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AF RPA TRAINING: UTILITY AND TRADITION IN CONFLICT

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The undersigned certify that this thesis meets masters-level standards of research, argumentation, and expression.

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About the Author

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Abstract

Demand for UAS is here to stay, and the U.S. Air Force force structure needs to adjust away from a contingency mindset to an enduring capability. AF leaders have turned their attention to this challenge, but difficulty normalizing training in such a dynamic field is elusive. The current AF training model has struggled to meet rising demand. What the AF needs is a new training strategy. This thesis examines AF and Army UAS training, why they are different, and what strategy the AF should adopt. Behind such simple questions lie different organizational structures and visions. Despite common technologies, each service approached UAS from different starting points, and created different training models. The AF built its RPA training based on its other aviation training programs, and hindered the organization's ability to deal with automation, significant personnel changes, and airspace integration. Conversely, the Army's UAS training community started with small, remote-controlled drones over 25 years ago at Fort Huachuca, Arizona. It has grown and expanded into new platforms with new capabilities, and its model of universal enlisted operators trained to operate as an organic divisional asset remains. The AF and Army's training programs each create a different product and, in turn, reflect institutional disagreement over what skills should be imparted. The Air Force's conflict between utility and tradition in its UAS training will have a profound effect on the AF, whose ultimate raison d'etre is to fly, fight, and win—in air, space and cyberspace. In the end, this study argues for a training strategy that leverages the RPA weapon system's unique modularity to produce well-trained RPA pilots more quickly.

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Introduction

The Air Force still has an enterprise that is undermanned, overworked, and demoralized while facing a potential mass exodus of pilots and insufficient training infrastructure to replace these losses

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Tom Cotton, U.S. Senator,
Committee on Armed Services Opening Statement,
"Army Unmanned Aircraft Vehicle and Air Force
Remotely Piloted Aircraft Enterprises,"
16 March 2016

On March 16, 2016, the Senate's Committee on Armed Services questioned General Herbert J. Carlisle, Commander of the AF's Air Combat Command and General David G. Perkins, Commanding General of the Army's Training and Doctrine Command. The hearing and subsequent testimonies addressed issues raised in a Government Accountability Office report titled "Unmanned Aerial Systems: Further Actions Needed to Fully Address Air Force and Army Pilot Workforce Challenges."[1] In the report, the GAO concluded that the AF had not fully addressed pressing issues of personnel requirements, retention difficulties, and producing enough pilots through its training pipeline. The result, as stated by Senator Tom Cotton of Arkansas in his opening remarks, is that "Despite literally dozens of reviews, task forces, studies, and reports on unmanned aircraft enterprises by the Department and the GAO, much room for improvement remains. It is plain that the Department is still struggling with [this] transformation."[2]

The Department of Defense grapples to manage the unmanned aerial systems' remarkable rise. Though unmanned flight dates back to the infancy of aviation itself, technological capabilities did not meet military and political demand until the 90s when advancements in space communications, computer processing, intelligence gathering, precision weaponeering, robotics, and network centric warfare coalesced into one

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[1] Government Accountability Office, *Unmanned Aerial Systems Further Actions Needed To Fully Address Air Force And Army Pilot Workforce Challenges* (Washington D.C., 2016).

[2] Statement of Senator Tom Cotton in "Army Unmanned Aircraft Vehicle and Air Force Remotely Piloted Aircraft Enterprises," unclassified testimony before Senate Armed Services Committee (Washington D.C.: 16 March 2016).

culturally-redefining military platform. From the Balkan conflict in 1995 to Operations Iraqi Freedom and Enduring Freedom, demand for unmanned drones had turned into an uncontrolled conflagration. As drone missions increased tenfold, operators were pushed relentlessly to meet the insatiable demand. Rapid growth resulted in a series of haphazard improvisations in operations, personnel management, and training. Anticipated drawdowns in Iraq and Afghanistan, however, have not provided an expected respite, and pressing demand has risen in Libya, Syria, Niger, and Somalia. Demand for UAS is here to stay, and the force structure needs to adjust away from a contingency mindset to an enduring capability. AF leaders have finally turned their attention to a long-overdue training bill, but normalizing training in such a dynamic field is proving elusive. What the AF needs is an entirely new training strategy.

As the two generals testified, sitting beside each other, they described vastly different problems. The disparate issues reflected different approaches each service took to Unmanned Aerial Systems (UAS) operational employment, personnel management, and training. Strikingly, despite operating remarkably similar platforms produced by the same manufacturer, General Carlisle stated, “The MQ-1C, the Gray Eagle, and the MQ-9 Reaper are totally different systems. The tactics, techniques, and procedures doctrine would be similar, but the actual training on the system between the MQ-9 and the MQ-1C are significantly different.”[3] To outside audiences, these differences are not intuitive. While the Army and Air Force may have justified integrating unmanned aircraft in their services based on unique competencies, roles, and mission requirements, the security environment has forced increased overlap. In actuality, Army and AF employ similar aircraft utilizing similar capabilities, operating in the same airspace, and supporting the same customers. This leads one to conclude that service culture is the primary differentiator for any remaining program differences.

A historian of technology, Thomas P. Hughes, provides the academic framework for such thinking in his theory on technological momentum. He states, “The social constructivists have a key to understanding the behavior of young systems; technical

[3] Statement of General Herbert Carlisle USAF in "Army Unmanned Aircraft Vehicle and Air Force Remotely Piloted Aircraft Enterprises," unclassified testimony before Senate Armed Services Committee (Washington D.C.: 16 March 2016).

determinists come into their own with the mature ones."[4] In layman's terms, sociologists advocating technological momentum posit that innovations are initially strongly susceptible to cultural shaping. Hughes argues that time drives what influences advancement. Early in a systems development, sociocultural pressures shape how a system integrates, and, in older systems, technology determines change. In the case of UAS, its formative stage gave both services the leeway to incorporate a new weapons system into its respective cultures. Despite common technologies, each service approached UAS from different starting points to create a different training pipeline.

The rise of UAS presents a unique opportunity to compare and contrast two training pipelines and determine how each services' organizational values manifested. Each training program creates a different product and reflects institutional disagreement over what skills should be imparted despite remarkably similar end-state capabilities. If Hughes' theory is correct, UAS maturation will drive the AF and Army training programs closer together, and, in the process, test the services' underlying cultural assumptions. Current efforts, however, drive the community closer to the AF's manned flying communities rather than Army's UAS. Whether such a strategy is wise or even possible, or whether the AF can realize RPA's utility within its cultural confines, is the focus for this thesis.

This study hopes to fill a literature void that has heretofore left the divide between Army UAS and AF RPA operations and training relatively unexamined. Previous studies briefly described the different services' approaches to UAS operator training, but not explored the cultural reasons why they are different. This thesis examines AF and Army UAS training, why they are different, and what strategy the AF should adopt going forward. Behind such simple questions lie organizational structures and differing visions that make untangling the issue difficult. Underlying assumptions, particularly for the AF, start to unwind when increasing automation, significant personnel changes, and airspace integration push RPA's future away from AF tradition. This conflict between utility and

[4] Thomas P. Hughes, "Technological Momentum", in *Does Technology Drive History? The Dilemma Of Technological Determinism*, 3rd ed. (Cambridge, MA: MIT Press, 1994), 112.

tradition will have a profound effect on the AF, whose ultimate raison d'etre is to fly, fight, and win—in air, space and cyberspace.

Overview

This study focuses on the Army and AF's medium altitude, long endurance (MALE) UAS operator training pipelines, starting from the initial course and onto qualification for the MQ-1C Gray Eagle and MQ-9 Reaper, in an effort to compare training for similar platforms. The AF is currently phasing out its MQ-1B Predator, a more similar platform to the Gray Eagle. Reaper and Predator training are nearly identical, and, therefore, examining Reaper training is a reasonable substitute. When addressing both services, terminology will be industry standard: UAS and operator for example. Service specific verbiage like RPA and pilot are used when treating each service individually.

This thesis uses Edgar Schein's framework on organizational culture to understand the dynamics of change and the AF, its RPA community, and the Army. Schein defines culture as a series of assumptions a person makes about the group in which they participate. He divides assumptions into three levels. Each level becomes more difficult to articulate and change, and more influential on the other levels.[5] First are assumptions about external adaptation issues. Culture develops as groups express assumptions when making decisions on missions and strategy, goals, means, measurements, and corrections in response to external stimuli. On the second level are assumptions about managing internal integration. As groups decide how to work together, they create culture by the choices they make on internal integration issues like power distribution, friendship norms, defining rewards and punishments, and defining group boundaries. The third level comprises deeper cultural assumptions that reflect the group's view on fundamental issues like time, space, human nature, and the nature of human relationships. These deeper dimensions answer questions like how humans should interact and where leaders derive their power.

[5] Schein, 26.

An observer can see these assumptions through artifacts, espoused beliefs and values, and underlying assumptions. Artifacts are visible organizational structures and processes that may be hard to decipher to outsiders. Examples include military insignia, corner offices, and designated parking spots. Espoused beliefs justify actions through codified strategies, goals, and philosophies. The AF's core values of integrity first, service before self, and excellence in all we do are examples of beliefs embodied in an ideology that "can serve as a guide and as a way of dealing with the uncertainty of intrinsically uncontrollable or difficult events."[6] When those values repeatedly produce success, groups transform them slowly into basic, nonconfrontable assumptions that provide stability and meaning. Underlying assumptions are extremely difficult to change.

The first chapter educates the reader on the origin of AF RPA training and describes the current Undergraduate RPA Training (URT) and MQ-9 Initial Qualification Training (IQT) syllabi. The chapter's historical look starts in 1996 and continues to the present to show how the influence of civilian leaders, capabilities requirements, and AF culture mixed to create RPA training. Chapter 2 describes the manning woes the training pipeline struggles to overcome and the current remediation plan in effect. Chapter 3 transitions to the Army's UAS community and explores how its training system reflects its unique beginning. Much more organically developed and resourced by the Military Intelligence Branch, Army UAS thrived under its sometimes watchful, sometimes neglectful eye.

Chapter 4 looks to the future to identify and explore approaching advancements that will either threaten or provide opportunities to the AF's training system and its normalization efforts. The chapter addresses three specific developments: increasing automation, the AF introduction of enlisted RPA pilots, and the Federal Aviation Administration's push to integrate UAS into the national airspace. It peels back how AF service culture and emerging change may shape RPA training. More automation, low expected retention, and the introduction of the enlisted pilot threaten not only the AF training culture but also its identity.

[6] Schein, 29.

Chapter 5 establishes a comparison methodology and begins directly comparing both services' training pipelines. This chapter merges the insight gained into AF culture with emerging threats and opportunities to analyze possible RPA training strategies going forward. The first section presents a method to analyze, classify, and test current and potential strategies. The second section dissects the AF's current RPA training strategy of focused differentiation in the context of its broader Strategic Master Plan and in comparison to Army UAS training.

Finally, Chapter 6 takes the final step and answers what training strategy the AF should adopt as RPAs enter mainstream aviation. At that point, the AF will broaden its training strategy into either Low Cost Leadership or Differentiation. This chapter conducts a Strength, Weakness, Opportunity, and Threat (SWOT) analysis of each strategy and recommends a Low Cost Leadership course of action. To conclude, a five-question check scrutinizes this strategy recommendation to see whether the chosen strategy has a distinctive value proposition, a tailored value chain, trade-offs that are different from rivals, a good fit across the existing value chain, and whether there is continuity over time.

The AF and the Army offer competing views on the future of UAS training. Both services export its cultural values, as the Navy, USMC, and international partners watch and adopt best practices. Finding the right technical approach may require overcoming cultural barriers, but just as likely, an effective training strategy may be able to accommodate various cultures. Such a crisis presents an opportunity to course correct; now is the time to properly tailor RPA training to leverage today's capabilities while anticipating tomorrow's technology.

Chapter 1

AF RPA Training History

Ultimately, all organizations are sociotechnical systems in which the manner of external adaptation and the solution of internal integration problems are interdependent and intertwined. Culture is … not easily reduced to a few major dimensions. Culture reflects the group's effort to cope and learn; it is the residue of that learning process.

Edgar Schein, Organizational Culture and Leadership

Edgar Schein creates logical stepping stones to explain how an organization's culture develops and influences decision making. Examining an organization's cultural origin and subsequent issues faced is an important step to understand how it makes decisions. This chapter will explain and then use Schein's framework to examine the origins of the AF's Undergraduate RPA Training and its status. The chapter will conclude by identifying the underlying assumptions, values, and artifacts reflected as the AF developed Undergraduate RPA Training (URT).

U.S. military operations in Afghanistan and Iraq required real-time information. As combatant commanders struggled to understand the battlefield, they relied increasingly on RPA's Intelligence, Surveillance, and Reconnaissance (ISR) coverage of full motion video. This demand relentlessly pressured the RPA community to increase its hours flown. Consequently, combat lines, then known as combat air patrols (CAPs), grew exponentially and outpaced the AF's will and ability to keep pace. Under these difficult conditions, the RPA community solved problems of member identity, goal setting, metrics selection, labor division, and correction. In the process, it created a culture around learned solutions to these problems. URT is more than a training course; it is the cultural manifestation of "the ultimate problems that every group faces: dealing with its external environment and managing its internal integration."[1]

[1] Schein, 85.

Context Surrounding URT Standup

Schein states, "If the environmental context is changing, such conflict can be a potential source of adaptation and new learning."[2] This certainly describes the Air Force's predicament in 2007 as it struggled to understand the context in Iraq and take appropriate action to quell the rising counterinsurgency. Shein's cultural framework includes five steps of adaptation that organizations continuously cycle through in response to external change: mission and strategy, goals, means, measurements, and correction. On January 10, 2007, President Bush addressed the nation and covered each step. He frankly admitted, "It is clear that we need to change our strategy in Iraq."[3] Current actions based on faulty assumptions were not meeting goals nor achieving peace, and the stakes of defeat meant losing the "decisive ideological struggle of our time."[4] He then articulated a new strategy and new metrics:

> The most urgent priority for success in Iraq is security, especially in Baghdad. Our troops will have a well-defined mission: to help Iraqis clear and secure neighborhoods, to help them protect the local population, and to help ensure that the Iraqi forces left behind are capable of providing the security that Baghdad needs.[5]

The President explicitly declared new assumptions: protecting the local population and strengthening Iraqi forces would achieve victory. This change required a different force structure, and he authorized twenty thousand additional soldiers to Iraq and increased deployment durations. Instead of kinetic strikes and force to win, the troop surge marked a mission refocus to security. President Bush closed his speech by defining what success looked like. "Victory in Iraq will bring something new in the Arab world -- a functioning democracy that polices its territory, upholds the rule of law, respects fundamental human liberties, and answers to its people."[6]

President Bush's new approach set in motion a collision course between Secretary Robert Gates' mandates and the AF's reluctance to address ISR supply shortcomings. The AF struggled to accept its tactical, supporting role and adapt its skill set, weapons

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[2] Schein, 108.
[3] President George W. Bush, "President's Address To The Nation", (Speech, 2007).
[4] Bush, 2007.
[5] Bush, 2007.
[6] Bush, 2007.

systems, and training output in reaction to the new character of warfare. In 2014, Gates described in his memoir how the AF resisted change. He commented, "Whatever the complications, the surge of troops in Iraq and mounting difficulties in Afghanistan required a surge in ISR capabilities. Indeed, in nearly every one of my weekly videoconferences with Dave Petraeus, first in Iraq and later in Afghanistan, he would raise the need for more ISR."[7] The AF did not agree with this assessment, and it made no plans to increase beyond the eight MQ-1 Predator combat lines it was providing. Each combat line provided over 20 hours of surveillance daily. Gates pushed for change but did not get a satisfactory response. His frustration mounted, as he surmised, "As the need for more ISR kept growing through the winter of 2007-8, it was clear my haranguing wasn't working."[8] Clearly, the external environment and its requirements were at odds with AF values. Airmen's culture needed transformation, but deeply held values do not change easily.

The AF's historical internal integration explain why the AF did not willingly pursue change. Previous decisions reveal institutional preferences for pilots and manned aircraft. Fighter pilots' monopoly on key leadership positions makes clear assumptions about power, status, rewards, and punishments. Asymmetric warfare created a need suited to unmanned aircraft and its long endurance capability, a need that traditional aircraft could not fulfill. Even when the skills and services provided by fighter pilots were found wanting, the AF refused to reexamine its underlying assumptions until Secretary Gates pushed it.

Unfortunately, Secretary Gates perceived that the AF leadership was shirking and out of touch.[9] Several developments confirmed his suspicions that AF leadership did not accept the urgency for more ISR and were not taking creative steps to acquire more. One was the AF's tone-deaf proposal to discontinue the U-2, a key strategic ISR asset. Another signal to Gates was the AF's preoccupation with unrelated acquisitions projects. Those projects, specifically the F-22 and a new bomber, reinforced AF cultural

[7] Robert M. Gates, *Duty: Memoirs Of A Secretary At War* (New York, USA: Knopf Publishing Group, 2014), 129.
[8] Gates, 129.
[9] In Peter Feaver's *Armed Servants: Agency, Oversight, and Civil-Military Relations*, he introduces a working-shirking continuum to describe the military's varied levels of compliance to its civilian leaders. He defines shirking as doing things the way those in the military want.

assumptions about pilot primacy and its glorious struggle for conventionally attained air supremacy, but were at odds with Gates' desires and Petraeus' needs. Gates states,

> Then, at a time when we were trying to put every intelligence platform possible into the war, the Air Force proposed ending all funding for the venerable U-2 spy plane by the end of summer 2008. I thought proposing to ground it at this juncture was just plain crazy. Further, nearly every time Moseley and Air Force Secretary Mike Wynne came to see me, it was about a new bomber or more F-22s. Both were important capabilities for the future, but neither would play any part in the wars we were already in.[10]

Previous interactions with the AF as CIA director earlier in the 90s had primed Gates for this resistance. Then, he had tried to persuade the AF to develop drones to pursue its potential advantages of loiter, collection, and signals intelligence. He was rebuffed and told that people join the Air Force to fly airplanes, and drones had no pilot. When he returned to government in 2006, he was disappointed to see that "the Air Force mind-set had not changed."[11]

AF intransigence and Secretary Gates' determination would cost the AF in two long-lasting ways. First was the AF's miscalculated bid for executive agency over the RPA. On one hand, the AF had little enthusiasm for building its RPA fleet and providing the combatant commander and, by extension, the Army, with sufficient ISR. On the other, it was grasping for absolute control of this asset. Gates was loath to give oversight of RPAs to the AF.[12] Second, Gates dismissed the Secretary of Air Force Mike Wynne and General T. Michael Moseley, the CSAF. General Norton Schwartz, a C-130 pilot, replaced General Moseley. By selecting Schwartz, the only recent Chief of Staff not from the fighter or bomber community, Gates signaled the AF's need to fence mend with the Army and remedy its previous "stinginess in getting to ground commanders badly-needed UAV assets."[13] While Moseley had put on hold and then cancelled URT, his replacement, Schwartz gave the green light during a speech just a few months after taking over.[14]

[10] Gates, 129-130.
[11] Gates, 127.
[12] Gates, 129.
[13] Carroll, Ward. "Schwartz a Chief to Mend Fences." *The Defense Biz* (Defensetech), June 13, 2008. http://defensetech.org/2008/06/13/schwartz-a-chief-to-mend-fences/.
[14] Jeff Wiseman (AETC/A3FR), interview by the author, 22 December 2016.

Schwartz's command to grow the RPA fleet forced the AF to scrutinize its assumptions about internal integration. Group boundaries excluding unmanned aviation needed reexamination. Power and status from other communities toward RPAs would not be ceded willingly, but the RPA's sheer size, growth, demand, and capabilities could no longer be dismissed. Lack of rewards like professional military education (PME), promotions, or staff positions initially plagued the community, and significant effort continues to this day to reverse this perceived punishment.

AF Thoughts on URT

The AF then rapidly established initial classes as a Beta Test and then established a formalized Undergraduate RPA Training course. Despite its hurried response, much previous internal AF thought and debate over the years had gone into who should fly RPAs. While external conditions forced the AF to expand its RPA program, the AF had the latitude to use its cultural preferences to institute a solution. Organizations reflect internal assumptions in their decision-making, and the standup of URT stands as a strong embodiment of the AF's culture. "Beyond Butterflies," a 2007 SAASS thesis by then-Major Houston Cantwell, lends insight into the logic influential AF leaders used to craft URT. Cantwell's many interviews trace strategic leaders' thoughts and decisions over the years as they struggled to overlay AF culture onto a disrupting innovation.[15] These thoughts leading up to 2007 foreshadowed the establishment of a dedicated 18xx Air Force Specialty Code (AFSC) and training pipeline.

AF personnel policies on UAV aircrew are rooted with General Ronald Fogleman, former CSAF. In 1995, the AF had little interest or involvement in the Predator's Advanced Concept Technology Demonstrations (ACTD) process under DARPA. But then, three developments--operations in Bosnia that demonstrated UAV capability, interservice competition with the Army, and leadership interest--coalesced into a sudden service bid for Predator.[16] Fogleman anticipated that Predator was going to be fielded, and he felt the AF was best positioned to exploit the platform. Prior to AF

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[15] Major Houston R. Cantwell, "Beyond Butterflies: Predator And The Evolution Of Unmanned Aerial Vehicle In Air Force Culture" (School of Advanced Air and Space Strategy, Air University, AL, 2007), 79.
[16] Thomas P. Ehrhard, Air Force UAVs: The Secret History (Arlington: Mitchell Institute for Airpower Studies, 2010), 50-1.

interest, the Army had operated the Predator unit and was naturally suited to assume the position as lead service. Fogleman was disdainful of the Army's approach to UAVs and was convinced their poor service and safety record would implode the program. In response, he established a new UAV squadron, the first UAV squadron since 1979. Fogleman's position and eclectic background gave him the authority and perspective to identify this transition point and mobilize AF resources to get Predator.[17] His varied career path included a distinguished Forward Air Controller (FAC) tour in Vietnam as an F-100 pilot and a tour teaching history at the Air Force Academy. In the 1980s, Fogleman, as an Air Division commander, stood up ground-launched cruise missiles, something that had contrasted sharply with the AF's cultural affinity for flying airplanes. Prior to his CSAF appointment, he commanded Air Mobility Command and Transportation Command. These varied experiences broadened his aperture, and his weight of influence proved pivotal in wresting control of the Predator program from the Army.

Fogleman's time as CSAF marked the genesis of Predator, and he formulated the original policies that still affect the community's culture. In his bid for program control, Fogleman argued the Army's poor UAS record was in part due to its approach. Amongst fellow AF generals, he imbued the view that they were going to "treat it like an airplane."[18] He also provided the necessary personnel to assure Predator's early success. Besides standing up a dedicated UAV squadron, he assigned non-volunteer instructor pilots to fly the Predator UAV. "If this program fails," he commented at the time, "it won't be because of our pilots."[19]

This first requirement introduced initial values to Predator's emerging subculture. First, by requiring pilots, Fogleman defined the RPA's boundaries. Being a pilot was the critical criteria for inclusion. He had successfully excluded the Army and its enlisted operators, and navigators could volunteer only if they had personally procured their pilot licenses. Pilots surveyed overwhelmingly assessed that training requirements prior to

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[17] Ehrhard, 51.
[18] Thomas Ehrhard, "Unmanned Aerial Vehicles in the United States Armed Services: A Comparative Study
of Weapon System Innovation," (Ph.D. Diss., The Johns Hopkins University, 2001), 593.
[19] Ehrhard, 593.

Predator initial qualification training were roughly equivalent to undergraduate pilot training. Further, they believed that "manned aircraft flying experience [was] essential to effective employment of the Predator."[20] This survey had an air of authority despite lacking a formal requirements review. Essentially, junior pilots had supported the AF's defined boundaries.

Fogleman created a perception by assigning non-volunteers to a Predator tour. Pilots identified the tour as a punishment, a notion that would haunt the community. Communities subsequently relegated poor performers to RPA assignments, and the Predator developed the leper colony's curse of low status and power. Had manning requirements framed the assignment as a select opportunity available only to volunteers, whether pilots or officers with flying experience, the community's misfit label might have been avoided.

Staffing policy also fragmented the RPA subculture. The assignments drew from multiple communities each with their own subculture. After a three-year tour, pilots would return to their previous communities. To add to the fragmentation, separated ground control stations, constant shift work, and the lack of coordinated, socialized flying missions isolated squadron members. Loose personal bonds resulted, and camaraderie suffered. This weakened the potential institutional power of the RPA community and reduced its clout among other subcultures. When Fogleman abruptly resigned, no powerful advocate replaced him until General John Jumper four years later.

General Jumper picked up where Fogleman left off. He advocated arming the Predator with Hellfires and adding a laser designator while commander of ACC. As CSAF, he published an RPA strategic vision. He echoed Fogleman's approach of using pilots, stating,

> The original notion of using pilots was because of the Army experience [with UAVs]…If you treat it like an airplane it will act like an airplane…. We were trying to get the accident rate down and get the operator caused accidents down. We knew if we crashed a bunch of these things that we weren't going to get [the program] either. That's why we insisted on pilots.[21]

[20] William C. Tirre and Ellen M. Hall, *USAF Air Vehicle Operator Training Requirements Study* (Brooks AFB, TX: AF Research Laboratory, 1998).
[21] Quoted in Cantwell, "Beyond Butterflies," 79.

As the AF gained RPA experience, Jumper softened on this issue and started advocating for a Combat Systems Officer concept. In February 2003, he directed a reengineering of undergraduate navigation training to incorporate a remotely piloted aircraft track in the new revised program. The Combat Systems Officer concept built upon traditional Undergraduate Navigator Training (UNT) to create "credentialed warriors." His 2005 RPA Strategic Vision conveyed this approach: "the Air Force vision is to develop a new career field to man these billets. Part of this transformation will be the creation of an RPA training program for new Air Force officers and enlisted personnel to transition directly into RPA."[22] The pipeline to create dedicated RPA pilots "hopelessly tied to future acquisition, employment doctrine, and career path development" would spur community investment and innovation.[23] Jumper's leadership laid the groundwork to change the community's initial assumptions about who would fly RPAs.

The step from vision to fruition took place in 2008. Internal disagreement existed about the desired training requirements for RPA personnel, but a near unanimous consensus within AF leaders emerged that an officer with developed airmanship was required. Some felt a rated airman was a prerequisite to flying safely in an integrated national airspace, some felt that high airmanship levels were required to solve dynamic problems, and some were concerned that a distinct career field would create second class citizens.[24] Ultimately, a new career field was created with a dedicated training pipeline. This satisfied two goals: the desire to impart needed technical skills and the cultural buy-in required for long-term success of RPAs. Those who recognized the future of RPA also recognized the large stake the AF had in the program. Then Brigadier General Charles Lyon, former 57th Operations Group Commander noted, "if anyone can fly a Predator then anyone can fly UAVs—any rank, any service. If anyone in any service can fly a UAV then the USAF cedes our authority over managing, commanding, and controlling the effects that take place from the air to anybody that wants to do it."[25] By creating a

[22] U.S. Air Force, *The U.S. Air Force Remotely Piloted Aircraft And Unmanned Aerial Vehicle Strategic Vision*, 2005, 19.
[23] Ehrhard as quoted in Cantwell, "Beyond Butterflies," 124.
[24] Cantwell, 101-2.
[25] Quoted in Cantwell, "Beyond Butterflies," 102.

separate AFSC, the AF had attempted to settle internal issues and better allow its people to concentrate on performing its mission. Schein's organization culture theory describes the path the AF followed to maintain operational relevance in the face of a disruptive technology: "the confrontation of survival issues most often is the critical stimulus that creates rapid consensus around the internal integration issues. The internal integration and external adaptation issues are thus interdependent."[26]

Building URT

Training is vital to military organization. Three elements are vital to the training process: tasks, conditions, and standards. Tasks are the tangible questions to be dealt with, conditions are the operating environment where the function is to be performed, and standards are the minimum of acceptable proficiency.[27] Training is task dependent and focused on a specific skill and the tools of that specialty in a stable environment with known conditions. In times of rapid changes to tasks, tools, or conditions, training by its very nature will struggle to maintain relevancy. The struggle to keep RPA training relevant when mission requirements and capabilities continue to evolve is substantial.

General Jumper retired from the AF on November 1, 2005, but not before setting the wheels in motion for a dedicated RPA pilot AFSC and training pipeline. The next stage involved translating the vision into a training course. That would fall to a recently retired F-15E Weapons Systems Officer named Lt Col Jeff Wiseman in Air Education and Training Command's A3FR branch. As the development progressed, he hired another recent retiree, Lt Col Robert Englehart. These two would build URT.

Undergraduate RPA Training was a piecemeal creation. It initially borrowed heavily from the Combat Systems Officer (CSO) training syllabus and some from Specialized Undergraduate Pilot Training (SUPT) to maintain a commonality across AETC's Undergraduate Flying Training.[28] Colonel Stephen Wilson, the AETC Assistant Operations Officer in 2006, recommended following SUPT's developmental

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[26] Schein, 134.

[27] Curtis E. LeMay Center for Doctrine Development and Education. *Volume 2: Leadership; Appendix C: Education and Training*, 8 August 2015. https://doctrine.af.mil/download.jsp?filename=Volume-2-Leadership.pdf.

[28] HQ AETC/A3F. *AETC Undergraduate Remotely Piloted Aircraft Training (URT) Powerpoint Brief*, 2016.

methodology. Wiseman and Englehart heeded that advice. First, they identified the necessary skill sets required to operate UAVs by soliciting input via survey from the formal training unit at Creech AFB. The two contacted the FAA for input to ensure URT graduates would be qualified to transit in national airspace, a key requirement. Goals established at this phase included: to provide qualified graduates to enter RPA Formal Training Units, to impart foundational skills to meet RPA mission requirements, to impart the ability to operate in National Airspace System or International Civil Aviation Organization airspace, to grow and sustain professional RPA community, to train pilots—not operators, and to instill airmanship and flight discipline.[29] Second, Wiseman and Englehart borrowed tactical instruction from the CSO syllabus. Similar to CSO training, classroom academics would be in lockstep with computer-based training and simulation. Front loading contextual operational academics on tactics, authorities, and command structures was intended to ease the transition a recent graduate would make into the operational environment.

Third, a mandate existed from the start to maintain efficiencies, keep costs under control, and proceed quickly. Feedback from the Predator Formal Training Unit identified flight experience as crucial to follow-on training, and flight screening was placed as URT's first phase. In accordance with maintaining efficiencies, the then-AETC commander, General Stephen Lorenz, insisted on integrating this screening into other training pipelines in Pueblo, Colorado. Initially, 18 hours were allotted, same as SUPT candidates, to allow for local area flying and a solo flight. Later, the FTU and operational units requested more student instruction to increase airspace awareness. Subsequently, Initial Flight Screening expanded to 39 hours, adding more local flying as well as cross-country orientation.

In parallel to this developmental effort, officials conducted trials placing non-rated officers directly into the MQ-1 Formal Training Unit at Creech AFB. Lt Leslie's experience as the first test case demonstrates the difficulty the AF had adapting its bureaucracy to the RPA enterprise.[30] In 2005, Lt Leslie had been eliminated from SUPT, unable to overcome motion sickness. Before his dismissal, he had completed

[29] HQ AETC/A3F.
[30] Major Leslie, USAF, (49 Wg OGV), interview by the author, 7 Jan 2017.

introductory academics, solo'ed, and progressed to his pre-contact check ride in the T-6. Thirty days out from administrative separation, Maj General Mark Zamzow, a family friend, contacted Leslie to see if he was interested in participating as the inaugural test member. A few months later, Leslie joined MQ-1 Class 06-03 along with members of the California Air National Guard. The FTU instructors enrolled him into the class without any special treatment or additional preparation. He successfully navigated the course, including a form 8 check ride. Along the way, his progress informed and refined AETC's developing syllabus. Upon graduation, Leslie received an e-mail from the Operations Group commander. In his e-mail, the OG relayed authorization for Leslie to wear aircrew officer wings. Without ceremony, he summarily went to the uniform store and purchased his wings.

Lt Leslie reported to the 15th RS and immediately met roadblocks. A running tally of issues mounted that following classes would later solve. Questions surrounded whether he was rated or not. Was he entitled to flight pay, to sign a flight authorization, or required to fulfill flying gate months? The Squadron Aviation Resource Management personnel could not enter him into their database tracker with his unique 17xx AFSC designation. How then would the SARM office record his flight hours? No authority pushed through any resolutions, and the squadron did not authorize Leslie to fly. Instead, he made himself useful in the squadron as a Mission Intelligence Coordinator (MIC) and then as the Senior MIC. Without a senior AF advocate pushing to overcome cultural hurdles, a distinctive Predator training pipeline was paused. In October 2006, without explanation, the AF notified Leslie that it had cancelled the trial. Lt Leslie transferred to the missile career field and bided his time.

In September 2008, General Schwartz directed the standup of URT, and in January 2009, the first RPA Beta test class started. Forty qualified volunteers across the AF applied, and ten joined the initial class. The Beta test trialed the syllabus, taking previous aircrew and non-aircrew alike through flight screening, then instrument training, and finally an RPA fundamentals course. The classes then reported to the Predator FTU and folded into established transition courses. Lt Leslie rejoined the RPA community and graduated from the fifth and final Beta test class. In May 2010, General Schwartz declared the trial a success, and five months later, the first URT class started. All accession sources contributed to the RPA pilot candidate pool, and the Air Force Personnel Center designated RPA pilots as the 18xx AFSC. In two short years, RPA training had morphed from the initial "go-do" order to concept to testing to production. Additionally, URT operated at a fraction of the cost of SUPT. AETC approximates URT costs at $65k per graduate while SUPT averages $560k per graduate.

Many RPA pilot milestones have followed. To date, 917 RPA pilots have graduated. Their many accomplishments include operating "solo" in combat since 2009, countless weapons deliveries, thousands of flight hours, instructor qualifications, serving on MAJCOM Staffs, graduating from the Weapons Instructor Course, and serving as squadron directors of operations. Initially, the community was skeptical of young RPA pilots arriving at Creech AFB. As their performance validated the training pipeline, direct MQ-9 billets became available. Starting in 2012, the MQ-9 FTU accepted RPA pilots for initial qualification training. The mixed community is making strides to transition toward 90% 18xx personnel.[31] The next imminent milestone is the community's first 18xx-designated squadron commander. URT grows more effective at graduating students as instructors gain experience and students manage course expectations better. Overall attrition numbers decrease each year. In 2011, attrition stood at 36%, and it declined to 10% by 2016. This final metric testifies to the program's success in filling ISR demand: RPA pilots will be the largest group of AF pilots by 2018, after only six years of existence.[32]

URT Description

URT, as it stands now, consists of three courses: RPA Initial Flight Training, RPA Instrument Qualification Course, and RPA Fundamentals Course.

RPA Initial Flight Training (RFT) shares a flight screening contract operation in Pueblo, Colorado with SUPT and UNT. Initially modelled as a screener, URT granted candidates 18 hours of flight instruction and was the greatest cause of attrition. This feedback combined with a reevaluation led to an increase in flight hours with potential for re-flying rides. Correspondingly, AETC/A3FR updated the course title from RPA

[31] 49th Operations Group RPA Mission Brief, Oct 2015.
[32] Lt Col Jason Green, "A Brief Look: The State of Remotely Piloted Aircraft (RPA) Operations Local, Global… Past, Present, and Future…," 2016.

Introductory Flight Screening to RPA Introductory Flight Training. The training takes 8 weeks and consists of 35 training days. Students fly 39 hours in Diamond DA-20. Twenty-two flights are dual sorties, and five are solo. Academics include basic flight maneuvers, flight safety, emergency procedures, navigation, and communication. Students must pass the FAA's Private Pilot Knowledge Test. This stage is a contracted operation and costs $10k per student. Ninety-nine percent of attrition occurs in this phase.

The 558 Flying Training Squadron at Randolph AFB, Texas instructs the RPA Instrument Qualification (RIQ) course following flight training. Original concepts of URT considered an RPA track after T-6s in SUPT, but RFT along with a T-6 simulator-based instrument qualification course replaced the requirement. Over 56 training days, instructors deliver 140 hours of classroom academics and instruct 36 simulator sorties totaling 47 hours in a T-6-like Flight Training Device simulator. In later stages of the course, instructors link the simulators, and students interact in an air traffic pattern with each other and an Air Boss who controls the ensuing chaos. This forces students to act under stressful, unpredictable situations. Additionally, students receive emergency procedures training and practice applying corrective actions.

The last phase of URT is the RPA Fundamentals Course (RFC). Described as "a mile wide and an inch deep," it is designed to introduce students to operating an RPA in a tactical environment as well as educate them on tactical mission elements ranging from the unique physiology requirements of 24/7 shift work to traditional Close Air Support procedures. The course is 22 training days, and the syllabus allots 78 academic hours and 31 simulator hours. The simulators, called Predator Reaper Integrated Mission Environment (PRIME), replicate the console interfaces and displays students will see at the MQ-9 FTU. Course material includes physiology, joint force command & control, datalinks, bandwidth, GPS, threats, brevity, weapons, air defense, and mission systems. Upon URT completion, the 558 FTS hosts a winging ceremony and pins specially designed RPA wings on the new graduates.

Figure 1: RPA Pilot Wings
Source: "U.S. Air Force Aeronautical Rating", En.Wikipedia.Org*, 2017*

Reaper FTU

The Predator and Reaper Formal Training Units have had much less internal controversy surrounding its operations or personnel. Its main struggle is graduating enough students in a timely manner to alleviate the community's manning woes. The AF is phasing out the Predator, and what follows here covers the General Atomics MQ-9 Reaper.

Beginning in October 2008, the 11 Reconnaissance Squadron conducted formal training at Creech AFB, Nevada under the 432d Air Expeditionary Wing. The first MQ-9 class started in February 2009, and in October 2009, formal training moved to Holloman AFB under Air Combat Command's 49th Wing. The AF reactivated three squadrons, the 6th Reconnaissance Squadron, 16th Training Reconnaissance Squadron, and the 29th Attack Squadron. To handle increasing demand, the AF reinstituted the 9th Attack Squadron in September 2012, and currently in 2017, the 6th RS is transitioning from the Predator to the Reaper.

The FTU Initial Qualification Training syllabus consists of 157 academic course hours, 22 simulators totaling 58 hours, and 22 sorties totaling 44 hours.[33] The seven academic phases are introduction, transition, ISR/Synthetic Aperture Radar employment, Basic Surface Attack (BSA)/Surface Attack Tactics (SAT), Air Interdiction (AI)/Strike Coordination and Reconnaissance (SCAR), and Close Air Support (CAS)/Combat Search and Rescue (CSAR). Handover training occurs in the transition phase to prepare students for remote-split operations (RSO) at their operational squadron.[34] An emergency procedure evaluation and an in-flight check ride awarding the student an AF Form 8 conclude the course.

[33] MQ 06 (IQT Change 2), 10.

[34] Handover training/remote split operations: transferring aircraft control from a local line-of-sight data link to a over-the-horizon satellite link controlled remotely. Both changing aircraft control and controlling an RPA remotely are two critical enabling capabilities of the RPA infrastructure.

Recap

The RPA community has significant training hurdles in its future, but its recent success is astounding. In two decades, it transformed from a shoestring operation into the AF's most significant capabilities advancement in decades, possibly eclipsing the development of stealth and precision munitions. Basic technology and combatant commanders' insatiable demand for information created the exponential growth that led to today's RPA community. These challenges forced the RPA community to solve problems of identity, goals, and influence. In "dealing with its external environment and managing its internal integration," the RPA community created URT. [35] In the process, it took a pivotal step to establish its own culture.

[35] Schein, 85.

Chapter 2

Storm Brewing: RPA's Current Status

In the ISR portfolio alone, we grew an RPA industry from scratch that has become the oxygen the joint force breathes.

General David Goldfein
in CSAF letter to Airmen

Training is the connective tissue that enables Airmen to operate RPAs in a desired way to achieve a desired effect. Fundamentally, training has these requirements: a desired skill to achieve a desired effect, an instructor that possesses the knowledge and techniques to impart that skill, a student, and a tool to translate that applied skill into a result. The overarching assumption in a training environment is predictability. As Shein argues, when an operating environment changes due to external stimuli, an organization develops strategies and goals to respond based on its beliefs and values. An observer can reverse the process by examining an organization's artifacts, espoused values, and underlying assumptions to intuit its culture. Alternatively, if the observer already understands an organization's behavior patterns, he can predict its future decisions.

Few areas in the RPA community have remained static during times of rapid growth in an evolving security environment, yet the community elusively searches for continuity and a desire to achieve sustainable, steady operations. Figure 2 illustrates the exponential growth in combat lines provided by the AF since 2000, with more planned on the horizon. Drawdowns in Iraq and Afghanistan have not reduced persistent, armed ISR requests, as the Pentagon announced plans to increase daily RPA operations by 50% starting in 2019.[1]

[1] Brian Everstine, "DOD Plans 50 Percent Increase In RPA Caps By 2019", *Air Force Magazine*, 2015, http://airforcemag.com/DRArchive/pages/2015/august%202015/august%2018%202015/dod-plans-50-percent-increase-in-rpa-caps-by-2019-.aspx?signon=false.

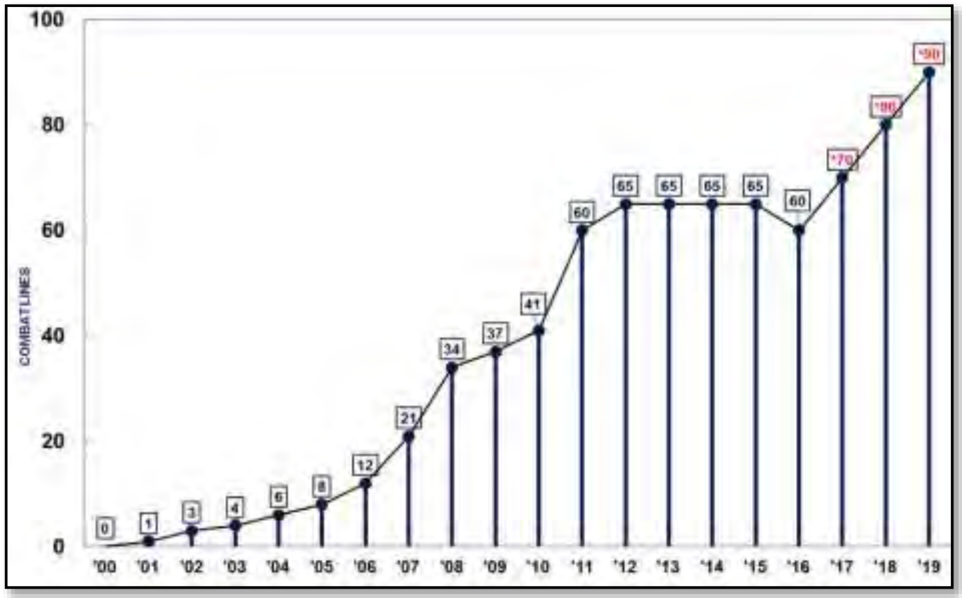

Figure 2: Past, present, and forecasted RPA Combat Lines by Calendar Year
Source: Lt Col Jason Green, "A Brief Look: The State of Remotely Piloted Aircraft (RPA) Operations Local, Global… Past, Present, and Future…"

Despite initial expectations that reduced operations in Iraq and Afghanistan would reduce RPA demand, the opposite has happened. RPA forces have dispersed across the globe, reducing efficiencies gained by concentrating forces. Forecasting on the supply side mirrors the difficulty of predicting demand as well. In 2012, staffs wrongly expected a reduction in force and underestimated future requirements. Planners under resourced the training pipeline, and instructor pilots now struggle to replenish work force requirements. Commanders wait expectantly to see if low retention rates materialize as the first batch of RPA pilots conclude their 6 year Active Duty Service Commitment (ADSC). Staffs struggle to estimate future requirements without historical attrition statistics to rely upon. Low manning sets up a vicious cycle, where stretched working conditions leads to job discontent which leads to increased attrition which then leads back to poor manning. In short, RPA pilots are in short supply, and solutions to escape the downward spiral involve short-term sacrifice, something that makes the problem more acute.

In 2015, Headquarters Air Force responded to community outcries, Congressional inquiries, and external audits. It developed a systemic set of initiatives to remedy the community's many issues, and an RPA Tiger Team formed to implement some 57 initiatives addressing manning, pay, scheduling, basing, and squadron organizations.[2] This chapter examines the Air Force's comprehensive and on-going response to its shortfall in three distinct steps. The first step increases training throughput, the second streamlines the training pipeline, and the third reduces attrition to lessen the need for replacement. The initiatives are consistent with larger AF culture, and parsing what those decisions mean at different levels of Schein's cultural assumptions provides greater understanding of how the AF makes choices. The examination of each responsive step will conclude by deconstructing decisions in the context of culture.

First Step: Increase Capacity

The community's on-going manning woes, lifestyle issues, and continuing fight for bureaucratic integration has received attention from Congress, the Governmental Accounting Office, RAND Corporation, and senior leaders. On March 16, 2016, General Herbert Carlisle, commander of Air Combat Command testified before the Senate Armed Services Committee. He addressed the approach needed to alleviate the community's shortfalls:

> The first step to fixing that is to increase the number of RPA crews by increasing the output of our training pipeline. Air Combat Command is responsible for the training of our Air Force's RPA pilots and sensor operators. We will graduate 384 next year which is 200 more than we have graduated annually in past years. This tremendous output is currently achieved with very limited resources as we strive to balance ACC's two main priorities: Provide for Today and Prepare for the Future.[3]

The AF wants 1400 RPA pilots to meet flying demands, staff requirements, and squadron overhead. It currently has 900. URT is doubling its output to close that gap. Accession sources continue to produce an abundant supply of willing URT candidates. According to its Director of Operations, the 558 FTS "is on track to produce 220 pilots [in 2016]. Next fiscal year [2017]-

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[2] HAF/A3OC, *RPA Tiger Team Initiatives Update Brief*. 28 Jul 2016.
[3] Statement of General Herbert Carlisle, USAF in "Army Unmanned Aircraft Vehicle and Air Force Remotely Piloted Aircraft Enterprises," unclassified testimony before Senate Armed Services Committee (Washington D.C.: 16 March 2016).

384 pilots. In perspective, Laughlin AFB, the AF's largest pilot training base, produces 300 pilots annually."[4] The 558 FTS expanded the flight training contract at Pueblo, installed more simulators, stood up more student flights, and added contract instructors to aid in the instrument qualification course and the RPA fundamentals course. The 12th Operations Group is establishing a student support squadron in the summer of 2017 specifically to alleviate increased administrative demands on the 558 FTS.

URT program managers have scaled productions smoothly to meet demand. It contracts out flying operations and relies on simulators and in-class instruction during RIC and RFC. The emphasis on simulator instruction increases scheduling reliability. Weather days exist only at Pueblo for RFT. Production therefore is predictable and timely. Fundamentals taught in RIC do not require RPA experienced contractors or AF instructors. Additionally, URT operates out of Randolph AFB, home of Air Education and Training Command, in San Antonio, Texas. The desirable location provides a large pool of flight instructors to drawn from. Attracting current and qualified RPA pilots from operational assignments has previously been a struggle attributed to URT instructor positions not qualifying for flying gate months. The AETC/A3FR staff corrected the oversight in January 2017, and more pilots are now eligible for an instructor assignment. Should additional RPA pilots be required, a new squadron in a new building will be required as flight rooms, briefing rooms, simulators, and instructors are all fully resourced. In short, the expansion to 384 RPA pilots per year has required great effort from the 558 FTS, but the squadron expects to achieve its production requirements.

[4] Lt Col Jason Green (Director of Operations, 558 FTS), interview by the author, 22 Dec 2016.

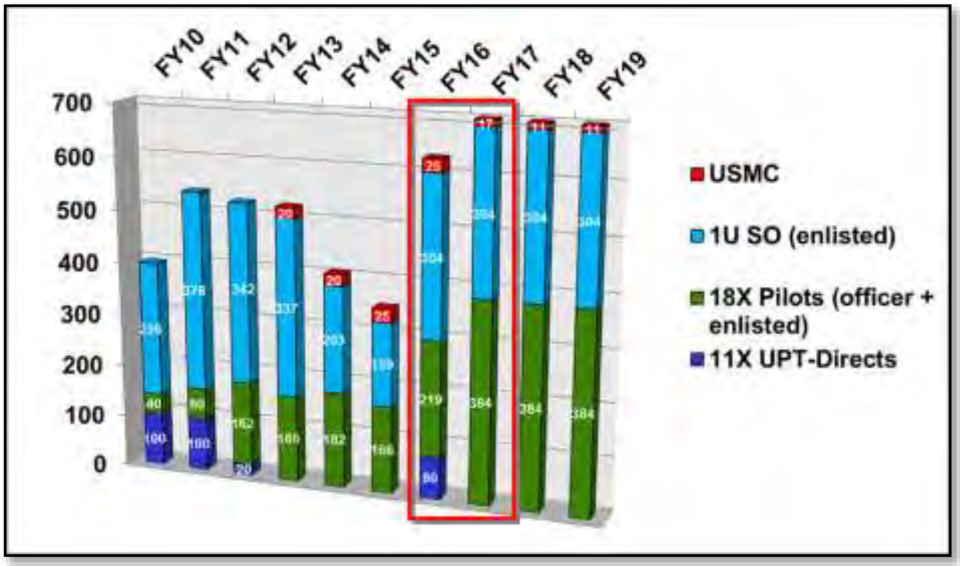

Figure 3: Historical and projected URT output
Source: Lt Col Jason Green, "A Brief Look: The State of Remotely Piloted Aircraft (RPA) Operations Local, Global… Past, Present, and Future…"

While URT has scaled to increase student production and has a viable plan of success, Holloman AFB's Formal Training Unit (FTU) falls further behind its required output. Squadrons are under high pressure to produce qualified graduates in a timely manner, but a multitude of issues conspires against this pursuit. Production requirements have grown, but the pipeline capacity struggles to adjust. The predominant issue is that instructors are under-resourced. Training squadrons use a metric called Basic Course Equivalency (BCE) to quantify the amount of time and resources required across training programs. Planners compute BCE requirements for instructor upgrades, launch and recovery instruction, and initial qualification training, and then ideally devote the timing and personnel resources to achieve the flying program. Problematically, though, no standard model translates BCE into clear staffing and time requirements.[5] No agreement exists on BCE assumptions, meaning that no commander can positively state his unit's production capability. The FTU needs an accepted model to link its capacity to its training burden.

[5] Ferro, Maj Jonathan Ferro and Maj Derek Benkoski. *Issues for the MQ-9 FTU: FY17 & Beyond*. 2016.

The lack of clarity means that Headquarters Air Force, Air Combat Command, and the FTU Programmed Flying Training manager disagree on how much manpower is required to fix the problem. Headquarters Air Force dictates the Programmed Flying Training (PFT) program, but the RPA community's only PFT manager, the person with the clearest picture, resides at Holloman AFB. ACC resources the squadrons to provide student initial qualification training and instructor upgrade training but leaves out other requirements. The PFT manager communicates these discrepancies, but lacks authority to institute changes. Currently, FTU squadrons do not receive BCE credit for instructing Transition 2 and 3 courses for returning fliers. Daily launch and recovery operations and instruction incur a daily bill but are not reflected either. ACC tasked the two MQ-9 squadrons to transition the 6th ATKS instructor cadre from MQ-1s to MQ-9s, but the squadrons have not received additional resources.[6] New MQ-1 instructor pilots do not have 250 instructional hours, and, in accordance with AFI 11-2MQ-1&9, they require 50 hours flying the MQ-9 before upgrading. The PFT program does not account for this deficiency. Measurements tracking a squadron's instructors distort reality as well. A student in Flight Instructor Upgrade Training (FIUT) drains resources until qualified but counts against the squadron's Unit Manning Document (UMD) immediately after in processing. Upgrading instructors quickly alleviates the burden, but backlogs penalize squadrons twice. Ultimately, operational commanders and staffs plan and expect squadrons to achieve 120 BCE per year, but capacity only meets 78% of actual requirements. To meet expected output and cover additional requirements, each FTU squadron needs five additional qualified instructors, an 8% UMD increase.[7]

A few equipment challenges on the horizon will decrease BCE output to an unknown extent. The AF has scheduled MQ-9 Block 5 aircraft and Block 30 Ground Control Station cockpit upgrades in 2017. Current aircraft software is several generations behind operational units' software and is planned for upgrade

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[6] The AF recently renamed the 6th Reconnaissance Squadron as the 6 Attack Squadron.

[7] Major Derek Benkoski (49th Wing Programmed Flying Training manager), interview by the author, 6 January 2017.

as well. Instructors welcome these upgrades, but disruptions to aircraft availability, additional instructor training, and an updated syllabus will adversely affect student output. More simulators known as the Predator Mission Aircrew Training System (PMATS) will supplement current inventory, but it still falls short of requirements. Twelve operational PMATS are scheduled for March 2017, but unofficial PFT models forecast that eighteen are needed.

As a result, MQ-9 student production falls further behind, and prospects for erasing the deficit are overly optimistic. To lessen the widening gap between desired and actual production, the FTU surged in 2016. The FTU increased its student output from 280 BCE to 449, a 60% gain.[8] MQ-1 student production, which is healthy, masked the true gains. Col Robert Kiebler, the 49th Wing Commander who instituted the surge, called the plan unsustainable. Surge operations max out instructors routinely averaging 7 to 8 instructional events per week. Instructor events include academic instruction, phase briefs, simulator instruction, and flight instruction. To squeeze more productivity out of an instructor, squadrons introduced "super sorties," where two students share a single sortie. Initial calculations showed squadrons must surge to 2018, but the surge efforts continue to fall short. Figure 4 highlights the widening gap between required and expected effectiveness. As the situation worsens, the wing recently started advertising days behind the timeline to increase awareness. With the surge, MQ-9 students still graduate 25 days behind schedule. Students attend MQ-9 training as a temporary duty (TDY). Additional TDY days cost the AF $2.7 million per year. And despite all these stop-gap efforts, still there is a yearly shortfall of 24 pilots per year, roughly half an operational squadron.

[8] Colonel Rob Keebler, USAF (49th Wing Commander). "RPA Strategic Vision". Presentation, 2016.

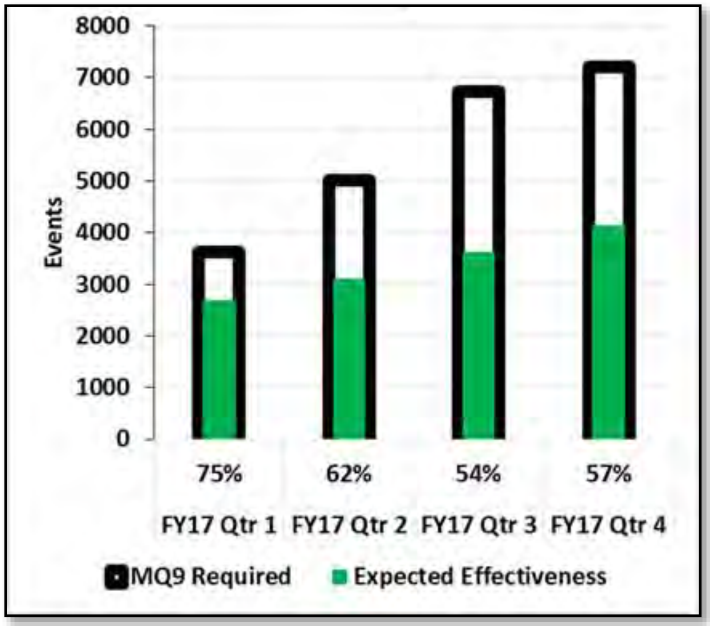

Figure 4: MQ-9 Projected Effectiveness for Fiscal Year 2017
Source: Major Jonathan Ferro and Major Derek Benkoski. Issues for the MQ-9 FTU: FY17 & Beyond. 2016.

Studies investigated launching a fourth FTU squadron, but two reasons drove recommendations to remain at three. One, the overhead costs and time to build a larger instructor cadre reduce current resources, exacerbating the immediate situation without seeing gains until much later. Consultants paid to recommend courses of action assess that the 49th Wing would see a net gain in 2022. Second, four FTU squadrons at full capacity surpass demand and overwhelm anticipated operational requirements. A wing of four FTU squadrons could train 334 pilots above that currently required, and would produce an extra 206 pilots once in sustainment mode.[9] Three FTU squadrons can produce 360 BCE, 145 more pilots per year than required to sustain operations once at full instructor strength.

To summarize, at current operating levels, the 49th Wing is unable to produce the expected number of qualified students. Without allotting more resources or resetting expectations, the surge strategy will not resolve the

[9] Booz, Allen, Hamilton. *Remotely Piloted Aircraft Pilot Production Pipeline Study Final Report*, 2016, ii.

shortfall, and adding another training squadron will likely add too much capacity and take too long. Schein includes repair strategies as a step that groups cycle through as they adapt. The Air Force typically prioritizes operational requirements over other needs. In this case, training shortfalls affected combat squadrons' ability to sustain 65 combat lines. By convincing the Secretary of Defense to authorize a temporary reduction to 60 lines, the AF took remedial action and demonstrated its value on training. In an interview, an instructor pilot assessed his squadron morale as higher than his sister squadron's due to better perceived training, despite being further behind the timeline. Such an insight discloses deeper cultural values: training trumps time. In managing internal integration, staffs have yet to resolve boundaries and communicate work expectations. Power and authority reside at Air Combat Command and Headquarters Air Force staffs, but the knowledge and management reside locally at Holloman AFB. Leaders recognize that Air Combat Command's RPA branch is not structured to handle student training issues, and will transition the 49th Wing to Air Education and Training Command in 2018.

Second Step: Improve/Refine Pipeline

Another way to train more students is to increase pipeline efficiency or decrease its length. But, the current syllabus' sequential structure creates barriers to this solution. Rather than branching and opting students to several progression tracks, prerequisite events slow class progression. At the conclusion of each phase, classes regroup for academics and phase briefs. This forces students ahead of their class to wait. The two latest MQ-9 IQT syllabus iterations increased its scope, number of events, and time. The previous syllabus needed 49 training days; the current one requires 77 days, but takes 90 days due to attrition; and the draft syllabus on its way to approval needs 92. Air Combat Command resists cutting requirements deemed necessary by operational squadrons at syllabus review boards. As more training creeps into each IQT syllabus iteration, the FIUT syllabus has expanded 400%.[10] In response, the 49th Operations Group has

[10] Booz, v.

waived a third of flights and shifted them to the simulator. The increased syllabus drives more time and resource investment precisely at a time when both are limiting factors.

Previously, course start dates were haphazard. A concerted effort to coordinate start dates between the squadrons to offset airspace, aircraft, simulator, and academic instruction requirements has increased efficiency. Trying to find more efficiencies like this prompted the AF to contract with the Booz, Allen, Hamilton (BAH) consulting company to study the process and make recommendations. Completed in 2016, their report included multiple proposals to streamline training which, according to their analysis, is the best approach to achieve the manning required within time constraints to operate sustainably.[11] The study notes that the most impactful and timely way to increase production is through reduced flying sorties, increased simulator sorties, and reducing duplicated training between URT and the FTU. These measures should have immediate impacts.

The report identified that the AF needs to conduct a formal, end-to-end training needs assessment (TNA) and training systems requirements analysis (TSRA). The two standard procedures define the required skills and determine the appropriate curriculum, delivery methodologies, and training devices appropriate to produce a basic qualified RPA pilot. Both studies are mandatory but not accomplished due to high operations tempo. Currently, the ACC Training Support Squadron Detachment 2 hosts syllabus review conferences to identify training requirements. Bringing together operational and training squadrons to identify requirements and shortfalls helps refine syllabi, but no agency has performed a technical or cost benefit analysis to assess the cost of proliferating mission requirements or judge how instructors should accomplish the syllabus. Surveys and conferences reflect institutional culture and values more than true technical training requirements. As an example, an Air Force Research Laboratory study in 1998 reported that most RPA pilots felt T-37 training was

[11] Booz, i.

absolutely necessary to fly military aircraft- a demonstrably false impression, as the AF has since learned.

Training Task List	Not Applicable (1.00 - 1.50)	Nice-to-have < Necessary (1.63 - 2.38)	Absolutely Necessary (2.43 - 3.00)
T-3 Flying	8 (15.1%)	10 (18.9%)	35 (66.0%)
T-37 Instrument Training Maneuvers	0 (0%)	12 (28.6%)	30 (71.4%)
T-37 Navigation Training Maneuvers	0 (0%)	11 (26.8%)	30 (73.2%)
FAA Instrument Rating	0 (0%)	10 (35.7%)	18 (64.3%)
Predator Ground Control Station	0 (0%)	0 (0%)	23 (100%)
Predator Flying	0 (0%)	0 (0%)	38 (100%)
All Tasks	8 (3.6%)	43 (19.1%)	174 (77.3%)

Figure 5: Task Criticality as Assessed by Air Vehicle Operators in 1998.
Source: William C. Tirre and Ellen M. Hall, USAF Air Vehicle Operator Training Requirements Study (Brooks AFB, TX: AF Research Laboratory, 1998), 4.

As Booz, Allen, Hamilton noted, "As a result [of no formal requirements review], there is not a widely accepted understanding of the required capabilities RPA pilots should possess at Initial Qualification, nor agreement on appropriate curriculum and training methods to efficiently and effectively produce qualified RPA pilots."[12]

Though not an official TRSA, the Booz, Allen, Hamilton report argues to replace more flights with improved simulators to streamline the course and reduce redundancy between URT and the FTU. Figure 6 depicts BAH's recommendation to combine URT's RFT and RIC and shift RFC to the FTU. BAH concludes this is the most immediate and productive course of action available, but its authors fail to address how streamlining will increase production if the FTU's bottlenecks remain. In addition, the study recommends transferring Reaper IQT from ACC to AETC, a recommendation the AF accepted and plans to do in 2018. This will have two effects: it will establish unity of command for the entire production process, and it will introduce increased staffing overhead as

[12] Booz, iv.

AETC brings its established manpower model to the FTU. The study echoes the 49th Wing PFT manager's assessment. It concludes that while the surge is beneficial, current FTU output is insufficient to make short-term improvement to the existing shortfall.

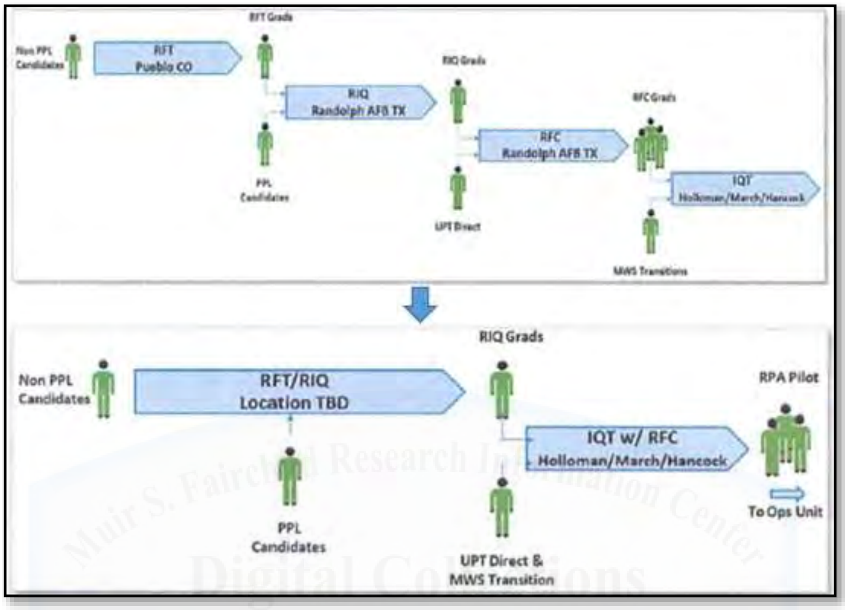

Figure 6: Streamlining RPA Pilot Production by Restructuring URT Sub-phases across URT and FTU. Source: Booz, Allen, Hamilton. Remotely Piloted Aircraft Pilot Production Pipeline Study Final Report, 2016, ii.

According to Schein, training is a visible organizational process, and, as an artifact, what it represents can be hard to decipher. In this case, the AF has shown a clear preference to ensure quality training across burgeoning mission sets rather than emphasizing quantity of graduates. Commanders have not elected to streamline training or combine courses despite recommendations. The reality of limited resources has forced leaders with the tough choice to pare back flight requirements, choosing production over quality. These reluctant choices are waivers and exceptions that reflect a reluctant, temporary value judgement.

Third Step: Stop Impending Attrition

> *In April 2014 we also found that the Air Force may face challenges retaining UAS pilots. Pilots in 7 of the 10 focus groups we conducted at three Air Force bases indicated that retention of UAS pilots is or will be a challenge and UAS unit commanders in one location we visited and other Air Force officials stated that they were concerned with future retention rates of UAS pilots. As mentioned above, we recommended that the Air Force develop a tailored strategy that addresses both recruiting and retention of UAS pilots and the Air Force concurred.*
>
> Ms Brenda Farrell, Government Accountability Office's Director of Defense Capabilities and Management, testifying to Senate Armed Services Committee

Manning is also affected by outflow. The AF follows a typical pattern where demand is miscalculated, overproduction overcorrects, and then personnel separate. This induced oscillation has yet to visit the RPA community. Up to this point, outflow has been in form of completed Alpha tours, retirements, and 11U pilots (SUPT graduates) separating from the AF.[13] URT carries a 6-year Active Duty Service Commitment. Because 2018 will mark the first URT class' ADSC expiration, attrition within the community does not have any historical data to serve as a guide, and Headquarters Air Force A1, responsible for manpower projections, refuses to forecast attrition; it only uses actual data.[14] Using historical data works in other established communities, but not in the RPA community, where no such data exists. Organic research anticipates a grim outlook: the forecast is 64% overall 18xx attrition amongst those whose commitment is ending. That translates to 31% of the RPA pilot community that is expected to separate in 2018 (118 pilots) and 2019 (163 pilots). Currently, the MQ-9 Aircrew Retention Program (ARP) has a take rate of 36% compared to the AF pilot average of 59%. If the low take rate is a leading indicator of retention,

[13] Alpha tours are tours of duty away from a pilot's primary aircraft. Alpha tour options include pilot training, Introduction to Fighter Fundamentals, Air Liaison Officer, and RPAs. The AF recently discontinued RPA assignments as Alpha tours. At the conclusion of an Alpha tour, pilots typically return to their primary aircraft.

[14] Keebler, 2016.

then the FTU should anticipate a dramatic correction in production in the coming years.

To preempt an exodus, the AF instituted multiple initiatives and a Culture and Process Improvement Program (CPIP). Dubbed the RPA get-well plan, 57 initiatives aim to achieve a community-wide 10:1 crew to combat line ratio and 100% FTU manning. This wide-reaching plan addressed ten different areas. Ones that address retention include decreasing operational requirements and increasing pay. Secretary of Defense Ash Carter approved a reduction in combat lines from 65 to 60 in order to alleviate the RPA community's state of constant surge. This freed a squadron's worth of manning to relocate to Holloman AFB. Moreover, the Secretary of Air Force rapidly implemented a $1500/month flight pay increment for the handful of RPA pilots whose commitment had expired. Then, once routed through Congress, the AF offered an increased retention bonus of $35k per year. General David Goldfein, CSAF, acknowledged the bonus as a crucial step to help "retain these valued aviators to execute our current operations and shape the future."[15] Reducing combat lines took buy in from the Secretary of Defense and required the AF admitting it could not meet combatant commanders' needs. The AF's institutional preference was to reduce combat capability rather than to reduce training requirements. The AF responded to a manning shortfall with an oft-repeated technique: the bonus amount equals fighter pilot bonuses, signifying parity and recognition.

Meanwhile, Culture and Process Improvement Program focuses on community standardization and stabilization. The program formalizes the squadron, group, and wing structure across the AF, stands up a new wing and operations group, establishes a dedicated launch and recovery squadron, builds dwell time, renames reconnaissance squadrons to attack squadrons (ATKS), and

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[15] Secretary of the Air Force, *RPA Pilots Set To Receive $35,000 Annual Bonus*, 2016, http://www.af.mil/News/Article-Display/Article/911383/rpa-pilots-set-to-receive-35000-annual-bonus/.

allows logging combat time.[16] A standard squadron will now consist of four combat lines; an ops group will consist of three combat squadrons and an OSS; and a wing will add a maintenance group and a launch and recovery squadron. Additionally, through CPIP, another wing and operations group will stand up, and, as announced in December 2016, one of those will be at Shaw AFB.[17] Dedicated launch and recovery squadrons allow Mission Combat Element (MCE) squadrons to focus on their combat mission without additional overhead from launch and recovery training and deployments. The realignment in responsibilities also allows LR squadrons to develop experience and retain trained personnel in the squadron. Other communities use a deploy to dwell metric to measure aircrew strain. The RPA community is adopting this metric to rotate squadrons out of combat lines to reconstitute and train. Ultimately, CPIP aims to create sustainable and predictable working conditions in an environment that has been anything but that over the past decade.

The two plans have reinforcing objectives. Normalization is the process of bringing something to a normal condition. Here, it brings RPAs into the AF's fold, but it also demonstrates that the larger AF is reevaluating its beliefs. Through CPIP, the AF signaled to RPA pilots and sensor operators their institutional value. Logging combat time reflects the AF's growing understanding of the significance and honor involved in remote warfare. Changing squadron names better conveys the multirole missions tasked to these squadrons.[18] Combat RPA squadrons belong to Air Combat Command and AF Special Operations Command, and both commands treasure their kinetic capabilities. While only a cosmetic move that requires new patches and signs, the renaming moves RPA "Attack" squadrons closer toward a shared identity with Air Combat Command's

[16] Secretary of the Air Force, *Air Force Approves RPA Initiatives*, 2016, http://www.af.mil/News/Article-Display/Article/717598/air-force-approves-rpa-initiatives/.
[17] Major Landon(ACC/A3MU), "Persistent Attack And Reconnaissance Division MA-1/MQ-9 Branch Brief", (Presentation, 2016).
[18] Dave Blair, "A Categorical Error: Rethinking 'Drones' As An Analytical Category For Security Policy", 2016, https://www.lawfareblog.com/categorical-error-rethinking-drones-analytical-category-security-policy.

fighter squadrons. As more and more cultural artifacts overlap between the sub-communities, the grayer the distinction becomes between them.

Increasing squadrons, groups, and wings achieves multiple objectives. First, more units mean more leadership opportunities and therefore more promotions. More promotions translate to more advocacy via more RPA flag officers and more staff officers exercising influence. Second, having more squadrons enables units to rotate out of combat lines to train and reconstitute. Dwell time provides a respite from shift work and an opportunity for squadron events, upgrade training, and continuity training. Operational squadrons previously accomplished training in an ad-hoc manner in a combat zone, a unique feature to the RPA community. Rotating out of combat sorties like other communities allows operational units to adopt standard upgrade and continuity training practices. The initiatives also clarified unit manning by linking personnel requirements to a desired capability.

The two plans together are the AF's response to operate, train, and equip RPAs; they also are significant steps toward integrating the RPA community. An organization makes assumptions about managing internal integration. Schein states that power, status, group boundaries, rewards, and common language are areas where an organization discloses those assumptions. While no definitive prescription can account for individual decision-making, how an organization approaches retention reveals much about the organization's culture and values. By allocating pilot-level bonuses and flight pay, the AF has signaled its level of commitment to its RPA pilots. Borrowing from other communities' best practices moves the RPA closer to resembling manned flying operations and reduces cultural boundaries separating manned and unmanned platforms. Renaming squadrons and adopting a deploy-to-dwell metric reframes RPA's conceptual category and introduces more language commonality with manned aircraft squadrons. It demonstrates an inclusionary if unimaginative effort to promote the RPA community's sustainability and belongingness. Such measures are a welcomed departure from previous manpower decisions.

Recap

Corporately, the active duty AF views its personnel system as a conveyor belt that loads recruits onto one end, uses them, and returns them back to society years later at the other. To maintain the health of the community, a steady flow of accessions ideally matches the same steady flow of separations. The AF prizes experience and therefore predictability. Once experience leaves the conveyor belt, it is gone, and the AF cannot hire an immediate substitute to replace the loss. By anticipating levels of attrition along progressive year groups, the AF can respond by loading more recruits onto the conveyor belt and trying to keep existing personnel from falling off. The RPA community's young existence means that the expected pull of separations is unknown. In anticipation, the AF has not stood by idly.

Managing the training pipeline is a response to the uncertainty of intrinsically uncontrollable or difficult events. Each decision tests the validity of corporate AF values. If the initiatives are successful, they will reaffirm corporate values and beliefs. But, if they are not, the RPA community will question and reexamine its deepest fundamental assumptions.

Chapter 3

Army UAS Training

Our identity is strengthened through education, training, and experience.

Department of Army's
The Army Profession

Tension between the Air Force and the Army started before the National Security Act of 1947 when the Air Force became an independent service. Prior to and through World War II, there was suspicion, if not outright hostility, between many air and ground commanders over what equipment to acquire, how to allocate resources, and how to prioritize missions. Air Corps leaders, with the tangibly close realization of an independent Air Force, chose to "throw as much into bomber and pursuit forces as they could" to emphasize strategic bombardment to the detriment of air-ground integration.[1] Ground commanders viewed the effort as imbalanced and unsatisfactory and looked to find a solution.

The Secretary of War on 6 June 1942 ordered the formation of organic aviation assets to support artillery observation. Earlier, Major General Mark W. Clark, Lieutenant General McNair's Chief of Staff in Army Ground Forces, had approved and passed the recommendation to the War Department without McNair's knowledge.[2] When McNair discovered what had passed, he did not protest, and the War Department accepted the recommendation. Lieutenant General Henry H "Hap" Arnold vehemently opposed the move. Arnold argued to no avail that putting light planes in the ground forces would effectively "create a separate Air Force in the Army and that such a thing was unthinkable."[3] The budding Army Air Forces strived for centralized and unified command of air forces. The Army conversely had taken steps to decentralize control of air assets to ensure ground commanders received the reliable support they deemed necessary. A few months later in November 1942, Army aviation units entered into

[1] James W. Williams, *A History Of Army Aviation: From Its Beginnings To The War On Terror*, 1st ed. (New York: iUniverse, 2005), 33.
[2] Williams, 35.
[3] Williams, 37.

combat on the North African coast to adjust artillery fire, gather intelligence, support naval bombardment, and direct bombing missions.

A nearly identical scene played out in 2007 in Operations Iraqi Freedom and Enduring Freedom. As mentioned in Chapter 1, General Petraeus' counterinsurgency and nation-building strategy dictated a surge and a need for more ISR. The USAF's failure to meet the Army's growing Reconnaissance, Surveillance, and Targeting Acquisition (RSTA) needs can be attributed to a lack of assets and to servicing higher priority requests, such as special operations and supporting troops in contact with the enemy. Colonel James G. Rose, Commander of Army Intelligence in 2007, observed, "Current and envisioned non-Army UAV systems are limited in their ability to provide responsive support to various requesting ground-maneuver units based on limited assets. When units were successful in requesting UAV support, communications problems, delays in data receipt, and retasking procedures/authority decreased the effectiveness and responsiveness of the UAV system."[4] With Secretary Gates' support, the Army procured an organic medium altitude, long endurance UAS capability to ensure future reliable ISR support despite Air Force protests.

As introduced in earlier chapters, examining an organization's artifacts, values, and underlying assumptions to understand organizational culture lends insight into current and future decision making. Army Headquarters states in its Army Regulation 350-1, "All training and leader development actions occur within the Army culture, a culture which embraces values and ethics, the Warrior Ethos, standards, and enduring principles and imperatives. Army training strategies serve to synchronize the role each training domain plays in building force readiness."[5] Thus, an organization's cultural origin is an important first step to understanding how it makes decisions.[6] Next, "from an evolutionary perspective, we need to identify the issues that any group faces from the moment of its origin through to its state of maturity and decline."[7] This chapter will use Schein's framework to examine Army UAS training, how it has dealt with its external

[4] Colonel James G. Rose. "Extended Range/Multi-Purpose (ER/MP) Unmanned Aerial Vehicle (UAV) Operational Requirements Document," 4.
[5] United States Army, *350-1 Army Training and Leader Development*, 2014, 2.
[6] Schein, 84.
[7] Schein, 87.

environment and managed internal integration. The chapter will conclude by identifying the underlying assumptions, values, and artifacts tied to the organization.

Army UAS History

The Army generally views UAS as a valuable support tool, and the desire is to decentralize control and maximize autonomy and reliability. Beyond that, though, little controversy surrounds the program, especially in comparison to the USAF. The Army's training program values practicality, is more affordable, and requires less time. Consequently, civilian leaders use it as a measuring stick to scrutinize the Air Force's more expensive RPA training pipeline.

The Army's involvement in unmanned aircraft goes back to 1918 and Charles Kettering's Bug. In World War II, the Army developed drones for anti-aircraft target practice, and in the Cold War, the Signal Corps tested various reconnaissance platforms at Fort Huachuca, Arizona. In 1955, they introduced the RP-71, a precursor to the Shadow UAS.[8] It solved many ground commanders' problems with airborne reconnaissance: it launched rapidly, it imbedded with ground forces, and personnel quickly gathered and processed intelligence for immediate use by the commander. From the RP-71 came the SD-1 through SD-4 variants, but ballooning costs, an inability to overcome technical hurdles, and poor performance convinced the Army to cancel the programs. The Army and its industry partners then made little headway during the Vietnam War. The next significant UAS iteration for the Army was the Aquila in 1975. Before its cancellation in 1987, the program demonstrated significant capability leaps in its sensor and data-link packages and laser designation capability. The Navy and Marine Corps would continue Aquila's next iteration with the Exdrone, which they employed as the renamed the BQM-147 Dragon in Desert Storm.[9] Significant, cost effective, sustainable capabilities emerged shortly thereafter. The Army finally ushered in the drone age as it is known today when it fielded its RQ-5 Hunter UAS in 1995.

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[8] John David Blom, *Unmanned Aerial Systems: A Historical Perspective* (Fort Leavenworth, Kansas: Combat Studies Institute Press, 2010), http://usacac.army.mil/cac2/cgsc/carl/download/csipubs/OP37.pdf, 50.

[9] Mark Farrar (2-13th Aviation Regiment Director of Training), interview by the author, 5 January 2017.

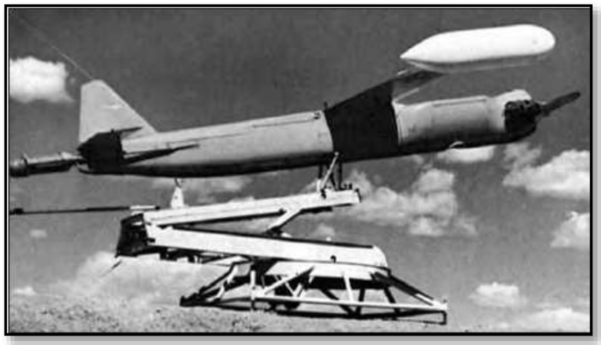

Figure 7: RP-71
Source: John David Blom, Unmanned Aerial Systems: A Historical Perspective (Fort Leavenworth, Kansas: Combat Studies Institute Press, 2010), http://usacac.army.mil/cac2/cgsc/carl/download/csipubs/OP37.pdf, 49.

Figure 8: Aquila UAS
Source: "Lockheed MQM-105 Aquila", Wikipedia (Wikimedia Foundation, 2015.

Figure 9: Exdrone, Later Renamed BQM-147 Dragon
Source: Andreas Parsch, "BAI Aerosystems BQM-147 Exdrone", 2002, http://www.designation-systems.net/dusrm/m-147.html.

Figure 10: RQ-5 Hunter
Source: "Hunter RQ-5A / MQ-5B/C UAV", accessed 1 March 2017, http://www.army-technology.com/projects/hunter/.

The first Army UAS operator was Master Sergeant Mark Farrar, now the 2-13th Aviation Regiment's Director of Training as a GS-14 employee. As he recounted, in 1986, the Training and Doctrine Command's (TRADOC) System Manager, Colonel Ted Fictel, formed a UAS Task Force consisting of 5 NCOs with broad latitude to "figure out how to integrate UAS into the Army."[10] The Colonel selected then-Sgt Farrar, with expertise in communications and stationed at the Army's Center for Military Intelligence in Fort Huachuca, Arizona, to the team. Other team members had expertise in aviation-related ground maintenance, aerial image observation, photo interpretation, and aerial maintenance. Although given flexibility, their budget was minimal. With it, they purchased and built several remote control (RC) aircraft kits. Serendipitously, an avid RC enthusiast and civilian, George Makowitz, was serving at Ft Huachuca as an interrogator. The team tapped into his expertise, and all learned to fly from him.

The group connected with a Marine Corps project officer, Captain Allan Watt at the Johns Hopkins University's Applied Physics Lab (APL). The Marine Corps had contracted with APL to develop an amphibious, expendable jamming platform. Capt Watt had a prototyped delta wing drone, the Exdrone, and he relied on APL's one qualified pilot for flight tests. The Army and Marine Corps began a collaborative relationship at Ft Huachuca, where restricted airspace and good weather permitted consistent flight operations and surrounding hills blocked electromagnetic interference.

[10] Farrar interview.

The Marine Corps' payment was equipment, and the Army provided the operators, the developmental team, the runway, and airspace. The successful partnership achieved multiple milestones. The group achieved two long distance world records with handovers coordinated by line of sight radio communications. The Exdrone deployed to Desert Storm as the Dragon drone, and after successful testing, the intrepid group declared Ft Huachuca the Department of the Army's Unmanned Training Center. The title stuck when no one disputed the claim. The Army and Marine Corps continue to jointly train enlisted operators on the Shadow UAS.

Thus far, Army UAS had been small, entrepreneurial, innovative, and practical. Each UAS Task Force member had a specialty, and overlap developed as the team gained experience. Operators flew, conducted maintenance, and solved overlapping problems in radio or camera control or navigation. As the platform matured, the team wrote and amended a curriculum for future operators with each subject matter expert handling their respective section. The syllabus reflected their personal RC aircraft experiences and expectations of Army employment. The Army's first UAS company conducted both combat operations and testing. Operators visually accomplished takeoffs and landings. Personnel cross-trained to conduct maintenance while standing by for unplanned early recoveries. At that time, personnel were selected based on their maintenance aptitude. To that point, external pressures brought few fiscal resources and little oversight, and its initial success reinforced the decision to use NCOs and to work from small, hobbyist RC aircraft toward larger and more sophisticated UAS. Specialized NCOs able to perform generalized tasks across the spectrum of operations continued to be the UAS cornerstone.

In 2005, Military Intelligence Commanding General, Major General Barbara Fast, and Aviation Branch Commanding General, Brigadier General E.J. Sinclair, argued for UAS proponency within the Army. UAS had grown under MI, and MG Fast wanted to maintain control of the payload operator to ensure imagery responsiveness. UAS had been a boon for intelligence communities, and they jealously guarded such a capable asset. The emerging capability did not always escape cultural inertia; in MI's case, it surfaced in an unsuspecting way. As a case in point, imagery training occurs at Ft Huachuca, and for 2 years, black and white image interpreters successfully blocked upgrading the Shadow's camera to color full motion video.

Despite MI's best efforts, on 19 Apr 2006, Aviation Branch took proponency of the operation they referred to as the "R/C club at Ft Huachuca." Aviation Branch intended to bring UAS in line with best aviation practices, and they had maneuvered to keep the crew dual qualified to aid flexibility and crew coordination. In reality, two things happened. One, the UAS program began to professionalize and normalize to Aviation Branch standards. Safety and maintenance records dramatically improved, but the shift was not to everyone's liking. Some tenured instructors bemoaned the move away from efficiency, innovation, and dedication. Two, in reorganizing, the UAS community lost a powerful advocate in Military Intelligence. Under MI, UAS brought a unique capability to the sub-culture, and its operationalized intelligence was prized. The reorganization under Aviation Branch established a pecking order similar to the USAF's situation with RPAs, and, similarly, UAS found itself at the bottom. Career Aviation Branch helicopter pilots without UAS experience rotated through officer leadership positions. The training center remained at Ft Huachuca and fell under 1st Aviation Brigade at Ft Rucker. The geographic separation hurt UAS advocacy, and it turned UAS training into an island on Ft Huachuca. Practically, this translated to lack of resources as prioritized by the Aviation Branch. The 2-13th Aviation Regiment must negotiate launch and recovery windows at Libby Airfield with tenant units and USAF squadrons at Davis Monthan AFB, AZ. Obtaining range time has been problematic as well, but as Forces Command (FORSCOM) and National Guard units ramp up UAS training at Ft Huachuca, range priority has increased.

In 2009, Army enlisted operators started flying the Warrior A, essentially an MQ-1 Predator, until Gray Eagle was fielded. Initially, they flew MQ-1s owned by Big Safari, the Air Force's rapid procurement force that oversees the acquisition, modification, and logistics support for special purpose weapons systems. At the Army's behest, General Atomics added point and click interaction to achieve ease of use and efficiency as well as an auto takeoff and land feature. Before the upgrade, warrant officers performed takeoffs and landings and handed off control to enlisted "cruise" operators for the mission. General Atomics lengthened the wings and added 2 hard points to allow the Gray Eagle to carry 4 Hellfire missiles. Increases in autonomy allowed Gray Eagle operations to have an enlisted, universal operator capable of executing all aspects of aircraft and payload control. Wider Army efficiency practices drove universal maintenance personnel to work on all UAS and universal ground control stations to operate Shadow and Gray Eagle. Simplicity of operations has strong value in the Army and has allowed it to maintain a widely trained force. Interoperable equipment, operators, maintainers, and UAS procedures will result in further dispersed UAS control beyond Army Aviation Branch.[11]

Current Army UAS Employment

A divisional Gray Eagle company is assigned to each of the Army's active duty Combat Aviation Brigades to provide ground force commanders organic reconnaissance, surveillance, security, and attack capabilities. Additionally, two larger Gray Eagle companies are assigned to Intelligence and Security Command (INSCOM), and two are assigned to Army Special Operations Aviation Command (ARSOAC). The companies organize to deploy as a standalone unit and conduct operations from one or more locations within their division area of operations. Each company consists of 127 soldiers and 12 air vehicles. With the company collocated, it can provide six simultaneous 24-hour missions per day. When geographically split, it can provide four to six combat lines.

In the development of UAS, the Army chopped its organic assets to divisions, with actual control delegated down to Brigade Combat Teams (BCTs). Gray Eagle followed this model. In a nearly opposite operational approach to the USAF, this can theoretically mean launching a Gray Eagle from an established runway away from the battlefield and then performing a line-of-sight handover to the division. In practice, however, once operators launch via line of sight control, they transfer the aircraft to KU band satellite control and continue flying the mission. USAF operators deal with the stigma of remoteness, but the Army operators embed as a platoon or company in a deployed combat aviation brigade (CAB). As UAS capabilities increase, CABs grow more accepting of enlisted operators' contributions and take concerted efforts to include the operators in collective training and missions. A unique outflow of these efforts and

[11] Major Ariel Schuetz (US Army TRADOC UAS Capabilities Manager), interview by the author, 3 March 2017.

organizational structure is that “these platoons are employed with the AH-64 Apaches to execute manned/unmanned teaming for enhanced reconnaissance, security, and attack operations.”[12] This present model dominates, but current events may morph this concept of operations closer to USAF methods, especially with INSCOM and ARSOAC formations.

Recent ISR Request for Forces (RFF) tests the Army’s organic model. According to General David G. Perkins, the current Training and Doctrine Command (TRADOC) Commanding General, “Although designed to support Army division requirements, these formations have been recently deployed in support of combatant commanders separate from their divisions.”[13] The Army responded by creating Gray Eagle companies at echelons above division (EAD) designed to conduct split operations. Assigned to both the Intelligence and Security Command (INSCOM) and the Army Special Operations Aviation Command (ARSOAC), these Gray Eagle companies have 165 soldiers and 12 air vehicles. Currently, the Army fields three Echelons Above Division (EAD) Gray Eagle companies and plans to stand up one additional company this year.[14] These companies are specially organized, trained, and equipped to conduct long-endurance, extended range, multidiscipline intelligence, and precision strike operations to provide timely intelligence and destruction of high value targets in joint organizations. Enlisted soldiers and warrant officers rotate through these units and conventional Army units throughout their careers.

Assigning organic UAS to divisions allows flexibility, but it has efficiency and expertise costs in operations and training. The Army’s Human Resources Command assigns soldiers to either a BCT, CAB, or EAD after completing initial UAS training with no additional unit specific training. The gaining units incorporate soldiers into their operational unit’s aircrew training program (ATP), which is designed to produce fully mission trained, combat-ready crewmembers. This training, specifically Readiness Level (RL) 2, parallels the Air Force’s Combat Mission Ready (CMR) training conducted at the

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[12] Statement of General David G. Perkins, USA in "Army Unmanned Aircraft Vehicle and Air Force Remotely Piloted Aircraft Enterprises," unclassified testimony before Senate Armed Services Committee (Washington D.C.: 16 March 2016).
[13] Statement of General Perkins, 2016.
[14] Statement of General Perkins, 2016.

operational squadron level. RL 3 parallels an AF squadron's continuation training. The level of ATP training differs dramatically with each unit; BCTs have the least training, followed by CABs, followed by INSCOM and ARSOAC.

The ATP focuses on task proficiency to enable the execution of the unit's mission essential tasks. The process consists of progressing through three readiness levels (RL). Graduates from Fort Huachuca operate to an RL 3 standard. RL 3 focuses on training and demonstrating proficiency in basic launch, recovery, and flight tasks. RL 2 is specific mission training and focuses on training and demonstrating proficiency in those tasks required to execute missions. These tasks include reporting, air-ground operations, acquiring and engaging targets, conducting reconnaissance, and MUM-T. The third progression level is RL 1, continuation training. Once designated RL 1, the UAS crewmember is expected to maintain proficiency in base, mission, and special unit tasks by accomplishing semiannual and annual critical task iterations as well as meet semiannual flying hour minimums. RL 1 crewmembers must also pass an annual standardization flight evaluation and written examination.[15]

In testimony to the Senate Armed Services Committee, General Perkins reported difficulties achieving and maintaining RL 1. Operational Gray Eagle companies have a dismal record maintaining required readiness. Installations that maintain UAS assets do not necessarily have the appropriate infrastructure like airspace or Ground Based Surface to Air Avoidance (GBSAA) set up to permit transiting, the frequency spectrum needed to control its UAS, or suitable weather for consistent flying. After graduating from training at Ft Huachuca, young operators may not fly again for several months if they are assigned to divisions during initial fielding or if the installation is not properly equipped to support operations. As an example, the Army operates 104 Shadow units, and 86 failed to make their minimum flight hour requirements for various reasons.[16] Too often, the units sit boxed in the motor pool at home station, unable to train. Divisions that need ISR wartime capability collocate Gray Eagle companies regardless of whether the airspace environment is conducive to training. In the majority of locations, the companies are unable to achieve needed readiness levels. At Fort Irwin in southern California, the

[15] Statement of General Perkins in Senate, 2016.
[16] Bill Coleman (Gray Eagle Project Manager), interview by the author, 5 January 2017.

runway can only handle single direction operations. At Fort Wainwright in Fairbanks, Alaska, difficult weather reduces the flight availability window, and environmental restrictions prohibit runway de-icing. Fort Carson has the most operating difficulties. Spectrum management, access to restricted airspace, mountains, and required GBSAA support are problematic. This led one instructor at Ft Huachuca to lament, "The Army wants the capability but not to manage and harness it."[17]

Schein states that cultural assumptions evolve around all aspects of a group's relationship to its external environment. "If the environmental context is changing, such conflict can be a potential source of adaptation and new learning."[18] Assumptions about adaptation to external stimuli to enhance survival is reflected in an organization's mission and strategy, goals, means, measurements, and corrections made. The Army's stated mission is to "fight and win our Nation's wars by providing prompt, sustained land dominance across the full range of military operations and spectrum of conflict in support of combatant commanders."[19] Seen in this light, the Army's UAS approach to gain and sustain land dominance by focused air-ground integration is appropriate, but because it is a support asset, it does not demand the means it needs. As the new security environment demands greater battlefield intelligence and possibly increased standoff distance due to threat, original decisions about UAS strategy and means need revisiting. The Army has realized errors and made corrections slowly. In the case of achieving poor readiness levels, it took Congressional involvement to raise the issue.

UAS Training Description

General Perkins in his Congressional testimony plainly laid out a fundamental underlying assumption: "the centerpiece of the Army's UAS strategy is the Soldier." Army's training is well equipped and experienced in transforming young high school graduates into cohesive operating units capable of wielding advanced weaponry on command. It naturally follows that enlisted soldiers and Noncommissioned Officers (NCOs) operate and maintain the Gray Eagle. The UAS overarching mission objective is

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[17] Interview with Gray Eagle instructor from 2-13th Aviation Regiment, 5 January 2017.
[18] Schein, 108.
[19] "Organization: The United States Army," accessed 3 March 2017, https://www.army.mil/info/organization/.

to take entry-level soldiers and create graduates able to conduct "air reconnaissance, surveillance, targeting and acquisition missions, plan and analyze missions, perform preflight, in-flight, and post-flight checks and procedures, launch and recover aircraft, and perform maintenance on communications equipment, power sources, wheeled vehicles and crane operations."[20]

Soldiers that enlist as either UAS operators or maintainers are among the Army's most capable. Soldiers who enter the UAS Military Occupational Specialty (MOS) must achieve a surveillance and communications (SC) score of at least 105 on the Armed Services Vocational Aptitude Battery military entry exam. This score is the highest SC score for entry into any Army MOS. Based on their particular enlistment agreement, these soldiers enter with a 4 to 6 year service obligation that begins at in processing. The Army has successfully attracted qualified applicants, but retention remains a problem. Currently, the Army offers UAS operators a reenlistment bonus of $45,000 for an additional five year commitment. Those that pursue the reenlistment develop into the UAS senior NCO force.

The Army has recognized how formative initial training is, and it deliberately approaches training as an opportunity to instill values while building force readiness. According to its Training regulation 350-1:

> All training and leader development actions occur within the Army culture, a culture which embraces values and ethics, the Warrior Ethos, standards, and enduring principles and imperatives. Army training strategies serve to synchronize the role each training domain plays in building force readiness.[21]

Accordingly, while in Enlisted Initial Military Training (IMT) and Advanced Individual Training (AIT), all aspects of a soldier's life are closely controlled. They live in dormitories, conduct daily physical training, do not consume alcohol, eat at dining facilities, take bus transportation on post, and receive formalized instruction up to 12 hours per day. The 2-13th Aviation Regiment, the UAS training unit, recognizes and rewards soldiers who are "skilled, tough, and ready around the clock."[22]

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[20] 2-13th Catalogue. *15W Common Core Course Design*. 2016.
[21] 350-1 Army Training and Leader Development (2014), 2.
[22] Mark Farrar (2-13th Aviation Regiment Director of Training), interview by the author, 5 January 2017.

Since April 2007, graduates are awarded an Aviation Badge at course completion. Major General Virgil Packett, commander of the U.S. Army Aviation Warfighting Center at the time, unveiled the renamed Crew Member Wings as the new Aviation Badge. Packett in his commencement speech recognized the inertia against recognizing UAS operations and the value the Army places on uniform insignia. The petition to recognize UAS operators began in 1992. He commented, “It's a great day... because it's been a steep hill in order to be able to recognize, with this symbol of professionalism, these wings, the troopers that stand before you today. Now they can sit a little bit taller… with that shiny piece of brass on their chests that they have so duly earned.” Captain Kyle Duncan, operations officer for the UAS Training Battalion in 2007, both credited and clarified the wings’ meaning. His statement was a qualified compliment:

> They are not actually in the aircraft, but they are doing aviation duties. It's a credit to their skills, the hard work they do. They deserve this recognition. They are not pilots, but they are operating in theater, in aviation. They are not getting an aviator's badge; they are getting an aviation badge. We recognize them for their work, as part of aviation.[23]

As Duncan mentioned, the Aviation Badge is not an Aviator Badge, and UAS operators do not receive flight pay or incentive pay. The Aviation Badge is also awarded to aviation maintenance personnel at the completion of the Gray Eagle maintenance course.

Viewed through Schein’s methodology, the Army places mediocre value on its UAS operators. For one, Aviation Branch does not reward the young enlisted trainees with promotion into senior leadership opportunities. In fact, a disincentive exists for promotion. Once promoted to Master Sergeant, Human Resources Command (HRC) changes the 15W operators’ MOS to 15Z. A 15Z MOS is non-flying, and HRC assigns these Master Sergeants to any aviation positions like airfield operations, air traffic control, UAS operations, or aviation maintenance. The platoon leader retains operational authority, and an NCO oversees flight coordination. Officers from other Aviation Branch platforms fill UAS command and staff positions before returning to their aircraft. The UAS operators receive basic pay, not flight pay or Aircrew Incentive Pay (ACIP). The

[23] Rob Martinez, "New Policy Makes Soldier UAV Operators Eligible For Aviation Badge", 2007, https://www.army.mil/article/3012/new-policy-makes-soldier-uav-operators-eligible-for-aviation-badge.

artifacts associated with UAS operations could be mistaken for any other Army unit. They share insignia with air traffic controllers, airfield operations soldiers, and maintenance soldiers. They wear standard issue Army Combat Uniforms (ACUs) in contrast to their flight suit or Army Aviation Combat Uniform (A2CU)-wearing pilot officer counterparts at Ft Rucker.

Figure 11: Army Aviation Badge
Source: 2-13th Catalogue. 15W Common Core Course Design. 2016.

The Army more closely subscribes to the Joint Staff's minimum training guidance as spelled out in its *Joint Unmanned Aircraft Systems Minimum Training Standards* (JUMTS) than the Air Force does. The Joint Staff classifies Gray Eagle and the MQ-9 Reaper as Group 4 Unmanned Aircraft because they weigh more than 1320 pounds, predominately operate under VFR in all classes of airspace below 18,000' MSL, and prosecute ISR missions and missions as described by Joint Mission Qualification (JMQ) levels A or B. JMQ A supports unit-level ISR and fires tasks, and JMQ B supports theater-level advanced ISR. The JUMTS also spells out levels of Basic UAS Qualification (BUQ) knowledge required for each UAS group. A UAS crew must possess the general aviation knowledge and UAS knowledge-based skills to operate UAS safely as required by crew duties or position. As a minimum, regardless of UAS type, a qualified crew must be capable of airspace design and operating requirements, air traffic control procedures, rules, and regulations, aerodynamics, including effects of controls, aircraft systems and emergency procedures, performance, navigation, meteorology, communication procedures, and mission preparation.[24] BUQ Level III is the knowledge and knowledge-based skills required to fly under VFR in all airspace classes except Class A. The JUMTS for Group 4 UAS is BUQ III and JMQ B, and the Army trains to this standard.[25]

[24] CJCSI 3255.01 Ch 1. *Joint Unmanned Aircraft Systems Minimum Training Standards, 31 October 2011, A-2*.
[25] CJCSI 3255.01, 4.

Gray Eagle training has two frequently changing phases: currently they are an 8-week common core course and a 20-week Gray Eagle course. On completion of the initial phase, the soldiers possess requisite basic knowledge and skills required prior to training on a specific UAS system as well as common aspects of UAS operations within the Army and the Department of Defense. Academics also address the overarching structure of Military Intelligence and UAS operational role. Course attrition tends to be due to behavioral rather than academic or performance related issues. The pipeline front loads academics to reduce training investment while any student-related issues are addressed. The cost breakdown per student for the Common Core course is $11k for direct instruction and $5.6k in overhead costs. Pay, allowances, per diem, and travel incurred during an 8 week course amounts to $11.8k.[26]

During Module A, UAS operators receive in-depth instruction on the fundamentals of aerodynamics, doctrine, risk management, mission planning, flight safety, and navigation. The introductory module covers all knowledge necessary for a Federal Aviation Administration (FAA) Private Pilot's License. After four weeks of ground school, students take the FAA's Private Pilot Knowledge Test. Module B focuses on aeroscout operations to include visual identification of friendly and enemy vehicles and ground-based threats, base defense, and patrol concept of operations. Modules C and D quickly address Army aviation regulations and introduce gunnery in the eighth and final week.

[26] 2-13th Aviation Regiment Report entitled *Resident Training Cost per Graduate*, 2016.

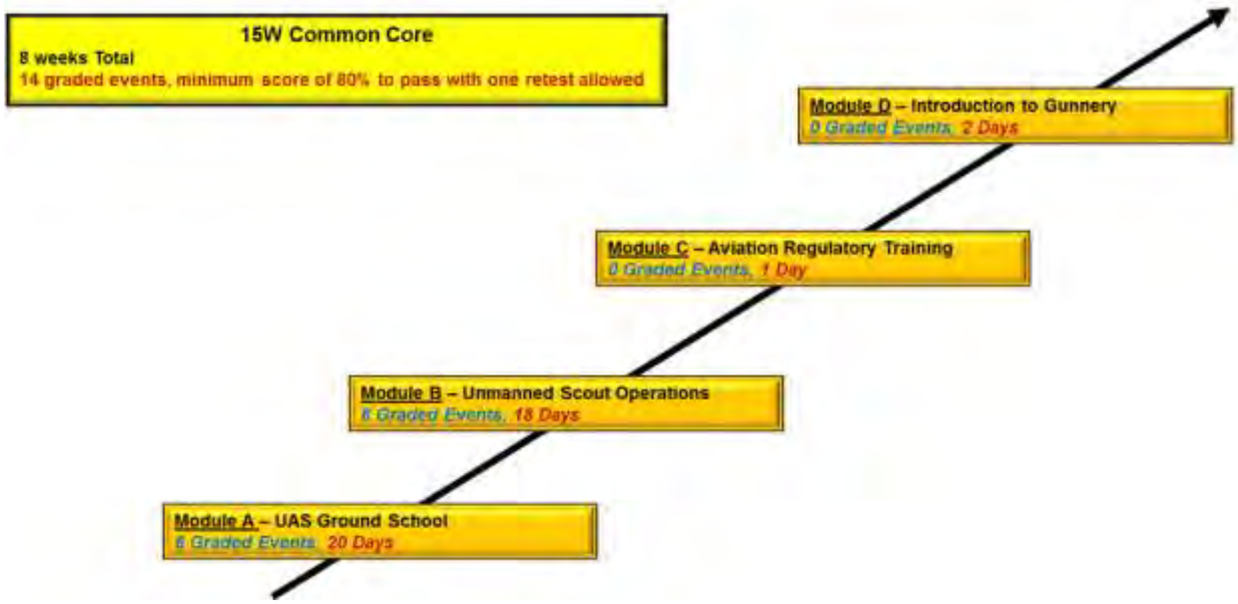

Figure 12: Common Core Training Modules
Source: 2-13th Catalogue. 15W Common Core Course Design. 2016.

After completing the Common Core, students track either to Shadow or Gray Eagle training. Previously, all students gained experience in the Shadow before progressing to the Gray Eagle. Upon graduation of either track, UAS students are expected to mission plan, prepare and conduct air reconnaissance missions, preflight, launch, remote pilot and recover an aircraft, perform emergency procedures, perform tactical and administrative radio communications, operate sensors for target detection, deploy ground and air systems, conduct maintenance/inspections on communication equipment, and be familiarized with gunnery operations. The Gray Eagle course consists of 8 modules and 680 hours of academic and flight instruction across 25 total weeks. The schoolhouse conducts six classes of sixty students per year. To train 360 students per year requires 24 hour operations, and instructors as well as aircraft are fully utilized. The cost breakdown per student over 25 weeks is $140k for direct instruction and flying costs. Overhead costs and student pay, lodging, and travel add an additional $41k.[27]

[27] 2-13th Aviation Regiment Report, 2016.

Figure 13: Gray Eagle Training Modules
(Source: 2-13th Catalogue. 15W Common Core Course Design. 2016)

Currently, Gray Eagles operate exclusively in combat zones or restricted airspace unless granted a domestic Certificate of Authorization (COA) to transit with chase aircraft or observers. To enable further national airspace integration, Module G has shifted to emphasize and practice IFR flight. Renamed as Module A, the phase now consists of 57 hours of instruction and covers instrument flight rules, practical exercises, and a performance evaluation.

Officer and warrant officer platoon leaders supervise enlisted Gray Eagle operators. The schoolhouse conducts four week courses to transform incoming lieutenants into UAS platoon leaders. The overarching objective is teaching how to manage and supervise UAS personnel, programs, and operations in wartime and peacetime situations. Topics covered include understanding mission-essential UAS systems, equipment operations, and capabilities; applying aviation doctrinal concepts during different phases of UAS operations, mission planning, and execution; and advising the commander in the use of UAS assets. Additionally, the 2-13th Aviation Regiment teaches a 3-week Air Cavalry Leaders Course to incoming unit commanders in the UAS chain-of-command and staff assigned to units who work directly and indirectly with UAS units. The course covers capabilities, concept of employment, limitations, UAS-specific safety, maintenance, standardization, gunnery requirements, and training requirements.

Recap

The Army's UAS training community has operated at Fort Huachuca for over 25 years. It has expanded into new platforms with new capabilities, but its model based on universal enlisted operators trained to operate as an organic divisional asset just prior to deployment has remained. The focus on efficiency has streamlined the training pipeline. Ironically, at the operational level, the Army prizes flexibility over efficiency and possibly effectiveness. Soldiers are trained to fly the Gray Eagle, to operate its payloads, to conduct certain maintenance items, and to handle basing requirements. Comprehensive training enables platoons and companies to operate autonomously, but the decentralized approach prevents specialized focus and high-end capability. It also reduces readiness levels. Low retention plagues the community, but current production meets needed replacement demand.

The underlying focus remains to support and enable the ground forces commander and his mission. The artifacts, values, and assumptions are in accordance with that focus. Such simplicity has led to practical and sustainable decision-making in regards to UAS. The Army will be required to navigate two opposing trends in UAS. One is increased automation, enhancing ease of use. Given the lack of prestige and distinction placed on UAS operators, the UAS community will not resist this advancement. The other trend is future UAS integration further into Army units. This is already raising questions over who flies UAS, where is it organic, who can shoot, and how much money, time, and personnel should be put towards UAS or manned platforms. Currently, UAS is only 5% of Aviation Branch's budget. Aviation Branch funds UAS, but all Army branches want the capability or the promise of capability. Specific demands include cargo, command and control, and Chemical, Biological, Radiological and Nuclear (CBRN) defense. Unless Headquarters Army funds and prioritizes UAS requirements, only Aviation Branch UAS requirements will be funded and developed, leaving gaping holes on the emerging multidomain battlefield.

Chapter 4-
Opportunities Knocking

This is an inflection point… The trend lines are unmistakable that the United States Air Force will be an increasingly unmanned aviation service.

General Norton A. Schwartz, CSAF,
in testimony to the Senate, 21 May 2009.

The RPA's origin has been tumultuous, and its future will remain so. Despite initial capabilities tracing back to World War I, the broad consensus is that unmanned aviation is still in its first generation of development; as General Mark Welsh opined: "Remember we're at the Wright flyer stage, we're just getting started."[1] Future threats and opportunities stand to revolutionize the RPA and bring it rapidly into its next generation. For the near term, technology and societal pressures will force the AF to adapt organizationally and in training more than an adversary will. In adapting, the AF itself will evolve. The impact on the organization is yet to be determined, but technology will undoubtedly leave its mark. As Schein commented, "Ultimately all organizations are sociotechnical systems in which the manner of external adaptation and the solution of internal integration problems are interdependent and intertwined."[2] This chapter transitions away from UAS history and the services' internal responses in forming a training strategy. This chapter looks to the future to identify and explore approaching developments. It addresses three specific developments: increasing automation, the AF introduction of enlisted RPA pilots, and the FAA's push to integrate UAS into the national airspace.

[1]Welsh, General Mark A. "National Press Club Speech", 2014. http://www.af.mil/Portals/1/documents/csaf/Nationalpressclub23April2014.pdf.
[2] Schein, 108.

Development One: Automation

Organizations change cultural assumptions through the subtle, cumulative, and sometimes unintended impacts of new technology….

Edgar Schein, *Organizational Culture and Leadership*

Autonomy will be the driving force behind the development of a new generation of RPAs optimized for more complex air environments, and human distrust in autonomy will lie at the heart of limitations on the design and deployment of these aircraft.

Caitlin H. Lee, "Embracing Autonomy: The Key to Developing a New Generation of Remotely Piloted Aircraft for Operations in Contested Air Environments"

Unmanned aircraft benefited from a confluence of several critical technologies in the early 1990s, such as the Global Positioning System (GPS), advanced microprocessors, and wide-band satellite communication links. In combination, these developments allowed drones to break free from their seemingly perpetual emergent state. Automation in robotics has built upon those technologies to bring widely anticipated capabilities to air power. In 2009, then Chief of Staff General Norton Schwartz commented,

> Industry has already refueled an unmanned aircraft and demonstrated multi-aircraft control-all feats that only a few contemplated 10 years ago. It's not hard to imagine a multitude of other missions for our unmanned aircraft, including air transport, air refueling, suppressing enemy air defenses, forward air control, combat search and rescue, and more. It also is not difficult to imagine new operational concepts, such as groups of unmanned aircraft flying 'swarm' tactics.[3]

Rather than see General Schwartz's comments to fruition, the AF has clung to its UAS construct as seen in Figure 14. It has yet to exploit the promises of automation despite rapidly growing capabilities. Unfortunately, Figure 14 no longer matches external reality. The assumed correlations between capability, complexity, and size have not held. UAS are growing smaller and more capable, while overall complexity for the operator decreases. MQ-9 Reaper aircrews hone their skills to manually track moving

[3] General Norton Schwartz, "Future Of Unmanned Aircraft (Remarks At The Graduation Ceremony For The Unmanned Aircraft System MQ-1 Predator Course, 25 Sep 2009)", (Speech, Creech AFB, NV, 2009).

vehicles, but off-the-shelf drones can now autonomously track targets using facial recognition. The Global Hawk has the wingspan of a Boeing 737, and high levels of automation through a keyboard and point-click mouse interface make it simple to employ. That ease of operation does not preclude its high capability: its effects are highly prized, and it routinely collects strategic ISR for multiple combatant commanders during a single sortie. All this means the dividing line separating SUAS operators and rated pilots based on aircraft performance has blurred.

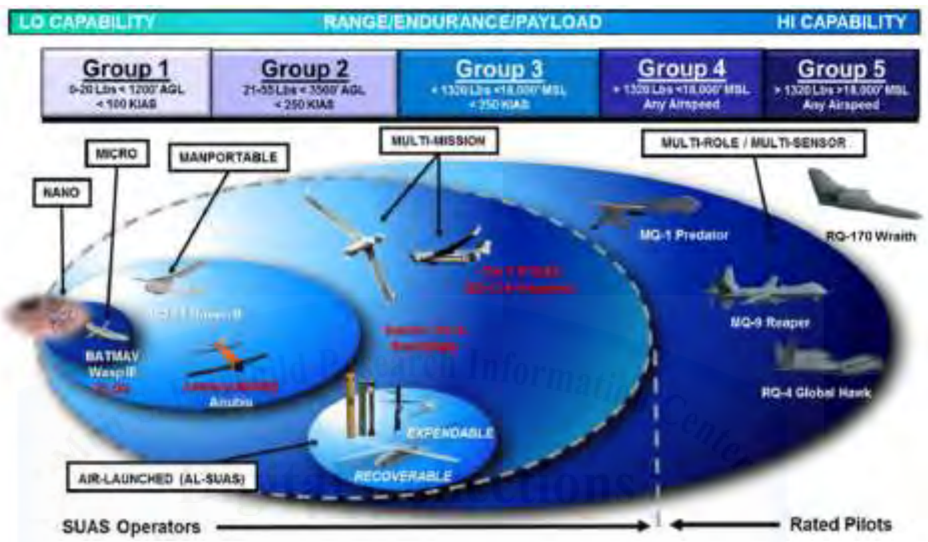

Figure 14: UAS Group Descriptions
Source: Lt Col Jason Green, "A Brief Look: The State Of Remotely Piloted Aircraft (RPA) Operations Local, Global… Past, Present, and Future…", 2016.

State of the art automation now resides in commercial, consumer-level Small UAS (SUAS). Once the realm of tactical employment by well-trained militaries, SUAS now provides tactical, possibly strategic, effects to the untrained and poorly funded. The Islamic State of Iraq and Syria (ISIS) currently employs SUAS as surveillance platforms, grenade launchers, mortar droppers, kamikaze bombers, and flying decoys that hide internal improvised explosive devices (IED). Recently, they have started using multi-ship tactics normally reserved for sophisticated air forces. Christopher Bolkcom, an employee of the US Congressional Research Service, highlighted this possibility in 2002 when he testified before Congress that seven particular features made UAS attractive to terrorist groups. Those seven features are low acquisition costs, ease of purchase, high accuracy, operational flexibility, ability to penetrate air defenses, high prelaunch survivability, and little to no infrastructure needed to deploy.[4] He failed to mention ease of use that requires little training. Such characteristics have allowed ISIS to replace expended assets faster than Iraqi forces can target drone factories. Don Rassler of the Combating Terrorism Center at West Point concludes the problem will worsen as capabilities improve:

> Future off-the-shelf drones will be able to carry heavier payloads, fly and loiter longer, venture farther from their controller and be able to do so via more-secure communications links. The increased speed of small drones and advancements in sensors and drone add-on technology (such as infrared and night vision cameras), will compound the problems for counterterror organizations.[5]

The threat has warranted a strategic response from the Department of Defense. Speaking alongside the Secretaries of the Navy and Army at the Center for a New American Security in October 2016, Secretary Deborah James announced the successful takedown of an ISIS drone that had previously killed four civilians. She then commented, "A top priority for me at the moment is this emerging danger that we're seeing in the Middle East in respect to unmanned aerial systems — these cheap, buy-them-over-the- internet, small drones. If explosives are placed on them, as we've seen a handful of times now in Syria and Iraq, they can do damage."[6] Comparatively, the AF has more resources yet has not pursued automation to the degree ISIS has. Several projects described below may change that.

Defense Advanced Research Project Agency's Aircrew Labor In-Cockpit Automation System (ALIAS) functions as a retrofitted vehicle management system in manned aircraft to alleviate pilot workload and crew requirements (see Figure 15). According to Dr. Dan Patt, DARPA's Tactical Technology program manager, ALIAS is a flexible, extensible automation toolkit for existing aircraft that enables safe, reduced

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[4] Christopher Bolkcom before Senate Governmental Affairs Committee, Subcommittee on International Security, Proliferation, and Federal Services, *Hearing on Cruise Missile Proliferation*, 108th Cong., 2[d] sess., 2002, 1–9.

[5] Don Rassler, *Remotely Piloted Innovation: Terrorism, Drones and Supportive Technology* (Combating Terrorism Center, US Military Academy, 2016), https://www.ctc.usma.edu/v2/wp-content/uploads/2016/10/Drones-Report.pdf.

[6] Brendan McGarry and Matthew Cox, "Air Force Zaps ISIS Drone With Electronic Weapon", *Defensetech*, 2016, https://www.defensetech.org/2016/10/24/air-force-zaps-isis-drone-with-electronic-weapon/.

crew operations. Benefits include enhanced safety in operations, reduced training burden, more capability per dollar via enhanced human effectiveness, and a speeded transition to the next generation of automation and interface.[7] ALIAS highlights automation's scalability well. Rather than distinctly separate manned and unmanned platforms, automation can blend the two. Currently, the Army and SOCOM have agreements in place with DARPA to transition the technology. The Navy and Marines have expressed interest in integrating the capability into existing manned platforms, and DARPA expects commercial participation from Fed Ex in the air proof of concept phase.

Figure 15: ALIAS Inserts New Automation into Existing Aircraft to Enable Operations with Reduced Onboard Crew
Source: "ALIAS – Aurora Flight Sciences", Aurora.Aero, 2017, http://www.aurora.aero/alias/.

The AF stands as the lone service not participating. A retired AF pilot working for DARPA called the AF's lack of involvement in a program with so much potential "mysterious."[8] A ventured guess is culture. Historically, aeronautical engineers balanced flight stability with maneuverability. Maneuverable aircraft demanded skilled, attentive pilots, and therefore flying became prestigious. Technology that reduces the need for skill threatens the prestige given to pilots. Significant gains must offset technology if it reduces the need for skill. Initially, aviators viewed gauges, instruments, and indicators

[7] Daniel Patt, "Aircrew Labor In-Cockpit Automation System", (Presentation, 2016).
[8] Peter LeHew (DARPA Adaptive Execution Office Systems Engineering and Technical Assistance Manager), interview by author, 29 December 2016.

of flight parameters as a threat before accepting how much safer they made flight. The F-16 had a Predictive Ground Clearance Avoidance System (PGCAS) for years that would notify the pilot of an impending crash into terrain, but it would not recover the aircraft automatically. The system needed a conscious pilot to recover the aircraft. In testing an Auto-GCAS, the overriding concern was uncommanded, undesired aircraft inputs.[9] Various levels of automatic recovery systems existed for three decades before the AF introduced Auto-GCAS in 2014.[10] Since its introduction, the automated system has saved four incapacitated pilots. Dr. Patt recognized that the AF loves technology but views it as a tool to aid human judgment not to replace it. He marketed ALIAS differently to each service. To the Army and Marine Corps, he emphasized the flexibility of ALIAS, how it provides staffing options based on mission requirements, threat levels, or costs. Leaders may identify a complex mission and elect two pilots to fly the aircraft, or they may elect to unman the aircraft for sorties in high-risk environments. To the AF, he emphasized that ALIAS augmented the pilot by offloading routine tasks. Patt envisions that, during critical phases of flight or emergencies, ALIAS can deliver timely information, warnings, and assistance to the pilot. He left out the obvious logical conclusion that, if successful, his program could unman the entire AF fleet.

The Army is working on developing the equivalent of a universal remote for its unmanned aerial systems. The capability allows training to be reduced, and for a universal operator to control multiple, different UAS without additional training.[11] The Scalable Control Interface (SCI) will combine the interfaces for Gray Eagle, Shadow UAS, and other small UAS into the system. If the program remains on schedule, the Army will field SCI by 2020. In the meantime, the Army's UAS Capabilities Manager staff is reevaluating mission management functions, redefining current UAS control terminology, and introducing new terminology to describe the control inner-relationships SCI will enable. Major Ariel Schuetz, the Army's Training and Doctrine Command UAS

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[9] Guy Norris, "F-16 Flight Demonstrates Auto-GCAS Potential", *Aviation Week*, 2017, http://aviationweek.com/technology/f-16-flight-demonstrates-auto-gcas-potential.
[10] Guy Norris, "Auto-GCAS Saves Unconscious F-16 Pilot—Declassified USAF Footage", *Aviation Week*, 2016, http://aviationweek.com/air-combat-safety/auto-gcas-saves-unconscious-f-16-pilot-declassified-usaf-footage.
[11] J.D. Leipold, "Army To Go Universal With UAS Operator Training", *US Army*, 2016, https://www.army.mil/article/161492/Army_to_go_universal_with_UAS_operator_training.

Capabilities Management operations officer, presented five different levels of operator authority and capability similar to computer software user permissions. A mission manager will serve the role of administrator where he will task aircraft, send mission plans, and assign aircraft to other managers, controllers, and users. Similar to a computer network administrator, the SCI manager will approve or deny requests from other users. Control that the manager can grant includes exclusive control, supervised usage, and unsupervised usage based on user qualification, need, situation, and command guidance. While SCI is in development, the Army is testing its techniques, tactics, and procedures via its current Manned-Unmanned Teaming (MUM-T) capability.

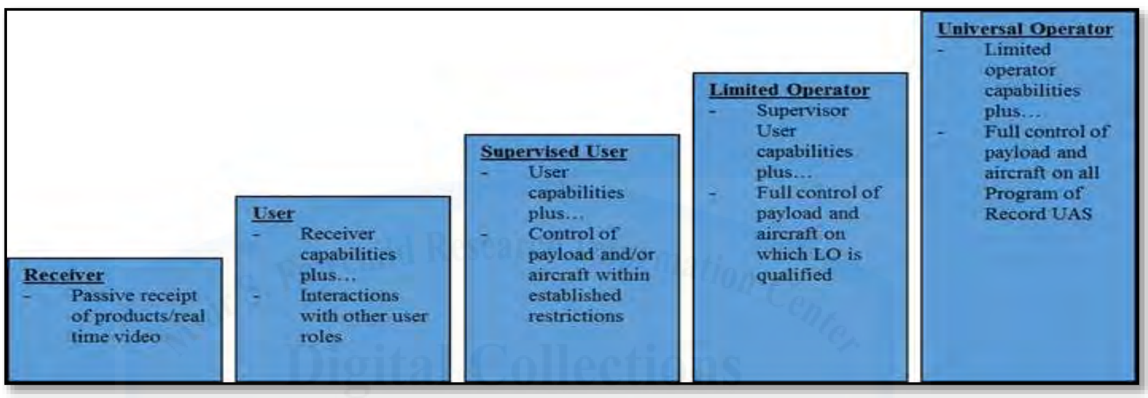

Figure 16: Army UAS Operator Terminology
Source: Army TRADOC UAS Capabilities Manager, Scalable Control Interface (SCI) Definitions, 2016.

In 2015, DARPA successfully demonstrated its Persistent Close Air Support (PCAS) concept. The program gives Joint Terminal Attack Controllers (JTACs) the ability to visualize, select, and employ munitions at the time of their choosing from optionally manned/unmanned aerial attack platforms. PCAS transfers decision making from the pilot to the JTAC via a weapon-carrying "smart rail" and an Android-based tablet.[12] Easily applicable to RPA, PCAS offers weapons solutions and delivery profiles as well as the ability to move weapons release closer to the release authority. An RPA Weapons Instructor Course (WIC) graduate commented that he did not see the utility of such a capability and reiterated that weapons release authority should reside with the

[12] Marshall Frith (DARPA PCAS Systems Engineering and Technical Assistance Manager), interview by author, 28 December 2016.

pilot.[13] In line with that thinking, the AF's Air Combat Command and Special Operations Command do not plan to leverage the capability. Meanwhile, the Marine Corps and ARSOAC's 160th Special Operations Aviation Regiment are actively transitioning the concept to an operational capability.

Congress's 2017 National Defense Authorization Act funded $15 million toward integrating an automated takeoff and landing capability on the MQ-9.[14] The Army's MQ-1C Grey Eagle has had this feature since its acquisition, and the AF will "look to the army, who figured it out with the same manufacturer."[15] This overdue development brings two significant advantages to the MQ-9. First, it will ease training requirements. Currently, launch and recovery training takes 32 training days and costs approximately $99,000 per pilot.[16] The indirect cost is the pilot's time away from the operational mission. While pilots train in launch and recovery, squadrons conducting real world remote-split operations pay the manning bill. The just-in-time training model puts undue stress on the squadrons and is inefficient. The Culture and Process Improvement Program, as discussed in Chapter 3, will change this model to a dedicated, deployable launch and recovery squadron.

Second, auto takeoff and land functionality increases operational flexibility. Divert airfields, if required, would not require on station recovery crews--just the guidance system. In addition, according to General Atomics, the capability needs less runway length due to better landing precision.[17] Launching and recovering aircraft with automation eliminates the need to use a line of sight frequency. In turn, this reduces congestion and interference in the electromagnetic spectrum.

A third additional but uncertain impact of automated operations is reducing the deployed RPA footprint. The Global Hawk has automated takeoff and landing capability

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[13] Interview with major from AF Chief of Staff Crisis Action Group, 30 November 2016.

[14] Dan Gettinger, Drone Spending in the Fiscal Year 2017 Defense Budget (New York: Center for the Study of the Drone, 2016), http://dronecenter.bard.edu/files/2016/02/DroneSpendingFy17_CSD_1-2.pdf.

[15] James Drew, "USAF To Automate MQ-9 Takeoffs And Landings", Flight Global, 2016, https://www.flightglobal.com/news/articles/usaf-to-automate-mq-9-takeoffs-and-landings-424975/.

[16] ACC does not track the cost of Initial Qualification Training, Flight Instructor Upgrade Training, or Launch and Recovery Training. Costs are estimated assuming $4,762 per MQ-9 flight hour, taken from Mark Thompson, "Costly Flight Hours", *TIME.Com*, 2017, http://nation.time.com/2013/04/02/costly-flight-hours/. Instruction is calculated at $33/hour of instruction, equivalent to Army UAS cost.

[17] Drew, 2016.

as mentioned earlier. The community still deploys crews to monitor landings, but in much smaller numbers. At a collocated downrange location, MQ-1 Predator operations require eight aircrew, and Global Hawk operations require three for similar launch and recovery demands. When properly equipped, MQ-9 Reaper operations will drawdown to mirror Global Hawk operations, but the primary benefits of automated takeoff and land capability will lie primarily in a reduced training bill and increased operational flexibility.

Autonomy is not binary; it scales. "Autonomy is an 'adjustable' concept that one can employ to varying degrees, depending upon the role of an aircraft and its mission—a critical point because of the tendency to view autonomy as an all-or-nothing proposition."[18] The AF struggle to embrace autonomy demonstrates one cultural value trumping another; the value placed in the operator and maximizing platform performance through training that operator is taking precedence over the service's trust in technology. At present, technologies are adopted as long as they do not undermine the operator's importance. Emerging advancements that allow the operator to scale automation may ease this cultural transition toward more technologically determined values.

US adversaries like ISIS are embracing autonomy to overcome scarce resources, expertise, and training. Likewise, autonomy will force the AF to adapt or risk irrelevancy. As highlighted, multiple autonomous capabilities are presently possible or on the horizon, and they will affect RPA operations and therefore training. The AF has integrated many systems at automation level 7 through 10 (see Figure 17). Traditionally, the service scrutinized and debated systems above that level like the F-16's Automatic Ground Collision Avoidance System before implementation in an attempt to preserve as much flexibility and capability to the pilot as possible. Now, though, automation increases flexibility and capability. Scaling automation rather than toggling it on or off is the final step to build operator trust and ease the AF's cultural transition.

[18] Lee, 83.

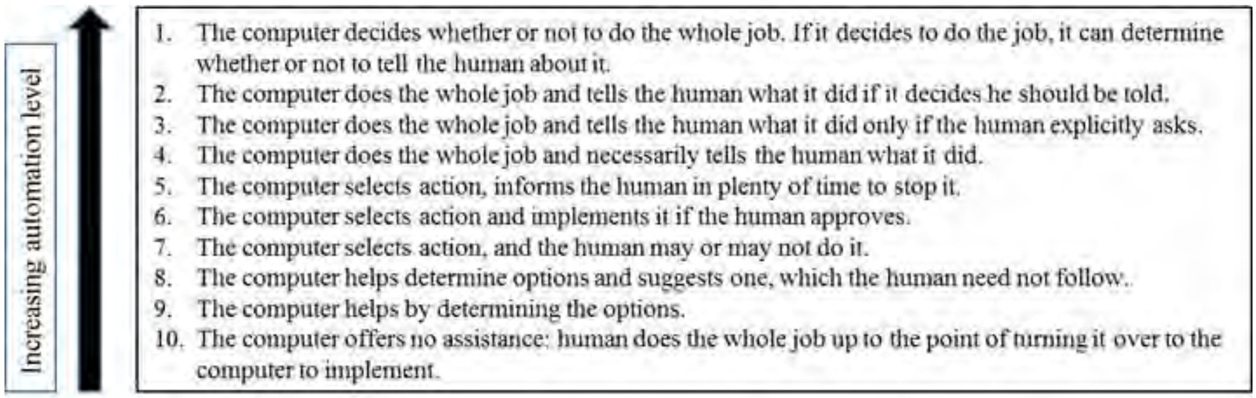

Figure 17: Automation Levels in Man-Computer Decision Making
Source: Caitlin H Lee, "Embracing Autonomy: The Key To Developing A New Generation Of Remotely Piloted Aircraft For Operations In Contested Air Environments", Air & Space Power Journal 25: 76-88.

Development Two: EPIC

On December 17, 2015, Secretary of Air Force James directed the integration of enlisted pilots into the RQ-4 Global Hawk community. This civilian mandate was a long time coming; in 2003, the Senate Armed Services Committee tasked the Air Force to "create a cadre of warrants to serve as pilots for unmanned aerial vehicles."[19] Twelve years later, James tasked ACC and AETC to develop an implementation plan to provide an additional avenue for capability growth.[20] In the fall of 2016, the AF implemented the Enlisted Pilot Initial Cadre (EPIC) program. The inaugural class of four candidates entered RPA Initial Flight Training in October 2016. One withdrew, and the three remaining transitioned to the RPA Instrument Qualification course and RPA Fundamentals Course to graduate successfully in the spring of 2017. The 558 FTS will produce 12 enlisted pilots in 2017. The AF selected EPIC candidates from enlisted aircrew career fields. As the AF transitions to full production, Air Force Personnel Center plans to accept NCO and SNCO applicants from any career field. Pilot officer candidates take an Officer Qualifying Test before entry to training; the AF will judge future enlisted applicants' aptitude based on their OQT score as well. In the EPIC program, an aptitude test has not been required, possibly due to oversight. AETC leaders did not make any URT syllabus changes to accommodate EPIC and, purposely, they did

[19] Colonel Timothy Schultz, UAS Manpower Exploiting A New Paradigm (Maxwell AFB: Air Force Research Institute, 2009), 38.
[20] Secretary of Air Force Deborah James, memorandum for record, 17 December 2015.

not name the program a test, trial, or beta case. Lt Gen Darryl Roberson, AETC/CC, summed up the plan: "Right now, the going-in plan is that the training we give to the enlisted pilots is going to be exactly the same as what we're giving our officer pilots. So right now there is no difference. We did that very deliberately."[21]

Unfortunately, the EPIC program does not expand the training pipeline, the community's bottleneck, and therefore does not alleviate manning troubles. General Roberson was clear on that point as well: "The way that we're approaching this is each enlisted pilot that comes in is going to replace what would have been an officer. So it's not additive, it's a replacement for."[22] The Air Force Personnel Center calculates that it needs 100 total enlisted graduates in the next few years to pilot 70% of Global Hawk missions. In the 2017 National Defense Authorization Act, Congress increased the mandate to enlisted pilots flying the preponderance of Global Hawk missions by September 30, 2020. The NDAA declared, "The Secretary of the Air Force shall transition the Air Force to an organizational model for all Air Force remotely piloted aircraft that uses a significant number of enlisted personnel as operators of such aircraft rather than officers only."[23] The directive states that, if any enlisted pilots operate an RPA, then the AF needs to adopt an enlisted force model. The wording incentivizes the AF to prohibit enlisted pilots from flying the MQ-9 lest it transition to an enlisted-dominated career field.

The Active Duty Service Commitment for URT is 6 years. Assuming timely pipeline production, enlisted pilots will serve 5 years. If they perform commensurate to their officer counterparts during their first tour, the opportunity may open to transition enlisted RPA pilots to MQ-9 slots. Without an overriding reason to prohibit such a move, inertia will push enlisted RPA pilots to more platforms. Whether for enlisted or officer pilots, the current RTU curriculum is identical. If both groups graduate with the same qualifications, officers become financially unjustifiable. The Army's model then is

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[21] Phillip Swarts, "Enlisted RPA Training To Begin In October, Head Of AETC Says", Air Force Times, 2016, https://www.airforcetimes.com/articles/enlisted-rpa-training-to-begin-in-october-head-of-aetc-says.
[22] Swarts.
[23] Senate, *S. 2943 National Defense Authorization Act for Fiscal Year* 2017, 114th Cong., 2nd sess., 4 January 2016, 398.

a proven way to incorporate an enlisted/officer force. Officer expectations and therefore training will need modification.

The AF reintroduced enlisted pilots under a different context and with a different goal than their World War I or World War II brethren. Enlisted pilots served proudly and effectively in the Army Air Corps first during a time of light supervision and then during a frantic buildup leading to war. At the conclusion of World War I and World War II, rapid force reductions coupled with pilot commissioning programs meant the enlisted pilot legacy was short-lived.[24] Public justification for today's move by senior AF leaders has focused on enlisted talent. This strikes the author as disingenuous and confuses the narrative. Introducing an enlisted RPA pilot cadre signals a desire to reduce personnel costs and recognizes that RPAs require less skill to operate. Today's enlisted RPA pilot is not serving in a transitory position or as an expedient.

Development Three: FAA's National Airspace Integration of UAS

Difficulty integrating UAS into the national and international airspace slows large UAS growth in the civilian industry and the production of new unmanned aircraft types with expanded missions. Michael Huerta, the Administrator of the FAA, published a UAS integration roadmap in 2013 and commented on the hurdles integration faces,

> In moving forward, we recognize that the expanded use of unmanned aircraft presents great opportunities, but it's also true that integrating these aircraft presents significant challenges. There are operational issues that we need to address, such as pilot training. We also need to make sure that unmanned aircraft sense and avoid other aircraft, and that they operate safely if they lose the link to their pilot.[25]

Safety for the FAA is an overriding priority, and several UAS characteristics currently restrict integration. As highlighted in its roadmap:

[24] Lee Arbon, *They Also Flew: The Enlisted Pilot Legacy, 1912-1942* (Washington: Smithsonian Institution Scholarly Press, 1998), 45.
[25] Huerta, Michael. "Speech – UAS Roadmap". *FAA.gov*, 2013.
https://www.faa.gov/news/speeches/news_story.cfm?newsId=15354.

1. The UAS pilot is not onboard the aircraft and does not have the same sensory and environmental cues as a manned aircraft pilot;
2. The UAS pilot does not have the ability to directly comply with see and-avoid responsibilities and UAS SAA systems do not meet current operational rules;
3. The UAS pilot must depend on a data link for control of the aircraft. This affects the aircraft's response to revised ATC clearances, other ATC instructions, or unplanned contingencies (e.g., maneuvering aircraft);
4. UAS cannot comply with certain air traffic control clearances, and alternate means may need to be considered (e.g., use of visual clearances);
5. UAS present air traffic controllers with a different range of platform sizes and operational capabilities (such as size, speed, altitude, wake turbulence criteria, and combinations thereof);
6. And some UAS launch and recovery methods differ from manned aircraft and require manual placement and removal from runways, a lead vehicle for taxi operations, or dedicated launch and recovery systems.

Figure 18: FAA UAS Integration Hurdles
Source: Federal Aviation Administration,. Integration of Civil Unmanned Aircraft Systems (UAS) In the National Airspace System (NAS) Roadmap. FAA, 2013. https://www.faa.gov/uas/media/uas_roadmap_2013.pdf, 18-9.

The six integration hurdles revolve around collision avoidance and control. Automating collision avoidance and ensuring aircraft control remotely present technological challenges. "Sense and avoid" capabilities must provide for self-separation and ultimately for collision avoidance protection between UAS and other aircraft analogous to the "see and avoid" operation of manned aircraft. The FAA judges "sense and avoid" technology as immature and far from an acceptable level of safety.[26] Additionally, airspace integration requires reliable control and communications systems. The FAA is crowd sourcing consensus-based recommendations from industry and safety organizations to shape its policy, program, and regulatory decisions. The resulting requirements need to support the minimum performance required to achieve higher-level (UAS level) performance and safety requirements.

The FAA's integration plan has three phases: special access, routine access, and normal access. Currently, UAS transit the national airspace predominately through special access channels that grant specific certificates of authorization (COA). The FAA levies numerous and varied operational restrictions in its COAs based on the

[26] Federal Aviation Administration, *Integration of Civil Unmanned Aircraft Systems (UAS) In the National Airspace System (NAS) Roadmap* (FAA, 2013), https://www.faa.gov/uas/media/uas_roadmap_2013.pdf, 19.

airspace environment, UAS performance, and operator training. Neither the FAA nor DoD are satisfied with the inflexible system, but a shift toward more integration is conditions-based to ensure safety. In its mid-term phase of routine access, the FAA plans to shift to non-segregated access as policy, procedures, and technology permit. Emerging Ground Based Sense and Avoid (GBSAA) capabilities allows that routine access in localized operational areas, but its infrastructure does not permit flexibility or easy expansion. The final phase is normalized access. Developments that produce a robust Airborne Sense and Avoid (ABSAA) assurance will finally allow UAS to operate in the NAS with an equivalent level of safety and efficiency as manned aircraft. Promising technologies include electro-optic, infrared, and radar sensors, Automatic Dependent Surveillance-Broadcast, and Traffic Alert and Collision Avoidance System.[27] The FAA wants to transition from accommodating UAS via COAs to full integration, but policy waits for technology to create suitably safe conditions.

Clear solutions are not obvious for UAS airspace integration, but pressure from influential businesses like Amazon and FedEx, Department of Defense, Department of Homeland Security, and civilian customers make integration inevitable. Once that barrier falls, AF use of RPAs will proliferate to other missions like cargo transport and air refueling, and training requirements will morph further to accommodate required skills. RPA training focuses heavily on ISR and weapons employment even in URT. New aircraft types that perform different missions will necessitate new training objectives. Furthermore, an integrated airspace will explode demand in civilian industries. Civilian companies will target AF RPA pilots' expertise and provide financial incentives for RPA pilots to leave the service. The AF will have to react; its difficult job will be to manage experience levels, forecast trends, and train efficiently.

The AF pushes the FAA for increased UAS integration for practical reasons. COA negotiations are lengthy and produce inflexible and inconvenient operating conditions. As integration moves forward, the RPA community's assumptions about internal integration will change. An observer sees organizational culture in group boundaries and identification. Right now, large UAS are exclusively military and

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[27] FAA Roadmap, 29.

predominately weaponized. Not having civilian functionality has led bystanders to view UAS as war mongering, faceless machines. Integration will lead to proliferation and, in turn, familiarity lessening the stigma.

Recap

Cumulative developments like automation, societal shaping as seen in EPIC, and sequential efforts like the FAA's integration plan will thrust UAS into its second generation. Whether perceived as opportunities or threats depend on perspective. The AF's large budget, advanced military industrial complex, and highly trained and experienced personnel create many competitive advantages that are well suited to leverage automation, an enlisted force, and airspace integration. The advancements highlighted have technological roots, but it brings several deep cultural assumptions into conflict. They each increase air power's reach, flexibility, and affordability, but they threaten the skill required by an aviator. Carl Builder observed that, "when other means such as unmanned aircraft… became available, it was the aviators who revealed, by deeds more than words, that their real affection was for their airplanes and not for the concept of air power."[28] This runs counter to military professionalism and American expectations. The US calls on the AF to provide lethal air power as an instrument of national power, but the cornerstone has been the pilot. As that changes, how the AF defines reality, time, and space will expand, and leadership, vision, and a good strategy will be key to the AF successfully navigating the sociotechnical waters ahead. The next chapter dissects the AF's current RPA training strategy in contrast to the Army's. Service strengths and weaknesses implied in chapters one through three by way of comparison and the emerging opportunities discussed here will merge in a Strength, Weakness, Opportunity, and Threat (SWOT) analysis.

[28] Carl H Builder, *The Icarus Syndrome: The Role Of Air Power Theory In The Evolution And Fate Of The U.S. Air Force* (New Brunswick, NJ: Transaction Publishers, 1994), 32.

Chapter 5
Strategy Analysis: AF RPA Training

The AF needs to reevaluate its current RPA pilot training strategy to prepare for future threats and opportunities. The AF reduced its ISR commitment from 65 combat lines down to 60 while combatant commanders increased their demand to 90. As Chapter 3 highlighted, the AF has been unable to scale production in a timely manner to meet increasing demand, and changing context will exacerbate the problem. In response, the Army has allocated more UAS resources to fill the gap. In essence, the AF has lost market share in an operating environment in which it clearly should be dominant. Debatably, the AF may recover with its current training strategy in the near term, but future opportunities and threats will require new approaches.

The first three chapters established a pattern of the external environment changing and the AF or Army subsequently adapting to meet needs. In the process, each service solved internal integration issues. The benefit of understanding each service's UAS origin and ensuing culture is an increased ability to identify organizational strengths and weaknesses. The last chapter forecasted three emerging developments that stand to reshape the UAS community. The first section of this chapter presents a method to analyze, classify, and test strategies. The second section dissects the AF's current RPA training strategy in the context of its broader Strategic Master Plan as well as in comparison to Army UAS training using a Strength, Weakness, Opportunity, and Threat analysis. The analysis concludes that emerging trends threaten to render the current strategy obsolete. Chapter 6 builds on that conclusion by analyzing two possible courses of action.

Methodology

This chapter conducts a Strength, Weakness, Opportunity, and Threat (SWOT) analysis for the AF's current training strategy. As implied in its name, a SWOT analysis is an analytical tool for understanding internal strengths and weaknesses and for identifying external opportunities and threats. Typically used in a business setting, SWOT analysis is useful in many decision-making situations to create a recommendation.

Strengths and weaknesses include human resources, physical resources, financial situation, activities and processes, past experiences, and organizational culture. Opportunities and threats stem from external forces and include future trends, the local, national, or international economy, funding sources, demographics, the physical environment, legislation, and local, national, or international events.

Michael Porter, an influential business professor at Harvard Business School, posits that an organization in a competitive landscape has three generic strategies available to pursue. The first is a Low Cost Leadership strategy. There are three main ways to achieve cost leadership. The first approach is achieving high utilization rates. In a training environment, this means maximizing the use of resources like simulators, aircraft, classrooms, and instructors. Spreading fixed overhead costs over a larger number of graduates results in a lower unit cost. Runways, air traffic control towers, base hospitals, and aircraft are examples of overhead. The second dimension is achieving low direct and indirect operating costs. Standardizing a basic product keeps costs low by using fewer parts and using standard components. Low wages, low rent areas, and establishing a cost-conscious culture contribute to lower overhead costs. Cost reduction avenues include outsourcing, controlling production costs, and minimizing other costs like research and development. The initiative to reduce unnecessary weight like heavy paper publications or extra fuel on C-17 flights is an example of reducing direct operating costs. Another is not teaching multiple mission sets in a training course to reduce time and operating expense. The third dimension is control over the value chain to ensure low costs. For a supply chain, this could be achieved by buying in bulk, instituting competitive bidding for contracts, or working with vendors to keep inventories low.

Mass production becomes both a strategy and an end in itself. This can be an advantage: higher levels of output both require and result in higher market share. In turn, the firm's low costs and efficiencies create an entry barrier to potential competitors who are unable to achieve similar economies of scale. Disadvantages include lower loyalty from price-sensitive customers and a reputation for low quality. Another risk is that cost reduction is not unique, and competitors may copy your cost reduction strategies. Combatting this requires continuous improvement by investing in technologies aimed at reducing costs, maintaining efficient logistics, and keeping labor, material, and facility costs low. The desired result in a Low Cost Leadership strategy is, given a constant budget, to produce more through cost reduction.

Differentiation, the second strategy, involves making your products or services different from and more attractive than those of your competitors. Uniqueness in features, functionality, durability, support, or image characterizes valued, differentiated products. Providing contrasting products or services is a successful strategy when the target customer is not price-sensitive, customers have specific and under-served needs, and the company has unique resources and capabilities. A differentiation strategy is successful not by increasing market share but by achieving brand loyalty or a price premium. Organizations see gains when a price premium outweighs the added cost of specialization. Conversely, differentiation is a poor strategy if competitors can easily copy the product, method, or service provided. As an example, the C-17's capability to land on unimproved strips does not appeal to the airline industry, the dominate aircraft purchaser, but it did appeal to air forces around the world. To execute a differentiation strategy successfully, organizations need: good research, development and innovation; the ability to deliver high-quality products or services; and effective marketing to communicate the benefits offered by the differentiated offerings.

A Focus strategy, the third option, divides the existing market and then adopts a Differentiation or Low Cost Leadership strategy to serve that niche market. By understanding the dynamics of that market and the unique needs of customers within it, smaller companies then develop uniquely low-cost or well-specified products to outcompete broader market strategies. The firm typically looks to gain a competitive advantage through product innovation or brand marketing rather than efficiency. By serving customers in a unique market well, a small company's advantages include strong brand loyalty and less competition. The barrier to entry for competitors is deep, local knowledge. Disadvantages include difficulty expanding to dissimilar markets.

AF Strategic Master Plan

In 2015, the AF released its 20-year Strategic Master Plan (SMP) to lay out five strategic vectors that identified priority areas for investment, institutional change, and operational concepts. The aim is to provide coherency and a unified direction across the

AF. One can also sift through the SMP to see how the AF answers fundamental questions about the service it provides and how it sees the future of armed conflict. Of the five strategic vectors, two in particular pertain to current RPA operations. The second strategic vector charges the AF to maintain a robust and flexible global ISR capability.[1] To accomplish this, Headquarters Air Force champions a "rebalance [of] resilient ISR sensors, systems, and processes toward operations in high-end contested environments," and advocates increased capabilities "against critical target sets in highly contested environments."[2] The third strategic vector complements the second: "Ensure a full-spectrum capable, high-end focused force."[3] The consequences of not achieving freedom of maneuver are dire: "Without high-end air, space, and cyberspace capabilities, these denied regions will pose significant, if not insurmountable, obstacles to friendly forces. Our greatest value to the joint force is dealing with these advanced threats…."[4] AF strategists, in crafting the SMP, used "high-end" 18 times and "deterrence" 22 times in 65 pages. The AF is positioning itself to win, or at least deter, in a Cold War II. As acquisitions and missions develop to counter near peer nation states, training will need to adjust.

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[1] Headquarters, Air Force. Strategic Master Plan, 2015. http://www.af.mil/Portals/1/documents/Force%20Management/Strategic_Master_Plan.pdf, 3.

[2] *Strategic Master Plan*, 2015, 43.

[3] *Strategic Master Plan*, 2015, 3.

[4] *Strategic Master Plan*, 2015, 45.

Figure 19: Platforms Tailored to Future Conflicts as Described in the Strategic Master Plan
Source: Author's original work

Clearly, the AF wants to refocus on the high-end spectrum of conflict where its role is more deterrence than brute force. This contrasts with the modern security environment and where the bulk of RPA training and assets are focused. RPAs matured during low intensity conflicts, and RPA platforms reflect that beginning. They operate in permissive environments and are primarily intelligence-gathering assets. Several noted security experts in academia disagree with the AF's prognosis on future conflicts. Mary Kaldor in *New and Old Wars* posits that, in the context of globalization, war between states in which the aim is to inflict maximum violence is becoming an anachronism. Present-day actors transcend previous geographic and political boundaries. The wars are fought for political goals using tactics of terror and destabilization that do not abide by the rules of modern warfare, and top down approaches to resolve issues favored by strong nation states are likely to fail. "Since the new wars are, in a sense, a mixture of war, crime, and human rights violations, so the agents of cosmopolitan law-enforcement have to be a mixture of soldiers and police."[5]

David Kilcullen in *Out of the Mountains*, identifies population growth, urbanization, littoralization, and networked connectivity as four emerging megatrends and correspondingly suggests that conflict is increasingly likely to occur in coastal cities,

[5] Mary Kaldor, New and Old Wars, 1st ed. (Cambridge: Polity Press, 2012), 12.

in underdeveloped regions, and in highly networked, connected settings.[6] The answer is "co-designing" a response to improve resilience. Outsiders bring training, mentoring, technical skill, functional knowledge, research, support, and technical assistance, and locals bring insight, hyperlocal context, spatial understanding of systems logic, day-to-day flow, and ultimate action to implement the program.[7] In this new security environment, "the paradox is that although there are no purely military solutions, there are also no solutions without the ultimate sanction of coercion to enforce the order that makes joint action possible."[8]

Finally, Emile Simpson's central proposition in *War from the Ground Up* is that the traditional model of war as a bipolar conflict between two discrete political units is no longer helpful to understand or exploit the modern battlefield. Whereas nation-states fought past wars to achieve a military end state, soldiers today conduct armed action to directly seek political outcomes. Military leaders now must consider the impact of their actions not only on the enemy but also on a diverse set of audiences.[9]

Since its origin, the USAF has historically had difficulty transitioning its focus away from near peer adversaries to the low intensity conflicts in which it frequently finds itself. If academics are right, the AF's current strategic preparations for great power war may be setting the service up for future identity problems and a capabilities mismatch similar to Operations Iraqi Freedom and Enduring Freedom. Positioning training well to accommodate high-end capabilities and low-end conflicts may be problematic.

Comparison Difficulties

Several factors make direct comparisons between Army and AF RPA training difficult. Cost differentiation is one. Army accounting includes fixed overhead costs and variable direct costs like student pay, lodging, and travel. Because the Army relies on remote split operations less than the AF, UAS operators deploy more frequently and for

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[6] David Kilcullen, Out Of the Mountains: The Coming Age of the Urban Guerrilla, 1st ed. (Oxford: Oxford University Press, 2013).

[7] Kilcullen, 255.

[8] Kilcullen, 257.

[9] Emile Simpson, War From The Ground Up: The Coming Age Of The Urban Guerrilla, 1st ed. (New York: Columbia University Press, 2013).

longer periods than do their RPA counterparts. Combat zone pay and tax relief programs bolster their take home pay. Furthermore, the Army Military Occupational Specialty (MOS) code for UAS is currently 15W regardless of UAS type. Data tracking UAS operators does not distinguish between Gray Eagle or Shadow operators. Finally, distilling the cost of just flight training to compare costs is subjective. The Army trains each operator to fly the aircraft and operate its sensor suites rather than specializing each task the way the AF does.

Compounding difficulties in comparison, many factors make AF costs unpredictable. For instance, at the FTU, temporary duty (TDY) costs amount to $100 per student per day. Additional training time due to poor weather or lack of instructor availability means additional TDY lodging and per diem costs. In 2016, FTU classes graduated on average 25 days late. This added up to $2.7 million in additional TDY costs.[10] It does not help that no AF staff is tracking RPA operating, training, or personnel costs to a high fidelity. Amazingly, ACC does not know exactly how much the MQ-9 FTU or Launch and Recovery course costs.[11]

Another cost variable difficult to track is AF personnel costs. They vary wildly, and a complete lifetime cost analysis is elusive due to multiple variables tracked across multiple staffs. Different personnel costs start with officer commissioning sources and AF education assistance. An Air Force Academy education costs $322,750 per graduate, whereas the AF often does not incur any undergraduate education cost for Officer Training School accessions.[12] Both commissioning sources feed officers to URT. In addition, Aviation Retention Pay packages offered by the AF vary each year, and an individual's aviation experience determines his Aviation Career Incentive Pay (ACIP). The recent ARP package for 2017 is $35k/year for 5 years return of service but previous years were $25k/year with a 20-year aviation service option.[13] The program's take rate

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[10] Major Derek (49 WG Program Flying Training manager), interview by the author. Over e-mail, 2017.

[11] Major Justin (ACC A3MU staff), interview by the author. Over e-mail, 2017.

[12] General Accounting Office, *DOD Needs To Enhance Performance Goals And Measures To Improve Oversight Of Military Academies*, GAO-03-1000 (Washington D.C., 2003), http://www.gao.gov/new.items/d031000.pdf, 2.

[13] Stephen Losey, "$175K Bonus For Air Force Drone Pilots Now Available", *Air Force Times*, 2017, https://www.airforcetimes.com/articles/air-force-offers-bonuses-up-to-175-000-for-drone-pilots.

varies each year as well. Another variable difficult to account for is supplemental income like Base Allowance for Housing (BAH). DoD determines BAH by location costs and scale the allowance proportionally to rank. An O-5 with dependents stationed at Creech AFB receives $2022 per month for housing, while an E-3 without dependents at Ft Huachuca is entitled to $624.[14] Personnel become more expensive as their Total Active Rated Service (TARS) increase. AF members have longer service commitments, and a greater percentage of rated personnel retire than do Army UAS operators. Finally, AF staff billets require more qualified field grade officers costing more than similar Army positions.

Comparison of Current AF and Army Training Pipelines

This section employs considered judgement to compare AF RPA training and Army UAS training based on time, qualifications, personnel, and cost. Previous sections and chapters have alluded to these differences; this section discusses and presents the comparisons using quick-reference visuals. It then transitions to a SWOT analysis based on the AF's current strategy of Focused, Differentiation compared to the Army's Low Cost Leadership strategy. The comparison includes the AF's RPA training including URT and the MQ-9 RTU but not Launch and Recovery training that many RPA pilots never attend. Army's UAS training includes the Common Core course and Gray Eagle qualification course. Several quick-reference figures and tables are included.

Figure 20 displays a comparative training timeline for each service. URT and the FTU take 40 weeks combined. This does not include frequent delays or any holding time between courses. Conversely, the 15W training pipeline is considered Advanced Individual Training (AIT), and graduation dates are non-negotiable. Infrequently, students who are unable to complete the syllabus due to poor weather or other extenuating circumstances still depart to their gaining unit on time.

[14] "BAH Calculator", Defensetravel.Dod.Mil, 2017, http://www.defensetravel.dod.mil/site/bahCalc.cfm.

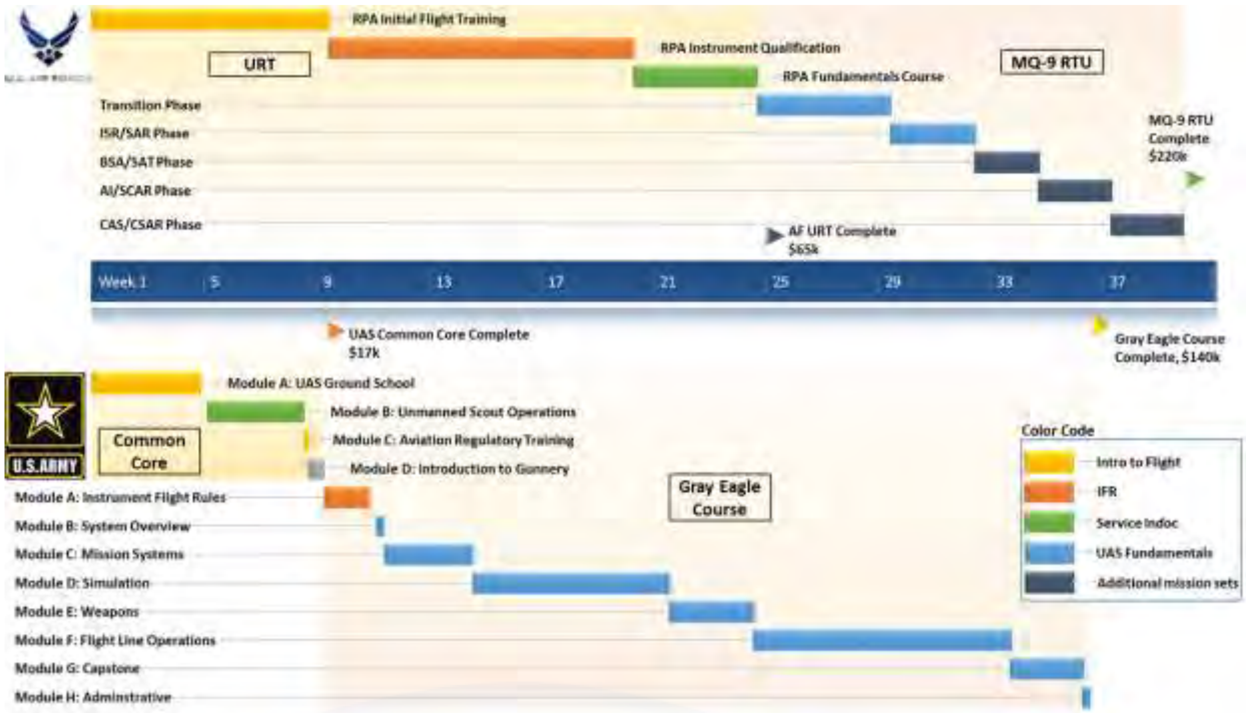

Figure 20: USAF RPA Training Pipeline Compared to USA UAS Training Pipeline
Source: Author's original work

At first glance, the training timelines appear similar, but the final products are significantly different. Gray Eagle training includes airfield operations, deployed setup and disassembly, and launch and recovery operations. The AF's launch and recovery (LR) course covers comparable material, but only deploying crews receive the just-in-time training. The course is 19 to 32 training days and costs approximately $99k. Some squadrons utilize contractors downrange for launch and recovery; those squadrons rarely send any pilots to LR training. The final five weeks of MQ-9 training is devoted to advanced mission sets like Surface Attack Tactics, Air Interdiction, Strike Coordination and Reconnaissance (SCAR), Close Air Support, and Combat Search and Rescue. The Gray Eagle course introduces basic gunnery and then allows follow on units to tailor further training to its particular mission.

Despite the comparison difficulties as explained earlier, personnel and training costs are a significant point of contention and deserve analysis. The following analysis focused on personnel costs irrespective of BAH costs, hazardous duty pay, tax-free deployments, or pensions in order to simplify the comparison. Flight pay and bonuses are included. The AF has roughly 915 RPA pilots. When extrapolated from AF-wide statistics, the estimated rank distribution for RPA pilots is: 125 O-1s, 129 O-2s, 398 O-3s, 242 O-4s, 180 O-5s, and 62 O-6s.[15] This averages to a yearly salary, including ACIP and a 55% bonus take of $35k/year, of $95k. The bonus take rate reflects the AF historical average. Adding retirement costs using the Top 3 Retirement plan adds approximately another $110k/year of service to O-5 and O-6 retirees.

The Army has 2370 total 15W personnel.[16] The current breakdown is 577 E3s, 719 E4s, 527 E5s, 348 E6s, and 199 E7s. These numbers include Gray Eagle and Shadow UAS operators that function as both pilots and sensor operators. This averages to a yearly salary of $36k. 15Ws do not receive ACIP, but the Army offers retention packages from $11k to $45k as needed. Table 1 lays out the course hours and costs for each segment of training. Total cost for URT and the MQ-9 RTU is $285k, and the cost for the Common Core and Gray Eagle courses is $157k.

Table 1: RPA/UAS Hours and Cost Breakdown Per Student

	URT: RFT/RIQ/RFC	**MQ-9 FTU**	**MQ-9 LR**	**Common Core**	**Gray Eagle**
Academic Training					
Course Hours	**273:** 62/133/78	157.5		328	272
Device Training					
Sessions	**52:** 0/36/16	22			37
Hours	**77.3:** 0/46.8/30.5	57.8			164
Mission Support	**81:** 0/41/40	68.7			
Flight Training					
Missions	**27:** 27/0/0	22			26
Hours	**39:** 39/0/0	44			178
Mission Support		88			16
Total Hours					
	470: 101/221/148	416		328	630
Total Cost					
	$65k: $10k/$35k/$20k	$220k		$17k	$140k

Source: Author's original work. FTU cost estimated by assuming similar academic instruction cost as Gray Eagle at $33/hr. Flight hour cost of $4762 taken from Time's "Costly Flight Hours." Student costs were estimated using $100/day per diem and 102 average training days.

[15] Data extrapolated from Rated Officer Retention Analysis, http://access.afpc.af.mil/vbinDMZ/broker.exe?_program=DEMOGPUB.static_reports.sas&_service=pZ1pub1&_debug=0.

[16] Kent A. May (Aviation Military Analyst, OPFD Directorate), interview by the author. 8 March 2017.

Current AF Strategy: Focused Differentiation

RPA employment has focused on low intensity conflicts. Its role, partly dictated by aircraft and architecture design and partly mandated by the character of recent conflicts, has been primarily persistent attack. Training has followed suit. Determining and understanding the AF's RPA training strategy depends on who is considered the end user. If viewed as serving "organize, train, and equip" major commands such as Air Combat Command, RPA training focuses on the low intensity conflict/persistent attack niche market as a low cost leader in comparison to other Combat Air Force (CAF) platforms. In this regard, RPA training strategy has mirrored the AF's RPA employment strategy of low cost. Compared to the fighter/bomber community, the RPA community downplays differentiation possibilities and trumpets its Low Cost Leadership in combat employment. The MQ-9 costs $4,762 per hour, the F-22 costs $68,362 per hour, and the B-1 costs $57,807 per hour.[17] The training arena is similar: the schoolhouses instruct a specific mission set, ISR and persistent attack, much more affordably than do other similarly capable platforms. MQ-9 Initial Qualification Training is estimated at $220k per student, and the F-16 RTU costs $2.7 million.[18]

Changing the targeted consumer to the combatant commander reveals a slightly different training and employment strategy. Selecting the combatant commander as the customer prioritizes the warfighter's needs and ultimately the defense of national interests over internal organizational needs. The combatant commander advertises his request for forces in terms of specific capabilities needed. To fulfill those needs, the AF has chosen a relative strategy of Focused, Differentiation. In comparison to the Army, AF RPAs deliver more employment flexibility and mission sets beyond ISR. Employment, manning, and training are relatively more costly, but the premium price brings with it higher end kinetic capability like interdiction, close air support, and search and rescue. The AF's reluctance to lower training standards or decrease the number of mission sets instructed in order to graduate more students to meet rising demand demonstrates its adherence to a Focused, Differentiation strategy. Whether the strategy is

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[17] Mark Thompson, "Costly Flight Hours", TIME.Com, 2017, http://nation.time.com/2013/04/02/costly-flight-hours/.

[18] HQ AETC/FMATT, *Representative Officer Aircrew Training Costs, Table A34-1*, 2014.

successful or not depends on the combatant commander's ability to discern between similar platforms' performance and the demand for one product over another.

A Focused, Differentiation training strategy has several strengths and weaknesses when compared to the Army's Focused, Low Cost Leadership strategy. RPA training enables a unique capability that other AF platforms cannot match: unparalleled loiter with on-call strike. Its limited multi-role capability provides more options than Army UAS. Moreover, as the RPA community has adopted the wider AF's model of organizing, training, and equipping, it has integrated into the AF culture. Benefits of that include empowered, capable personnel with opportunities for promotion and community advocacy.

Two significant weaknesses exist with the current strategy. One is that lengthy training creates an obstacle to upscale production quickly. Efforts to expand the training pipeline started in 2014, and significant progress has yet to be realized. Second, and most important, the value of training differentiation is in doubt. The vast majority of RPA tasking involves lengthy transiting and ISR. Additional mission sets are required much less frequently. As Army Gray Eagles fold into the Global Force Management Allocation Plan (GFMAP) and combatant commanders use them interchangeably with MQ-9s, the premise that enhanced training brings differentiation will be tested.

Trends highlighted in Chapter 4 will force the AF to change its training strategy. Automation, national airspace integration, and the shift to enlisted pilots will cause RPAs to flourish even more. This success in itself threatens the focused nature of RPA training. As RPAs and its missions proliferate, AF training will move from its niche of persistent attack to focus upon broader employment, rendering a Focused, Differentiation strategy obsolete. As the AF acquires unmanned transport aircraft, air-air platforms, or rotary wing aircraft, URT's RPA Fundamentals Course will no longer apply to all graduates. The 558 FTS will need either to amend or remove the course to keep training relevant. Automation threatens the current Focused, Differentiation strategy by reducing the need for flight training. Unless training incorporates additional skills to accentuate this trend, differentiation will not be achieved.

Moreover, the Congressional mandate to use enlisted pilots for RPAs threatens the current training strategy. Officers as pilots imply a better product on varying levels, but success in the EPIC program will erode that belief. This could have far-reaching organizational consequences, as it could ultimately lead to the AF adopting an Army personnel model. Conversely, that RPA pilots receive well-rounded, comprehensive training brings with it the flexibility to adapt to new opportunities. The current training construct allows pivoting to new and possibly complex mission sets. Furthermore, the FAA considers the level of IFR training provided at URT the gold standard, and, as UAS integrates into the national airspace, URT graduates will be well prepared to take advantage of the opportunity.

	AF: Focused differentiation	Army: Focused Low Cost
Strengths	Delivers unique persistent attack capability – Other AF platforms cannot – Limited multi-role capability Integrated in AF culture – Empowered, capable personnel – Advocacy, CSAF/Congressional visibility	ISR focus – LR and sensor suite training included Lowest cost – High utilization rate via 24 hr ops – Low labor costs – Shorter timeline – Able to outproduce poor retention
Weaknesses	Difficulty scaling to meet demand – Longer training pipeline – Unable to drive out competition Value of differentiation in doubt – ISR accounts for 99% operational tasking – Unique RPA architecture not maximized – Army GFMAP support	Enlisted operators – No vested advocate – Low ranking SMEs Kinetic employment introduced
Opportunities	Well rounded, comprehensive training – Allows scaling to more complicated missions – Current construct allows pivoting to new mission sets – IFR training best positions AF to implement UAS national airspace integration	
Threats	Automation reduces need for flight training Congressional mandate for enlisted pilots Poor retention expected increases burden	

Figure 21: Current Training Strategy SWOT Analysis
Source: Author's original work

Recap

In review, this chapter covered several topics that led to identifying and analyzing the AF RPA community's Focused, Differentiation training strategy. It introduced SWOT analysis as the methodology to compare current and future training strategies. The chapter discussed RPA training in the greater scope of the AF's Strategic Master

Plan and security environment. The SMP identifies two vectors that inform future acquisitions and strategic direction as "high end" and "deterrence" related. Several national security experts posit that the US and its allies need opposite capabilities as war devolves within the boundaries of corruptly governed poor states. Training to employ sophisticated, expensive platforms in low-end conflicts may be problematic. Transitioning, this chapter identified comparison difficulties when assessing Army and AF programs due to different metrics, accounting methods, locations, and skills taught. Then, the chapter compared URT and MQ-9 Initial Qualification Training against UAS Common Core and Gray Eagle course. With the comparison as a backdrop, a Focused, Differentiation strategy was identified as the AF's current RPA training strategy. The AF has a tendency to gold plate its training as well as its equipment. Conversely, the Army employs a Focused, Low Cost Leadership strategy. Each strategy brings advantages and disadvantages.

Edgar Schein describes three stages of organizational life: early growth, midlife, and decline. Founders influence culture most in early growth, and they embed their beliefs by what they pay attention to and measure, how they allocate resources, rewards and status, and how they recruit, select, and promote.[19] Chapter 1 painted a descriptive picture of Generals Fogleman, Jumper, and Schwartz transmitting their values through formative decisions. Quality over quantity has recurred as a consistent theme, first when mandating rated officers and, now, when not rewarding commanders for graduating students on time. In midlife, cultural change mechanisms are from systematic promotion and technological seduction. As RPAs enter midlife, automation, national airspace integration, and the shift to enlisted pilots will inevitably bring RPAs out of its niche ISR market and into mainstream aviation. A Focused strategy is for organizations with small market share. When the preponderance of air platforms are RPAs, a Focused training strategy will no longer match its environment. Consequently, the AF will broaden its strategy into either Low Cost Leadership or Differentiation. As it transitions, they will also force assumptions about external adaptation to change. The next chapter will conduct a SWOT analysis of each strategy and recommend a future course of action.

[19] Schein, 246.

Chapter 6

Other Strategies, Examined

Dr. Thomas P. Hughes, a noted historian, argues that, "younger developing systems tend to be more open to sociocultural influences while older, more mature systems prove to be more independent of outside influences and therefore more deterministic in nature."[20] If his hypothesis holds, as RPAs transition out of its initial growth phase into midlife, founders' leadership influence will wane, and technology will shape training more. Consequently, automation, national airspace integration, and the shift to enlisted pilots will inevitably bring RPAs out of its niche ISR market and into mainstream aviation. At that point, the AF will broaden its strategy into either Low Cost Leadership or Differentiation. This chapter first examines the possibility of joint training. The chapter then merges the insight gained into AF culture with the emerging threats and opportunities forecasted in Chapter 4 to consider, through a SWOT analysis, possible RPA training strategies going forward. A course of action is recommended. To conclude, the final step subjects the strategy recommendation to a five-question check as prescribed by Michael Porter. Porter argues that a good strategy creates and sustains competitive advantage by having a distinctive value proposition, a tailored value chain, trade-offs that are different from rivals, a good fit across the existing value chain, and continuity over time.[21]

Joint Training, the Obvious Solution?

> *We are disturbed that the Department of Defense has no standardized training program for UAS pilots and personnel. The continued lack of consistent and uniform training standards is simply unacceptable. In addition to collecting critical intelligence, the Department's UAS programs carry out sensitive strike missions that should require high standards and specialized training.*
>
> Senator John McCain, in letter to Secretary of Defense Ash Carter, 2015

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[20] Thomas P. Hughes, "Technological Momentum", in *Does Technology Drive History? The Dilemma of Technological Determinism*, 3rd ed. (Cambridge, MA: MIT Press, 1994), 101.
[21] Joan Magretta, *Understanding Michael Porter*, 1st ed. (Boston, MA: Harvard Business Review Press, 2012). Kindle edition, 1147.

This thesis originally intended to examine how the Army and AF have thus far justified separate training programs to Congress and what combined training would look like. On the surface, joint UAS training appears to be an obvious solution to the AF's staffing shortfall. The media and Congress have repeatedly inquired about merging UAS and RPA training into a single pipeline to create efficiencies.[22] Both services have dismissed the idea, and without civilian leaders intervening to force the issue, RPA training will probably remain service-specific. Despite operational context, societal pressures, and technology forcing the services to converge on UAS operations, the benefits of joint training are a mirage. Civilian leaders have the power to force joint training and deeper service interdependence of course, but their true motivations and the benefits of innovation lie in keeping them separate. Even Senator McCain's comment above may have ulterior motives. Fort Huachuca, Arizona, the site of the Army's only UAS training center, would serve as a likely location for joint training. Although duplication creates inefficiencies, it also creates competition. Civilian leaders use interservice rivalry to prevent shirking and encourage working. In his doctoral thesis on military innovation, Owen Cote posits that civilian leadership has structured the Department of Defense to function via interservice competition. The benefit is increased innovation: "Periods of intense and overt interservice competition in the US during the Cold War have covaried with periods of radical doctrinal innovation. Periods of relative interservice calm, or collusion, have covaried with periods of relative doctrinal stagnation."[23]

Had Cote written his thesis today, UAS stagnation under centralized control and innovation due to inter-service competition would be a persuasive case study. In *Air Force UAVs: The Secret History*, Thomas Ehrhard traces the stuttering progression of AF RPAs. He documents previous unsuccessful efforts to consolidate and centralize control of UAV development under the UAV Joint Program Office and the Defense Airborne

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[22] Mark Pomerleau, "Should Drone Training Be A Joint Operation?", *Defense Systems*, 2016, https://defensesystems.com/articles/2016/03/18/air-force-army-uas-training.aspx.
[23] Owen Reid Cote, Jr, "Politics Of Innovative Military Doctrine: The US Navy And Fleet Ballistic Missiles" (DPhil in Political Science, Massachusetts Institute of Technology, 1996), 46.

Reconnaissance Office. His report's final sentence captures his assessment: "The meteoric rise and fall of centralized UAV management provided strong evidence that 'pluralism and untidiness' indeed may be the only way for the US military to achieve weapon system innovation with the UAV."[24] Along with service-driven UAS innovation comes different platforms, different cultures, and different training approaches. Currently, the role of service rivalry in driving innovation outweighs potential gains in interdependence and interoperability

Should Congressional mandate override this arrangement, a viable joint URT would simply amalgamate Army and AF training to form a standardized foundation. A possible joint syllabus is quickly proposed here by taking portions from each service's training program and removing others. First, a joint syllabus would remove the contracted flight training course from the AF's training and change the final RPA fundamentals course to include more visual identification academics and scout maneuver fundamentals (depicted in Figure 22). Instrument qualification would remain, and the Predator/Reaper simulator training in the AF's final fundamentals course would be removed. The streamlined course would take 21 weeks and cost approximately $45k per student.

Figure 22: Possible Joint Undergraduate RPA Training Timeline
Source: Author's original work

[24] Ehrhard, 57.

This training pipeline requires concessions from both services, and both services would have valid objections. By moving more instruction to an earlier course, the Army would need to shorten its Gray Eagle course to focus on aircraft systems and employment. Overtraining Shadow UAS operators who do not need months of instrument flying rules would offset benefits gained. By eliminating RPA Flight Training, the AF would argue that its URT graduates would lack airmanship. In addition, unless the AF implemented personnel changes as well, commingled AF officers and Army enlisted would raise difficult questions over uniform wear, incentive pay, and off-duty expectations. Another difficulty JURT would face is responding to rapidly evolving capabilities and mission requirements. Whereas joint undergraduate pilot training has remained relatively unchanged for decades, URT adjusts frequently. In JURT, frequent joint staffing would be required to prevent program obsolescence, and managing the inevitable culture clash would be a significant hurdle. Edgar Schein presents three options to manage cultural conflict from a merger:

> The two cultures can be left alone to continue to evolve in their own way. A more likely scenario is that one culture will dominate and gradually either convert or excommunicate the members of the other culture. A third alternative is to blend the two cultures by selecting elements of both cultures for the new organization, either by letting new learning processes occur or by deliberately selecting elements of each culture for each of the major organizational processes.[25]

To broker disputes, the AF would make the most convincing bid for executive agency of the training program but could easily alienate the Army if it institutes doctrine heavy-handedly. Past URT, implementing joint training is not practical on different weapons systems. Each service develops its own UAS that require specialized training. Should civilian leadership force a joint acquisition, they could also naturally extend combined training.

In the only example of joint UAS training, the Marine Corps opportunistically sends officers to URT and enlisted marines to Army UAS training. As the Marine Corps considers purchasing MQ-9s, several officers attend URT each year. The Marine Corps currently operates the same Shadow UAS as the Army, and its enlisted operators go

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[25] Edgar Schein, *Organizational Culture and Leadership*, 3rd ed. (San Francisco, CA: John Wiley & Sons, 2004), 316.

through the Army's Common Core and Shadow course. At course conclusion, the Marine officers and enlisted join for operational training where officers learn to lead and supervise in a tactical setting. This example is short-lived: as the Marine Corps transitions away from the Shadow to the RQ-21A Blackjack, they plan to standup service-specific training at Cherry Point Marine Corps Air Station, North Carolina.

Joint RPA training has several potential pitfalls but also several mitigating factors. Merging training is not a strategy; it is combining and selecting best practices. Some services can achieve efficiencies, but only in early training phases where instructors teach foundational skills. The minimal efficiencies gained arguably do not outweigh benefits of inter-service competition and innovation. Both services have dismissed the idea of joint training, and without civilian leaders intervening to force the issue, RPA training will remain service-specific. Despite its apparent benefits, joint training undercuts many of the goals and objectives civilian leaders most desire from their military services.

Low Cost Leadership

The AF's service-wide strategic bias for Differentiation does not mean RPA training has to follow suit. Rather, the RPA community could pursue a training strategy that embraces mass production aided by increasing automation, rising demand from RPA's national airspace integration, and societal pressures to enlist the RPA pilot force. Cost leadership is about minimizing the cost of delivering products or services. There are two different successful outcomes possible in a cost leadership strategy. The first is increasing the assets contributed to a combatant commander by the AF without expanding its budget. The second is maintaining its contribution and diverting leftover capital toward other demands.

A danger of pursuing a low cost strategy is confusing operational effectiveness (OE) as strategy. Low cost leadership uses mass production to leverage economies of scale. Amortizing overhead costs quickly and reducing direct variable costs create barriers to entry. Out producing adversaries serves as a deterrence or forces a less-threatening asymmetric response. Conversely, OE refers to a competitor's ability to perform similar activities better than rivals through execution or best practices. Quality management or continuous improvement programs are examples. Simply improving operational effectiveness does not provide a robust competitive advantage because rarely are best practice advantages sustainable. Rivals quickly copy best practices, and frequent imitation results in hypercompetition.[26]

The three ways to reduce cost are to increase utilization rates, to control the value chain to ensure low costs, and to reduce overhead and direct costs. In many ways, the AF has streamlined its operations to maximize the first two methods. Utilization rates in the simulators and aircraft at the FTU are already high. Wing scheduling regularly programs 16-hour flying windows to accomplish as many training events as possible per day. Some instructors think allotted training times in the syllabus are generous, and even more events could be scheduled to increase instructor utilization.[27] The current daily flying window is long when compared to other AF flying programs. The MQ-9's primary sensor is an infrared video camera, meaning that night operations do not hamper training. The AF could gain higher utilization by instituting round the clock operations. In comparison, the Army UAS program operates 24 hours per day on weekdays. The AF uses remote split operations (RSO) in training, but diverting training sorties is not common enough to be seamless. Adverse local weather still cancels training sorties, thus lowering utilization and graduation rates.

Controlling the value chain is possible through renegotiated contracts with suppliers and manufacturers like General Atomics, but such an endeavor is enterprise-wide. Training platforms are bound to operational weapons systems. Contractor labor costs contribute to the value chain and are high for two reasons: remote training location and required instructional experience. Alamogordo, New Mexico, the home of Holloman AFB, is a small, desolate town not known for its expansive labor pool or amenities. Companies lure qualified contractors through higher salaries. Additionally, contractors can demand higher salaries because the various FTU syllabi teach multiple missions. This requires higher skilled employees. The town and businesses of Alamogordo rely heavily on the base as a source of revenue, and, therefore, moving the FTU and its

[26] Magretta, 1108.

[27] 9th ATKS instructor pilot at Holloman AFB, NM, interview by the author, 22 December 2016.

associated labor pool to somewhere less costly is politically difficult. Conversely, URT has neither problem. San Antonio offers amenities and provides a deeper labor pool of AF retirees and flight instructors in general.

The greatest value savings is in reducing direct costs. Reducing mission sets or eliminating courses instantly shortens the pipeline. Moving live sorties to the simulator is cheaper and more reliable, and as better simulators come on line, differentiating between the two will become more difficult. Replacing officer pilots with enlisted operators reduces labor costs immediately. As those enlisted operators complete their active duty service commitment, lower paid contractor opportunities will appear attractive. Two ensuing side effects counteract. One, contractor opportunities will tempt more enlisted operators to leave the AF. Two, the AF provides many of those contractor opportunities and can offer lower contracts. The Army UAS pipeline produces its enlisted operators using methods that are easily replicated. Accordingly, its strategy falls under the category of operational effectiveness.

Without making significant structural changes or changes that are difficult to imitate, the AF can emulate the Army UAS pipeline to silence critics and improve production. In a lightly implemented low cost strategy, the AF could adopt the Army's best practices. Eliminating URT's initial flight training would trim URT by 1 month and save $10k. By instructing enlisted operators in only emergency procedures, aircraft handling, ISR, and Basic Surface Attack, squadrons could reduce the MQ-9 course by 5 weeks, a 30% reduction. Without further costs or increased manning, the FTU squadrons could graduate 50% more students in the same time. The AF would save $104k by eliminating 11 flying sorties, 7 simulator sorties, 41 hours of academic instruction, and $3.5k in per diem costs per student. This would push the training burden downstream to operational squadrons, but those squadrons would provide additional mission training when needed and in an applicable format. Squadrons already tailor mission qualification training to a squadron's designed operational capabilities (DOC) statement and provide follow-on upgrades when experience allows. This just scratches the surface of potential.

Low cost leadership typically means generalization. In the age of specialization, though, carefully combining sheer size with required skills can achieve low cost. An analogy is a large hospital with many surgeons. Each surgeon brings valuable knowledge, but no single doctor knows every procedure or technique. During a procedure, surgeons operate as teams to complement each other's skill set. Having doctors narrow their field of study does several things. One, it reduces the education burden while allowing deep expertise. Already, medical school, residency, and specializations consume years and possibly decades of study and training. Medical students achieve familiarity in a core curriculum and in-depth knowledge in an area of interest. In-depth knowledge provides the most value. Two, specialization enables proficiency and currency. Surgeons repeatedly apply their skills to similar medical situations. That focused practice keeps their skills honed, and their knowledge current. Three, surgeons in an operating room create efficiencies by complementing each other's skills. The result is that when each doctor brings a skill to surgery, a team can perform operations that are more complicated better.

Manned aircraft platforms have adopted primary missions that suit their aircraft flying characteristics and capabilities. This specialization complements a strike package the way a surgeon supplements an operating room. Pilots, to a much lesser extent, attempt to do the same when they focus on one particular airframe and develop the specific skills to fly that aircraft. However, skill sets cannot subdivide further. Physics dictates that all pilots must know how to conduct basic skills like takeoff, land, transit, talk to agencies on the radio, mission plan, fly on instruments, and handle emergency procedures. The RPA architecture is not bounded by those restrictions, but current operational and training practices barely scratch the surface of modularity possible. Operational squadrons use specified individuals to lead strikes, and aircrew cycle through the ground control station cockpits when fatigued. Otherwise, to minimize risk, RPA pilots are expected to perform in all stages of flight that may occur between the gaining handover and the losing handover. Having aircrew specialize in specific phases of flight would result in higher performance, increased currency, and much lower training costs. This would entail a paradigm shift away from an independent decision maker and toward a networked operator. Low cost through specialization works as long as the skill set can be accessed when needed. RSO creates efficiency by concentrating its personnel; it is an ideal operational model for specialization. Conversely, organic Army units, by definition, are decentralized and cannot specialize.

A second, more ambitious strategy builds on the first and further exploits RPA's modular capabilities. Strengths include a reduced training pipeline, easier scalability, and exploiting RPA's unique RSO architecture. A pared down core curriculum would introduce fundamental skills like gaining and losing handovers, aircraft handling, airspace transit, and ISR. Rather than 22 sorties in the current syllabus, only 8, maybe less, would be required. In Mission Qualification Training or, ideally, in later upgrades, individual operational squadrons would teach skill sets like emergency procedures, Basic Surface Attack, Surface Attack Tactics, Close Air Support, and Combat Search and Rescue as their area of responsibility required. The cost and time savings in such a strategy would be dramatic, but operational squadrons would have to alter the way they operate and how they manage and schedule their personnel. The strategy would force squadrons to transition from several independently operating aircrew to a networked, interdependent operation. This takes advantage of AF RPA's unique architecture in a way adversaries and other services would have difficulty imitating. Efficiency and networked operations do incur risk. Weaknesses include transferring the training burden to operational squadrons, cultural acceptance by a wider AF that prizes the anachronous independent decision maker, and difficulty managing personnel. Operations that parcel out skills more efficiently and sparingly reduce a squadron's ability to handle low probability events like multiple time-critical emergencies or intricate kinetic strikes.

Current trends provide opportunities and threats to a low cost leadership strategy. As automation increases in capabilities, it will drive manpower and training requirements down further. In a low cost construct, when specialized skills become obsolete, course modules can be easily eliminated. Society and technology are already network centric; specialized training serves as a mechanism to force the RPA community to network. Modular training also complements the enlisted pilot mandate and the AF's current enlisted force structure. Qualifying RPA pilots initially as 3-level apprentices equates to the AF's current classification system. As the RPA pilot gains further specialized skills, he can transition to a 5-level journeyman, then 7-level craftsman, and finally a 9-level superintendent. Graduated qualifications make attrition less costly. A modular, enlisted-based system also repositions officers as mission commanders and supervisors. It allows focused training on employing a complete weapons system through leadership, reaffirming an ideal officer/enlisted construct. Pending UAS national airspace integration means more growth. Having a scalable training system will ensure that the AF can respond quickly to shape the environment and maximize new opportunities.

Although the strategy presented attempts to leverage US and AF advantages, other nations are intently watching the AF execute. The AF should expect both adversaries and allies to adopt proven best practices. The greatest threat though is existential. If automation and artificial intelligence drive pilots further from the cockpit and commoditize air-mindedness, is a separate AF justified? Martin van Creveld in his "Rise and Fall of Air Power" argues that it is not. He concludes that, with the possible exception of space vehicles, there is "no convincing reason why they should be part of an independent service. Supposing that twenty-first-century wars will be mainly of the low-intensity kind...there probably is no compelling case for independent air power at all.[28] A low cost strategy will not cause this shift, but it will hasten it.

[28] Martin Van Creveld, "The Rise and Fall of Air Power", *The RUSI Journal* 156, no. 3 (2011): 48-54.

Low Cost Leadership Training Strategy

	AF	Army (Focused Low Cost Leadership)
Strengths	Shorter training pipeline Scaleability- handle increasing and changing demand Unique RSO architecture exploited --Increased Modularity, Efficiency --Increased performance through specialized skills	Better utilization rate with 24 hr ops LR and sensor suite training included
Weaknesses	Specialized training burden on downstream squadrons Cultural, bureaucratic acceptance Personnel, skills management possibly unwieldy	Decentralized control --RSO architecture not used --Generalized skill set
Opportunities	Automation will increase capabilities, drive manpower and training requirements down further Modular training complements enlisted pilot mandate Pending UAS national airspace integration means more growth Modular training complements enlisted pilot mandate Network centric warfare Poor retention less costly	
Threats	Best practices quickly copied Existential reason for AF	

Figure 23: Low Cost Leadership Training Strategy SWOT Analysis
Source: Author's original work

Differentiation Strategy:

A differentiation strategy complements the AF's Strategic Master Plan and is a grander version of today's RPA training strategy. It values high quality training and maximizing a platform's capabilities. To execute a differentiation strategy successfully, the AF needs to continue its current vector: good research and development; the ability to deliver high-quality services; and effective communication to justify the differentiated offerings' price premium. While current efforts to distinguish added capabilities lack appreciation, as future full spectrum capabilities come online, the AF will have the right personnel in place to optimize them. Complicated, complex weapon systems that deliver strategic effects will validate this strategy's price premium.

The RPA community has grown and developed under heavy influence from the wider AF. As the AF's largest community, the reverse is starting to take place. Its size and resource requirements mean that it is influencing AF culture. A training strategy inline with the Strategic Master Plan will be more readily received. Jeff Smith in *Tomorrow's Air Force* surmises, "There are signs that the USAF is moving toward major organizational change that will focus on the full spectrum of war rather than on a particular facet, context, or weapon system."[29] RPAs transcend conventional thought about weapon systems; they cross cyber, space, and air domains easily. RPAs jump instantly from tactical intelligence gathering to strategic interdiction. RPAs represent this organizational change, and its maturing officer corps is well positioned to lead tomorrow's Air Force. Ensuring institutional recognition through promotion nurtures RPA's advancement. Promoting talent within is critical, and a differentiation training strategy cultivates that talent.

The differentiation strategy does not change the current problem of scaling to meet demand. The current MQ-9 syllabus is an optimistic 77 training days long. A revised syllabus currently in staffing adds 15 more planned days; this trend is in the wrong direction. Furthermore, what warfighters consider low-end capability requiring little training is outpacing high-end growth and will squeeze the AF into narrower responsibilities. UAS growth has been at low price points, exactly where the value of differentiation is in doubt. The glaring question is, if premium training is not appreciated now, what will more automation do?

A differentiation training strategy makes logical sense as the UAS capability envelope expands and unmanned aircraft further models manned aircraft training. The differentiation strategy presents several opportunities. The primary opportunity of pursuing high-end platforms and training is extending current airpower capabilities beyond manned aircraft limitations. Relegating low-end missions to the Army reduces inter-service rivalry and ensures a peaceful coexistence (Figure 24). Fully exploring options at the intersection of network centric warfare, RSO, and unmanned flight will require talented, empowered warfighters that fully understand UAS potential and limitations. Operating in contested, degraded environments is a barrier to wider RPA employment. Whether solving that problem technologically or tactically, talented, well-trained personnel are needed. As UAS proliferates and off-the-shelf technology reduces

[29] Jeffrey J Smith, *Tomorrow's Air Force: Tracing The Past, Shaping The Future*, 1st ed. (Bloomington: Indiana University Press, 2013), 158.

the AF's competitive advantage, knowledge will be the deciding advantage. Additionally, in the early days of airspace integration, trust from society and regulators will be low until a track record is established. If the AF retains its reputation for highly trained RPA pilots, not only will integration be smoother and more expansive, but the AF will have first mover advantage into the airspace.

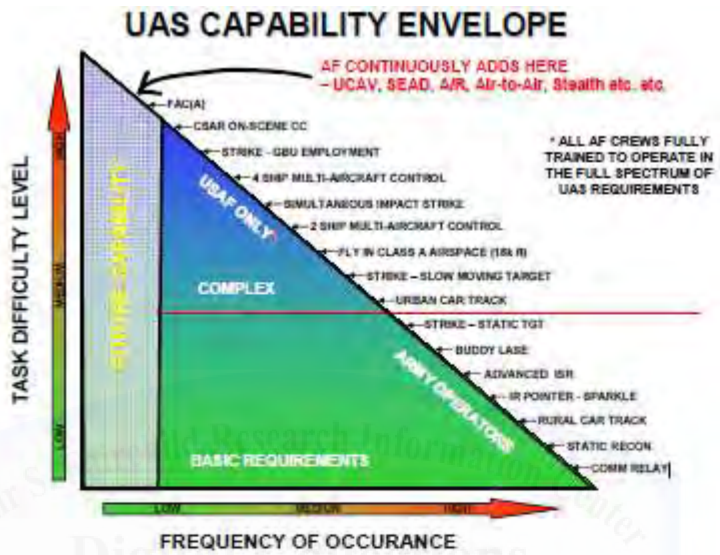

Figure 24: USAF and Army UAS Interdependence Model
Source: Major Travis A. Burdine, ""Organic" Army Unmanned Aircraft Systems: The Unhealthy Choice for the Joint Operational Environment" (Air Command and Staff College, Air University, 2008, 29.

Significant threats loom for a differentiation strategy. If the security environment favors frequent low intensity conflicts, high-end capabilities developed through differentiation are good for conventional deterrence but not for real world conflict. In addition, automation is moving the pilot further away from the cockpit and reducing the need for training not increasing it. Moreover, the Congressional mandate for enlisted pilots favors simplifying training and reorganizing the force structure. Poor expected retention will increase the training burden and further test this strategy.

Differentiation Training Strategy

	AF	Army (Focused Low Cost Leadership)
Strengths	Training to push aircraft capabilities -- Full multi-role capability -- Knowledge to pursue unique RPA architecture Influences AF culture; in line with SMP -- Future senior leaders in rise of RPA generals -- Advocacy, CSAF/Congressional visibility	ISR focus -- LR and sensor suite training included Lowest cost -- High utilization rate via 24 hr ops -- Low labor costs -- Shorter timeline -- Able to outproduce poor retention
Weaknesses	Difficulty scaling to meet demand -- Longer training pipeline -- Unable to drive out competition Value of differentiation in doubt at low end	Enlisted operators -- No vested advocate -- Low ranking SMEs Kinetic employment introduced
Opportunities	Well rounded, comprehensive training -- Allows scaling to new platforms, move closer towards full spectrum capabilities -- Current construct allows pivoting to new, more complicated mission sets -- IFR training best positions AF to implement UAS national airspace integration	
Threats	Low end conflicts mismatch for capability Automation reduces need for flight training, trend moving pilot further away from cockpit Congressional mandate for enlisted pilots Poor retention expected increases burden	

Figure 25: Differentiation Training Strategy SWOT Analysis
Source: Author's original work

Strategy Recommendation:

A Low Cost Leadership training strategy with low initial training requirements supplemented by follow-on specialized training is the AF's best way forward. A successful low cost strategy will produce enough qualified graduates to satisfy growing needs while allowing follow-on skill specialization. Skill specialization in turn enables differentiation. Unclear prioritization in implementation will blur a low cost and a differentiation strategy and yield muddled results. For example, if the AF develops an RPA air-air platform, it would replace current manned platforms only if the cost-benefit ratio improved. Is this Low Cost Leadership strategy or Differentiation? The dilemma is not whether to eschew the full spectrum of air power in the pursuit of low cost. The question is what should be prioritized. In implementation, a strategy and, therefore, a culture is made apparent by what is prioritized and what metrics are tracked. Ironically, a successful Low Cost Leadership training strategy introduces Differentiation.

The five tests of a good strategy include an examination of whether the proposal brings a unique value proposition, a tailored value chain, trade-offs that are different from rivals, a good fit across the value chain, and continuity over time.[30] A value proposition asks whether distinct value is being offered to a chosen set of customers at the right relative price. In a Low Cost Leadership strategy, end customers are combatant commanders and never the services tasked to organize, train, and equip. Combatant commanders' chief, unquenchable desire is for more information. Air power has a proven ability to provide valuable intelligence especially in areas difficult to access otherwise. If customers value quantity over quality, high price sensitivity requires discount pricing and ready availability.

A Low Cost Leadership strategy delivers a tailored value chain. Remote split operations counter Army aviation doctrine of decentralizing assets. The Army has reluctantly investigated RSO to fulfill requirements in Syria and Iraq; it is a model that forces divisions to relinquish control of their assets. Conversely, AF doctrine espouses centralized command, and RSO fits well with that air power tenet. Remote split operations is the key enabling piece in driving a low cost training strategy.

A strategy that relies on low initial training and then further specialization provides low cost but does have unique trade-offs. The downside to this low cost strategy is that few single operators would possess the knowledge to operate in isolation. The assumption is that more value lies in a group of personnel with highly specialized skills than with generalists. The Army designs its companies as generalists so they can deploy as organic assets in direct support of divisions or brigade combat teams.

Pursuing a different strategy than the wider AF, albeit just in training, comes with risks. The fourth test asks whether pursuing a low cost training strategy would be enhanced by other AF activities. Yes, the AF has the support structure required for any flying activity like restricted training airspace, runways, staffing, and transferable experience. The misfit, especially if not communicated effectively, is cultural. A pitfall for low cost producers is poor quality and a poor reputation. The AF prides itself on the

30 Joan Magretta, *Understanding Michael Porter*, 1st ed. (Boston, MA: Harvard Business Review Press, 2012), Kindle edition, 1187.

exact opposite. Inevitably, though, technological trends will carry more force than cultural legacies (Figure 26).

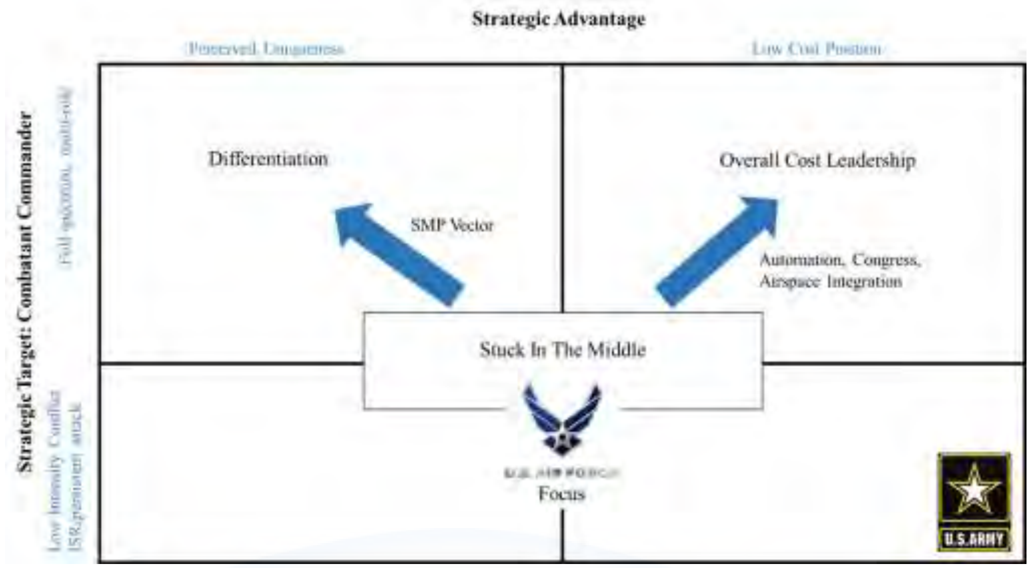

Figure 26: AF and Army UAS Employment and Training Strategy
Source: Author's original work

Finally, the strategy departs from current practices but does so flexibly. Operational squadrons already carry out upgrade training and have tiered operators titled wingman, flight leads, and instructors. A strategy provides a general vector whereby training syllabi are slowly reduced or divided into separate courses and organizations slowly adjust.

Recap

Automation, national airspace integration, and the shift to enlisted pilots will force the AF to broaden its strategy into either Low Cost Leadership or Differentiation. A SWOT analysis highlighted the advantages and disadvantages of each strategy. Based on that analysis, a Low Cost Leadership strategy is the best future course of action. Evaluating that course of action highlighted potential cultural conflict as the wider AF pursues a differentiated, high-end Strategic Master Plan. Based on how the AF employs RPAs, a Low Cost Leadership training strategy provides the AF a distinctive competitive advantage not only in comparison to the Army but to adversary air forces and allies alike. The recommended approach to low cost training is much different than the Army's current model. Using RSO provides modularity; it is an advantage not easily modeled and requires extensive multi-domain support. Producing enough timely RPA pilots to meet the demand for ISR collection is the customers' priority. Less time in military training equates to less cost. Finally, the proposed strategy is unique amongst all aviation training, and it is this strategy rather than competing on execution or in a race to the bottom line that will sustain the RPA community in the future.

Conclusion

Independence—one of the hallmark traits of military aviators, is challenged by the connectivity of UAVs.

Major Houston Cantwell, *Beyond Butterflies*

UAS training evolved differently under the AF and Army due to to their different starting points and respective cultural influences. The surge of American forces into Iraq in 2007 highlighted the AF's lingering resistance to expand its RPA force. Up to that point, the AF had borrowed from the existing fighter and bomber pool to pilot its RPAs while keeping its RPA pilot training pipeline on hold. AF senior leaders explicitly desired rated pilots to fill RPA cockpits in stark comparison to Army UAS enlisted operators. When pressure grew to provide more combat lines, the AF and a new Chief of Staff responded by rapidly instituting a dedicated RPA pilot training pipeline to produce specialized unmanned operators. The training model mimicked other AF undergraduate training programs like UPT and UNT. It was those two things, the initial insistence to operate RPAs with rated pilot officers and building URT from other rated programs, that both reflected and reinforced the AF's cultural influence on the RPA community.

Conversely, the Army's UAS training community started with small, remote-controlled drones over 25 years ago at Fort Huachuca, Arizona. It has grown and expanded into new platforms with new capabilities, but its model based on universal enlisted operators trained to operate as an organic divisional asset remains. The focus on efficiency has streamlined the training pipeline. Notably, at the operational level, flexibility is prized over efficiency and possibly effectiveness. Soldiers are trained to fly the Gray Eagle, to operate its payloads, to conduct certain maintenance items, and to handle basing requirements. The decentralized approach incurs costs in its specialized focus and in high end capability potential. It also costs in reduced readiness levels. Poor retention plagues the community, but current production meets needed replacement demand. Ultimately, the underlying focus remains to support and enable the ground forces commander and his mission. The artifacts, values, and assumptions are in accordance with that focus. Such simplicity has led to practical and sustainable decision making in regards to UAS.

The AF, in building the RPA training pipeline, reaffirmed its underlying assumptions rather than reevaluating them. The notion that RPAs are just like manned aircraft but remotely piloted continues as the AF pursues 65 initiatives in its RPA Get-Well Initiatives and Culture and Process Improvement Programs. A quick example of this alignment is renaming Ground Control Stations (GCS) to cockpits. The result is that each training program creates a different product and, in turn, reflects institutional disagreement over what skills should be imparted. This is despite similar end-state capabilities, at least similar enough to end state customers. This conflict between utility and tradition has yet to profoundly ripple through the AF, whose raison d'etre is to fly, fight, and win—in air, space and cyberspace.

The current AF training model has struggled to meet rising demand. Rather than accommodating AF tardiness, combatant commanders have looked elsewhere. As Global Force Management Allocation Plan needs are filled by Army Gray Eagles, skill differentiation is called into question. Moreover, three emerging trends--automation, enlisted pilots, and national airspace integration--will either exacerbate this demand/supply gap or force the AF to reevaluate its RPA training strategy. An analysis combining AF RPA strengths and weakness with the opportunities and threats these emerging trends brings recommends the transition to a low cost strategy to leverage remote-split operations and the modularity it provides. Prioritizing low cost achieves mass production which in turn creates more opportunity for modularity. This is the training paradigm that can achieve cost-prioritized differentiation.

A Low Cost Leadership strategy adopts automation and welcomes its irresistible rise. While automation threatens a differentiated training strategy by undermining the value of training provided, a low cost strategy views automation as an opportunity. Regardless, the unstoppable march of technology will shape AF operations and subsequently training. Automation combined with network centric warfare will force internal meaning making, and the result will be a dramatic culture shift.

Modularity undercuts an underlying assumption deeply held by the AF that aviation requires airmen instead of chauffeurs, independent decision makers instead of operators. This is a key justification for officers as pilots, but it is in contradiction to RPA's true advantage: network-centric operations. This struggle has played out since

1900, when Wilbur Wright wrote to Octave Chanute conjecturing that flight required piloting skill more than machine stability.[1] That skill subsequently meant differentiation from society. Different characterizations of pilots would evolve, but a dominant theme that aviators were more than machine operators, that they were independent professionals, emerged. The notion developed that aviators were "mechanical angels, carrying the 'winged gospel' of modernity" rather than chauffeurs.[2] Technological developments like autopilot, flight instruments, and now, automation and networked operations have modified this image. Automation and networked operations reduce individual control but lends tremendous opportunities. The stability gained enable longer flights, less physical risk, real-time intelligence dissemination, and quicker responses. Automation and networked machines may also hold the key to solving current operational dilemmas in contested, degraded environments or against anti-access adversarial strategies. It may also be hastening the end of the pilot as we know it.

Ultimately, this transition is indicative of the broader knowledge economy, but it creates an uncertain future for the AF. As technology advances, less importance is placed on activities that can be replaced by automation, and more on decision making and judgment. The rise of the RPA has highlighted the many external adaptations required to fully exploit these emerging capabilities, and these capabilities possible are barely being realized. The AF has evolved since its origin, and as groups evolve, "the assumptions they develop… reflect deeper assumptions about more abstract general issues around which humans need consensus in order to have any kind of society at all."[3] It is these deep assumptions that provide strongest resistance when threatened, but automation and connectivity are driving its change within the AF. The AF has yet to accept this trend, and it undermines its commitment to innovate through air power. How the AF attempts to make meaning of its external stimuli will reflect its deep cultural assumptions. In turn, how successful the AF response is will determine how drastic its culture will be affected.

Technological determinism makes transition inevitable, and AF culture will evolve. While how the AF will be forced to change and what it will look like is subject

[1] David A Mindell, *Digital Apollo*, 1st ed. (The MIT Press, 2008), 22.
[2] Mindell, 23.
[3] Schein, 137-8.

to conjecture, determining a proactive, viable strategy based on theory and doctrine to leverage technology is vital. If steps are not taken to leverage opportunities technology provides, technology will dictate a passive, incoherent strategy. In addressing space strategy but applicable to any competitive enterprise dominated by technology, Everett Dolman stated,

> The difference between theory or doctrine-driven strategy and, say, technology-driven strategy is profound. The first integrates new technology into a coherent vision; the latter abandons foresight and follows the apparatus wherever it leads. One is proactive, the other reactive. One wins, the other loses.[4]

In years past, independent decision makers were required to pilot aircraft. As those pilots were promoted in rank, they transitioned to organizational decision makers and strategists. The AF built their institutional personnel model off this phenomenon. In the near future, independent decision makers will not be required to operate aircraft but to command missions. "Human commanders will need to control swarms at the mission level, giving overarching guidance, but delegating a wide range of tasks to autonomous systems. In the near term, this will entail a shift to mission-level autonomy and multi-vehicle control. In the long term, new command-and-control models are needed to allow humans to employ large swarms effectively."[5] What is most threatening is that this Army model is the future AF model.

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[4] Everett C Dolman, *Astropolitik*, 1st ed. (London: Frank Cass, 2002), 148-9.
[5] Paul Scharre, *Robotics On The Battlefield Part II The Coming Swarm* (Center for a New American Security, 2014), https://s3.amazonaws.com/files.cnas.org/documents/CNAS_TheComingSwarm_Scharre.pdf, 35.

Appendix – Interviews Conducted

1. Jason Green, Lt Col, USAF Director of Operations, 558 FTS
2. Jeff Wiseman, Lt Col, USAF (ret.), AETC/A3FR
3. Peter LeHew, Lt Col, USAF (ret.), DARPA Adaptive Execution Office Systems Engineering and Technical Assistance Manager
4. Marshall Frith, DARPA PCAS Systems Engineering and Technical Assistance Manager
5. Bill Coleman, 2-13th Aviation Regiment Gray Eagle Program Manager
6. Mark Farrar, MSgt, USA (ret.), 2-13th Aviation Regiment Director of Training
7. Ariel Schultz, Major, USA, TRADOC UAS Capabilities Manager operations officer
   May, Kent A, US Army OPFD Directorate, Aviation Military Analyst
8. Leslie, Major, 49 Wg OGV
9. Derek, Major, 49th Wing Programmed Flying Training Manager
10. Justin, Major, ACC/A3MU

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