PILOTING THE USAF'S UAV FLEET

PILOTS, NON-RATED OFFICERS, ENLISTED, OR CONTRACTORS?

BY

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About The Author

Major Keith E. Tobin graduated from Rutgers University with a Bachelors of Science degree in Mechanical/Aeronautical Engineering and received his commission from the Reserve Officer Training Corps program. He entered active duty in February 1987 and attended Undergraduate Pilot Training at Columbus AFB, MS in class 88-04. Upon completion of pilot training, the Air Force brought him back to Columbus AFB as a First Assignment Instructor Pilot (FAIP) from 1988 through 1991. The Air Force then assigned him to McGuire AFB, NJ as a C-141 pilot. During his assignment in C-141s, Keith was qualified as a Prime Nuclear Airlift pilot, Examiner Airdrop Aircraft Commander, and Examiner Air-land and Air-refueling Aircraft Commander. He was also a Chief of Squadron Training and one of the first Flight Commanders following Air Mobility Command's (AMC's) conversion to this type of organization. In 1994, AMC selected the then Capt Tobin for the initial Mobility Enhancement Cross-Flow Program where they selected a small cadre of airlift and tanker pilots to retrain in the other's mission. From 1995 through 1997, he was assigned to the 9th Air Refueling Squadron, Travis AFB, CA. During this tour, he was an Aircraft Commander and Instructor Aircraft Commander in the KC-10 and held positions of: Chief of Operations Support, Flight Commander, and Assistant Operations Officer. He was also temporarily assigned as the Operations Officer for 4413(P) Air Refueling Squadron, United Arab Emirates and directed all KC-10 operations for Operation DESERT STRIKE. He earned a Masters of

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Abstract

The primary objective of this research project was to examine the four most frequently proposed alternatives for staffing current and future Air Force UAVs designed to operate within the manned airspace environment: rated officers, non-rated officers, enlisted, and contractors. This study examined three major issues, airspace integration, operational employment, and Air Force cultural considerations for each of the alternatives. A review of Air Force UAV operator experience was initially identified followed by an evaluation of projected potential future UAV capabilities and their impact on staffing considerations. The objective findings derived from an Air Force Research Laboratory (AFRL) survey concluded that it was feasible to train any of these alternative populations to operate at least the only current UAV system in this category, the Predator. Unfortunately, there was insufficient data to extrapolate these findings to future systems. In addition, the AFRL was unable to determine specific training programs for these various options. However, perhaps more important than the physical abilities simply to operate the vehicle is the comprehensive requirements to successfully employ them as weapon systems. In addition, there are the internal and external organizational considerations. These UAVs represent an entirely new category of vehicles in the national and international airspace structure. They also represent a potential shift in who projects conventional combat power within the Air Force. Because of these major issues, this paper concludes that for the foreseeable future, pilots should operate this category of UAVs for the United States Air Force. Although this study placed considerable emphasis

on the Predator system, the analysis also was intended to apply to future UAV systems operating within the manned controlled airspace.

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Chapter 1

Introduction

After a 19-year hiatus from the operational Unmanned Aerial Vehicle (UAV) business, the Air Force is once again on the cusp of exploiting this technology to facilitate, support, and execute airpower missions. Just as before, reconnaissance is the initial UAV application the Air Force is pursuing. However, the potential also exists to exploit this technology in a wide variety of other missions. A 1996 USAF Scientific Advisory Board (SAB) study determined twenty-two potential missions for UAVs including: 1) sustain nuclear and conventional deterrence; 2) project long-range, sustainable, lethal combat power; 3) support rapid global mobility; provide global situational awareness; and 4) dominate the information spectrum.[1]

In order for the Air Force to exploit this potential successfully, two major issues must be resolved. First, the Air Force must fund and develop the technology required to enable the various missions. Second, and perhaps more important, the Air Force must successfully incorporate these systems and their personnel into the organization and its culture. A failure in either of these areas could impede or prevent the realization of the potential value presented by UAV technology.

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[1] United States Air Force Scientific Advisory Board, *Report on UAV Technologies and Combat Operations*, vol. 1, *Summary*, SAB Report SAB-TR-96-01 (Washington, D.C.: Department of the Air Force, AF/SB, 1996), 10-12.

This study seeks to investigate the major issues involved behind who should operate the Air Forces UAVs and determine the best alternative to ensure the cultural acceptance and successful exploitation of this new category of weapon systems. It reviews past and present UAV operations and operator criteria and then evaluates potential UAV applications for the future. Next, it frames the problem with an elaboration of the current major issues surrounding UAV operator requirements. Then it presents the pros and cons of the various staffing options with respect to their impact on the major issues presented.

Background

Unmanned (or Uninhabited) Aerial Vehicles is the current terminology used to describe the category of aircraft where the operator controls the vehicle from a ground control station (GCS) without any human operators onboard the aircraft. In the past, people have also referred to these vehicles as Remotely Piloted Vehicles (RPVs) and drones. People frequently use the terms *UAV* and *RPV* interchangeably and traditionally they apply them to systems where the operator maintains continuous real-time control of the vehicle. The use of *drone*, on the other hand, has traditionally been applied to vehicles with primarily pre-programmed flight operations possessing minimal inflight control. The Air Force's initial operational experience in uninhabited aircraft started with air-launched drones in the early sixties and steadily evolved by increasing their inflight control capability into what they later referred to as RPVs.

Like the early days of manned aviation, the initial vision and role for these uninhabited vehicles was reconnaissance. However, as the technology began to mature and real-time control of the vehicles improved, other potential missions became feasible. By 1971, Teledyne Ryan had developed and successfully demonstrated a ground attack

version of their vehicle, the BGM-34A. By the mid 1970s they produced another version of this ground attack capability, the BGM-34C, however, the Air Force never opted to purchase or field this capability.[2] Despite being on the verge of a new capability, the Air Force elected instead to retire the last of its operational UAVs in 1976 rather than seeking to exploit their potential further.

Statement of the Problem

The current Air Force designation for individual(s) who operate UAVs is Air Vehicle Operators (AVOs). The qualifications and status of these operators are highly divisive and polarized issues. In 1995, the U.S. Air Force reentered the business of operating UAVs when it stood-up the 11th Reconnaissance Squadron (RS) flying the Predator. At that time, the Air Force decided that rated pilots would be required to operate the Predator. Since then, the Air Force has experienced tremendous difficulties in getting pilots to volunteer for this assignment and a number of pilots involuntarily tasked for AVO training have opted to separate from the service rather than accept the assignment. Further, the removal of pilots from their primary weapon systems to operate UAVs exacerbates the current pilot shortage.

Although it appears that existing pilot force issues have ignited the debate over who should operate UAVs in the Air Force, there is a wide range of factors to consider when determining the composition of a force structure. Some of these factors include: the size of the force, the physical and intellectual requirements for operators, the initial and continuation training requirements, the impact on the organizational structure, the impact on and requirements of external organizations, the short-term and long-term perspectives,

[2] William Wagner and William P. Sloan, *Fireflies and other UAVs (Unmanned Aerial Vehicles)*

costs, etc. More importantly, just as various aircraft have different operator requirements, it is reasonable to assume a variety of UAVs would also have various requirements based on their particular missions.

To facilitate addressing UAV operator requirements, it helps to group them into discrete categories because UAVs can range from simple inexpensive vehicles similar to model radio-controlled airplanes to multi-million dollar sophisticated combat aircraft. Joint Pub 3-55.1 divides UAVs into five sub-categories, close-range, short-range, vertical takeoff and landing (VTOL), medium-range, and endurance UAVs.[3] These categories appear to classify UAVs based on their operational employment roles and do not necessarily correspond to appropriate classifications for operator requirements.

This study groups UAVs into three distinct categories. First are *tactical* UAVs, which are those that operate in short ranges, generally in visual meteorological conditions, and require minimal or no interaction with civilian or military manned aircraft and their airspace structure. The second category is *high-altitude* UAVs, which are designed to operate above the manned aircraft airspace structure and above virtually all weather obstacles. The final category includes all others, which include those UAVs designed to operate within and in combination with manned aircraft and their airspace.

I established these particular categories because of their unique impacts on the operator requirements. First, both the tactical and the high altitude UAVs will most likely only represent a small percentage of Air Force UAV operations in the long term and their missions tend toward the periphery of the Air Force's focus and priorities. The Air Force has extremely limited requirements for tactical UAVs and the primary role of

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(Arlington, TX: Aerofax, Inc., 1992), 98-108.

the high-altitude UAVs will primarily be reconnaissance, communication, navigation, etc. Second, neither of these categories will require the extensive interface and interaction with manned aircraft and they will require significantly less operation within the formal airspace structure and the associated meteorological conditions. Finally, based on this categorization system, potentially nineteen of the twenty-two SAB proposed UAV missions will fall into this main category. Thus, establishing operator requirements for this broad category of UAVs, those operating within the manned airspace structure, will address the majority of Air Force requirements.

This study only seeks to analyze the physical requirements and the philosophical rationale behind whom should operate the category of UAVs operating within the manned airspace structure for the United States Air Force. This category includes the Air Force's only current UAV system, the Predator, as well as the vast majority of the projected potential missions for future Air Force UAVs. Although some of the arguments presented here may apply to the other categories, services, or countries, it is equally possible that other issues will bear greater weight and warrant different conclusions.

Significance of the Problem

The role of UAVs in the Air Force is expanding and appears poised for significant growth in the near future. As articulated in *Global Engagement*, the Air Force's most recent vision statement, "[t]he Air Force will exploit the technological promise of Unmanned Aerial Vehicles (UAVs) and explore their potential uses over the full range of

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[3] Joint Publication (JP) 3-55.1, Joint Tactics, Techniques, and Procedures for Unmanned Aerial Vehicles (UAV), 27 August 1993, I-2-3.

combat missions."[4] This represents an enormous potential for UAVs to have a major impact on current Air Force operations. However, it simultaneously represents a significant threat to the cultures and constituencies currently performing these missions.

Stephen Peter Rosen's premise in *Winning the Next War* is that two elements are essential for peacetime innovation in the military. First is the recognition of new requirements and tasks. Second, is the establishment of "career paths along which younger officers specializing in the new tasks could be promoted."[5] Documented statements of vision like the one above suggest the Air Force's senior leadership has taken the first step and has recognized the new requirements and tasks. What remains for the Air Force to accomplish is the appropriate staffing of these weapon systems and the cultivation of these career fields such that the innovation does not whither and die.

Therefore, a critical issue for staffing the Predator and any follow-on system within this category is the long-term effect these personnel decisions may have on the exploitation of UAVs in general. Several factors are converging that could drive a decision that is more focussed on near-term issues at the expense of nurturing the innovation. First is the magnitude of the current pilot shortage and the associated retention problems. Second is the nature of the current system's mission. Reconnaissance is not one of the Air Force's more glamorous roles and represents a small percentage of Air Force operators. Third is the small scale currently involved in staffing UAVs. The current entire Predator program, for both operational squadrons, only requires approximately fifty operators. Fourth is the potential to group all UAVs operator

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[4] United States Air Force, *Global Engagement: A Vision for the 21st Century Air Force*. (Washington, D.C.: U.S. Air Force, 1997?), 16.

requirements together under the reconnaissance category based primarily on the Predator and the next projected system, which is a high-altitude reconnaissance UAV. Fifth and finally, is a perception issue. Many USAF personnel, especially pilots, have a negative impression of flying UAVs and UAV operations. This impression contributes to a lack of understanding of what these missions entail and ignorance concerning their operational impact.

I was originally attracted to this topic because of its implications for current pilot manning issues. From the outside looking in, it appeared that there had to be a better alternative to staff the Air Force's UAVs than involuntarily taking fully qualified pilots from their operational weapons systems to be what seemed like little more than video game operators. In fact, I became even more convinced that an alternative solution existed as I plowed through background information, staff studies, reports around the decisions, and talked with people from the various aspects of the program. None of the information being debated and staffed throughout Air Combat Command (ACC) and the Air Staff effectively articulated the essence of the requirements. It was not until late into my research when I had the opportunity to spend some time with the 11 RS and experience their operations first hand that I realized the single best analogy for those operators—their job is identical to what any other pilot does except for where they sit. Considerable airmanship and piloting skills are required to maximize mission effectiveness, to ingrate UAV operations with the rest of the Air Tasking Order (ATO) process, and to fly safely in and among other manned aircraft.

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[5] Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca: Cornell University Press, 1991), 76.

Research Objectives

The primary objectives of this research is to examine the four major alternatives most frequently proposed for staffing AVO positions and determine which is the best for the long term interests of the Air Force. These alternatives include, rated officers (pilots and navigators), non-rated officers, contractors, and enlisted. Because it is currently the only active system in this category, considerable emphasis is placed on the Predator system. However, the intent of the analysis is also to apply to future systems operating within the manned aircraft environment and among manned aircraft.

As mentioned earlier, numerous factors contribute to a decision to select the correct operators for a weapon system. However, three factors have particular relevance to the category of UAVs that represent the bulk of potential future Air Force missions—airspace integration, operational employment, and organizational issues. This study will evaluate each of the four operator alternatives based, as a minimum, on their impact on these three factors.

Approach and Methodology

The first step in the analysis was to conduct a thorough review of the U.S. Air Force's past experience with UAVs and the operator requirements for those systems. Next, extensive research into the current operator requirements was conducted. This analysis included a thorough review of staff studies, background papers, talking points, etc. circulated throughout Air Combat Command, the Air Staff, the Air Force Personnel Center, and research conducted by the Air Force Research Laboratory on this subject. In addition, personal and telephone interviews with current UAV operators and individuals working UAV issues on the various staffs supplemented this study.

The second step in the analysis involved evaluating the future potential applications for UAVs and the influence these might have on future operator requirements. Once integrated, these first two steps helped to establish a foundation for examining future operator requirements. This method of analysis also helped identify three major issues influencing operator criteria: airspace management and integration, operational employment versus vehicle operation, and cultural considerations.

The final portion of the analysis involves analyzing the four most commonly proposed alternatives for UAV operators by considering them in light of their impact on the three major issues derived from the historical evaluation. Each of the three major issues was treated with relative equality, i.e. none was given significantly greater weight or importance than the others. Airspace management has considerable effect on peacetime training opportunities, peacetime and wartime deployment options, and wartime employment and integration with manned systems considerations. Conversely, the majority of studies involved in determining UAV operators focus on the mental and physical requirements to operate the vehicles. Unfortunately, they give relatively little emphasis on those aspects necessary for the Air Force to successfully employ UAVs in a combat environment. However, this study emphasizes the effect each of the proposed alternatives might have on combat employment. Finally, developing UAV technology is of relatively limited value if, as a category of weapon systems, they are relegated to cultural insignificance. It was for these very reasons that the Army Air Corps fought for thirty years for its own independence.

This study establishes a baseline for projecting future UAV operator criteria based on past and present requirements and the impact the major issues have on the various

alternatives currently being considered. By synthesizing the historical experience and the major issues derived from this experience with the potential future roles and missions for UAVs, this study makes conclusions and recommendation for current and future UAV operator requirements.

Chapter 2

Background on UAV Operations

USAF Experience with UAVs

AF Begins UAV Operations

The Air Force's interest in UAVs has been intermittent at best over the last three decades. Prior to the 1960s, the military used drones primarily for training support operations such as targets for air-to-air training and ground gunners. In the sixties and early seventies, interest in UAV technology in the U.S. surged, it stagnated in the mid seventies, then completely waned throughout the late seventies and eighties, reemerging as a major interest again in the nineties.

In July 1960, the Air Force awarded a small contract for $200,000 to Ryan Aeronautical to modify their Q-2A target drone for use as a reconnaissance platform. In just two months, the modified drone successfully completed its flight test evaluation. However, following the test flights, the program remained dormant for over a year and Ryan Aeronautical finally cancelled the program in Jan 1962.[6] Immediately after Ryan Aeronautical cancelled the program, the Air Force expressed renewed interest in UAV reconnaissance. They awarded Ryan a $1.1 million contract for four drones modified for

1,200 mile range, 55,000 foot cruise altitude, and a 2 foot photo resolution. In just three months, Ryan delivered on the contract.[7] Over the next decade, Ryan produced 28 variants of their basic model 147 drone. Some were for highly specific missions while others were for more generic mission types.[8]

In addition to the development and procurement successes, the UAV reconnaissance program was also an operational success. On 1 July 1963, the Air Force declared the first UAV squadron, the 4028th SRS(W)—Strategic Reconnaissance Squadron (Weather)—operational.[9] However, this squadron and its drones were for photo-reconnaissance and had nothing to do with weather, but the true nature of the unit and its mission was highly classified and secrecy was a major concern.

As tensions increased in Southeast Asia, the DoD perceived the drones as a way to observe possible Chinese intervention in Vietnam. Consequently, the Air Force deployed the drone squadron on 4 August 1964. Initially the drones' performance was checkered. However, as the squadron ironed out operational procedures their successes began to mount. By 1965, the drones had assumed the photo-reconnaissance mission from the U-2s, significantly reducing the political threat of having a manned aircraft shot down over China, and began to assume new missions such as low-level reconnaissance.[10]

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[6] Curtis Peebles, Dark Eagles: A History of Top Secret U.S. Aircraft Programs (Novato: Presidio Press, 1995), 84-5.

[7] Ibid., 85.

[8] William Wagner, *Lightning Bugs and other Reconnaissance Drones* (Fallbrook, CA: Aero Publishers, 1982), 213.

[9] Ibid., 90.

[10] Ibid., 96.

Initial UAV Operators

Initially the Air Force used non-commissioned officers (NCOs) as drone operators, but quickly changed this practice as drone systems and operations became more complex. In 1963, Strategic Air Command (SAC) concluded the new operational drones with their self-contained guidance systems and other various sub-systems were too complex for NCO operators. SAC decided electronic warfare operators (EWOs), with their background in navigation, intelligence, and electronics, were best suited to operate the drones.[11]

During this period, drone operations consisted of three different and independent tasks and corresponding duty positions: the launch control operator (LCO), the aircraft remote control officer (ARCO), and the recovery officer (RO). The LCO was responsible for the pre-mission, pre-launch, and launch operations of the vehicle. The ARCO was primarily responsible for monitoring the air vehicle in flight and had limited capability to adjust flight path and altitude manually. The RO was responsible to assume control of the aircraft from the ARCO, guide the aircraft the designated recovery site, coordinate with the recovery helicopter, and initiate the parachute recovery system.

As drone operations expanded in Southeast Asia, SAC employed EWOs as the LCOs and ACROs, but trained pilots as the ROs. SAC selected pilots for this duty primarily so they could also function as recovery site commanders. At this time, the U.S. Code Title 10, Section 8577 stated that a pilot would command all flying units and this was not changed until 1974. Thus, SAC could not assign an EWO to command these units and subsequently opted to train pilots. This decision was administrative and not based on an

EWOs lack of ability to function as a RO. In fact, in 1971 when Tactical Air Command (TAC) entered drone operations, they used EWOs to staff all three positions.[12]

UAVs Fall from Grace

As the Air Force's operational experience grew and Ryan Aeronautical surmounted the technological hurdles, the value and reliability of the drones improved dramatically. In total, 28 various models of the basic model-147 Lightning Bug drone flew 3435 missions with 84 percent of them successfully recovered. However, the last seven models flew approximately 75 percent of these missions with recovery rates in the middle to upper ninety percent ranges.[13] Clearly, the drones had demonstrated their utility and value. So, what happened to them?

Within the Air Force, there was little organizational awareness and understanding of UAVs and what they could bring to the fight. This was, in part, because until 1981 the U.S. closely guarded their story for security reasons. For example, William Wagner authored his manuscript for *Lightning Bugs and other Reconnaissance Drones* in the early nineteen-seventies; however, by the time the "security review" finished censoring his story they had not left much worth printing. It was not until 1981 that he was able to get the necessary clearance to tell the full story and get his book published.[14]

In the past, that lack of public visibility of UAV accomplishments was a major reason why military planners had not exploited them more. At least this was one

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[11] Robert G. Kiggans, "Air Force RPV Operators: Rated vs. Non-rated" (Masters Thesis, Air Force Institute of Technology, 1975), 10.

[12] Ibid., 11.

[13] Wagner, 213.

[14] Benjamin F. Schemmer, "Forward," in *Lightning Bugs and other Reconnaissance Drones* by William Wagner, (Fallbrook, CA: Aero Publishers, 1982).

conclusion drawn by the General Accounting Office (GAO) and expressed in a 1981 report on UAV operations. The GAO noted that because the "missions flown by the UAVs in Southeast Asia were for the most part classified, not very many people, including military, were aware of the role they played."[15]

It is also possible that the neglect of the UAVs was somewhat due to an overly zealous belief in satellites and their ability to accomplish the reconnaissance and surveillance mission. Perhaps this factor explains the coincidental canceling of Skunk Work's Tagboard drone and the loss of interest in Ryan Aeronautical's advanced drone with the successful orbiting of the first "Big Bird" reconnaissance satellite capable of six inch photo resolution.[16] Though no one ever expected satellites to be capable of gathering ELINT comparable to the SA-2 data the drones acquired, the DoD believed satellites would be capable of gathering sufficient intelligence to support our national interests and prosecute future conflicts.

Consequently, following the Vietnam conflict, the Air Force brought the UAVs back to the United States after their last operational mission in 1975. In 1976, the Air Force reorganized and placed the UAVs under the control of TAC. Soon afterward, TAC had a major change of heart about the utility of these UAVs and retired the force. This decision was most likely due to the revitalization of the TR-1/U-2R production run. However, regardless of the reason, for the next twenty years, the Air Force was out of the operational UAV business.[17]

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[15] Government Accounting Office, DoD's Use of Remotely Piloted Vehicle Technology Offers Opportunities for Saving Lives and Dollars, (Washington D.C.: General Accouning Office, 1981).

[16] Peebles, 133-4.

[17] Anthony M. Thornborough, *Sky Spies: Three Decades of Airborne Reconnaissance* (London, England: Arms and Armor Press, 1993), 36-38.

The Wake-Up Call

It would take another international crisis to highlight the utility of UAVs at enhancing our warfighting capabilities. The employment of UAVs during Operation Desert Storm clearly demonstrated their ability to complement other information systems, providing a total battlespace view to all commanders, from the tactical battlefield commander to the operational-level decision-makers.[18] According to the interim DoD report to Congress on Desert Shield and Desert Storm, UAVs performed "direct and indirect gunfire support, day and night surveillance, target acquisition, route and area reconnaissance, and BDA." The Pioneer system "appears to have validated the operational employment of UAVs in combat."[19]

Ironically, the Israelis originally developed the Pioneer system. Because of the Israeli success with UAVs and identified U.S. military needs for an unmanned penetrating reconnaissance platform, the Navy started the Pioneer Program in 1985. The Israeli Company, Israel Aircraft Industries (IAI), teamed with the U.S. Company, AAI, to form Pioneer UAV Inc. and produce the Pioneer UAV for the U.S. military. The Army also procured Pioneer systems from the Navy and received its first system in 1990.[20]

Prior to the Gulf conflict, primarily two types of assets provided reconnaissance: manned airborne platforms and satellites. Both of these types of collectors have positive and negative aspects. Manned platforms provide high-resolution data, are extremely flexible at adapting to multiple mission scenarios, and can loiter (with air refueling)

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[18] Dana A. Longino, LtCol, USAF, *Role of Unmanned Aerial Vehicles in Future Armed Conflict Scenarios* (Air University Press, Maxwell AFB, AL, 1994), 5.

[19] Secretary of Defense Dick Cheney, *Conduct of the Persian Gulf Conflict, An Interim Report to Congress*, (Washington DC: Government Printing Office, July 1991), 6-8.

within the conflict region up to the limitations of the crew. Unfortunately, crew limitations also limit their ability to react quickly to global conflicts. Additionally, manned platforms have extra costs and weight associated with crew requirements. However, the most significant limitation of manned platforms is the risk to the crew. The American populace and government leaders are becoming increasingly sensitive to loss of life scenarios.

Satellite electro-optical reconnaissance, because of the principles of orbital mechanics, has some significant capabilities and advantages, but it also has several limitations. In principal, these satellites can see virtually anywhere in the world every day, provided weather is not obscuring the desired target. They can also collect information across wide areas at no risk to human life. However, orbital mechanics also limit a satellite's coverage of a conflict area to about 20 minutes each orbit pass; with only about three to four passes a day, depending on target latitude. Continuous coverage of a conflict region from space would require a large satellite constellation costing billions, if not trillions, of dollars. In addition, satellite orbits are constant, enabling an enemy to predict when the satellites will observe the region and, therefore, conceal activities and forces. Satellites also tend to be expensive and considered "national assets," primarily used by the national decision-makers on strategic and operational issues. The lack of dissemination of satellite-derived intelligence to the tactical battlefield commander was a major fault of the national systems during the Gulf conflict.

Although UAVs were successful in providing critical information during the Gulf conflict, they could not provide high-resolution data covering large areas. Essentially,

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[20] Department of Defense, *UAV Annual Report FY 1996* (Washington, DC: Defense Airborne

the Pioneer system was a video camera flying about 5,000 feet above the battlefield. However, the true success of the Pioneer system was not in the quality of intelligence it provided, rather its greatest success was that of changing the opinions and attitudes of military officials about the role of UAVs. UAVs are a critical element of the U.S. military's ability to obtain and retain dominant battlefield awareness (DBA), crucial aspects of supporting *Joint Vision 2010* and the Air Force's concept of *Global Engagement*.

The Predator ACDT

The sudden realization of a gap in our reconnaissance capability combined with the simultaneous presentation of a possible solution set the stage for the DoD to establish an UAV development and procurement organization from scratch. In 1994, the DoD created the Defense Airborne Reconnaissance Office (DARO) to unify airborne reconnaissance architectures and enhance the acquisition of manned and unmanned airborne assets and associated ground systems. Since its inception, the DARO built an Integrated Airborne Reconnaissance Strategy for a comprehensive defense-wide airborne reconnaissance capability to work in concert with the National Reconnaissance Office (NRO) space-based assets. The DARO oversaw the Defense Airborne Reconnaissance Program, which consists of U-2, RC-135, and EP-3 aircraft programs, non-lethal tactical and endurance UAVs, the Distributed Common Ground System (DCGS), advanced reconnaissance technology and sensors, and the Common Data Link (CDL). The DARO developed, demonstrated, and acquired improved airborne reconnaissance capabilities, and performed system-level tradeoffs for manned aircraft, UAVs, sensors, data links, data

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Reconnaissance Office, 6 November 1996), 14.

relays, and associated processing and dissemination systems. The DARO also established and enforced commonality and interoperability standards for airborne reconnaissance systems.[21]

However, the existence of DARO was short lived. This was primarily due to bureaucratic reasons. DARO was formed as an analogue to the NRO, formally splitting airborne from space-based reconnaissance. The creation of DARO essentially escalated the loss of autonomy for the services over their reconnaissance money because DARO was not only the developer, but also the agency that spent the service's money. The services did not like this and, for various reasons, all opposed DARO.

Nevertheless, during its short existence, DARO used the Advanced Concept Technology Demonstrations (ACTD) process to demonstrate and evaluate promising UAV concepts through early user involvement in realistic operational scenarios. ACTDs for UAVs started in 1994 for the Medium Altitude Endurance UAV (Tier II or Predator), the Conventional High Altitude Endurance (HAE) UAV (Global Hawk), and the Low Observable HAE UAV (DarkStar). In 1996 the DoD canceled the HUNTER UAV program and initiated a Tactical UAV (TUAV), Outrider, ACTD.[22]

To maintain a robust posture in the face of reductions in procurement funding, the DoD has endeavored to increase both the effectiveness and efficiency of the existing acquisition framework. The ACTD process is one example of such initiatives the DoD created to facilitate the demonstration of new technologies to the warfighters. ACTDs represent an integrated effort to assemble and demonstrate a significant, novel, and

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[21] Glenn W. Goodman, Jr., "New Eyes in the Sky," *Armed Forces Journal International* 133, no. 12 (July 1996): 32.

improved military capability that is based on mature, advanced technologies. Whereas, historically, developing new capabilities has taken a decade or even longer, the ACTD process, from start to finish, is intended to take no more than three years. Within this short schedule, the DoD scales project sizes so that operational utility, or military utility, and system integrity can be established quickly. The DoD selected the Predator to serve as one of the prototypes for testing the ACTD concept. The Predator was the first ACTD to be completed and to make the transition to the formal acquisition process.[23]

The Predator Staffing Decision

In November 1995, General Joseph W. Ralston, the commander of Air Combat Command, directed using rated officers initially to operate the Predator. Several factors contributed to this original decision. The first was to meet the advanced concept technology demonstrator's initial training requirement of providing a trained operator in twelve weeks. In addition, other bureaucratic issues affecting this decision included meeting minimum Federal Aviation Administration (FAA) requirements and a desire to minimize liability insurance requirements. General Atomics, the primary contractor for the Predator, endorsed the use of military or "experienced" FAA pilots as suitable candidates for the program. In addition, US Atlantic Command (USACOM) also sanctioned the use of pilots to minimize the length of the training pipeline.[24]

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[22] Department of Defense, *UAV Annual Report FY 1997* (Washington, DC: Defense Airborne Reconnaissance Office, 6 November 1997), 2-3.

[23] Michael R. Thirtle, Robert V. Johnson, and John L. Birkler, The Predator ACTD: A Case Study for Transition Planning to the Formal Acquisition Process, (Santa Monica, CA: RAND, 1997), 2.

[24] Maj Craig H. Smyser, DPXPR Staff Summary Sheet, Pilots to UAV Squadrons, 1 August 1997, Tab 3.

In November 1995, the 11 RS' first site activation task force (SATAF) proposed to test the concept of training enlisted operators for the Predator. However, General Ralston rejected this idea until the Air Force had a better understanding of what flying UAVs would entail. The Army's experience with enlisted pilots in their Hunter program also influenced this decision. At that time, the Army had experienced nineteen Hunter crashes in less than two years and they attributed most of them to the inexperience of the enlisted pilots.[25]

Also considered at this same time was the concept of using navigators or non-rated officers with civilian aviation licenses as Predator operators. General Ralston approved the use of navigators with commercial instrument ratings but opted to wait on experimenting with non-rated officers until after seeing how well the navigators performed. The Navy had already experimented with four reserve naval flight officers (NFOs) with disparaging results. Three were unsuccessful at completing the initial qualification training and the fourth, the one that completed training, was later removed from the program for failure to maintain proficiency.[26]

Following these decisions, in February 1996, Headquarters Air Combat Command (HQ ACC) hosted a training and staffing conference with the other services to discuss the personnel requirements for Predator vehicle operators and payload operators. At that time the four services were considering a jointly manned 11 Reconnaissance Squadron. The Army was considering using rated Warrant Officers as AVOs, while the Navy was continuing to pursue more reserve NFOs. The Marines, on the other hand, were opposed to using any officer billets at all in the program. These disparate views were never

[25] Ibid., Tab 3.

resolved and the Army, Navy, and Marines withdrew from the program in April 1996 when the DoD assigned the Predator program solely to the Air Force.

In June 1996, HQ ACC sponsored its first Predator program review. At this meeting, General Richard E. Hawley, Commander ACC, specifically endorsed the use of only rated officers to pilot the Predator. He completely tabled the debate on enlisted or non-rated officers at that time. However, he did propose a study to determine what was necessary to train an UAV operator from the ground up. In addition, he advocated the normalization of the system by getting the Predator into the regulatory processes of the FAA and into the national airspace system (NAS) because requirements imposed by the FAA could drive the AVO selection process.[27]

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[26] Ibid., Tab 3.

[27] Ibid., Tab 3.

Chapter 3

AVO Requirements

Current Training Requirements

The four-star generals of the Air Force raised several issues during Corona South 1997 regarding current and future UAV pilot training requirements. As a result of these concerns, the Air Combat Command Director of Operations for Unmanned Aerial Vehicles (HQ ACC/DOU) tasked the Human Effectiveness Directorate at the Air Force Research Laboratory (AFRL) to conduct a study to determine what type of training pipeline UAVs would require. The study was to consider the training requirements for the Predator, and the impact future UAVs and unmanned combat aerial vehicles (UCAVs) might have on those requirements. It was also to consider the feasibility of creating an enlisted career field to operate the aerial vehicles.[28]

To conduct this task, the AFRL conducted a survey of qualified Predator AVOs and follow-up focus group discussions to examine these three issues. The survey queried the relevance of the various skills trained during the T-3 program, the T-37 syllabus' instrument and navigation phases, and the FAA Instrument Rating Practical Test Standards (FAA-S-8081-4B). The AFRL considered portions of the specialized undergraduate pilot training (SUPT) syllabus beyond the T-37 phase, however the AVO

training experiences beyond the T-37 varied between the T-38 and the T-1 and thus were not included. In addition, they considered the FAA instrument rating items to evaluate possible options of a civilian-based training program. In all, the respondents rated 225 individual tasks from the three categories as either; "not applicable," "nice to have but not necessary," or "absolutely necessary."[29]

Unfortunately, the lack of qualified AVOs hampered the study. At the time of the survey, there were only twelve qualified AVOs and four of them were deployed. Consequently, the survey was based on only eight respondents. The AFRL was able to slightly improve their sample size in the follow-up discussions by adding thirteen recently qualified AVOs, however only two of the original survey respondents were available to participate in the discussions. In total, only twenty-one individuals contributed inputs to the study.[30]

The results of the survey indicated the respondents considered the majority of the training items "absolutely necessary." On average, they considered seventy percent of the T-3, T-37, and FAA tasks "absolutely necessary" and another twenty-five percent "nice to have but not necessary." The five percent of the tasks the respondents rated "not applicable" were the aerobatic maneuvers conducted in the T-3 syllabus.[31]

The focus group discussions also revealed a belief that manned flying experience was required for Predator AVO training. The respondent's major emphasis was that all tasks and experience meld together to teach airmanship. Their belief was that, regardless

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[28] Ellen M. Hall and William C. Tirre, Air Force Research Laboratory Human Effectiveness Directorate, Brooks AFB, TX, USAF Air Vehicle Operator Training Requirements Study, January 1998, 1.

[29] Ibid., 24.

[30] Ibid., 8.

[31] Ibid., 9.

of where the Air Force decided to draw their AVO candidates from, the AVO pipeline training should be similar to undergraduate pilot training (UPT).[32]

Results from the discussion groups revealed a belief that the Air Force could train enlisted personnel as AVOs, but that the training requirements would be considerable. Six of the eight survey respondents concurred with this conclusion. The focus group discussions verified this response. However, the group discussion revealed concerns regarding the amount of training required to train an enlisted force. The training involves more than just teaching them how to operate one particular vehicle. They would also have to understand aviation principles and flight and navigation rules. In addition, they would require instruction and experience in employing and integrating Air Force weapon systems together. They raised additional concerns regarding decision making skills, effectively communicating these decisions both up and down the chain-of-command, and the level of responsibility for these decisions.[33]

In conclusion, the AFRL stated that the AVOs unanimously agreed that manned flying experience was necessary to employ the Predator effectively. There was also consensus that an UPT-equivalent training program was required before Predator initial qualification training, but further analysis could provide more specific training requirements. In addition, a carefully screened portion of enlisted personnel could complete basic flight and AVO upgrade training. However, they were not able to extrapolate training requirements for future UAVs or UCAVs.[34]

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[32] Ibid., 10-11.

[33] Ibid., 12.

[34] Ibid., 12-15.

Current Operating Requirements

In the case of executing a Predator mission, the process and requirements essentially mimic those of any manned reconnaissance platform and should be extremely indicative of future systems operated within this category. A validated mission requirement and an official tasking via the Air Tasking Order (ATO) initiate the process. Upon receipt of a mission tasking, the Predator squadron assigns the mission to a crew who then, working as a team, is responsible for planning the mission and its successful execution.

Mission Planning

The overarching objective of the mission planning process is to assimilate all of the various mission inputs into a coherent mission profile that optimally employs the aircraft and the sensors to effectively service the essential elements of information (EEIs) required. Some of the typical mission inputs include: range, satellite availability, aircraft equipment limitations, takeoff and landing times, time over targets, weather, target and threat information, maps, mission priorities, etc. Portions of this information is more relevant to the pilots while other pieces are more relevant to the sensor operators and some is relevant to both. The process of mission planning is to ensure the final plan successfully integrates both crew position's requirements and constraints—just like mission planning for any manned system.

It requires a team effort of aviation, sensor, and target expertise in order to plan a mission effectively. As currently configured, the Predator carries three different sensors, and with a 36-hour endurance, it could potentially service a multitude of targets. Thus, the possible route and sensor permutations for a given mission could be enormous. For example, the best sensor to service a particular target and its EEIs might be the synthetic

aperture radar (SAR). For such a target the best flight path to service it would be a straight approach, offset from and parallel to the target, and preferably into the wind providing the greatest resolution. On the other hand, a target more suited for electro-optical viewing might be serviced better by circumnavigating the target for a view from all angles.

This myriad of variables, combined with the fog and friction of war, places considerable emphasis on the ability of the crew for successful execution. Though many propose ideas such as automated flight and mission planning to reduce the crew requirements, there is little substitute for the creativity and resourcefulness of a well-trained operator. Even the relatively low-threat strategic airlift environment, which currently employs automated flight planning, relies heavily on the aircraft commander and other pilots. They review the computer-generated flight plan and modify it as necessary for last minute changes in weather, itinerary, navigational aide outages, air traffic control restrictions, etc. Similar requirements and flexibility are sure to be valued in any of the future UAV systems.

Sensor Operator Responsibilities

It is the responsibility of the enlisted sensor operators, who come from the imagery interpretation career field, to bring the sensor and EEI expertise to the mission planning process. They are the experts regarding the different sensor capabilities, various targets, and the desired EEIs. They determine the best way to find the correct target and satisfy the required EEIs for this particular mission. In addition, it is their responsibility to optimize the sensors to accomplish the mission, formulate alternatives in anticipation of problems, and plan to minimize the required time on target.

AVO Responsibilities

Similarly, it is the responsibility of the AVO to bring the aviation knowledge to the mission planning. They have the expertise and are responsible for the airspace rules, weather, safety of the vehicle, integration with other aircraft in the same airspace, etc. In other words, all of the knowledge and experience the aviation community collectively refers to as airmanship.

The AVO is ultimately responsible for determining target order and employment altitude. First, the AVO will plot the appropriate charts to include all known threats, targets, and any other aircraft operating in the area. He/She must consider the mission requirements and the sensor operator's inputs and combine these with the plotted threats, weather, terrain, day versus night, line of sight versus satellite control, etc. In addition, the AVO and sensor operator will discuss and consider various "artistic" considerations. Some of these include the line of sight angle from the sensor to the target, the effect of the sun, camouflage, and optimum range from the target to satisfy the EEIs, etc.

Upon resolution of a working plan, the AVO will accomplish normal flight planning requirements. He/She will complete a fuel plan and a flight plan, determine the minimum recovery fuel, and consider emergency and alternate recovery plans—just as is required for any other aircraft.

Once everybody has completed their respective responsibilities and the crew has resolved all of the coordination items, the AVO, who is also the mission commander, concludes planning with a complete mission brief. This provides an opportunity to refocus the crew on the task-at-hand and ensure the entire crew leaves with the same perception of how they will execute the mission.

Mission Execution

From standing in the ground control station observing flight operations, it is almost impossible to tell you are not on an aircraft. The relationship and interaction between the three crewmembers is identical to that on a flight deck. Each crewmember sits at their respective station, operating their respective equipment, working together to accomplish the specified mission. In fact, due to the hum of all of the equipment, each crewmember is actually wearing aircraft headsets and they communicate over an intercom system.

Vehicle Operations

A typical mission profile begins with an extensive series of ground checks to verify the integrity of all of the crucial communications links and the crew's ability to operate all of the onboard equipment through these links. Once the crew successfully completes these checks, the AVO taxis the Predator for take-off. Once cleared for take-off, the AVO *pilots* (using conventional throttle, stick, and rudder inputs) the Predator into the air and on its departure route.

Currently, the AVO coordinates the Predator's pre-planned route of flight with air traffic control who can then easily track the aircraft via its onboard transponder that the air traffic radar regularly interrogates. However, in anticipation of earning FAA approval to operate Predator more freely in the national airspace system, the Air Force is modifying Predator with an onboard radio. This will allow seamless communications between the air traffic controllers and the Predator crew.

During take-off and enroute operations, the sensor operator uses the sensors to assists the AVO with an expanded view of conditions outside the aircraft. The AVOs forward-looking camera only provides a thirty-degree field of vision straight ahead. The sensor

operator can use his day camera and swivel it a full three hundred and sixty degrees. He uses this camera to verify the position of the landing gear and visually clear on the sides and even behind the aircraft. However, because the sensors are mounted on the bottom of the aircraft, their one major limitation is upward viewing.

Once the aircraft approaches the designated target areas, the focus of the operations start to revolve around the sensor operator and the mission requirements. Again, this is a coordinated crew effort further compounded by the near real time dissemination of the collected information direct to various exploitation cells. It is fairly common for truly dynamic re-tasking or on-the-fly direction of collection assets, e.g., “look left”, “zoom in on that”, “how about an infrared image of that”, etc. This kind of flexibility provides excellent ISR support to the users, but also places real demands on the AVO to *fly* the aircraft.

Consequently, because of the real-time retasking and flexibility to support the users, the AVO ends up manually flying the majority of Predator mission profiles. Some of this is due to the limitations of the automation software on the Predator. However, a major reason is simply because it is much easier and more responsive to just *fly* the vehicle than attempt to reprogram it.

Once the mission requirements are satisfied, recovery operations mimic those of departure. The AVO is responsible for flying the aircraft back to its base of operations in complete compliance with all the instrument flight rules. In the advent of adverse weather, turbulence, or any other anomaly, the AVO, just like the pilot in any other aircraft, must coordinate and take the appropriate measures to safeguard lives and the aircraft.

This scenario of a typical Predator mission is synonymous with the execution of any manned aircraft system. Both have considerable automation, which will undoubtedly continue to get better. However, though automation has significantly improved the capabilities of our single-seat aircraft and has reduced the crew requirements of crew aircraft, it has not replaced those uniquely human qualities of flexibility and creativity. In fact, as automation has reduced crew size and increased mission capability, it has actually increased the intellectual demands on the operators. In other words, just as automation has not replaced the requirement for a pilot on a manned system, there is no evidence that automation can completely replace the pilot skills for current and future UAVs in this category.

Payload Operations

During mission execution, payload operations are a complete crew effort between the AVO, Payload/Sensor Operator (PSO), and the Data Exploitation, Mission Planning, and Communications (DEMPC) operator. The PSO is primarily responsible for operating the various sensors, aiming them at the desired targets, and ensuring the images obtained are the best possible to support the EEIs. While the PSO concentrates on operating the particular sensors and collecting on the current target, the DEMPC operator maintains the "big picture" of the target areas and EEI requirements. The DEMPC operator uses the "big picture" display to help direct the payload operator to point the sensors at the desired targets. In addition, the DEMPC operator is responsible for maintaining the communication and data links with the air vehicle and with the data dissemination locations.

Often additional vehicle maneuvering is necessary to collect the required EEIs. The DEMPC operator and the AVO coordinate this additional maneuvering and consider the EEI requirements for this particular target, the impact on future time-over-targets (TOTs), and any threat exposures generated by the additional maneuvering. Ultimately, the AVO must determine and execute the proposed courses of action.

Changing Characteristics of UAVs

Future Potential for UAVs

The current Air Force exploitation of UAV technology and capabilities is nascent at best. The only systems currently fielded or scheduled for operational employment are two reconnaissance platforms. The first, the Predator, has been fielded but has not yet fully achieved initial operational capability. The second is the Global Hawk, a high-altitude endurance UAV also designed for the ISR mission. Both of these platforms were designed with very different operator philosophies and consequently different requirements.

In order to consider UAV operator requirements in general, one must first consider the potential role and missions for UAVs as a category of weapon systems. Otherwise, the debate reduces to who should operate current systems and fails to consider the long-term requirements and ramifications.

To address issues such as these and more, the Air Force's Scientific Advisory Board (SAB) studied various technology issues and potential tasks and missions for UAVs. They identified twenty-two different missions or tasks to which UAVs could contribute: counter biological and chemical weapons, theater missile defense, fixed and moving target attack, suppression of enemy air defenses, electronic warfare, communication and

navigation support, etc. They concluded that the Air Force has the opportunity for working demonstrations of several of these capabilities by 2005 if they so chose.[35] See Table 1 for a summary of the various potential missions and a projection of possible timeframes for initial capability demonstrators.

Reviewing Table 1, one can see these diverse systems can benefit in varying degrees from automation and human interaction. Some mission profiles, such as high endurance reconnaissance, communication, and navigation support, lend themselves well to high degrees of automation. These systems will operate well above the normal airspace structure, weather, and the crowded and dynamic environment below. Meanwhile, the vast majority of the missions will operate in the heart of the manned airspace environment, with and among manned aircraft. Such systems, though capable of significant automation, probably benefit more from the inherent human qualities so very difficult to reproduce in automation.

[35] SAB Report SAB-TR-96-01, viii.

Table 1: Timeframes for UAV Initial Operational Demonstrations

Air Force Capabilities	Near-Term (1996 – 2005)	Mid-Term (2005 – 2015)	Far-Term (2015 – 2025)
Sustain Nuclear and Conventional Deterrence		Strategic Attack	
		Space Control	
Project Long-Range, Sustainable, Lethal Combat Power	Fixed Target Attack		
	Base Defense		
	SEAD		
	Theater Cruise Missile Defense		
	Moving Target Attack		
		Special Operations	
		Area Denial	
		Decontamination/Defoliant Dispensing	
		Air-to-Air	
			Counter WMD
			CSAR
			Trans/Post SIOP
Support Rapid Global Mobility		Tanker	
			Cargo Transport
Provide Global Situational Awareness	ISR		
		Humanitarian Assistance	
Dominate the Information Spectrum	UCN		
	Jamming		
		Information Warfare	
		GPS Augmentation	
Assumptions	• Complement to manned vehicles • Current Tier platforms, mission systems, & weapons • Use of UTA	• New UAV platforms • New mission systems & weapons • New UAV C^2 systems	• Autonomous or complementary • Robust C^3 • Out-of-box platforms, mission systems, & weapons

Source: Extracted from USAF Scientific Advisory Board Report SAB-TR-96-01, Volume 1[36]

Human Qualities Versus the Machine

One of the major findings in the SAB study was a lack of sufficient emphasis on human systems issues.[37] There are a vast number of tasks and functions which automation can accomplish much better than human beings. Autopilots, for example,

[36] SEAD is Suppression of Enemy Air Defenses; WMD is Weapons of Mass Destruction; CSAR is Combat Search and Rescue; SIOP is Single Integrated Operations Plan; ISR is Information, Surveillance, Reconnaissance; UCN is UAV Communications Node; and GPS is Global Positioning System; UTA is Unmanned Tactical Aircraft.

[37] Ibid., 3-55.

have been a great asset throughout the aviation industry. They allow automation to perform the monotonous and relentless task of monitoring aircraft performance and make the necessary inputs to maintain specified flight parameters. Automation has excelled in the areas where human beings have limitations. People are limited in the number of parameters they can simultaneously control, the speed they can respond to observed changes, and their potential for error. However, they are better at adapting to unexpected inputs and demands, reasoning effectively during periods of uncertainty, and they can accomplish higher order integration of tasks. In order to capitalize on the unique qualities of each, there needs to be a systematic study and approach to allocating functions between humans and automation.[38]

Like most design decisions, developing future UAVs will require a balance or trade-off between automation and flexibility. If the Air Force elects to pursue greater automation, then they can make corresponding reductions in operator requirements. However, such a course of action will also entail sacrifices in operational flexibility. For example, cruise missiles are essentially completely automated and the Air Force could design future UCAVs with similar levels of automation such that they are little more than reusable cruise missiles. If the Air Force pursues UAVs emphasizing such levels of automation then they will also incur similar limitations in flexibility that cruise missiles experience.

However, if the Air Force desires to exploit high degrees of flexibility, similar to that enjoyed with manned aircraft, then a considerable increased emphasis on human operator capability and responsibility will occur. Considering several basic axioms about war,

[38] Ibid., 4-3.

such as “no plan survives first contact with the enemy” or “that flexibility is the key to air power,” then the Air Force should favor systems with the greatest degree of flexibility. This is especially true of the initial systems as their capabilities are first exploited and adversaries pursue counter-measures.

Throughout history, airpower advocates have earned a reputation for overstating capabilities. Perhaps UAVs could be an example where the Air Force is satisfied with walking before running. For the first generation of UAVs, the Air Force should be content with just removing the human from the threat environment and then look forward to further removing them from the operating loop. On the other hand, the Air Force risks considerable failure and setbacks if they seek to achieve both goals simultaneously. Such failure could seriously threaten the exploitation of UAV technology.

Chapter 4

Major Issues

In order to evaluate the merits of various UAV operator alternatives, one must first consider the major issues influencing this decision. As stated earlier, numerous factors contribute to determining the operator requirements for any weapon system. However, for UAVs, three major issues bear considerable weight on their long-term acceptance and successful incorporation into the Air Force and they warrant elaboration prior to evaluating the various staffing alternatives.

Airspace Management and Deconfliction

Currently, the Predator represents a capability and requirement for current and future UAVs to operate in the heart of the national airspace system (NAS). To date, UAVs have had a minimal impact on the NAS largely due to their limited range and altitude at which they operated. However, the current UAVs, and the entire list of potential UAVs (see Table 1), can now operate over extended ranges and at altitudes having significant interaction with other aircraft operating in the same airspace. In addition, potential follow-on vehicles will fly at 300 knots, or more, and may have little or no see-and-avoid capability.[39]

[39] Maj Tom Wozniak, ACC/DOU Bullet Background Paper on UAV Operations in the National Airspace System, 3 Dec 96.

The DoD and FAA must work together to establish guidance on the required equipment to safely and effectively operate in an ever more crowded airspace system. Will a Traffic Alert and Collision Avoidance System (TCAS) suffice for suitable see and avoid capability? Will a forward-looking camera be required? If yes, then what minimum field of vision should be required? What should the minimum communications capabilities be? The Predator was originally designed without a radio. However, to facilitate its incorporation in the NAS, the Air Force is currently modifying it with a radio so the crew can conduct normal air traffic control communications just as if they were on-board.[40]

In addition to the hardware requirements, numerous procedural issues must be resolved. Will UAVs require some type of special airspace or procedures such as standard instrument departures or climb corridors to deconflict other traffic? On the other hand, perhaps the FAA could support UAV operations through the employment of temporary restricted areas. What should the minimum operator requirements be? These questions are not completely independent. It is probable that the more restrictive the operator requirements, the more latitude that can be exercised in the procedural requirements.

The ideal conditions for operational flexibility is for UAVs to be allowed to operate in the NAS just as freely as manned aircraft. Currently, the Predator is restricted to operating in the military range airspace around Nellis AFB and overhead its home at Indian Springs Air Field. Special coordination is required for any operations outside this airspace. If the Predator were free to operate just as a manned aircraft, then with its range

[40] Lt Col Dana A. Richards, 11 RS Squadron Commander, interviewed by author, 23 February 1999.

it could easily support training exercises over most of the United States, such as at the Army's national training center at Ft Irwin, California. Anything short of this freedom of operation will limit the Air Force's ability to fully exploit the potential of this technology. As seen on the earlier chart, the majority of missions envisioned for future UAVs will probably require operations throughout the entire spectrum of the current airspace structure.

Once the Air Force and FAA establish a set of specified guidelines and regulations for the operation of UAVs in the NAS, then such policies could theoretically be negotiated and incorporated into the International Civil Aviation Organization (ICAO). This organization is the international body responsible for establishing accepted common practices and procedures for international aviation. The establishment of such an agreement would significantly improve deployed operations. Currently, special operating procedures must be established with every host and affected nation through which the Air Force wants to operate these UAVs.[41]

Operational Employment

A significant portion of the debate surrounding who is qualified to be a Predator AVO has concentrated on traditional piloting skills. The Predator has a traditional stick control with a throttle, rudder trim, flap, and propeller controls and requires conventional piloting skills to operate. The AVO must manually taxi and take-off the aircraft and manually recovers it to a landing. In fact, most qualified Predator operators claim it actually requires considerable stick and rudder skills to successfully take-off and land. In many cases, they find the Predator as much if not more challenging than their previous

aircraft from this perspective. Once airborne, the AVO can select to place the aircraft on an automatic programmed course with limited intervention required. However, due to limitations in the automation, most of the qualified AVOs claimed they accomplished a significant portion of most missions manually.[42] This is not necessarily, or even likely, to be the case for future UAV systems. Most, if not all, future UAVs will be designed with automated take-off and recovery systems and will most likely have considerably greater degrees of enroute automation.

However, stick-and-rudder skills are only one part of being a successful Air Force pilot. They are a requirement, but they are far from sufficient. The primary emphasis of Air Force training is on *airmanship.* This is a somewhat nebulous term used to encapsulate a myriad of skills, qualities, and attributes. Airmanship represents the pilot's ability to assimilate a comprehensive understanding of the aircraft, its systems, its environment, the surrounding threats, the plethora of rules and regulations regarding its operation, the mission, etc. From all of this, the pilot must deduce sound judgements and courses of action.

Thus, the role of the UAV operator is synonymous with the role of a pilot in any other aircraft. They are responsible for every aspect of the mission from receiving the tasking, carefully and thoroughly planning the mission, successfully executing the mission, safely recovering the aircraft, and completing any post mission requirements.[43] The stick-and-rudder skills are only one aspect of what makes a successful pilot.

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[41] Maj Robert E. Monroe, 11 RS Flight Training Unit Director of Operations, interviewed by author, 23 February 1999.

[42] Capt Michael A. Theurich, 11 RS Instructor Pilot, interviewed by author, 22 February 1999.

[43] Maj Gregory E. Harbin, 57 OGV, Group Evaluator Pilot for UAVs, interviewed by author, 23 February 1999.

Consequently, the improvements in the level of automation in a UAV only alter one aspect, that of physically controlling the vehicle, used to derive the operator requirements. Increased vehicle automation does little or nothing to address all of the other operational requirements.

The Air Force needs effective *employers* of weapon systems, not just *operators*. The vast majority of potential UAV systems envisioned by the Scientific Advisory Board (see Table 1) would operate in the heart of the airspace structure. This will occur at the altitudes and in the geographic area where other air assets operate, potentially hundreds of other aircraft. Consequently, there is significant potential for future UAV operations to include multiple systems, with different objectives, flying to satisfy various target sets. As such, the requirements for operators of these vehicles should be synonymous the requirements to operate the manned systems with perhaps the exception of certain physiological requirements not relevant to a stationary ground control station.

Cultural Considerations

The advent of manned flight combined with the carnage of early twentieth century warfare inspired visionaries to conceive of a theory of airpower. This theory sought to exploit the third dimension, over-fly the fighting armies, and strike directly at the heart of an adversary. As Carl Builder expressed in his book *The Icarus Syndrome*, "[t]he concept of air power gave aviators and those who supported them—technically, logistically, financially and politically—a unifying sense of purpose and a cause far more noble or altruistic than the aviator's abiding love of flight and flying machines."[44] However, Builder suggests that once the process of creating the Air Force was complete,

the underlying romanticism of aviation influenced the individuals and the service and caused their focus to shift from exploiting the theory to protection of the image. A significant portion of his book details the impact of this hypothesis on the Air Force's exploitation of missiles, space, and other means to exploit the vertical dimension.[45]

This is not a new or unique phenomenon to the Air Force. As Stephen Peter Rosen pointed out in *Winning the Next War*, "[t]he horse Cavalry persisted in European armies well into the 20th century despite the impact of modern weapons because, one historian wrote, the 'cavalry was a club, an exclusive one. . . a group of men who were at once hard-riding and hard-headed. . . the cavalry was the home of tradition, the seat of romance, the haven of the well-connected.'"[46] From this perspective, it would appear that such a tendency is endemic to large institutions and bureaucracies, and the military is no exception. In fact, the military's potential to resist change may be even greater due to their very nature which presents limited opportunities to employ, test, and validate their theories in actual practice.

Rather than dwell on this fact as a futile inevitability, Rosen elected to attempt to identify the necessary characteristics of successful innovations. He examined three successful peacetime innovations: the Marine's adoption of amphibious warfare, the Navy's acceptance of carrier aviation, and the Army's incorporation of helicopter airmobility. Each of these innovations was a slow arduous process taking no less than twenty-one years. He also examined two failures: the Royal Navy's incorporation of carrier aviation and the Army's feeble attempt to develop a counter-insurgency

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[44] Carl H. Builder, The Icarus Syndrome: The Role of Airpower Theory in the Evolution and Fate of the U.S. Air Force (New Brunswick, NJ: Transaction Publishers, 1994), 32.

[45] Ibid., 32.

capability.[47] In each of the successful case studies, the respective services created opportunities for promotion and professional development of those individuals practicing the new forms of warfare. This was not the case in both of the failures. Rosen concluded, "[p]eacetime innovation has been possible when senior military officers with traditional credentials…have acted to create a new promotion pathway for junior officers practicing a new way of war."[48]

Underlying the success of the Navy's incorporation of carrier aviation was Rear Admiral William Moffet. He faced a plethora of young aviation officers, which by their sheer numbers alone were threatening to the surface officers, clamoring to lead themselves and a senior leadership irate at the arrogance of these young aviators. Moffett convinced the aviators that "[b]y pursuing a separate Flying Corps…the aviators were ensuring that they would never obtain the necessary sailing skills that would make them eligible to command aircraft carriers and become admirals and in charge of fleets incorporating aircraft carriers."[49] At the same time, Moffet allowed Navy captains the opportunity to earn aviation wings as observers and then placed them in aviation command billets. Eventually, career aviation officers would fill these positions once they were eligible. "Thus aviators were kept within the Navy, and surface-ship officers were drawn into aviation as observers. Both groups were available for the development of naval strategy and tactics based on a sound understanding of the potential of carrier

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[46] Rosen, 2-3.

[47] Ibid., 6.

[48] Ibid., 251.

[49] Ibid., 78.

aviation, and both became eligible for promotion to senior ranks."[50] In addition, by keeping aviators in the promotion system, they were available to contribute to and help develop carrier doctrine.[51]

In contrast, Great Britain removed aviation from its Army and Royal Navy to establish the Royal Air Force (RAF). Consequently, the aviators with the most experience and seniority were removed from the Royal Navy. The resultant professional opportunity for a naval aviator was abysmal. All naval aviators had to spend three to four years attached to the RAF. During this period they were ineligible for promotion with the Royal Navy and the RAF was reluctant to promote naval officers within their ranks. Consequently, the Royal Navy had limited aviation expertise in its leadership and this was reflected in its lack of carrier doctrine. The disparity between the two approaches and their results is amazing. "By 1927, the U.S. Navy had one operational aircraft carrier and one Vice Admiral, three rear admirals, two captains, and 62 commanders receiving flight pay. The Royal Navy, in contrast, had six aircraft carriers in 1939, but only one flag rank officer and few captains or commanders receiving flight pay."[52]

The introduction of UAVs into the Air Force's arsenal of weapon systems is an innovation that may be as significant as the introduction of aviation into naval operations. Prior to carrier aviation, one-hundred percent of naval combat power was within its surface vessels. However, the advent of carrier aviation presented a different means to project power from the sea and this eventually came at the expense of the battleship. This redistribution of combat power from surface vessels to carrier aviation did not

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[50] Ibid., 79.

[51] Ibid., 79.

[52] Ibid., 99-100.

happen overnight, though World War II did significantly accelerate the process. Likewise, one-hundred percent of the Air Force's current conventional combat power comes from manned aircraft. The introduction of UAVs presents the potential to shift the apportionment of combat power away from manned aircraft and toward UAVs. As noted earlier, this is not the Air Force's first attempt to field and exploit UAV technology. A 1981 GAO report concluded that a lack of awareness about UAVs due to their shroud of secrecy was why the military had failed to exploit them further.[53] On the other hand, perhaps as Rosen would suggest, there was a lack of organizational support for the innovation. This lack of support may have been related to the limitations secrecy placed on the program, but, in contrast, the Air Force still has the F-117 despite its origins in the black world.

If the Rosen model is correct, then in order for the Air Force to ensure the successful incorporation of this innovation it must create a viable career path for the operators of this weapon system. There must be opportunities for the operators of UAVs to achieve the highest ranks available in the service. The Air Force must allow these operators to contribute to the development of doctrine and explore the possibilities for UAVs to exploit airpower theory.

The Air Force can accomplish this in one of two ways, either it can create and nurture a new career field or it can exploit an existing career field. Unfortunately, several factors are currently impeding the viability of creating a new career field. The first factor is the limited size of the current requirement. This exacerbates the fixed overhead costs of establishing a separate training pipeline and hinders their opportunities for

[53] Government Accounting Office, DoD's Use of Remotely Piloted Vehicle Technology Offers

advancement in competition with other career fields. A second factor working against the establishment of a new career field is the peripheral role, that of reconnaissance, of the current and immediate future UAV systems. This makes it more likely the USAF would relegate UAVs to a tangential and or subservient existence. Another significant factor is the incorporation of this new category of vehicle into the airspace structure. It is much more difficult to introduce a new category of vehicle with a new category of operators than to first introduce the new vehicles with an established pool of operators.

However, the option of exploiting an existing career field, pilots, is not a panacea solution without major areas of concern. Although this option does eliminate the requirement for a separate pipeline and minimizes the airspace integration challenges, the Air Force must still work aggressively to ensure these individuals are not "punished" professionally. From Rosen's prospective, pilots, in general, have no problems rising to senior ranks within the Air Force. However, not all pilots have an equal opportunity to achieve the highest ranks. Consequently, the Air Force must initially ensure that UAV assignments are not detrimental to officer professional development. Otherwise, the result would be the same as creating an impotent career field.

Almost immediately after the initial Predator staffing decision various administrative issues began to appear demonstrating the stress the new system was placing on the existing culture. The first was professional concerns raised by those assigned to the Predator such as the awarding of Operational Flying Duty Accumulator (OFDA), commonly referred to as "gate" credit. This decision was quickly followed by a lack of volunteers to fill the required positions. Another issue became a debate over the length of an assignment and concern over unit corporate knowledge and average experience levels.

Opportunities for Saving Lives and Dollars, April 1981.

Gate Months

Aviation career incentive pay (ACIP) is awarded for "the frequent and regular performance of operational or proficiency flying duty required by orders."[54] However, a rated officer can become eligible for continuous ACIP. "To be entitled to continuous monthly incentive pay, an officer must perform the prescribed operational flying duties (including flight training but excluding proficiency flying) for 8 of the first 12, and 12 of the first 18 years of the aviation service of the officer."[55] The Air Force tracks compliance with this allowance on a monthly basis. For any given month or portion of a month that an officer is qualified to perform flight duties and is assigned to a duty meeting the above definition, they are awarded credit for one gate month. Thus in order to meet their first gate, an officer must accumulate a total of ninety-six months where they are eligible for gate credit prior to reaching one-hundred and forty-four months of commissioned service.

Historically, continuous ACIP has been used to discourage the Air Force from repeatedly assigning rated officers to non-flying duties and to encourage rated officers to seek assignments where the Air Force can capitalize on its investment in training.

After ACC determined that they would use rated officers to staff the Predator weapons system, they tasked the Air Force Judge Advocate General to determine if these officers would qualify for gate month credit. The AF/JAG concluded that they were not eligible for gate credit because they determined that operating a UAV did not constitute "operational flying duty." The term "Operational Flying Duty," is defined in 37 U.S.C.

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[54] United States Code, Title 37 - Pay And Allowances of the Uniformed Services, Chapter 5 - Special and Incentive Pays, Sec 301a - Incentive pay: aviation career, February 1996, on-line, internet, 18 Apr 1999, available from http://www4.law.cornell.edu/uscode/37/301a.html.

301a(a)(6)(A) as: "…flying performed under competent orders by rated or designated members while serving in assignments in which basic flying skills normally are maintained in the performance of assigned duties as determined by the Secretary concerned, and flying performed by members in training that leads to the award of an aeronautical rating or designation." This version of the law established in 1974 replaced a previous version implemented in Executive Order (E.O.) 11157, June 22, 1964. In this version, "Aerial Flight" was defined as, "…flight in an aircraft…; and a flight to be deemed to begin when the aircraft…takes off from rest at any point of support located on the surface of the earth and to terminate when it next comes to a complete stop at a point of support located on the surface of the earth." In this version, Congress' intent was clear that actual flight in an aircraft was necessary. The JAG could find no evidence that it was Congress' intent to change this definition of flight when they rewrote the legislation in 1974. As such, the JAG concluded the law did not intend to include UAV operations.[56]

This issue becomes significant when one considers the officer professional development of Predator operators. Typically, the four or six years available to perform other than flying duty in the gate system is to allow rated officers to attend professional military education and to accomplish one or two staff tours without losing continuous ACIP. If rated UAV operators do not get gate credit and the tour does not fulfill a staff requirement, then the perception is that any officer filling these assignments is punished financially and or possibly professionally with respect to their peers.[57]

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[55] Ibid.

[56] Richard A. Peterson, Deputy Chief, General Law Division, Office of the Judge Advocate General, memorandum to the Air Force Directorate of Personnel, AF/DPPC. Subject: Aviation Career Incentive Pay (ACIP), 6 December 1996.

[57] Smyser, DPXPR Staff Summary Sheet, Tab 3.

Volunteers/Pilot Retention

As soon as the Air Force attempted to fill these new Predator assignments, they found a dearth of volunteers. ACC and the Air Force Personnel Center (AFPC) had collaborated to establish the Predator's initial assignment eligibility criteria. The original plan called for "[a] pilot other than fighter, in the grade of captain, first gate met, and worldwide deployable" for a three year tour.[58] By June 1997, just one year into the program, the aggregate numbers amounted to nineteen non-volunteer assignments, resulting in fifteen assignments and four separations, and only one volunteer.[59]

The Air Force's first attempt to remedy the difficulty in attracting volunteers occurred in December 1996. The Air Force XO and DP proposed three alternatives to improve the attractiveness of Predator assignments. Option 1 consisted of leaving the tour length at three years but adding the assignment to the list of career broadening assignments, known as "ALFA" tours. This would make pilots now eligible for assignment on their second or third tour as opposed to after completion of their first gate. The second alternative was the same as the first except to shorten the tour to two years instead of three. Finally, the third option was to create a separate AVO career field. The Air Force XO and DP recommended option 1 and the Chief of Staff approved it.[60]

Unfortunately, the Predator assignment process experienced little or no improvement by the primarily cosmetic changes implemented by this initiative. It was not long until several new proposals were making their way through the Air Force operations and

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[58] Ibid., Tab 1.

[59] Brigadier General John F. Regni, DPXFC Staff Summary Sheet, UAV Pilot Incentives, 23 June 1997, Tab 1.

[60] Colonel Rick Lewis, AF/XOOA Staff Summary Sheet, Nellis AFB, NV Taskers: Unmanned Aerial Vehicles, 9 December 1996.

personnel channels. By June 1997, the new Predator assignment package consisted of a *two-year* Alfa tour with a choice of follow-on assignment after tour completion. This lucrative deal finally managed to attract volunteers to the Predator, but at a great price. The generals believed it was worth it to obtain motivated volunteers.[61]

Tour Length

Before this decision, the principle reason many opposed shortening the tour length was because of the impact this would have on the experience levels in the Predator squadrons. With a two-year assignment, the average experience level in these squadrons will be less than one year. This also means the squadrons must train and upgrade their cadre of instructors and evaluators extremely quickly and the squadron will get little utility out of them before they will depart.

A two-year tour also increases initial qualification pipeline requirements fifty percent over that required for a three-year tour. This translates into a fifty-percent increase in training man-hours, sorties, permanent change of station (PCS) costs, etc. This may be worth while initially, since the entire Predator program will only consist of approximately fifty pilots. However, this issue is definitely something the Air Force must resolved before they can hope to exploit UAVs on a larger scale.

[61] Regni, DPXFC Staff Summary Sheet, 23 June 1997.

Chapter 5

Staffing Alternatives

As laid out in the previous chapters, throughout the entire Predator program a significant debate has transpired over UAV operators. Basically, there are four staffing alternatives to consider for UAV operators. One option is to outsource UAV operations and employ contractors to operate the air vehicles. Another option is to create a separate AVO career field, a unique Air Force specialty code (AFSC), and recruit and train individuals for this specific task. To select this option, the Air Force must first further break this option down and decide whether to use an enlisted force or an officer force to constitute this new AFSC. The final option is to continue to employ pilots as UAV operators. Thus, the question becomes "what are the merits and drawbacks of these various alternatives?"

Contractor

The option to outsource UAV operators may sound strange at first, but this concept does have precedence. The Air Force has contracted out the majority of its SUPT simulator instruction. The aviation community once considered pilot training the sacred territory of the pilot fraternity. In addition, for numerous years, the Air Force has contracted out the initial screening process to enter pilot training. At first, reserve officer training corps (ROTC) cadets would accomplish the flight screening program at local

airports supporting the contract while officer training school (OTS) cadets would attended a contracted program at Hondo, Texas. Later, the Air Force changed this policy and required all ROTC and OTS cadets to attending screening at Hondo. Through 1997, when the Air Force grounded the T-3 program, the Air Force Academy operated a military flight-screening syllabus synonymous with Hondo's program for academy cadets. The Air Force's current plans now are to contract out this program as well, if they ever reinstate the T-3 program. In addition, the Air Force has outsourced numerous facets of various major weapon system initial qualification and continuation training programs, but they have not outsourced any actual operational flying requirements.

In particular, the Air Force has contracted out UAV operations in the past. The most significant example is the outsourcing of air-to-air combat drone operations. For example, Lockheed-Martin owns the contract for the drone operations at Tyndall AFB, Florida. They employ separated Air Force officers with fighter pilot experience to remotely pilot the drones for various air-to-air training requirements.[62]

The primary motivation to consider outsourcing these requirements was based on a cost benefits analysis. First, the Air Force has not yet accomplished such an analysis for the Predator, however it is probable that such an analysis could demonstrate an economic justification. Moreover, from a training perspective, if the Air Force can meet its training objectives and benefit from increased economic efficiency then, in general, it should outsource.

On the other hand, outsourcing operational requirements requires much more than just a cost-benefit analysis. First, what are the future missions of Air Force UAVs? As

depicted in Table 1 in Chapter 3, there is a huge spectrum of possible missions. Does the Air Force want contractors dropping bombs? This dilemma strikes directly at the heart of what Carl Builder alluded to regarding the mission of the Air Force. Is the Air Force a service devoted to the prosecution of national policy through the exploitation of the aerospace continuum? Or, is it more interested in the preservation of the romantic idea and image of the courageous fighter pilot, gallantly risking life and limb for country.[63]

Furthermore, on a more practical note, the Air Force has no Uniformed Code of Military Justice (UCMJ) authority over contractors. For example, given a reconnaissance, surveillance, and target acquisition (RSTA) mission, who would be responsible to the user? What if a supported army unit is overrun or they shoot the wrong target? On a more basic level, what if they simply do not want to go? Can the nation afford to possibly lose a weapon system because the employees strike, or the contractor defaults on his contract?[64] General Atomics, the Predators prime contractor, has deployed with the systems for over three years to Bosnia to help support operations and provide technical expertise. However, recently the Air Force tasked the 15 RS to deploy to Kuwait and they took five people from General Atomics with them. However, when the contractors learned that they would require anthrax shots and the Air Force issued them gas masks, suddenly, it was very hard to get five people. Now they are struggling to replace the originals.[65]

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[62] Larry Breau, Lockheed-Martin drone operations, Tyndall AFB, FL, interviewed by author, 14 January 1999.

[63] Builder, 32.

[64] Lt Col Brian C. Bergdahl, 11 RS Director of Operations, interviewed by author, 22 February 1999.

[65] Lt Col Dana A. Richards, 11 RS Squadron Commander, interviewed by author, 23 February 1999.

This is not to denigrate contractors or their capabilities. Numerous contractors have deployed to support various weapon systems and preformed admirably. The emphasis here is on *support* versus *operate*. Is the Air Force ready or willing to outsource the operation of its weapon systems? If so, then how does it delineate between what systems it will outsource and which it will not.

Furthermore, if the Air Force elects to outsource its current UAVs, then what impact does this have on exploiting future UAV potential? If all of the UAV operators are civilians and the entire "Blue Suiter" pilot force operates manned aircraft, then who advocates for the exploitation of future UAV or UCAV potential? Based on Rosen's model, such a scenario could seriously impede UAV exploitation within the Air Force.

Enlisted

An extremely sensitive and highly controversial alternative is the establishment of an enlisted AVO career field. Many people, from outside the UAV operations, envision this task as little more than a sophisticated video game operator. Consequently, they are vehemently opposed to using pilots to fill such a requirement because they believe pilots are extremely over-qualified based on their perception of the mission. The current severe pilot shortage and the continual quest for any alternatives that might help alleviate this situation continue to fuel arguments along these lines.

There certainly is a fair amount of validity to support these arguments. One item in particular that is often cited is the AFRL's training requirements study, summarized earlier. In the study, six survey respondents and all follow-up focus group discussions

expressed a belief that enlisted personnel could be trained as Predator operators.[66] This should come as no surprise since enlisted personnel could be trained to become fully qualified pilots in the Air Force. This concept has already been tested and validated during the US Army Air Force's (AAF) Enlisted Pilot Program. Over twenty-five hundred enlisted soldiers earned their aeronautical rating and graduated as Staff Sergeant Pilots during the period between 23 August 1941 and 10 November 1942. Many of these enlisted pilots worked their way up through the ranks with seven achieving the rank of General Officers. The most famous of these enlisted pilots was Brigadier General "Chuck" Yeager. The short duration of this program is in no way a reflection of a lack of success. The army continued the essence of the program and merely changed the rank of the graduates from Staff Sergeant to Flight Officer, a rank somewhere between enlisted and Second Lieutenant.[67] In addition, the Army continues to use a significant Warrant Officer force to operate its helicopters and several other nations do not use college-educated personnel for their pilots.

However, this has not been the Air Force's way, until recently. In the early 1990s, the Air Force decided to convert a couple of critical career fields from officer to enlisted requirements. One of these major conversions was the transition from officer satellite operators to enlisted satellite operators. The Air Force was under significant pressure during the military drawdown to control and reduce their officer-to-enlisted ratios. There were also considerable efforts directed at finding areas to reduce operating costs.

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[66] Hall, et al., 10-11.

[67] Harry O. Mamaux, "The Enlisted Pilot Program in the USAF 1941-1942: Was it Successful" (ACSC Research Project, Air Command and Staff College, Air University, 1984), 22, 30.

Historically satellite operators were officers with engineering degrees. Consequently, the 50th Space Wing had a particularly high officer to enlisted ratio of 2.63 to 1.[68]

Initially, there was some resistance to the conversion. Many felt that the enlisted force could not effectively accomplish the tasks involved in operating the various satellite systems. Needless to say, one of the largest dissenting bodies was the existing pool of officer satellite operators. Nevertheless, the conversion began when the 2d Space Wing converted approximately 39 officer positions at the 1000th Satellite Operations Group (later redesignated the 6th Space Operations Squadron) at Offutt Air Force Base, Nebraska. Enlisted personnel began performing space systems operator and ground systems operator duties. Lieutenants and Captains had previously held these posts. The success of this initial conversion led wing officials to identify another 185 billets for reclassification to enlisted authorizations, expanding the process to all space operations squadrons.[69]

At first, the conversion did not occur without some challenges to overcome. The first hurdle was the courseware. The crew training squadron had developed the original materials for engineers and they were too technical for enlisted students lacking an engineering background. They easily remedied this situation by modifying the course materials to accommodate the new pipeline of students. Another key to the success of the conversion was the 50th Space wings phased approach. They planned to convert just three to five positions per squadron per month over a five-year period. This would ensure

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[68] History, Air Force Space Command's 50th Space Wing, 1 Janaury - 31 December 1995, Supporting Document 46, 4.

[69] History, Air Force Space Command's 50th Space Wing, 1 Janaury - 31 December 1995, Supporting Document 44, Point Paper (U), 50 OG/CCO, "Point Paper Update Additional Information [on] Officer-to-Enlisted Conversion, 50th Space Wing," 9 Feb 93.

a seamless transition that would not gut existing experience and would groom others to fill instructor and staff authorizations at the group and wing.[70]

"According to senior leadership at the 50th Operations Group, the reclassification was 'a success story.'"[71] In a little over four years, the 50th Space wing successfully converted approximately 290 officer billets to enlisted without any degradation in operational capability. They were able to reduce their initial officer to enlisted ratio from 2.63 to 1 down to .65 to 1. In addition, the average annual savings per position converted was $36,767 generating annual savings over the life of the conversion of $10,662,430 in FY91 dollars.[72]

Another synonymous conversion conducted during the same period was the introduction of enlisted Air Battle Managers into the AWACS system. Again, just like the satellite conversion there were skeptics about the ability of an enlisted force comprehending all of the airspace requirements. They also had reservations about their ability to process the potentially large volumes of information, assimilate this information, and make sound and accurate decision. However, the Air Force successfully converted this career field without any degradation in performance.[73]

However, there are several major striking differences between these conversions and the proposition of enlisted UAV operators. First, both of these examples were conversions of well-established programs. The Air Force had a thorough understanding

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[70] History, Air Force Space Command's 50th Space Wing, 1 Janaury - 31 December 1995, Supporting Document 42, 1.

[71] History, Air Force Space Command's 50th Space Wing, 1 Janaury - 31 December 1995, 21.

[72] History, Air Force Space Command's 50th Space Wing, 1 Janaury - 31 December 1995, Supporting Document 43, 5.

[73] Major Andrew M. Mueller, Former AWACS Flight Commander and Chief of Weapons Training, interviewed by author, 18 January 1999.

of what the mission entailed and there was considerable history and depth of experience from which to train the new personnel. This is neither the case for the Predator nor UAV operations in general. Second, in both cases, the new enlisted force was provided the exact training program the incumbent officer force received. This is not the case for UAVs unless the Air Force intends to send the proposed force through UPT before initial qualification training. Finally, in both scenarios presented above the enlisted force works in an environment where a single officer has direct supervision over a group of enlisted operators. Again, this is not the case for the UAVs unless the Air Force made significant changes to their concept of operations.

In addition, it is not likely that the Air Force would gain a comparable fiscal benefit to the above scenario from an enlisted UAV force. The monetary savings achieved from the above conversion occur because of a one-for-one exchange of an enlisted troop for an officer. This would not be the case in the Predator. Currently the Air Force only assigns pilots with at least one full operational tour of experience to the Predator. Thus, they are able to capitalize on this experience and employ them directly as mission commanders. These pilots developed their operational experience through an apprenticeship program. Pilots coming from crew aircraft functioned as copilots for their first couple of years, while single seat pilots functioned as wingmen. It is during this period, where pilots have limited decision making authority, that they learn from more experienced pilots and develop their airmanship. Lacking a comparable pipeline, an enlisted crew force would most likely have to function like a crew aircraft for this force to develop its operational experience. Thus, an enlisted option would probably require approximately a two-for-one replacement and this would erode any fiscal gain.

Non-rated Officers

There are many similarities between the alternatives of creating a separate officer career field to operate UAVs and the just-considered enlisted option. First, the Air Force would have to determine and establish some type of undergraduate UAV training program. Such a program, in all likelihood, would have to meet, at a minimum, an FAA training requirement for an instrument certificated pilot. Next, as mentioned above, is the challenge of developing operational experience and airmanship believed necessary for all UAV operations to be conducted within the normal airspace structure. In addition, the creation of a special rating reduces assignment flexibility and would virtually eliminate cross flow between UAVs and manned aircraft operations. Finally, there is a legitimate concern over whether a separate specialty could support successful officer professional development and progression within the Air Force.[74] This strikes directly in the face of Rosen's thesis. The creation of a separate career field, which is so stove-piped and limited in scale that it would impede professional growth, could doom the attempted innovation to failure.

Most of the predator operators believe that a separate undergraduate UAV course could be developed, however in order to teach somebody everything they needed to know, the program would look a lot like UPT. In addition, such a program also neglects to take into consideration the charge of developing operational experience and airmanship. Currently, the Predator squadrons rely heavily on the experiences their pilots obtained through their other weapons systems. By considering the proposed UAV missions outlined in Chapter 3, one can anticipate an increased requirement for

[74] Monroe interview, 23 February 1999.

operational experience rather than a decrease in future systems. Further, by creating a separate specialty for UAV operators, whose training is extremely similar to pilot training, the Air Force runs the risk of creating a second-class citizen.

Rated Officers

For the rated officer option there is virtually no debate regarding their qualifications to perform these duties. In fact, as a testament to the success of experienced pilot operators, the Air Force has flown the Predator for over 6000 hours without an operator-error caused crash. Though this is no significant accomplishment in terms of manned flight safety records, it is a huge improvement for UAV operations.[75]

The heart of the debate over using rated officers stems almost entirely from the current pilot shortages. Had the predator been fielded five years ago, while the Air Force was still assigning UPT graduates to non-flying assignments because of a lack of cockpits, their would be no debate. However, there are several issues that the Air Force needs to resolve for this option to remain viable.

First, if the Air Force is convinced that operating UAVs requires a pilot and piloting skills, then the operators should get credit, gate credit, for performing these duties. There are currently two options for making this happen. The first option is to provide the UAV squadrons with a companion trainer program. In other words, provide them with manned aircraft for the pilots to fly to maintain and improve their aviation proficiency and comply with the AF/JAG's interpretation of the intent of the U.S.C. 301a.[76] The other alternative is to petition Congress for clarification on the intent of aviation career incentive pay. Is

[75] Richards interview, 23 February 1999.

[76] Richards interview, 23 February 1999.

ACIP provided as compensation solely for the increased hazards associated with a career in aviation, as the JAG concluded? Or, is there some intent to provide professional compensation to the career field such as in U.S.C. 301d, which provides a retention bonus to medical officers?

Once the gate credit issue is resolved, the Air Force can then increase the assignment tour length back to three years. This will help address the concerns over corporate knowledge and experience levels. It will significantly reduce the effort required for pipeline training requirements, making the units more combat capable. In addition, the longer tour length will improve the officer professional development opportunities by increasing their tenure in leadership positions.

Most significantly, from the Rosen perspective, the Air Force benefits in two ways. First, it mainstreams UAV operations by employing those same officers that execute the Air Force's existing mission. This effectively includes UAV operations into the fold of all other flight operations in the service. In addition, by continuing to draw pilots from all of the existing aircraft categories, these officers will bring UAV capabilities back to their other weapon systems. These officers can see first hand what UAVs can bring to the fight and help conceive of ways that they can either support or accomplish various aspects of these missions. This is the key for the Air Force to start to exploit UAV technology effectively.

Chapter 6

Conclusions and Recommendations

The primary objective of this research was to examine the criteria for Air Force UAV operators and to determine both the feasibility and desirability of alternatives other than pilots as current and future UAV operators. Past and present UAV operator criteria were established followed by an evaluation of potential UAV applications for the future. In order to set the stage for an analysis of various staffing options, an elaboration of the current major issues surrounding the problem, based on interviews with the only available core of expertise on the subject, were presented. For the final element, the various staffing options were presented in light of their impact on the presented issues. Although there was significant emphasis on the Predator's requirements, since it is the only operational UAV in the Air Force inventory, the intent of the study was to address UAV staffing for the foreseeable future.

Conclusion

Based on the need to successfully incorporate UAVs into the mainstream of Air Force operations, rated officers are the best staffing alternative now and for the immediate future. It is extremely unlikely that the Air Force will acquire a significant UAV capability within the next ten years that is sufficient to support an independent career field. Consequently, any move now that attempts to establish this could seriously

jeopardize the inculcation of UAV operations into the Air Force. The greatest advocate the Air Force can hope to have for future UAV potential, such as UCAVs, is credible Air Force leadership that understands the current missions and the potential for UAVs. The examples Rosen presented in *Winning the Next War* of successful peacetime innovations took over twenty years, the time for the initial cadre to rise through the ranks of their service. It will be the bomber, transport, fighter, tanker, etc. pilots that fly UAVs today that will push for UAV exploitation in their respective fields. They will be the ones with the credibility to speak both in terms of their specialty and in terms of UAVs.

Rated officers are also the best alternative to facilitate the normalization of UAV operations within the existing airspace structures. A major objective of the Air Force should be to pursue a freedom for UAV operations commensurate with that of manned aircraft. To exploit the potential of the envisioned UAVs, the Air Force will need to fly them from their assigned bases to ranges just as they do with their manned aircraft. Ideally, they would need to be able to self deploy these aircraft to participate in various exercises such as Red Flag, Green Flag, Joint exercises etc. If the Air Force fails to achieve something along these lines, then UAV operations will be severely handicapped. They will be restricted to basing locations within military protected airspace and limited to training within those same areas. Given the conservative nature of organizations like the FAA, the Air Force can eliminate one of the variables involved in breaking this new ground by using pilots, which the FAA is already comfortable with operating in controlled air space.

Experienced UAV operators emphasize that operational manned flight experience is essential to *employ* UAVs effectively. To date the limited studies surrounding UAV

operators have focused on the skills required to *operate* these vehicles. Today, any pilot graduating from an initial qualification course is considered qualified to operate that respective aircraft. That does not mean they are qualified to employ that aircraft. In fact, mission qualification training occurs after the pilot has completed this initial training and has reported to their gaining unit. Though there is a fixed syllabus for each pilot to meet his or her initial mission qualification, true mission qualification training is always occurring. In the case of the Predator, it is the equivalent of moving from initial qualification directly to single-seat flight lead. There is no copilot or wing apprenticeship program through which to develop airmanship. Consequently, the Predator squadrons rely heavily on the operational experience their pilots obtain before arrival. It is very unlikely a pipeline UPT graduate could report directly to a UAV and succeed at employing the system effectively.

In the future, once the Air Force has thoroughly established UAV operations within the service, there may be potential to reconsider enlisted or non-rated officer operators. First, in the interest of ensuring UAV technology is sufficiently developed and exploited when and where feasible, it is not recommended that the Air Force takes steps such as these which could result in UAV operations becoming ostracized from the rest of flight operations. However, in light of the current, and continuing challenge the Air Force faces attempting to recruit, train, and maintain an adequate pilot force, the Air Force should continue to investigate all viable alternatives. Clearly, the advances in technology and automation continue to facilitate the operation of both manned and unmanned aircraft. Therefore, the possibility may exist someday where the current criteria for pilot candidates and an all officer pilot force are no longer correct. It would not be prudent to

close our minds to viable alternatives simply because they run contrary to existing paradigms.

Recommendations

The Air Force needs an active campaign to accurately inform its pilot force about UAVs. Virtually all of the pilots in the 11 RS expressed their original reservations when they learned of their assignment to fly UAVs. Most confessed their ignorance about the Predator, it mission, and the assignment in general. This was perfectly understandable considering these pilots represented the initial cadre of Air Force line operators. However, all individuals interviewed that had employed the Predator operationally expressed a respect for the mission and that they felt the assignment was both challenging and rewarding. This is the type of information that needs to be disseminated, and it will as this initial cadre starts to depart this summer and disperses throughout the Air Force.

The Air Force needs to establish a better vocabulary for UAVs. An unmanned, or uninhabited, aerial vehicle, what is that? A weather balloon is an unmanned aerial vehicle. The service must use more accurate vocabulary. The aerial vehicles the Air Force is talking about are aircraft, so call them that. More specifically, they are remotely piloted aircraft, so call them remotely piloted aircraft, (RPAs). Now, where did the term "air vehicle operator," AVO, come from? Well, if an air vehicle is an aircraft, and according to *The American Heritage Dictionary*, "One who operates or is licensed to operate an aircraft in flight" is a pilot, then just call them pilots. In addition, the Air Force needs to start referring to these aircraft the same as it refers to all of its aircraft. For example, the Air Force has assigned a mission design series (MDS) designator to the

Predator, RQ-1, so why not refer to it as such, just like F-16 or B-2. Mainstreaming the vernacular goes a long way toward facilitating the acceptance of the weapon system.

Finally, the Air Force needs to engage and resolve the gate credit issue immediately. The Air Force itself has concluded that pilots are required to operate the Predator and this paper concludes that the majority of future UAVs will also require pilots. Therefore, if the duty requires a pilot to operate the vehicle, then those individuals should get the commensurate credit. The issue of gate credit is a miniscule issue in terms of the Air Force budget and its operational decisions. However, mainstreaming UAVs and their operators is extremely important to bolstering the credibility of UAV operations within the Air Force. This small gesture for the Air Force to make would have a huge impact facilitating the acceptance and incorporation of UAVs into its culture.

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