a pilot, allows UAV designers to expand the flight envelope in terms of the dynamics and loads the platform can endure. This may indeed yield more maneuverability for a combat UAV, but it does not help ISR UAVs. In fact, the author has professional knowledge of advanced sensors that are highly sensitive and require as stable a flight environment as possible.

Another often cited advantage is the supposed cost-effectiveness of UAVs. Theoretically, the lack of heavy, complex and expensive cockpit and life support systems makes the UAV more aeronautically and monetarily efficient. However, for a number of reasons beyond the scope of this paper, many UAVs are as expensive as their manned aircraft and not treated as expendable assets.¹⁴ Perhaps the non-stop deluge of UAVs will one day result in an economy of scale, but for now they are hardly throwaways.

Finally, there is perhaps the most praised benefit of UAVs: since there are no pilots, the airframes are (technically) expendable and can be risked in hostile environments and locations. “The principal operational advantage of UAVs is their ability to fly close to highly defended targets, which in the case of nuclear, biological, and chemical (NBC) targets, creates significant risk for pilots,” says one Air Force officer who represents the hopeful expectation of many UAV advocates.¹⁵ This is indeed a key advantage – but given the currently high cost of many UAV systems, it is not as yet a realistic benefit to advertise to the operational commander. The Air Force has confirmed the value of their Global Hawk HALE

UAV fleet by planning for an on-board defensive suite.¹⁶ The message is clear: tactical commanders may risk hand-launched aerial cameras for a high payoff, but the operational commander will not realistically risk a Global Hawk or Predator unless the circumstances are extraordinary – in which case it would likely be a strategic mission directed from above.

THE FORCE-TO-SPACE RATIO AND TIME-SENSITIVE TARGETING

History abundantly shows how important the relationship is between the size of the employment area and the strength of one's forces operating there. ... A sound force-to-space ratio is one of the most critical factors in planning a major operation or campaign. This relationship becomes increasingly more important the longer hostilities last, the greater the expanse of space involved, and the more stringent the limitations on resources.

Milan N. Vego, *Operational Warfare*¹⁷

Never has this been truer than in the ongoing global war on terror (GWOT), where persistent ISR is critical in pinpointing our adversaries. The enemy is dispersed over large spaces, defying our ability to mass for a decisive battle. As powerful as our military is, senior RAND defense analyst David Ochmanek points out that “finding, not shooting, becomes the determinant of success.”¹⁸ The Department of Defense (DoD) recognized this in the 2005 Quadrennial Defense Review (QDR), by highlighting the need for improved persistent surveillance capabilities in order to root out insurgents and terrorists.¹⁹ UAVs will certainly be at the center of the solution, as they have already proved highly successful in GWOT missions. Maj. Mark Lister, air officer for Marine Regimental Combat Team-2 concurs: ““Since you can't put enough Marines to cover 33,000 square miles, you have to use what you can...these cameras make up a huge gap in the fact that you can't put a Marine on every piece of dirt in Iraq.”²⁰

In other words, the low force-to-space ratio in the GWOT suggests that the ability of UAVs to find time-sensitive targets (TSTs) via persistent ISR has taken on much greater

importance. *Joint Publication 3-0* defines TSTs as “air, land, or sea based targets of such high priority to friendly forces that the JFC designates them as requiring immediate response because they pose (or will soon pose) a danger to friendly forces or are highly lucrative, fleeting targets of opportunity.”²¹

A recent report on the use of air power in the GWOT noted, “Only continuous surveillance of a potential bad actor is likely to catch him as he leaves a safe house, buys C-4 on the black market, and enters an international airport.”²² Therefore, the operational commander must consider how to capture such TSTs while also allocating enough sorties to cover standing intelligence requests. The use of the Global Hawk to dwell over large areas in Operation Iraqi Freedom (OIF) suggests a possible approach: one platform collected over fifty percent of the information on TSTs while flying only five percent of the intelligence sorties.²³ Analysts have been quick to build on this idea. One method would have mission planners “develop detailed scan strategies to ensure adequate focus on key targets and adequate coverage of their entire area. So, instead of preplanning an exact collection deck, planners should adopt “a ‘scan strategy’ that interleaves focus on narrow target areas of interest (houses, etc.) with broader looks at the general area for suspicious activity.”²⁴

While this is always done to some degree, the intent of the strategy is to allocate more sorties for “broader looks” than is currently done, and to mix up coverage within sorties. However, since pre-planned collection requirements will always exist, new schemes must be applied in a balanced approach.

TIMELY INTELLIGENCE FOR THE WARFIGHTER

A common complaint of the troops in the field is that they don’t have access to the intelligence they need in a timely fashion. The presumption is that a lot of great information

is being collected and sent somewhere, but it doesn't come back in time to make a difference. Part of this issue may be a command and control bottleneck, where the command centers receive the analyzed products but then are not able to distribute it in a timely fashion to the right people. However, perhaps the bigger delay is one that cannot be avoided: analysis of battlefield imagery is a difficult and time-consuming task. Consequently, the U.S. has invested heavily in the training of imagery analysts.

Nevertheless, the TST successes enabled in part by persistent UAVs have led the DoD to pursue a new intelligence model whereby the “formerly linear process of massaging data into usable information is short-cut by the direct posting of raw data for any potential customer to use (posting before processing).”²⁵ Meanwhile, the UAV industry has harkened to the rallying cry for a quicker collection-to-delivery process, and clever technologies are being developed and tested to this end. For example, the Global Hawk is being equipped with the Advanced Information Architecture (AIA), a system that copies raw imagery from the on-board data recorder and downlinks it to a ruggedized handheld computer.²⁶ The implication is that so-equipped troops within line-of-sight of the platform can see what the UAV sees, in near-realtime. The author can testify that AIA field tests were spectacularly successful, and the troops and their commanders raved about and lobbied for this new feature.

On second thought, however, one must think about the deeper implications of such demonstrations for the way ISR UAVs are perceived by the warfighter. Lt. Gen. Walter Buchanan, commander of U.S. Central Command Air Forces, noted that the AIA capability makes Global Hawk seem like “a large server in the sky.”²⁷ Clearly, this can be a significant advantage in some circumstances, especially if ISR missions are specifically flown in support of a given mission. Generally speaking, though, is it wise to have the troops grabbing raw,

unanalyzed data, when they are not trained in imagery interpretation? Will they be making major tactical decisions based on this information? These questions must be doctrinally considered before the battlefield is flooded with “large server in the sky” technology.

CENTRALIZATION OF CONTROL

Unfortunately, it isn’t just tactical users who crave live pictures. Many operational commanders have become fascinated by the never-ending imagery from the battlefield. Maj. Gen. Norman Seip, the Air Force assistant deputy chief of staff for air and space operations, speaks of “that appetite that all of us out there have for full-motion video.”²⁸ As will be shown, this “appetite” has fed the temptation for higher-level leaders to interfere with lower levels of mission execution. History is replete with debacles stemming from this habit; but now that a higher leader can have high quality, near-real time imagery downloaded to his desktop computer, he may not be able to hold back from directing the action.

Joint Publication 3-0 emphasizes the tenet of “centralized planning and direction, and decentralized execution.”²⁹ Yet recent spectacular successes with ISR UAVs, combined with the ability to send near real-time imagery to nearly anywhere on the globe, have tempted commanders to flout this principle. In *JFQ*, Professor Milan Vego of the Naval War College warns that “there has been steady movement in the last decade toward increased centralization on all levels.”³⁰ Vego writes of this phenomenon plaguing Operation Allied Force in Kosovo, and notes that in Operation Enduring Freedom (OEF),

...senior leaders in the United States not only observed but also second-guessed subordinate commanders. Commander, Central Command, reportedly exercised direct command in real time over forces in Afghanistan from headquarters in Florida. He could also monitor images of the battlefield from unmanned aerial vehicles that were retransmitted by orbiting satellites.³¹

A recent report in *Aviation Week and Space Technology (AWST)* claims that this trend continued in OIF, where “senior leaders often intervened at the tactical level not because circumstances required it, but simply because they could.” Referring specifically to Central Command, the report echoes Vego’s concern: “...the proverbial 8,000-mile-long screwdriver is generally not a recommended tool for conducting combat operations.” The article goes on to show how this “reach forward” interfered with and delayed time-sensitive targeting.³² Ironically, this is the opposite of the intended result from persistent surveillance.

Still, before judgment is passed on “video” commanders, the political circumstances of recent GWOT conflicts must be taken into consideration. In truth, the required degree of centralization depends largely on the political sensitivity and risk inherent in the operation. Where the risk is high, the ability to monitor imagery from an orbiting UAV could be a tremendous advantage to the decision maker. The *AWST* article acknowledged that in OEF “...a single untoward collateral-damage incident might have caused the campaign to fail disastrously. Senior leaders accordingly had legitimate concerns for imposing due discipline on combat operations.”³³ A recent *JFQ* article expounded on and defended this idea:

...warfare is no longer controlled under the same model that prevailed throughout most of the 20th century. Commanders can anticipate conducting operations in an environment in which political goals are vague; domestic and international support is tentative; and casualties are dutifully avoided. To redress this dilemma, DOD has spent billions on command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) systems.³⁴

Politically, this argument makes sense; but from a practical standpoint, as Dr. Vego notes, higher level leaders simply cannot handle the details of a tactical operation as well as the subordinates who have been trained and prepared to do so.³⁵ Moreover, with many tactical operations under his overall leadership, the operational commander and his intelligence staff can be quickly overwhelmed with data. This will become an increasingly

difficult problem as improved processing, communications and bandwidth capabilities allow for rapid transmission of massive quantities of information. Oddly, senior leaders seem more concerned with capturing everything available. Gen. Hagee of the Marines reflects, “One challenge we have right now is getting enough ground stations to downlink all the information that is available. I would say that is one of the things we need to focus on.”³⁶ One might well ask whether the amount of information that *can* be currently downloaded is all being used, or even assimilated effectively.

This question, in fact, leads to an area where perhaps commanders do need to exert more control: the proper integration of all UAV sensor data into the existing, structured processes for collecting, analyzing and disseminating ISR information. Some could argue that the time-sensitive circumstances so prevalent in the GWOT have created the need to frequently bypass these processes. Others, however, might label “urgency” as just an excuse; the real problem is the multitude of UAV users at all levels that have not been educated in correct ISR practices. Career intelligence officer Capt. Sandy Neville, a professor at the Naval War College, believes that while the technology and processes for proper ISR data integration are adequate and accessible, senior leadership must motivate their subordinates to utilize them.³⁷

OPERATIONAL VS. TACTICAL PLATFORM CONTROL

The amount of available information will, of course, increase at least proportionally with the number of UAVs in operation – and this leads to a final issue. Senior military leaders such as the Air Force’s Gen. Jumper have expressed concern over the prospect of UAVs proliferating an area of operations, especially given the lack of regulations for their control.³⁸ These issues have largely been expressed in technical language, but there is a deeper doctrinal issue to be decided: what level of command authority should an operational

commander exercise over the fleet of UAVs in his theater? Furthermore, to what degree should tactical commanders be able to control operational level UAVs?

The answers should be grounded in joint doctrine. *Joint Publication 3-0* states:

Levels of command, size of units, types of equipment, or types and location of forces or components are not associated with a particular level [of war]. ...Actions can be defined as strategic, operational, or tactical based on their effect or contribution to achieving strategic, operational or tactical objectives.³⁹

In other words, there should be no formal platform-centric hierarchy that designates *operational* or *tactical* UAVs per se. Operational commanders must choose UAV capabilities to exploit in a mission-centric framework, while respecting the need for tactical users to employ their platforms with minimum interference.

In considering this, it must be understood that the military services have a “bring your own UAV” mentality, for two reasons. First, as has been mentioned, they are separately (in most cases) partnering with an eager industry to develop UAVs based on their service-specific requirements. Second, their units fear the prospect of relying on a non-organic UAV, only to find it has been allocated to a higher priority mission. These are cultural and national-level issues, and for now the operational commander must accept the fact that there will be many varieties of UAVs traversing his AO, all of them beaming data and communications in different directions. Senior commanders cannot hope to keep up with the latest UAV technology being delivered to tactical users, but they should at least have a general grasp of the capabilities of their units.

Given that knowledge, under what circumstances would an operational commander take tactical control (TACON) of a subordinate unit’s UAV? There are only two possibilities: either the asset is needed for a mission with an operational or strategic objective, or it is not –

in which case the transfer of control is irrational and violates the principle of decentralized execution as discussed above.

Perhaps the more complex issue of control is in the opposite direction: tactical forces controlling higher-level assets. Generally, the HALE and MALE variety of UAVs are controlled at the operational level, for two reasons. First, they have persistence over large ISR coverage areas, and therefore are valuable as the operational commander seeks to fulfill his intelligence needs. Second, they are expensive and hard to come by. Hence, they are sometimes referred to as high demand/low density (HD/LD) assets. Naturally, the controller of such assets is loath to give them up, even temporarily, to lower levels – especially since there are so many would be users.

However, if the above discussion of force-to-space ratios and time-sensitive targeting is taken into account, especially in light of the GWOT, a strong case can be made for giving more control to lower level units. The post-OIF airpower report cited in that discussion goes on to note that when surveillance is narrowly focused to enable tactical action, tactical leaders need to be able to direct that capability: “[We] need to give the “reins” to the entity that can actually take action against a target...”⁴⁰ Obviously this would have to occur within a responsible framework of overall theater airspace control.

The difficulty of implementing this principle is in the details. Advocates of tactical control over operational assets are pressing for technology and procedures that will allow for even finer degrees of control. A typical scheme would specify protocols for platform and sensor direction (authority to direct), along with actual platform and sensor control; all occurring below the level of mission control, but all participating “in a collaborative network to share situational awareness and speed decisions.” The author of this scheme

acknowledged that “authorities will still need to prioritize, apportion, or establish a scheme for optimizing coverage and permitting those with the most urgent needs to conduct tactical execution of platform direction and sensor control. Mission control will continue to require judgment and situational awareness.”⁴¹

Therein lies the real problem. A scheme like this sounds beneficial, and no doubt industry is presently working on the requisite technology. However, the attempt to codify procedures or even doctrine to govern the concept could be extremely complex and problematic – and in the end, it’s a matter of judgment.

CONCLUSIONS

This last point leads to a fundamental conclusion that goes deeper than the questions and issues that were raised at the beginning of this paper. The leadership and conduct of military operations is ultimately an art, not a science. No one attempting to create doctrine and procedures for UAVs, or any technological tool or advancement, should forget that an operational commander is paid for his judgment, skill, and even artistry.

With that, the main question of this investigation must be addressed. UAV-specific doctrine should be created only insofar as it highlights anything uniquely advantageous that UAVs add to the commander’s toolbox. Currently, at the operational level, the principal advantage of UAVs is persistence. This advantage, especially delivered from medium and high altitudes, is the primary reason higher level military commanders are demanding the rapid fielding of more Predators and Global Hawks, or UAVs with similar capabilities.

If anything is profound about this conclusion, it is in terms of what it does *not* encompass. Some of the fundamental conclusions of this paper pertain to facets of the operational art that are not germane to UAVs: targeting, intelligence, centralization vs.

decentralization, and command and control. The UAVs themselves are only catalysts, stimulating new ways of thinking about warfare. Many of these ideas have merit, but they could also lead to dangerous practices if not considered carefully. The explosion of intelligence information that has been aided by the proliferation of UAVs, and questionable trends regarding that information, should lead the military to re-examine its doctrine for intelligence, network-centric warfare, and command and control. Perhaps the existence of globally linked, persistent sensors that can broadcast raw information to any point on earth in realtime represents a technological revolution in warfare; perhaps not. Regardless, changes in methodology should be consciously grounded in sound doctrinal principles, as opposed to platform-centric, haphazard, experimental application.

In that regard, military leaders must discourage the use of their areas of operation as technological laboratories. The major defense corporations have been encouraged and rewarded for bringing new products to the warfighter, even during the fight. While this phenomenon has always existed, it has certainly been amplified exponentially by the advent of modern UAVs. While it is natural for industry to aggressively pursue marketing opportunities, its customer (DoD) needs to hold itself in check. Military leaders should definitely encourage and demand new technologies to help them master warfare, but they should not introduce products and concepts to the field until they have been fully vetted. This trend would only be exacerbated by any doctrine that treats UAVs as revolutionary instruments of warfare, when in fact they are not.

As to the function of persistent ISR, there are certain UAV-related concepts that are worth considering for further doctrinal development. The small force-to-space ratio experienced by the U.S. military in the GWOT leads to the need for optimizing the capability

and effects of time-sensitive targeting. Currently, most ISR sorties are pre-planned collection missions to meet a JFC's requests; but OEF and OIF proved the value of having some "roaming" sorties, where a UAV patrols a general area looking for time-sensitive targets. The "scan" technique mentioned in this paper is a reasonable method, whereby narrow and broad scans are alternated. However, any such scheme should not be over-subscribed. The JFC will always have more intelligence requests than can be satisfied, and pre-planned missions will continue to drive a significant percentage of ISR sorties.

Whether UAV missions are pre-planned or scan-oriented, a deeper question is whether the platforms should be thought of as easy access "servers in the sky." The excitement over UAVs has led to unrealistic expectations on the part of tactical leaders and soldiers about the kind of real-time intelligence they will have access to. Furthermore, unless our warriors are more thoroughly trained in imagery exploitation, the ability for them to directly download imagery from UAVs, without professional processing and interpretation, should be strongly limited. Intelligence analysis is a complex, highly specialized process that cannot and mostly should not be short-circuited by impatient warriors. A commander must properly assess the risk of allowing himself and his troops to access raw intelligence data. If the imagery doesn't lead to clear conclusions, the warfighter should wait for proper analysis by the professionals.

The operational commander must also resist the temptation to reach forward into tactical operations, a prospect made highly tempting by the ability to see what the lower echelon commanders see. Given the ever-expanding panoply of ISR tools available to tactical units, the higher commander must accept a segmented battlefield where his subordinates have more information than he does. Rather than being a problem, this circumstance is actually an affirmation of the time-tested principle of centralized control/decentralized execution. The

reality of a low force-to-space ratio in the GWOT only further emphasizes the importance of this principle, despite high levels of political risk. Senior leaders must trust their subordinates and allow them the flexibility to conduct their missions as they see fit.

Unfortunately, commanders are in danger of becoming addicted to the never-ending stream of live imagery available from persistent UAVs dwelling over the battlefield. Military leaders must learn that fascinating technology is not a substitute for leadership. They must regain their discipline and realize that the *ability* to watch and interfere doesn't translate to the *necessity* to do so. Intervention should only occur under extraordinary circumstances, the discernment of which is at the core of the art of command. Instead, the growing risk aversion of U.S. leadership is causing the "political" excuse for higher level interference to become the rule, rather than the exception. Commanders at the operational level of war must realize that this tendency cuts both ways: just as they can interfere with lower levels, so too can they be interfered with from above.

While the issue of centralization is being worked out, commanders and their staffs have already felt the impact of information overload. Contrary to the desires of some leaders at the highest levels, the services should not be primarily focused on expanding the ability to downlink more intelligence data. Rather, they should worry about what to do with the overwhelming amount of information that is already deluging commanders. Operational leaders must try to limit the amount of incoming data by using their intelligence experts and systems to filter the intake. Furthermore, commanders must risk some additional centralization in order to enforce the proper integration of UAV sensor data into the recognized channels for analyzing and disseminating intelligence information. Time-critical

circumstances requiring the bypass of these channels should remain a rare exception, otherwise ISR dissemination will become a haphazard free-for-all.

Finally, the issue of asset control should be grounded in the doctrine that there are no strategic, operational or tactical assets as such; the objective of a mission defines its corresponding level of warfare. Nevertheless, many varieties of UAVs are used at the tactical level of war, and the operational commander should not try to take control of these assets unless absolutely necessary. Even if he wanted to, the myriad of unique systems would make it overwhelming. A hands-off approach gives tactical commanders and units the flexibility and autonomy they need to do their jobs. Even so, the operational commander certainly must be aware of the capabilities of his tactical units. This will help him define the boundaries of what is possible in terms of overall mission tasking.

Conversely, units that are generally considered tactical must be allowed to control “higher level” UAVs if it is necessary to achieve the given objectives. In other words, if lower level units are to be used to conduct missions with operational or strategic objectives, there should be no issue with them controlling HALE or MALE UAVs, as long as it occurs within a responsible framework of airspace control. Therefore it is appropriate to develop schemes and degrees of platform and sensor control. It will be critically important for the joint warfighting community to be fully engaged in this development before the technical capability is express-delivered to the battlefield.

RECOMMENDATIONS

These conclusions, although broad in nature, do lead to a few recommendations for doctrinal consideration. First, it is becoming critical for operational commanders to have doctrine for the exploitation of the persistent ISR capability inherent in UAVs, in particular

the HALE and MALE varieties. The “scan strategy” of interleaving narrow and broad area coverage patterns shows promise for enhancing time-sensitive targeting. This idea came from an Air Force source, but the other services should be invited to help develop the concept. Variations on this scheme should be evaluated in a joint exercise.

Second, the concept of sensor and/or platform control from “external” users should also be fully exercised. The characteristics of a congested airspace should be included (at least simulated) in order to fully investigate the side effects of the demonstrations.

Third, the practice of downloading raw imagery directly to tactical units should be thoroughly exercised and subjected to doctrinal analysis before it becomes the expectation of troops in the field. Technology such as the Advanced Information Architecture should not be introduced into the combat arena without such analysis.

Fourth, the established doctrines of ISR, centralized control/decentralized execution, and command and control should be revisited, in light of the impact of enabling technologies (of which the UAV is but one example). Senior leaders are eager to achieve network-centric warfare, but futuristic vision statements are not a substitute for doctrine.

Fifth, operational commanders and their senior leaders, including the national command authorities, must hold forums to discuss the importance of the principle of decentralized execution, and how it can survive in an environment of high political risk. Commanders must fight to retain the discretion to run their operations.

Finally, the military services must consider how their UAV acquisitions will impact operational commanders. It is always presumed that the technology will be a tremendous asset; however, the doctrinal ramifications are seldom examined. Both the operational customers and the acquisition professionals bear responsibility in this regard.

Notes

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Reconnaissance: “A mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or potential enemy; or to secure data concerning the meteorological, hydrographic, or geographic characteristics of a particular area.”

Surveillance: “The systematic observation of aerospace, surface or subsurface areas, places, persons, or things, by visual, aural, electronic, photographic, or other means.”

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15. Glade, *Unmanned Aerial Vehicles*, 12.

16. Craig Hoyle, “UK to Advance Anti-TUAV Weapon Development,” *Flight International*, 15-21 June 2004, 19.

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18. Stew Magnuson, “Air Force in Transition: Service Pondering Future Roles,” *National Defense*, December 2005, 64.

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19. Keith J. Costa, "Draft Quadrennial Review Calls for 'Vastly Better' Intel Capabilities," *InsideDefense.com*, 26 January 2006, <http://defense.iwpnewsstand.com/insider.asp?issue=1262006>.
 20. Kimberly Johnson, "Marines in Iraq Rely On UAV As Force Multiplier," *Aerospace Daily & Defense Report*, 5 July 2005, 3.
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 22. John Riehl, "Actionable Intelligence," in *Vantage Points: The Use of Air & Space Power in Counterinsurgency Operations and the Global War on Terrorism: Proceeding of the Air and Space Power Strategy Conference in Alexandria, Virginia, March 22-25, 2005*, by the Institute for Defense Analysis (Alexandria, VA: Institute for Defense Analysis, 2005), 38.
 23. Pardesi, "Unmanned Aerial Vehicles," 47.
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 29. *Joint Publication 3-0*, II-12.
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