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Incentive Pay for Remotely Piloted Aircraft Career Fields

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Preface

Remotely piloted aircraft (RPA) are expected to be a major component of the Air Force's future mission capability. With current demand for RPA ramping up quickly, the Air Force has, among other measures, extended Aviation Incentive Pay (AVIP) and Career Enlisted Incentive Pay (CEVIP) to the RPA career fields, equivalent to the traditional flight pays given to personnel who crew manned aircraft.

The Office of the Under Secretary of Defense for Personnel and Readiness (OSD [P&R]) issued a memo in late December 2010 to the Assistant Secretary of the Air Force for Manpower and Reserve Affairs (SAF/MR) extending authority for AVIP and CEVIP for RPA operators for calendar year 2011. One of the conditions for extending the authority was that the Air Force provide a report on the "econometrics of effectiveness and efficiency of RPA incentive pays as they relate to attracting and retaining pilots and sensor operators." This monograph addresses this subject using an econometric model of officer and enlisted retention behavior developed for the 10th and 11th Quadrennial Reviews of Military Compensation (QRMCs), along with new data on civilian opportunities for RPA pilots and sensor operators (SOs) and data on Air Force requirements for the RPA career fields.

The research reported here was sponsored jointly by the Air Force Directorate of Force Management Policy (AF/A1P) and the Office of the Assistant Secretary of the Air Force for Manpower and Reserve Affairs, Force Management and Personnel (SAF/MRM). The study was conducted within the Manpower, Personnel, and Training Program of RAND Project AIR FORCE as part of a fiscal year (FY) 2011 study "Enhancing Personnel Selection and Screening Methods."

This monograph should interest those involved in compensation policy or RPA career-field planning in the military services.

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Background and Purpose

RPA have figured prominently in the conflicts in Afghanistan and Iraq, and they are expected to continue to do so in future operations of U.S. military forces. The United States Air Force currently operates three types of RPA: the MQ-1 Predator, the MQ-9 Reaper, and the RQ-4 Global Hawk.[1] Each requires an aircrew that comprises a pilot and a sensor operator at both the continental United States–based mission-control element (MCE) and the deployed launch-and-recovery element (LRE). Under current policies, the Air Force pays the personnel who operate the aircraft and its sensors incentive pays, specifically, AVIP and CEVIP. Controversy surrounds the awarding of these special pays to RPA operators, with some arguing that such pays should go to only those who crew traditional manned aircraft and others debating the need for and affordability of such incentives when the services are facing substantial budget cuts.

The demand for RPA required the Air Force to divert pilots who were trained to fly traditional aircraft to flying RPA. The Air Force also created two new career fields, one for officer RPA pilots (18X career field) and one for enlisted RPA SOs (1U career field). Personnel in these new fields will eventually replace those who have been temporarily operating the RPA. The Department of Defense asked the Air Force to assess the effectiveness and efficiency of RPA incentive pays

[1] Most of the analysis in this monograph focuses on the Predator and Reaper.

for attracting and retaining pilots and SOs, and the Air Force asked RAND to assist in that assessment.

Manpower Demands

A first step in determining the effectiveness and efficiency of incentive pays is to ascertain the demand for RPA skills. Here, the Air Force has both a short- and a long-term issue. The short-term task is to produce enough RPA pilots and SOs to meet current operational demands, i.e., 24/7 coverage for 51 active-duty MQ-1 and MQ-9 combat air patrols (CAPs). While ten crews (consisting of one pilot and one sensor operator) per CAP are required for normal 24/7 operations, only seven or eight are currently available, resulting in the need for extensive overtime.

The long-term issue is the need to effectively transition from growing to stabilizing the career fields. Our analysis suggests that the ten-crews-per-CAP requirement will be satisfied quickly, after which the current training production level can and should be reduced. Current Air Force short-term ramp-up plans call for a training production of 60, 146, and 168 new 18X RPA pilots in FY 2011, FY 2012, and FY 2013, respectively, and 353, 327, and 327 SOs in FY 2011, FY 2012, and FY 2013, respectively. These ramp-up numbers are significantly higher than normalized training-production requirements, which we estimate to be 95 18X RPA pilots and 95 SOs per year. PAF analysis indicates that the currently planned production levels will eliminate opportunities for those in the FY 2011 through FY 2013 training-production cohorts (i.e., graduating classes) to serve second operational tours. A more deliberate pace of replacing the traditional pilots that are filling in as RPA pilots (designated 11U pilots) with 18X RPA pilots (i.e., pilots in the new RPA career field) could provide a better transition to a normalized crew force.

Civilian Employment Opportunities

Another key issue in determining what sort of incentives might be needed to retain RPA personnel is the demand for RPA skills in the civilian market. Since civilian organizations could offer much higher salaries than the Air Force can, if they especially prized RPA skills, they would likely offer salaries that are lucrative enough to induce members of the Air Force to leave the service.

Our analysis shows that the unmanned-aircraft-system (UAS) industry has experienced significant growth in the 2000s, much of it fueled by contracts from the U.S. military. This growth has sparked an increase in employment opportunities for individuals with RPA operational experience. If military spending on RPA continues at the pace some predict, so should employment opportunities. However, the role that cuts in U.S. defense budgets beyond FY 2011 could play in U.S. defense spending on RPA is unclear. As the Air Force develops its strategies to man RPA career fields, it will have to consider the pull of the defense-contractor job market on its RPA pilots and SOs.

Employment outside defense-contracting organizations will remain limited for the foreseeable future, although opportunities will likely exist in other government and public service organizations, such as U.S. Customs and Border Protection (CBP). Until the Federal Aviation Administration (FAA) opens public national airspace to RPA and the UAS industry finds solutions to its technological hurdles, civil and commercial UAS markets will remain small. Thus, retention of RPA pilots and SOs in the Air Force will depend largely on the pull of defense-contractor positions until nonmilitary UAS markets grow significantly, and the strength of that pull is not clear.

The Effect of Incentive Pays

Evaluating incentive pays requires estimates of their effect on retention and their cost. We used an econometric model of officer and enlisted retention behavior, the Dynamic Retention Model (DRM), to simulate the effect of the CEVIP and AVIP under varying assumptions regarding the wages available to individuals with RPA training in the civilian labor market. The parameters of the model were estimated using a longitudinal sample of approximately 30,000 enlisted airmen and 30,000 officers, where each individual's history of active component (AC) and reserve component (RC) participation was tracked for up to 20 years. The version of the DRM used in this analysis was originally developed to support the 10th QRMC and was refined, further developed, and reestimated to support the 11th QRMC.[2]

For the Air Force, there is a tipping point at which it becomes cheaper to retain a trained individual than to recruit and train a new one. Even if this tipping point is not reached, incentive pays may be needed to meet experience requirements.

If the civilian wage opportunities for RPA pilots are no different from those for other officers, reducing or eliminating the 18X RPA pilot incentive would have only a marginal impact on the career field's ability to meet requirements. However, if civilian wage opportunities for RPA pilots are higher than those for other officers, the conclusions regarding the need for incentive pays differ markedly. When civilian wage opportunities are 110 percent of those of other officers, the career field may not retain enough personnel to meet the current planned manning requirements without incentive pays.

The situation is similar for the SO force. If civilian wage opportunities for SOs do not differ from those available to other enlisted personnel, the consequences for retention are negligible. However, if civilian wages for SOs are higher than those for other enlisted personnel, the conclusions change considerably, even when enlistment bonuses are in place. When civilian wage opportunities for SOs are 130 percent of those of other enlisted personnel, the career field may not retain enough personnel to meet the current planned manning requirements without the incentive pays. At 140 percent, retention will fall short of the planned manning requirement, even with the current incentive pays and reenlistment bonuses.

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2 The mathematical foundations, data, and estimation methods for the DRM are presented in Asch et al. (2008) and Mattock, Hosek, and Asch (forthcoming).

Thus, cutting incentive pays for either officers or enlisted personnel would result in a significant decline in the cumulative retention of 18X RPA pilots and SOs. If training cost or civilian wages available to airmen with RPA training are sufficiently high, CEVIP results in steady-state cost savings for RPA SOs. While there is no cost savings in a steady state, the cost premium associated with offering AVIP to 18X RPA pilots is small (1 to 3 percent) over the likely range of wages available to those who enter the civilian labor market.

Meeting Career-Field Demands

Because retention rates vary depending on the civilian wage potential of the career field, it is necessary to understand the civilian wage potential for 18X RPA pilots and SOs. For officers, we assumed a wage opportunity comparable to the earnings of 32- to 36-year-old men with four or more years of college in professional/technical occupations. In 2009 dollars, that demographic group earns an average of $86,808 per year. For enlisted personnel, we assumed a wage opportunity comparable to the earnings of 27- to 31-year-old men who have completed some college courses in professional/technical occupations. In 2009 dollars, that demographic group earns an average of $45,811 per year.

Comparing these average wage estimates with the medians of the ranges of the salary figures reported by civilian-employer representatives, we find that RPA pilot jobs for those deployed to overseas war zones pay at least 150 percent of the average wages that would be expected for separated officers in general. Findings for SO wages are even more striking. Although only two organizations reported having SOs, even the lowest figures they provided were 127 percent and 181 percent of the average civilian wage for stateside and deployed positions, respectively.

Given that a wage potential of even 110 percent for 18X RPA pilots and 140 percent for SOs would result in a staffing shortage, these estimates of higher-than-average wage potential for SOs and RPA pilots suggest that it would be advisable to continue the full incentive pays for both career fields and the bonus pays for the SOs, for whom a large increase in programmed training production may also be needed.

Recommendations

On the basis of our findings, we offer the following recommendations.

Recommendation 1: Retain incentive pays for the 18X RPA pilot and SO career fields, at least until more information on the normalized career fields is available.

Current estimates of the civilian wage potential suggest that civilian pilot positions (requiring deployment) pay much higher salaries than the typical salaries officers can expect. Pay for SOs is even higher relative to the average pay of enlisted personnel in the civilian market. This information, combined with the predicted low retention rates given even modest civilian wage premiums, suggests that incentive pays are needed. In the case of SOs, continuing the reenlistment bonuses would also be justified.

Recommendation 2: Reevaluate the training production ramp-up and continue to rely on 11U pilots.

Our analyses showed two diametrically opposed findings regarding the appropriate number for training production. There is a need to keep the training-pipeline production limited to no more than about 100 people to ensure that existing RPA personnel will have an opportunity to complete a second tour in MCE units to increase the experience level of squadron personnel. Yet if retention is poor, training-pipeline production would need to be increased to have enough personnel to meet operations, training, staff, and leadership requirements. We suggest that greater emphasis be placed on retaining personnel and growing the mature career field rather than ramping up so quickly that MCE units will in only a few years have more personnel than they can absorb. The health of the future career field in the long term should take priority in decisions regarding training-pipeline production and desired levels of retention.

To balance the need for meeting MCE requirements quickly and building a healthy and sustainable career field, we suggest retaining the incentive pays and starting with a tempered ramp-up, with a training production rate that will fill MCE requirements for 18X RPA pilots by FY 2016 and for SOs by FY 2013. Traditional pilots could continue to fill the gaps in the MCE force as the 18X RPA pilots are trained, with a target end date of 2016.

Recommendation 3: Study attracting and selecting candidates for the 18X RPA pilot career field.

Air Force personnel must volunteer for all rated positions. This requirement is not new; however, because rated jobs have always received the same rated incentive pay, that pay has not been a factor in deciding which rated position to select when volunteering. Such other factors as interests, prestige, responsibility, civilian career opportunities, danger, and various types of compensation, such as bonus pays, drive career choices. That could change if RPA positions do not receive the same incentive pays as other rated careers. Analyzing the effect of incentives and other compensation policies on the Air Force's ability to attract many candidates and high-quality candidates would be worthwhile. We therefore recommend investigating this issue when at least a few cohorts of data are available and collecting new data on potential applicants' reasons for or against volunteering for the RPA career field, along with their final decisions and qualifications.

Recommendation 4: Revisit the issue of RPA incentive pays in three to eight years.

Since the two RPA career fields are quite new, much of the planning is still under way, and many aspects of them are still uncertain. The number of personnel lost to training attrition, difficulties in recruiting, and even the length, content, and costs associated with training are likely to change in the next few years as the Air Force learns more about the career-field requirements and as the personnel are selected and developed under normalized conditions.

In addition, the civilian market for personnel with RPA training is only in its infancy, and its magnitude is hard to anticipate. For example, because at present the FAA will not permit unconstrained RPA operations in commercial airspace, commercial applications, such as remotely piloted cargo planes, are still in development. If and when the FAA reverses that decision, commercial RPA applications could grow rapidly. As another example, other countries (such as the United Arab Emirates) are beginning to enter the UAS market, so the international job market may grow rapidly as well. Because of the many uncertainties in both the U.S. and international markets, the civilian pay estimates and the number of job openings we present in this monograph, while based on the best information available at the present time, could turn out significantly differently as the Air Force career fields and civilian markets mature.

For this reason, we strongly advise the Air Force to reexamine the issue of RPA career-field retention, incentive pays, and other compensation policies once the career field has at least a few years of data available. Until then, our recommendation is to continue incentive pays for both career fields and retain the SO bonuses because the consequences of failure to retain enough personnel would cause serious problems with filling operations, training, leadership, and staff positions.

Acknowledgments

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This study also greatly benefited from the insights of RAND colleagues Albert Robbert, Ray Conley, and James Bigelow, who offered their expertise on manpower models for Air Force rated communities; James Hosek and Beth Asch, whose expertise on retention modeling and general civilian opportunities for former service members proved invaluable; Craig Martin, who provided us with information on average civilian wages from the Current Population Survey; and Jerry Sollinger, who assisted in revising the final draft report. Finally, we acknowledge those individuals outside of the Air Force and RAND who contributed to our understanding of the civilian job market for RPA personnel. Specifically, we thank Joshua Brungardt of Kansas State University Salina and Theodore Beneigh of Embry-Riddle Aeronautical University for telling us about their institutions' education programs in UAS, and we complete our acknowledgments by thanking all of the people we interviewed about the civilian labor market in the UAS industry. We promised them confidentiality—and hence do not list them by name—but we truly appreciate the time they took from their busy schedules to speak to us. Their participation was a pivotal component of our study, and it greatly advanced our understating of RPA retention issues facing the Air Force.

Abbreviations

11U	career field for traditional pilots serving as RPA pilots
18X	RPA pilot career field
1U	RPA sensor operator career field
ABM	air battle manager
AC	active component
ACC	Air Combat Command
AETC	Air Education and Training Command
AFI	Air Force Instruction
AFOQT	Air Force Officer Qualifying Test
AFROTC	Air Force Reserve Officer Training Corps
AFSOC	Air Force Special Operations Command
AVIP	Aviation Incentive Pay
BMT	basic military training
CAP	combat air patrol
CBP	U.S. Customs and Border Protection
CEA	career enlisted aviator
CEVIP	Career Enlisted Aviation Incentive Pay
CMR	combat-mission-ready
COA	certificate of authorization
CSO	combat system operator

CYOS	commissioned years of service
DRM	Dynamic Retention Model
DSA	detect, sense, and avoid
FAA	Federal Aviation Administration
FTU	formal training unit
FY	fiscal year
IDE	intermediate developmental education
LRE	launch-and-recovery element
MCE	mission-control element
MQT	mission qualification training
NASA	National Aeronautics and Space Administration
OSD	Office of the Under Secretary of Defense
OSD(P&R)	Office of the Under Secretary of Defense for Personnel and Readiness
OSS	operations support squadron
OTS	Officer Training School
PAF	Project AIR FORCE
PCSM	Pilot Candidate Selection Method
QRMC	Quadrennial Review of Military Compensation
R&D	research and development
RC	reserve component
RMC	Regular Military Compensation
ROTC	Reserve Officer Training Corps
RPA	remotely piloted aircraft
SDE	senior developmental education
SME	subject-matter expert
SO	sensor operator
SRB	Supplemental Reenlistment Bonus

STP	students, transients, patients, and prisoners
TBAS	Test of Basic Aviation Skills
UAS	unmanned aircraft systems
UAV	unmanned aerial vehicle
USAFA	United States Air Force Academy
YOS	years of service

CHAPTER ONE

Introduction

Remotely piloted aircraft (RPA) are expected to be a major component of the United States Air Force's future missions. Current demand for RPA is increasing faster than the Air Force can train new personnel, but the Air Force has worked quickly to solve the personnel shortage. Manned-aircraft pilots have been filling RPA pilot slots as an interim solution,[1] and the Air Force has created two new career fields (18X RPA pilots and 1U RPA sensor operators [SOs]) to meet the long-term demand.[2] It has begun training 18X RPA pilots and SOs, with the hope of normalizing the new career fields by 2015.

While the other services are also swiftly ramping up their RPA capabilities, each one is dealing with the supply and demand for RPA operators differently. For example, the Air Force has decided to extend Aviation Incentive Pay (AVIP) and Career Enlisted Aviation Incentive Pay (CEVIP) to the RPA career fields. This decision is not without controversy. Some within the Air Force have expressed concerns that such pay should be provided only to personnel who are crewing manned aircraft. Others within the Air Force have expressed concern about

1 Manned-aircraft pilots receive additional training on RPAs in addition to their preexisting skills.

2 The 18X RPA pilot career field is for personnel whose primary role is piloting RPA. The 11U specialty code designates traditional pilots (i.e., manned-aircraft pilots) who are filling in as RPA pilots until the 18X career field is fully staffed. Because the term *RPA pilot* can be used to refer to members of either the 18X career field or the 11U career field, we use the term *18X RPA pilots* to clearly distinguish them from the 11U RPA pilots. No enlisted career field shares the term *sensor operator,* so there is no confusion when referring to the new 1U personnel as SOs.

the fiscal climate; with all services facing funding cuts, they question whether incentive pays are affordable, necessary, or desirable.

The Office of the Under Secretary of Defense for Personnel and Readiness (OSD [P&R]) extended authority for AVIP and CEVIP for RPA operators for calendar year 2011 on the condition that the Air Force host an RPA summit for all services and prepare an after-action report that includes the perspectives of all services and a theoretical overview of how and why pilots and SOs should receive incentive pays. Additionally, the Air Force was tasked with using an econometric approach to evaluate the effectiveness and efficiency of RPA incentive pays as they relate to attracting and retaining 18X RPA pilots and SOs and providing a report of the findings.

The Air Force asked RAND Project AIR FORCE (PAF) to assist in responding to that request, and this monograph summarizes the results of our efforts.

Approach and Tasks

RAND developed an econometric model of officer and enlisted retention behavior for OSD (P&R) and the 10th and 11th Quadrennial Reviews of Military Compensation (QRMCs). This model, the Dynamic Retention Model (DRM), has been used and is being used to evaluate the effectiveness and efficiency of pays by simulating force-management outcomes under alternative compensation policies. For this project, we revised the DRM to deal with RPA career field incentive pays. We also explored other issues relevant to decisions about the need for incentive pays, including the magnitude of the personnel shortage that might result in the absence of incentive pays and the consequences of filling staff and leadership positions as the career field matures.

Our research tasks were as follows:

- Gather data on current and potential future civilian career opportunities for RPA pilots and SOs, training costs and the training pipeline, and RPA career-field demands (e.g., ideal experience

mix and minimum number of personnel needed to fill operations, training, wing leadership and staff, and above-wing staff requirements).
- Use civilian compensation data/projections and incentive pays as inputs to the DRM to determine the cost effectiveness of incentive pays for RPA operators and predict retention rates under different incentive pays and civilian job market conditions.
- Estimate the potential effect of various incentive pays on the Air Force's ability to meet the new career-field demands.

To accomplish these tasks, we sought out information from Air Force RPA career-field subject-matter experts (SMEs), experts in the RPA civilian employment market, and the existing literature and research sources. Interviews with Air Force SMEs covered training costs, operational personnel requirements and constraints, training-pipeline constraints, and other career-field planning issues. Interviews with members of the civilian employment market covered current pay and amount of RPA job opportunities for former Air Force RPA operators. Research by the Teal Group (2011) was used to understand future civilian RPA market forecasts. Data sources on recruiting and retention in other Air Force career fields were also consulted.

A range of training costs and potential civilian wages was entered into the DRM to forecast retention in the two new career fields under various incentive scenarios. We then compared the DRM forecasts with the desired shape and grade composition of the RPA career fields to illustrate how reduced retention from lowered incentives would affect each of them.

Organization of This Report

The effectiveness of RPA incentive pays hinges on the amount of retention needed to meet the immediate and long-term demands of the RPA career fields, as well as the costs and time associated with training new personnel. In addition, the number of and potential pay for civilian jobs are major factors in determining whether personnel will choose to stay in the service or leave. In Chapter Two, we describe the Air Force's new RPA career fields and the training time line and costs for each. In Chapter Three, we introduce the manpower requirements for the career fields, and in Chapter Four we describe the current and future civilian market for RPA jobs. Chapter Five provides career-field retention estimates, using the DRM to examine various potential civilian wages and levels of incentive pays, and calculates the tipping point at which it becomes more cost effective to increase retention through incentive pays than to train new personnel to replace losses. Chapter Six compares the retention estimates from Chapter Four with the career-field demands outlined in Chapter Three to determine whether demands will be met under various wage and incentive scenarios. Chapter Seven concludes with our recommendations regarding short- and long-term compensation policies for the Air Force's RPA career fields.

CHAPTER TWO

Remotely Piloted Aircraft Training Pipelines

In this chapter, we describe the Air Force's two new RPA career fields and the training time line and costs for each. This training information is used in Chapter Three to determine how training-pipeline production influences manpower planning and in Chapter Six to estimate the cost effectiveness of RPA incentives. Except where noted otherwise, the information was obtained through discussions with RPA SMEs in the Air Force, including career-field managers (AF/A3O-AT); the Air Force Reserve Officer Training Corps (AFROTC) registrar; and representatives from Air Combat Command (ACC/A3CU, ACC/A3CH, and ACC/A8/A8YR-RQ4), Air Education and Training Command (AETC/A3FR), and the Air Force Directorate of Force Management Policy (AF/A1PP).

Overview of the Air Force's New RPA Career Fields

Until recently, traditional pilots (classified in the 11U career field) have been called upon to pilot the three RPAs currently supported in the Air Force (the MQ-1 Predator, the MQ-9 Reaper, and the RQ-4 Global Hawk). In the last two years, however, the Air Force has introduced two new career fields, RPA pilots (18X) and RPA SOs (1U), that are dedicated solely to RPA operations. The 18X RPA pilots and SOs are intended eventually to replace those who have been temporarily operating the RPAs, once there are a sufficient number of experienced personnel in the career fields to meet the RPA demand.

The 18X RPA pilot career field was established in April 2010 (Air Force Personnel Center, 2011a). RPA pilot positions in the Air Force are held exclusively by officers, whereas in the other services, they can be staffed with enlisted personnel.

The Air Force's decision to allow only officers to fly RPA was based on a number of considerations, the most commonly cited of which is that RPA piloting will play a central role in the future of the Air Force, increasingly supplanting manned pilot missions.[1] All pilot positions in the Air Force have historically been reserved for officers, and maintaining that tradition would preserve a vital component of Air Force culture that would be lost as manned missions are replaced by RPAs. Moreover, if RPA piloting is the career field of the future in the Air Force, allocating the position to officers will ensure that an RPA viewpoint is present within the Air Force leadership of the future.[2]

The RPA SO career field was established in January 2009, about a year before the 18X RPA pilot career field (Air Force Personnel Center, 2011b). Because it has existed longer than the 18X RPA pilot career field, issues regarding the SO career field are better understood, although many aspects, such as the training pipeline, are still undergoing changes. According to the official description, the SO career field

> Employs manual and computer-assisted active and passive airborne-based sensor systems to acquire, track and monitor airborne, maritime and ground objects. . . . As a crewmember, provides assistance to aircraft pilot with all aspects of aircraft employment. Provides continuous monitoring of aircraft flight

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[1] A recent collision between an RPA piloted by an Army warrant officer and a cargo plane have raised questions about the safety of operating RPA in controlled airspace (Hodge, 2011). The dangerous consequences of such collisions could be another justification for restricting RPA pilot positions to officers.

[2] Although the Air Force finds these sound reasons for establishing RPA piloting as an officer career field, they may not be relevant considerations in the other services. Nevertheless, given that the Air Force is the furthest along in the RPA career-field planning, the other services have raised concerns that the Air Force's decisions concerning the career field, including establishing an officer-only policy, will set a precedent that they will have to follow. Whether the Department of Defense will allow the services to set different policies for RPA piloting has yet to be decided.

status, weapons during offensive air operations, and terminal weapons guidance (Air Force Personnel Center, 2011b)

Qualifying for 18X RPA Pilot and SO Training

Like all rated officers and career enlisted aviators (CEAs) in the Air Force, 18X RPA pilots and SOs must be qualified for the job and must volunteer for the position (Air Force Instruction [AFI] 11-402, 2010). Currently, the requirements for 18X RPA pilots are the same as those for traditional pilots. Those commissioned through AFROTC and Officer Training School (OTS) must achieve at least the minimum scores on the Air Force Officer Qualifying Test (AFOQT), shown in Table 2.1. No AFOQT minimums are required for those commissioning through the United States Air Force Academy (USAFA). Pilot candidates are also evaluated using a composite of total previous flying experience, AFOQT scores, and a computerized psychomotor test battery, the Test of Basic Aviation Skills. That composite score, called the Pilot Candidate Selection Method (PCSM) score, is used as a measure of a candidate's aptitude for pilot training. The PCSM score is provided

Table 2.1
Minimum Percentile Scores on the AFOQT to Qualify as a Pilot (Traditional or RPA)

	Minimum AFOQT Composite Percentile Score				
	Pilot	Navigator	Pilot + Navigator	Verbal	Quant
USAFA	NA	NA	NA	NA	NA
AFROTC[a]	≥25	≥10	≥50	≥15	≥10
OTS with private pilot's license[b]	≥25	≥10	≥50	≥15	≥10
OTS with no private pilot's license[b]	≥50	≥10	≥60	≥15	≥10

NOTE: Percentile scores range from 1 to 99.
[a] AFI 36-2013, 2008.
[b] AETC Instruction 36-2002, 1999.

to the pilot selection boards along with other “whole-person-concept” information.

Along with test scores, height limits and certain medical conditions (including a number of common vision problems) exclude many candidates from qualifying for traditional pilot positions. At present, the same height and vision requirements are being used to screen 18X RPA pilots and traditional pilots; however, this may change in the future. Height requirements, for example, are driven by the size and configuration of traditional airplane cockpits. RPA ground-control stations, where 18X RPA pilots fly RPA, do not have any such restrictions. Adults of nearly all heights can reach the RPA pilot controls without difficulty. Nonetheless, because the training program requires that 18X RPA pilot trainees actually pilot traditional aircraft, the height requirements remain. As a result, many women are excluded. To address this issue, the Air Force is considering employing training aircraft that can accommodate a wider range of heights for use in this phase of training. Until then, the current height requirements for 18X RPA pilots will likely remain.

The process of volunteering for an 18X RPA pilot position is the same as that for any rated positions and the same across accession sources. In AFROTC, for example, decisions about volunteering for rated positions are usually made during the junior year in college. At that point, candidates who meet the minimum qualifications provide lists of the rated career fields for which they would like to be considered. With the addition of the 18X RPA pilot career field, selection decisions in AFROTC for rated positions occur in the following order: (1) traditional pilot positions, (2) RPA pilot positions, (3) combat systems operators (CSOs, formerly navigators), and (4) air battle managers (ABMs). For each career field, the top candidates are selected until all positions are filled. The remaining candidates are then considered for the next position for which they volunteered. Each position is filled in a similar fashion, ending with the ABMs. This means that if an officer’s first choice is CSO but he or she also volunteered to be an RPA pilot, he or she could be selected to be an RPA pilot if his or her qualifications were better than those of other RPA applicants.

Understanding the selection process, some students volunteer for only the most desirable rated career fields. If it is decided that the pay for 18X RPA pilots will not be comparable to that for the other career fields, students may not volunteer for that career field. As RPA pilot slots are filled before the CSO and ABM positions, students who volunteer for RPA pilot risk being selected, in essence forfeiting a chance at a higher-paying career as a CSO or ABM. If the pay differential does affect candidates' willingness to volunteer for the 18X RPA pilot career field, it will inevitably have a detrimental effect on the quality of those who apply.

Air Force RPA Training

Several newly commissioned officers completed the first beta version of the 18X RPA pilot training program during fiscal year (FY) 2010, and the first undergraduate RPA training class started in October 2010. The SO training pipeline has been running for several years, although it too is still in flux, e.g., there are plans to merge the first two training blocks into one. At present, 18X training on MQ-1s is under way, with MQ-9 and RQ-4 training to begin in early FY 2012. Since the MQ-1/MQ-9 training pipeline plans are better formulated, much of the discussion in the remainder of this monograph focuses on the development of personnel for operating these RPA. Nevertheless, when information on RQ-4s, however tentative, was made available to us, we note it in our discussion.

Training and development of RPA operators takes place first under AETC, continues under ACC, and concludes after the 18X RPA pilots and SOs arrive at their first operational duty assignment with Air Force Special Operations Command (AFSOC) or ACC. The entire development process, through the point of achieving "experienced" pilot or SO status, is summarized in Figure 2.1. Table 2.2 lists the total months spent at each step in the process.

Figure 2.1
18X RPA Pilot and SO Training Pipelines

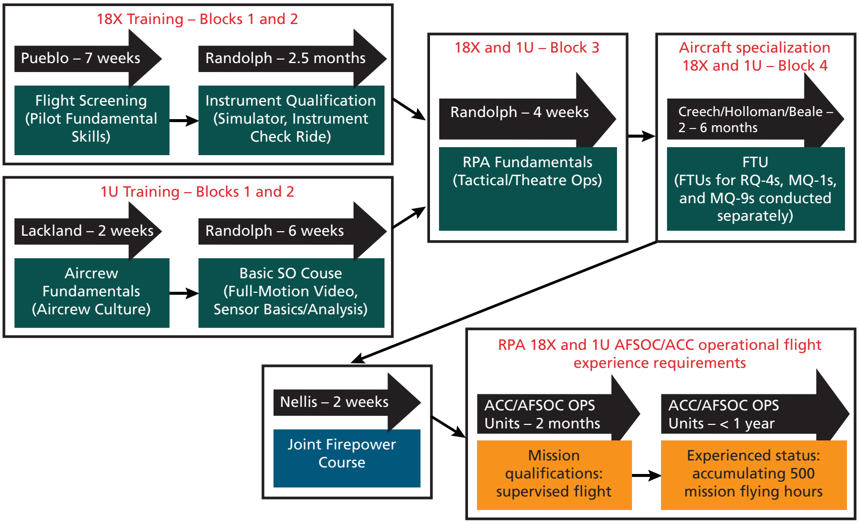

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Table 2.2
Number of Months at Each Step in the RPA Training Pipelines

	18X Pilot			SO		
	MQ-1	MQ-9	RQ-4	MQ-1	MQ-9	RQ-4
Basic military training (BMT)	—	—	—	2	2	2
Blocks 1 to 3	5.25	5.25	5.25	3	3	3
Block 4 (formal training unit [FTU])[a]	3	6	4	3	6	4
Joint firepower course	0.5	0.5	0.5	0.5	0.5	0.5
STP moving time	1	1	1	1	1	1
Total from enlistment/commissioning to arriving at first operational tour	9.75	12.75	10.75	9.5	12.5	10.5
Mission qualification (achieving "mission-ready" status) [b]	2	2	2	2	2	2
Achieving "experienced" status	< 12	< 6	< 12	< 12	< 6	< 12
Total from enlistment/commissioning to achieving "experienced" status	23.75	20.75	24.75	23.5	20.5	24.5

NOTE: STP = students, transients, patients, and prisoners.
[a] Numbers of months in FTU are approximate and may vary from these estimates.
[b] Achieving mission-ready status can take longer than two months, depending on the trainee's performance.

RPA Training Pipeline

A sizable portion of the 18X training applies to all RPA pilots regardless of RPA type. For this reason, all 18X RPA pilots complete their first three blocks of training (flight screening, instrument qualification, and RPA fundamentals) together. This first set of training courses is shown in the upper left-hand box in Figure 2.1. Similarly, all SOs complete their first two training blocks (aircrew fundamentals and the basic SO course)—shown in the mid-left-hand box in Figure 2.1—together, regardless of their RPA type. 18X RPA pilots and SOs train separately for the first two blocks of training. The SOs join the 18X RPA pilots during the last week of the 18X RPA pilot Block 3 training. New enlisted personnel must also complete eight and one-half weeks of BMT, so all SOs have an additional two months of training prior to entering Block 1.

The first three 18X RPA pilot courses cover the basics of piloting, including instrument qualification, check ride, and 49 hours in a T-6 simulator. These three courses are significantly shorter than the Specialized Undergraduate Pilot Training completed by traditional pilots, and while trainees do not receive a traditional private pilot's license, 18X RPA pilot training does cover some of the same basic activities.[3] For example, instrument qualification is a Federal Aviation Administration (FAA) requirement for any pilot flying in controlled airspace. Because Air Force RPA fly in controlled airspace, all 18X RPA pilot trainees must become instrument-qualified. In the process, they have to take off and land a traditional aircraft as part of their training and instrument qualification check ride. Because these and other aspects of 18X RPA pilot training already satisfy many of the requirements for obtaining a private pilot's license, some 18X RPA pilots may choose to supplement their training and obtain a license on their own.

Specialized expertise in a specific type of RPA is developed during the last block of training at an FTU, currently administered by ACC.

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[3] Traditional pilots do not receive a private pilot's license from the FAA at the completion of their flight training. Instead, the services issue their own certification, which is accepted by the FAA for service-authorized piloting activities only. Anyone (including pilots certified through the services) wishing to obtain a private pilot's license from the FAA must complete separate FAA-required training and pass the FAA's certification tests.

As noted in Table 2.2, the FTU course takes about three months for the MQ-1, six months for the MQ-9, and four months for the RQ-4. Each trainee completes specialized training in his or her aircraft type only. At the FTU, SOs and 18X RPA pilots train together for the entire time and practice working as a team. The 18X RPA pilots complete FTU between 9 and 12 months after starting pilot training, and the SOs complete FTU between 7 and 10 months after starting BMT.

SOs are "winged" at completion of their second block of training, whereas 18X RPA pilots are winged and assigned an aeronautical rating at the completion of FTU. After FTU, SOs and 18X RPA pilots typically join personnel from other career fields to complete the two-week joint firepower course before moving on to their first operational duty assignments.

Continued Training in the Operational Duty Assignment

After arriving at their first AFSOC or ACC duty assignment, 18X RPA pilots and SOs are permitted to operate RPA, but only under the supervision of experienced RPA operators. This supervised mission qualification training (MQT) takes about two to four months. Once supervision is no longer required, 18X RPA pilots and SOs are deemed combat-mission-ready (CMR). The last hurdle in RPA training is accruing enough operational flying time and completing certain types of RPA missions to be considered an "experienced" member of the operational flying unit. Requirements for obtaining experienced status differ by RPA type, as shown in Table 2.3. The time to achieve

Table 2.3
Hours of Operational Flight Required to Achieve Experienced Status

RPA	18X RPA Pilot	SO
MQ-1	500	500
MQ-9	200	200 plus 6 months as combat-mission-ready
RQ-4	500	250

SOURCES: AFI 11-2MQ-1 Vol. 1 (for MQ-1); AFI 11-2MQ-9 Vol. 1 (for MQ-9); AFI 11-2RQ-4 Vol. 1 (for RQ-4).

NOTE: SMEs noted that the MQ-9 experience criteria may be revised in the near future.

experienced status will depend on the operational tempo of a given unit, but our SMEs estimated that it would take a little less than a year to complete a 500-hour requirement under a typical operational tempo.

Training Costs

Training-cost estimates are available for all well-established training pipelines; however, the 18X RPA pilot and SO career fields are by no means well established. Table 2.4 shows preliminary cost estimates for each part of the training pipeline. Many elements normally included in training-cost calculations are missing from these preliminary estimates (see Table 2.5). For example, estimates provided by AETC and ACC do not include instructor pays. However, we estimate annual instructor pay per student to be between $37,000 and $160,000 for officers and between $19,000 and $79,000 for enlisted personnel. These estimates are based on the expected grades of instructors and ratios of instructors to students outlined in Chapter Three.

Table 2.4
Per-Student 18X RPA Pilot and SO Training-Cost Estimates (dollars)

Training Factor	MQ-1	MQ-9
18X pre-FTU costs (Blocks 1 to 3)[a]		
Total	32,500	32,500
SO pre-FTU costs		
Aircrew fundamentals course	4,371	4,371
Basic SO course	9,651	9,651
1 week working with RPA pilots in RPA fundamentals course	9,499	9,499
Total	23,521[b]	23,521[b]
18X and SO FTU (Block 4)[c]		
Student per diem during FTU [d]	10,000	10,000
Operating costs for FTU training buildings (squadron operations facilities)[d]	1,572	1,572
Other facilities/staff support costs[d]	3,333	3,333
Computers[d]	1,000	1,000
Simulators (operating costs only)[d]	3,038	3,038
RPA usage (fuels + RPA maintenance and upkeep)	14,963	17,025
Training supplies (e.g., books, paper, pens)[d]	500	500
Total	34,406	36,468
Total training costs (Blocks 1 to 3 plus FTU)		
18X RPA pilot training	66,906	68,968
SO training	57,927	59,989

SOURCE: Interviews with AETC/A3FR representatives, 2011.

NOTES: See Table 2.5 for a breakout of factors that are included in training-cost estimates.

[a] No breakdown of costs provided.

[b] AETC recently reduced the SO pre-FTU training pipeline by 14 days, so the pre-FTU costs could decrease by as much as $5,000 per student.

[c] The total estimated cost to support Holloman FTU is more than $6 million. This estimate includes not only FTU costs but the cost for the entire operating group at Holloman, which runs the FTUs.

[d] MQ-9 FTU is slightly longer than MQ-1 FTU, so most of the FTU costs are a slight overestimate of MQ-1 training and underestimate of MQ-9 training.

Table 2.5
Factors Included and Not Included in Cost Estimates for 18X RPA Pilot and SO Training

	Included in Pre-FTU Estimates	Included in FTU Estimates
Instructors' pay	Yes	No
Other instructor-related costs (e.g., moving costs)	No	No
Students' pay	No	No
Other student-related costs (e.g., housing costs)	Yes	Yes[a]
Operating costs for buildings where training occurs	Yes	Yes
Cost of computers	No	No
Cost of simulators[b]	No	Partly[c]
Cost of RPA and other training aircraft (e.g., DC-20s)[d]	No	No
Cost of computers and simulators used in the classroom	No	Yes
Aircraft fuel costs + maintenance and upkeep	No	Yes[e]
Other costs associated with use of aircraft (e.g., air traffic control, runway upkeep, satellite communication time, etc.)	No	No
Training supplies (e.g., books, paper, pens)	Yes	Yes
Base operating costs that do not include other factors	No	No

SOURCES: Interviews with representatives from AETC/A3FR for pre-FTU cost factors and ACC/A3CU for FTU cost factors.

[a] Includes costs when students are in a temporary status only. FTU cost includes per diem.

[b] A T-6 simulator costs about $245,000. This estimate is not factored into the per-student estimates for pre-FTU training.

[c] Estimates reflect operating costs only, not maintenance and upkeep or cost to purchase the simulators.

[d] A DC-20 costs about $200,000. This cost is not factored into the per-student estimates for pre-FTU training.

[e] Estimates based on number of flight hours for MQ-1 and MQ-9 crews.

CHAPTER THREE

Manpower Demands

Manpower demands—best understood through careful career-field planning—are a key consideration in determining the effectiveness of incentive policies. Manpower requirements of the normalized career field (i.e., demand) drive *long-term* retention requirements. Rapid growth needed in the *short term* also drives retention requirements.

In the case of rated positions, career-field planning is one aspect of *aircrew management.* Its purpose is to meet "near-term, operational requirements while building leaders for tomorrow thereby ensuring a healthy aircrew force (i.e., combat ready and sustainable) to effectively support current and future Air Force missions" (AFI 11-412, p. 5). This chapter describes the immediate- and long-term RPA operational manpower requirements, as well as some long-term goals of building leadership and maintaining a healthy RPA force. The following issues are explored:

- Adjusting training-pipeline supply during the immediate ramp-up to fit within the mission-control element (MCE) crew constraints
- Retaining and developing personnel in the normalized career field to fill operations, training, staff and leadership positions.

We interviewed several Air Force RPA career-field SMEs to obtain information on training-pipeline constraints, operational demands, long-term staffing needs, and leadership development goals in the RPA career fields. Not surprisingly, we heard that many of these factors were in flux or not yet clearly defined. As a result, while the SMEs were able to provide some concrete estimates, many of them may change as the career field matures and its demands and constraints are solidified.

Table 3.1 summarizes SMEs' estimates of the programmed manpower requirements for the normalized career fields. Details on each of these manpower requirements are provided below.

Combat Air Patrol Demands

The 18X RPA pilot and SO career fields supply the RPA pilots and SOs needed to crew RPA MCE combat air patrols (CAPs) and RPA LREs.

Table 3.1
Estimated Normalized 18X RPA Pilot and SO MQ-1/MQ-9 Manning Requirements (assumes 51 active-duty combat air patrols)

	18X RPA Pilots	SOs
STP—initial training-pipeline production	95	95
MCE crew	510	510
Launch-and-recovery element (LRE) crew	68	68
AETC instructors (Blocks 1 to 3)	20	14
FTU instructors (Block 4)[a]	153	153
Squadron leadership	92	18
Wing and group staffs and operations support squadron (OSS)	206	81
Above-wing staff positions	250	35
STP—intermediate/senior developmental education (IDE/SDE)[b]	33	NA
STP—transients	20	13
Special duty assignments/tax	54	7
Total	1,501	994

NOTE: Includes planned manning requirement through 26 commissioned years of service (CYOS) (i.e., colonel and senior master sergeant [SMSgt] grades) for MQ-1/MQ-9s only.

[a] For more explanation on the FTU instructor requirement, see Appendix A.

[b] IDE estimated as 33 percent of those promoted to major; SDE estimated as 20 percent of those promoted to lieutenant colonel (Lt Col).

An RPA MCE CAP consists of the approximate amount of personnel, resources, and equipment necessary to keep one RPA on patrol 24 hours a day, seven days a week. A single RPA MCE CAP comprises four aircraft (one aircraft is airborne while others are refueling, taking off, landing, or undergoing repairs) and is crewed by ten full-time pilots and ten full-time SOs. Each MCE crew consists of one pilot and one sensor operator; hence, the ratio of crews per MCE is 10:1.

The Air Force plans to have at least 51 active duty MQ-1/MQ-9 CAPs and an additional 14 Air National Guard and Air Force Reserves CAPs.[1] At present, only 60 CAPs are operational (including active duty, Guard and Reserve CAPs), and crews are operating at nearly a 7:1 ratio and are working overtime. The crews were expected to reach the 10:1 ratio by 2015, but increased operational requirements will necessitate operations at a reduced ratio of crews per CAP. CAP crews are expected to achieve the 10:1 ratio by 2017.[2] In addition, 17 LREs, each consisting of four crews, are needed to fly RPA takeoffs and landings. MCE and LRE crew requirements are shown in Table 3.1.

Operations, Staff, and Leadership Experience Requirements

RPA organizational manning includes the MCE and LRE crews described above, plus staff and leadership positions at the squadron, group, and wing levels. MCE crew-absorption requirements specify that at least 60 percent of the crew must be *experienced* personnel, and it typically takes a little less than one year of full-time MCE crew experience to accrue the necessary flight hours.[3] Therefore, up to 204 18X RPA pilots and 204 SOs with less than one year of experience can

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1 About 40 percent of the 51 CAPs will be MQ-1s, and 60 percent will be MQ-9s. The total number of RQ-4 CAPs has yet to be established. A total of 65 MQ-1 and MQ-9 CAPs, including Air National Guard and Air Force Reserves and active-duty personnel, is planned.

2 The 7:1 ratio cannot be maintained in the long term. When CAP ratios are set too low, operational tempo is too high, and quality of life and retention can suffer (AFI 11-412). Moreover, according to our SMEs, the increased workload has prevented RPA operators from completing important Professional Military Education and other developmental assignments that would make them competitive for promotions.

3 Absorption refers to the total number of inexperienced personnel that an operational unit can take in annually while still maintaining the appropriate experience mix, maintain-

crew the MCE. Most wing-staff positions are open to personnel of any grade, while wing leadership positions (e.g., command positions) are reserved for higher-grade personnel (e.g., lieutenant colonels and colonels). The total required numbers of wing-staff and leadership positions are shown in Table 3.1.

Other Career-Field Requirements

Instructor positions in the AETC training pipeline (Blocks 1 to 3) and ACC FTUs (Block 4) are a significant component of the manning plan, which has a total of 173 18X RPA pilots and 167 SOs.[4] As shown in Table 3.1, career fields also have above-wing staff requirements, other special duty assignments (i.e., a career-field tax) such as regional-affairs strategist and political-military-affairs strategist, and a small number of personnel (STP—transient in Table 3.1) who change base locations in any given year of service (YOS). We used the average special duty assignments on other rated-officer career fields and the tax on 1Ns to estimate the special duty tax on 18X RPA pilots and SOs, respectively. We estimated that 2 percent of 18X RPA pilots and 1 percent of SOs would change base locations per year of service. 18X RPA pilots also have an IDE requirement, estimated to apply to one-third of the personnel promoted to major, and an SDE requirement, estimated to apply to 20 percent of the personnel promoted to lieutenant colonel. Finally, we estimated that the normalized training production (i.e., the number expected to graduate from FTU) would be 95 annually for both career fields. Exact training-production numbers for the normalized career fields have yet to be established, so this number could change. Nevertheless, the SMEs confirmed that 95 would be a reason-

ing combat capability, and allowing for appropriate development of personnel (AFI 11-412, 2009). Experienced-status requirements are described in Chapter Two.

4 The SMEs determined that 153 FTU instructors are needed during the immediate personnel ramp-up. Instead of providing us with a lower normalized instructor requirement, they asked us to use the ramp-up estimate for FTU instructors in our manpower models. While this number appears high given an annual training production of 95 personnel, they provided sound justification for it. That justification is presented in Appendix A.

able normalized sustainment training-production estimate, given the planned manning requirements by YOS described below.

Planned Manning Requirements by Year of Service

Using the programmed manning numbers from Table 3.1 and the experience requirements described above, we produced a steady-state model of each normalized career field, illustrating the types of requirements filled at each YOS, as shown in Figures 3.1 and 3.2.

The models show the remaining 18X RPA pilot and SO personnel at each YOS over a normal career cycle of 26 years (from commissioning/enlistment through the grades of colonel and SMSgt). The models begin with the estimated training production of 95 per year (in

Figure 3.1
Planned Distribution of the 18X RPA Pilot Career Field

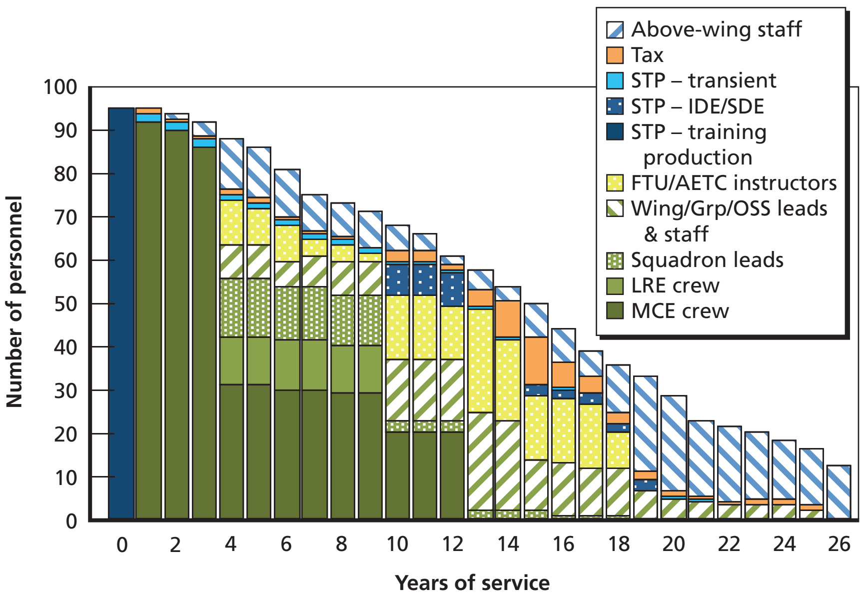

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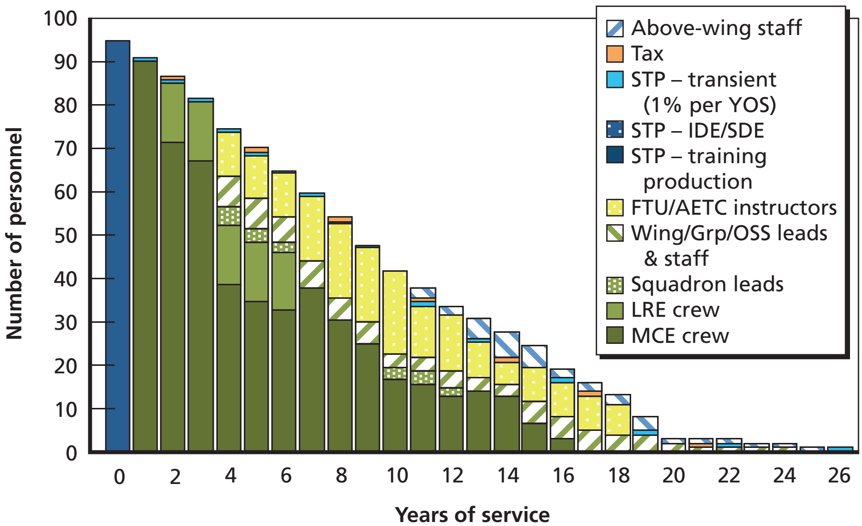
Figure 3.2
Planned Distribution of the SO Career Field



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commissioned year of service [CYOS] and YOS = 0), and end with 12 colonels and one SMSgt remaining at the end of the career cycle.

Our SMEs reviewed these models and agreed that they are reasonable manpower profiles for both normalized career fields, although the shape and size of the actual distributions in the future may vary.

Training-Pipeline Ramp-up

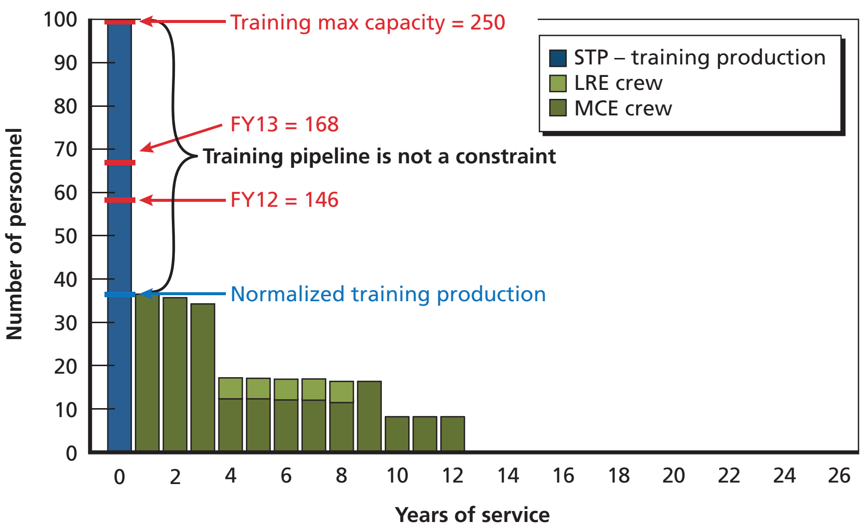
Because up to 40 percent of the workforce in operational units can be inexperienced, and because time to reach an *experienced* level (roughly one year) is relatively short for RPA pilots compared with the time required for other pilot specialties, experience requirements do not result in experienced-related absorption issues. However, there is an expectation that personnel will serve in more than one operational tour, and that does cause absorption complications.

Each operational tour lasts about three years. 18X RPA pilots and SOs are, at present, slated to complete at least one tour, with some going on to complete a second tour, either with the same RPA or after training on a different RPA type. The multiple-tour requirement was satisfied without a problem in the normalized manning plans shown in Figures 3.1 and 3.2. For example, the normalized plan would allow all 18X RPA pilots to complete at least two tours. Some could go immediately into a second tour in their fourth year of service, while others could return in their seventh year of service after serving in another role (such as in an instructor position) and could complete their second tour at that time.

While the number of personnel completing initial training annually was set at 95, the training pipeline reportedly can handle as many as 250 18X RPA pilot trainees and 440 SOs. The difference between the pipeline capacity and the desired shape of the normalized career field is shown in Figure 3.3.

While there are no plans to push training production to maximum capacity, there are plans to increase it significantly in the short

Figure 3.3
Training-Production Maximum Capacity for 18X RPA Pilot MCE and LRE Manning



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term, because, at present, the MCE crew force is understaffed. According to our SMEs, the following is the planned production ramp-up to meet that need:

- FY 2011: 60 18X RPA pilots and 353 SOs
- FY 2012: 146 18X RPA pilots and 327 SOs
- FY 2013: 168 18X RPA pilots and 327 SOs.

As shown in Figure 3.3, as the 18X RPA pilots enter the MCE crew force, they will fill existing vacancies and will then begin to displace the 11U pilots currently serving in the MCE crew force. If the total number of active-duty CAPs remains stable at 51, 18X RPA pilot training production could go back down to our estimated normalized level (i.e., 95 per year) in FY 2014 and beyond. These production levels, however, would cause the MCE crew force in FY 2014 and several subsequent years to be filled almost entirely by junior personnel, leaving no opportunities for the 18X RPA pilots who entered the crew force in the initial years (FY 2011, 2012, and 2013) to serve in second operational tours. As an alternative, the Air Force might consider scaling back the ramped-up training production to the smaller numbers shown on the right-hand side of Table 3.2, particularly if it is feasible to retain sufficient 11U pilots to fill any gaps in the MCE crew requirements. It might also be advisable to fill some of the ramped-up production targets with officers who will ultimately be slated for other non-rated career fields (i.e., those who spend one tour as an 18X RPA pilot and then permanently transfer into another career field), thereby reducing later demand for second operational tours by individuals in the very large cohorts.

There remains a distinct possibility that requirements for CAPs will grow beyond 51 active-duty MQ-1/MQ-9 CAPs and that the Air Force will be resourced to meet the additional requirements. If so, the normalized production requirement will be greater than 95, and the projections shown here will have to be revised.

There may be similar concerns with the ramp-up of SO training production. We recommend that the Air Force review the SO training production plan with a view toward desired experience distributions during the transition to a normalized force.

Table 3.2
Current and Alternative MQ-1/MQ-9 Training Production for 18X RPA Pilots

	Current		Alternative	
	Training Production	MCE Crew End-of-Year Vacancies (negative numbers indicate surplus)[a,b]	Training Production	MCE Crew End-of-Year Vacancies (negative numbers indicate surplus)[a,b]
FY 2011 (already completed)	60	450	60	450
FY 2012	146	305	120	331
FY 2013	168	142	120	215
FY 2014	95[c]	53	120	100
FY 2015	95[c]	–35	95	11
FY 2016	95[c]	–74	95	–27
CYOS 1-6 Inventory in FY16[a]	628		581	
CYOS 1-6 ideal inventory[a]	517		517	

[a] Calculations assume annual retention is equivalent to predicted retention with 100-percent incentive pay and at an average civilian wage potential. See Chapter Five for more information on predicted retention.

[b] 18X MCE crew vacancies do not necessarily indicate manning shortages in operational units. 11U pilots may be available to fill some or all of these projected vacancies.

[c] Normalized production numbers computed by RAND for this analysis.

CHAPTER FOUR

Civilian Employment Opportunities in the Unmanned-Aircraft-System Industry

The opportunity cost of forgoing a civilian career is a key consideration in military separations. To estimate this cost for RPA civilian-sector careers, we spoke with representatives from eight of the following organizations advertising RPA pilot or SO positions on job-search websites between March and June 2011:[1]

- AAI Corporation
- BAE Systems[2]
- Booz Allen Hamilton
- BOSH Global Services
- Crew Training International (CTI)
- General Atomics Aeronautical Systems, Inc.
- Insitu, Inc.
- ISR Group
- Northrop Grumman
- Raytheon

[1] The term *unmanned aircraft system* (UAS) has largely replaced *unmanned aerial vehicle* (UAV) and RPA in the international community. UAS reflects the fact that operating unmanned aircraft requires an entire system (e.g., ground-control stations, satellites), not only an aircraft. In this monograph, we use UAS to describe the industry and market and UAV when necessary. However, when talking about Air Force personnel (or former personnel), we use RPA, which is the Air Force terminology.

[2] BAE Systems is a global defense organization headquartered in the United Kingdom. The other organizations are based in the United States.

The representatives provided estimates of employment opportunities, levels of compensation, and future markets for UAS, each of which is described in the following sections. Interview questions are given in Appendix B.

The UAS Industry in 2011

Although RPA have been around for decades, much of the UAS industry growth has occurred only in the past decade. According to a recent report, the global UAS market is expected to grow from nearly $6 billion in 2011 to more than $11 billion in 2020 (Teal Group Corporation, 2011). The U.S. military has spurred much of the current growth, with contractors providing everything from UAS development to RPA pilot training and support. Most RPA-related employment opportunities are in aerospace organizations that contract to the U.S. military.

Current Employment Opportunities

Civilian organizations offer a wide variety of RPA-related positions, ranging from avionics technicians to UAS software engineers. We identified three positions for which RPA pilots or SOs would be qualified and competitive: RPA pilot, RPA SO, and site mission coordinator. RPA pilot positions generally require either manned-aircraft or RPA piloting/operational experience, and their duties often include instructing others on how to operate RPA. Although not required for SO positions, prior experience would make an applicant more competitive. Likewise, instructor experience for both pilots and SOs is highly desired but not always necessary. Site mission coordinators manage one or more RPA missions, as mission coordinators would in the Air Force. Most of the civilian organizations prefer to hire individuals with manned-aircraft or RPA piloting experience as well as several years of military experience. RPA pilots who leave the Air Force after they fulfill their service obligation would qualify for some mission-coordinator positions.

Table 4.1 shows total openings in the civilian UAS industry and the numbers of employees in each position.[3] Only two organizations reported hiring SOs; however, the number of SO openings exceeds that of pilot openings. The organizations that hire SOs supply them to clients that meet most of their pilot demand internally but lack internal SO staff. Although there are fewer pilot openings, they are spread across a larger number of organizations. Some organizations, using smaller and less-complex RPA than "endurance" RPA such as MQ-1 Predators, MQ-9 Reapers, and RQ-4 Global Hawks, expect their pilots to operate both the RPA and the sensors. It is unclear whether these organizations would consider former Air Force RPA pilots overqualified.

Deployment requirements vary. From 26 to 31 percent of the openings listed in Table 4.1 require deployments of six months or longer; the other 69 to 74 percent are based in the United States. Seven of the eight organizations deploy RPA pilots, and one deploys SOs. Contractor deployments reflect U.S. military demand for RPA training and operational support in areas such as Afghanistan. Most stateside positions are either at military installations, in U.S. government orga-

Table 4.1
RPA Positions in the Civilian UAS Industry

Position Type	Number of Organizations with These Positions	Total Openings (Summed Across All Organizations)	Total Already in These Positions (Summed Across All Organizations)
RPA pilots	8	160 to 228	478 to 520[a]
RPA SOs	2	324 to 354	232 to 332
Site mission coordinators	3	3 to 4	—[b]

NOTES: Most SMEs provided ranges of estimates (e.g., between X and Y pilot openings), so the first number in the two rightmost columns reflects the sum of the lowest numbers in the ranges, and the second number reflects the sum of the highest numbers.

[a] Only seven of the organizations had employees already working as RPA pilots.

[b] Experts were unsure of the total number and did not provide estimates.

[3] To protect the confidentiality of the organizations, we present aggregated estimates only.

nizations such as U.S. Customs and Border Protection (CBP), or in contractor organizations conducting operational tests. [4]

Using information from seven of the eight organizations, we determined that annual salaries[5] for deployed RPA pilots can range from $60,000 to $225,000, with the median between $130,000 and just under $194,000.[6] Salaries for stateside RPA pilots can range from $50,000 to $125,000, with the median between $63,500 and around $110,000.[7] Deployed pilots often work in hostile foreign areas for six months or more. Thus, their higher salaries are akin to military hazard pay. According to one SME, salaries for deployed RPA pilots can be as high as 210 percent of those for stateside positions.

The salary range for deployed SOs is from $83,000 to $185,000, while that for stateside positions is $58,000 to $95,000. Because only two organizations provided estimates for SOs, we did not calculate median salary ranges.

The representatives did not offer salary ranges for site mission coordinators; however, they did indicate that salaries are the same as or higher than those for RPA pilot positions. Because site mission coordinators often deploy, salary ranges for deployed RPA pilots could serve as lower-bound estimates.

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[4] Only three of the eight representatives stated that their organizations currently provide UAS services to civilian agencies. Two of them stated that only about 5 percent of their UAS business comes from civilian government contracts. The civilian UAS market is discussed in the next section.

[5] The representatives provided estimates of base salaries only, not total compensation (i.e., salary plus benefits). However, all of the positions are full time, meaning that employees receive full-time benefits (e.g., health care).

[6] Because we had information only on salary ranges, we could not estimate the median salary for the entire range of salaries. Instead, we estimated two median salaries, one based on the seven minimum values provided by the representatives and another based on the seven maximum values provided by them. For example, if we had only two salary ranges, $100,000 to $200,000 and $75,000 to $120,000, we would estimate the median of the minima as $87,500 and the median of the maxima as $160,000. We used the same method to estimate stateside RPA pilot salaries and SO salaries.

[7] Only five representatives provided salary estimates for stateside RPA pilots. Four of the five also provided salary estimates for deployed RPA pilots.

Our interviews with industry experts suggest that individuals with RPA operational experience have lucrative opportunities for employment. However, six-figure salaries require six-month or longer deployments, often to hostile areas. Salaries are lower (usually five figures) for stateside positions. For RPA pilots, stateside positions are also harder to find. It is not clear whether the situation will change, even as the military conflicts abroad wind down. Deployments may instead shift to new locations. The most likely source of growth in stateside RPA pilot positions would be new civilian or commercial clients. However, as discussed below, civilian and commercial applications for UAS have a long way to go before they make up a significant share of the UAS market.

Future Employment Opportunities

Unlike other aviation jobs, RPA pilot and SO positions do not have a long history. The U.S. Department of Labor has decades of statistics on commercial pilots but not on RPA pilots. The newness of this U.S. job market makes predicting future employment opportunities difficult. Therefore, we used information from the eight RPA industry representatives and the 2011 Teal Group report to suggest where employment opportunities could arise in the future.

Military Spending in the UAS Market

The UAS organizations currently focus primarily on military applications for RPA. Three organizations provide UAS services to civilian organizations, but the civilian contracts constitute only about 5 percent of their UAS business. Two of the remaining five organizations plan to continue to focus only on defense, one plans to pursue civilian contracts but to continue to focus primarily on defense, and two were unclear as to their organizations' future UAS plans.[8]

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8 As noted by a reviewer, the nonmilitary market for RPA pilots and SOs is highly concentrated in a few companies, and their main client is the U.S. military, resulting in a virtual monopsony within the RPA employment market. This monopsony power could influence

The focus on defense contracts follows market trends in UAS research and development (R&D) and procurement spending. The Teal Group predicts that global defense spending will continue to drive UAS industry spending throughout the current decade (Teal Group Corporation, 2011). The U.S. military alone is expected to spend more than $10 billion on UAS in FY 2020. Although U.S. military spending on UAS far outstrips that of other countries, other militaries have increased UAS spending over the past decade. For example, the United Kingdom and Germany have bought RPA such as the Global Hawk from U.S. organizations. Militaries are purchasing RPA to meet traditional needs, such as intelligence, surveillance, and reconnaissance, and they are also looking for new ways to apply them. For example, military RPA are starting to transport cargo and could potentially be used for aerial refueling. Militaries are also interested in the development of new UAS platforms. The U.S. Air Force, for example, is planning for a next-generation RPA that could replace the Predators and Reapers. The new RPA would have enhanced capabilities, such as combat search and rescue and limited suppression of enemy aircraft defenses (Teal Group Corporation, 2011). New RPAs and new applications for existing ones led the Teal Group to predict further growth in military RPA spending.

Such increased spending should mean more business for U.S. organizations over the next decade. However, new players are entering the global UAS market. For example, the United Arab Emirates could become a major UAS exporter to neighboring Arab states (Teal Group Corporation, 2011). In addition, it is reported that "over 50 countries have purchased surveillance drones, and many have started in-country development programs for armed versions because no nation is exporting weaponized drones beyond a handful of sales between the United States and its closest allies" (Wan and Finn, 2011). Thus, in addition to organizations in countries that have been developing and exporting RPA for decades, such as Israel, other countries are positioning themselves to enter the global UAS market.

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the extent to which these companies can offer higher-than-average pay and limit the number of jobs they can offer.

The increased presence of non-U.S. organizations should not, however, hamper U.S. organizations in the domestic UAS market. The United States is expected to account for 77 percent of R&D spending and 69 percent of procurement spending. Furthermore, the United States has an edge over most countries in developing sophisticated RPA like the Global Hawk (Wan and Finn, 2011). As long as the country maintains this edge and its current level of military spending on RPA (as projected by the Teal Group), former Air Force RPA pilots and SOs should be able to find employment in the UAS industry.[9]

Nonmilitary Applications

The military market is expected to dominate global UAS development and sales until at least 2020. However, interest in nonmilitary UAS applications continues to grow. The Teal Group classifies nonmilitary applications into three categories: government (civil), commercial, and university/research. Forecasts for nonmilitary UAS markets do not include university/research applications, because they involve "small scale 'boutique'" RPA, which should not significantly affect the global UAS market. For this reason—and because civilian organizations can and do research RPA use—we use the terms *civil* and *commercial* only to describe nonmilitary UAS applications.

Civilian UAS applications are expected to drive the initial growth in a nonmilitary UAS market (Teal Group Corporation, 2011).[10] A few such applications already exist. The National Aeronautics and Space Administration (NASA) and the U.S. Department of Energy began using RPA to measure air radiation in 1994, and the National Oceanic and Atmospheric Administration and NASA began to use RPA for coastal mapping and hurricane forecasting in 2005 (Cox et al., 2006). As these examples suggest, most of the early civilian RPA applications have been for scientific/research purposes. However, nonresearch applications have begun to appear, and several have been proposed on UAS

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9 The Teal Group report and our report were prepared before U.S. defense spending authorizations were set for FY 2012. Spending on RPA could change if major cuts to the U.S. defense budget occur over the next few years.

10 Constraints on nonmilitary UAS markets are addressed in the following section.

websites and in articles and reports about the UAS industry. Table 4.2 presents some current (as of 2011) and future nonmilitary applications of RPA. Nearly all of these applications already exist or will soon exist. In addition to the scientific/research examples cited, applications for homeland security have grown in the 2000s. CBP began to acquire Predators in FY 2005. As of 2009, CBP had five operational Predators (Teal Group Corporation, 2011) for patrolling the U.S.-Mexican border and plans to add them to the U.S.-Canadian border and U.S. coastal areas (in cooperation with the U.S. Coast Guard). A handful of local law enforcement agencies have begun to use small RPA to conduct aerial surveillance (Homeland Security Newswire, 2011). However, FAA airspace restrictions have limited widespread use of RPA for local law enforcement (Teal Group Corporation, 2011).

Outside the United States, interest in RPA for homeland security and law-enforcement purposes has also increased. Saudi Arabia has expressed interest in using RPA for border protection and to monitor oil pipelines (Teal Group Corporation, 2011). Some countries have already used RPA for homeland security and law enforcement—11 countries in North and South America are using small RPA to monitor drug trafficking and gang activity (Cattan and Barnes, 2011). These examples support the Teal Group prediction that the first widespread use of RPA outside military organizations will be in other government or public service organizations, such as law-enforcement agencies.

Commercial applications of RPA have been limited. One of the few commercial applications in the United States has been in the film industry: In 2005, a California firm made RPA helicopters available to a company that provides "airmobile cameras to the film industry and television" (Teal Group Corporation, 2011, p. 10). Another potential commercial application is agricultural spraying/crop dusting. RPA have been used for this purpose since the 1980s in Japan, where a technological solution to tend crops was needed as the number of farmers decreased. In both the film-and-television and the Japanese-agriculture examples, RPA have been used at low altitudes to avoid running up against restrictions in the use of controlled airspace.

Table 4.2
Nonmilitary RPA Applications

Application	Sector
Agricultural spraying, crop dusting	Civilian/commercial
Cargo transport (e.g., FedEx)	Commercial
Disaster surveillance (e.g., earthquakes)	Civilian
Earth science	Civilian
Climate observation	—
Topographic mapping	—
Weather reconnaissance	—
Film and television (e.g., aerial footage)	Commercial
Homeland security	Civilian
Coastal and border patrols	—
Broad area surveillance (e.g., monitoring drug smuggling)	—
Land management	Civilian
Wildlife population monitoring (e.g., fisheries protection)	—
Wildfire management (e.g., spray fire retardants)	—
Local law enforcement (e.g., surveillance)	Civilian
Transportation	Civilian/commercial
Road infrastructure assessments	—
Road traffic monitoring	—
Utility monitoring/surveillance (e.g., power lines)	Commercial

SOURCES: Anderson, 2009; Cox et al., 2006; Homeland Security Newswire, 2011; Teal Group Corporation, 2011.

Because of airspace restrictions, use of RPA in other commercial applications, such as cargo transport and monitoring of road traffic or infrastructure, is not likely in the near term.

Regulatory and Technological Challenges

The nonmilitary sector faces both regulatory and technological hurdles. The main regulatory hurdle, already mentioned, is access to controlled airspace. In the United States, the FAA does not allow RPA access to controlled airspace except in very limited cases (Teal Group Corporation, 2011). As a first step toward developing standards for RPA to fly in controlled airspace, the FAA has issued certificates of authorization (COAs) to a limited number of organizations operating certain types of RPA. However, these UAS-specific COAs are fairly restrictive and do not allow routine streamlined access to the national airspace. Except for Israel and South Africa, most other countries have the same regulatory hurdle.

This regulatory hurdle goes hand in hand with one of the main technological hurdles for the nonmilitary UAS industry: the need for detect, sense, and avoid (DSA) capabilities. Aviation regulatory bodies such as the FAA want to ensure that RPA will not collide with each other or with other aircraft. Regulations associated with certifying DSA capabilities are still under development, and DSA technology is still under development as well. At present, RPA have a high "casualty rate." As the Teal Group puts it, "It is difficult to see a city council funding police UAV operations if the UAVs suffer accident rates far in excess of police helicopters" (Teal Group Corporation, 2011, p. 10). The accident rates also result in high insurance costs, which would add to the fiscal non-viability of RPA. Therefore, until RPA have better DSA capabilities, civilian and commercial UAS markets will remain small (Teal Group Corporation, 2011).

Given such regulatory and technological challenges, civil and commercial applications are not likely to change much by 2020. Until the challenges can be overcome, the nonmilitary UAS market will be limited to U.S. government or public service organizations. However, civil organizations might lease RPAs for limited use. For example, the U.S. Forest Service might use private RPA for wildfire management. Private contracting of RPA services could provide the first growth area for commercial RPA applications, which could translate into future commercial employment opportunities for RPA pilots and SOs.

Civilian Education in UAS

Growth in the UAS industry has prompted civilian colleges and universities to offer training and education in UAS operations. Embry-Riddle Aeronautical University, Kansas State University Salina, and the University of North Dakota are among the leaders in this growing trend. Embry-Riddle offers an academic minor in UAS applications and will offer a bachelor's degree in UAS science at its Daytona Beach, Florida, campus in fall 2011 (Embry-Riddle Aeronautical University, 2011a, 2011b). Kansas State University offers three UAS courses in its aviation degree program (Kansas State University Salina, 2011). The University of North Dakota started its UAS degree program in 2010; students there can earn a bachelor's degree in aeronautics with a major in UAS operations (Trapnell, 2010).

These programs will not offer the military-specific operational experience that RPA pilots and SOs receive in the Air Force. However, they offer education and training that could give their students advantages in the job market. For example, their students receive FAA commercial pilot certification. In addition, the civilian programs may offer education and training on different types of RPA than those used in the Air Force. Taken together, civilian UAS education programs could give graduates certain advantages that typical military UAS education and training programs do not provide.

The features that distinguish civilian UAS education programs from their military counterparts could be especially important in a robust civil and commercial UAS market. Civil and commercial UAS applications would use more types of RPA than military applications. Civil and commercial UAS applications also require extensive knowledge and experience with FAA standards for operating manned and unmanned aircraft in U.S. airspace. Military RPA pilots receive training in FAA regulations, including those that address the use of public national airspace; however, they may have less traditional piloting experience than graduates of civilian UAS education programs. To the extent that traditional piloting experience matters to an employer, graduates from civilian UAS education programs could have an advantage over former Air Force RPA pilots.

For the time being, however, former Air Force RPA pilots and SOs should continue to compete successfully with graduates of civilian UAS programs. Such programs are just starting to develop their curricula, and because of their broader focus, they may not be able to provide as much intensive operational experience and in-depth, hands-on training as the Air Force. In addition, defense spending is driving demand for RPA pilots and SOs, and defense contractors value prior military service (particularly deployment experience) and RPA operational experience. The Air Force supplies both for its RPA pilots and SOs. As long as the military UAS sector remains dominant, former Air Force RPA pilots and SOs should continue to be highly competitive in the UAS labor market. The more probable competition for former Air Force RPA operators in the civilian labor market would be from operators trained by the other military services.

Summary

The UAS industry has grown significantly in the 2000s, with much of the growth fueled by U.S. military contracts. This growth has increased employment opportunities for those with RPA operational experience. If Teal Group forecasts are accurate, military spending on RPAs should continue, and so should employment opportunities. However, the role that cuts in U.S. defense budgets beyond FY 2011 could play in U.S. defense spending on RPA is unclear. As the Air Force develops its strategies to man RPA career fields, it will have to consider the pull of the defense-contractor job market on its RPA pilots and SOs.

However, employment outside defense-contracting organizations will remain limited for the foreseeable future. The best chance for civilian employment of individuals trained in RPA operation is likely to be in other government and public service organizations such as CBP. Until the FAA opens public national airspace to RPA and the UAS industry solves its technological problems, civil and commercial UAS markets will remain small. Thus, retention of RPA pilots and SOs in the Air Force will depend largely on the pull of defense-contractor positions until nonmilitary UAS markets grow significantly.

CHAPTER FIVE

The Impact of Incentive Pays on Retention and Personnel Costs

In this chapter, we discuss the effect of AVIP and CEVIP on the retention of RPA pilots and SOs. We examine the cost savings or premium associated with incentive pays under varying assumptions regarding training cost and the civilian opportunities for service members. We find that if training cost or civilian wages available to service members with RPA training are sufficiently high, provision of CEVIP results in steady-state cost savings for SOs; that is, over an extended period, the additional amount paid out through incentives is more than made up through training savings. We also show that while there is no cost savings in steady state, the cost premium associated with offering AVIP to 18X RPA pilots is small (1 to 3 percent) over the range of wages likely to be available to them in the civilian labor market.

Approach

We use the DRM, an econometric model of officer and enlisted retention behavior, to model the effect of CEVIP and AVIP under varying assumptions regarding the wages available in the civilian labor market. The parameters of the model were estimated using a longitudinal sample of approximately 30,000 enlisted personnel and 30,000 officers whose history of active component (AC) and reserve component (RC) participation was tracked for up to 20 years. The version of the DRM used in this analysis was originally developed to support the

10th QRMC and was refined, further developed, and reestimated to support the 11th QRMC. During the present research, it was further enhanced to account for the effect of the Supplemental Reenlistment Bonus (SRB) on enlisted retention. It was also modified to explore the effect of training cost and variance in civilian opportunities on the per-person cost for trained 18X RPA pilots and SOs.[1] Some of the technical details are discussed in Appendix C.

The Effect of Civilian Earning Opportunities on Retention

We simulated the effect of different civilian earning opportunities by multiplying the stream of earnings over time by a constant factor, the ratio of the civilian wage that might be available to RPA pilots and SOs to the average civilian wage available to non-rated officers and enlisted members. A factor of 1.00 means that RPA operators have no special premium in the civilian market over the average officer or enlisted member, while a factor of 1.10 would indicate that those trained in RPA operation receive a civilian wage 10 percent higher than average.

For enlisted personnel, we assume an SRB is offered in the fourth, eighth, and twelfth years of service, conditional on accepting a reenlistment term of four years. We assume the SRB is $50,400 in the fourth year, $78,700 in the eighth year, and $79,200 in the twelfth year. Fifty percent of the SRB is paid up front, and the remainder is paid in equal anniversary payments for the duration of the contract. A service member who leaves before completing his or her contract does not receive the anniversary payment and forfeits the SRB amount received up to that point.

Figures 5.1 and 5.2 show the effect of different civilian earnings opportunities on enlisted and officer retention, respectively, when no incentive pay is offered. The effect of the SRB payment for SOs can be seen in the "ripples" in each curve of Figure 5.1, in the fourth, eighth, and twelfth years of service.

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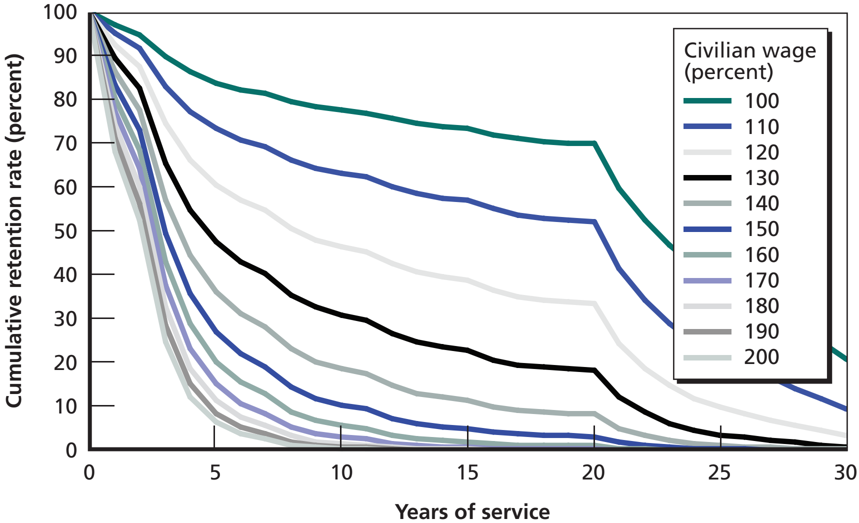
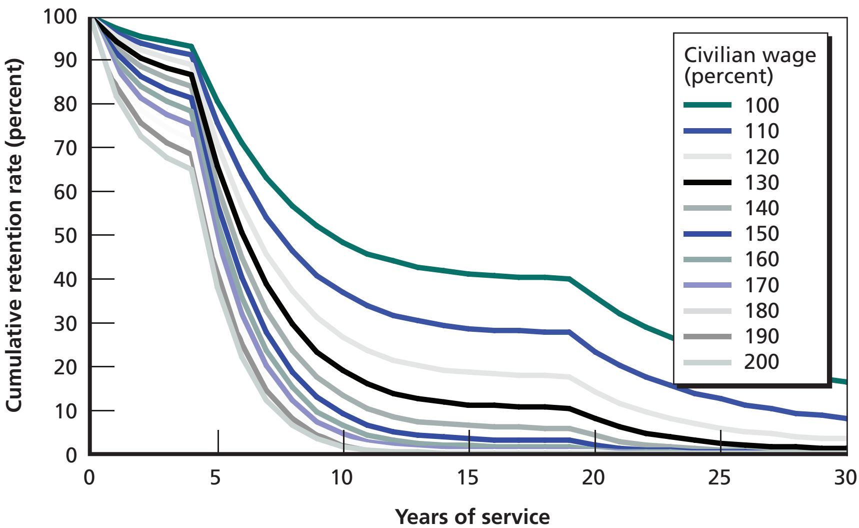
[1] The full technical details of the model are presented in Asch et al., 2008; and Mattock, Hosek, and Asch, forthcoming.

Figure 5.1
Effect of Civilian Earning Opportunities on SO Retention (no incentive pays)



RAND *MG1174-5.1*

Figure 5.2
Effect of Civilian Earning Opportunities on 18X RPA Pilot Retention (no incentive pays)



RAND *MG1174-5.2*

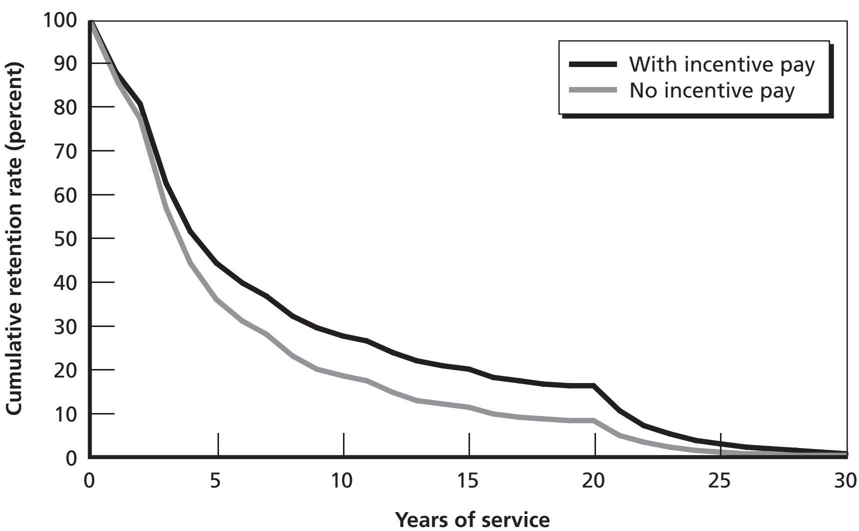
Enlisted retention is more sensitive than officer retention to increases in civilian wages, and thus it might be expected that enlisted retention will also be somewhat more sensitive to incentive pays.

The Effect of Incentive Pays

We also simulated the effect of incentive pays on retention, directly addressing the question of whether they increase retention. Figure 5.3 shows how enlisted cumulative retention changes in response to the presence or absence of incentive pay, under the assumption that RPA operators receive a 40-percent premium in the civilian labor market.

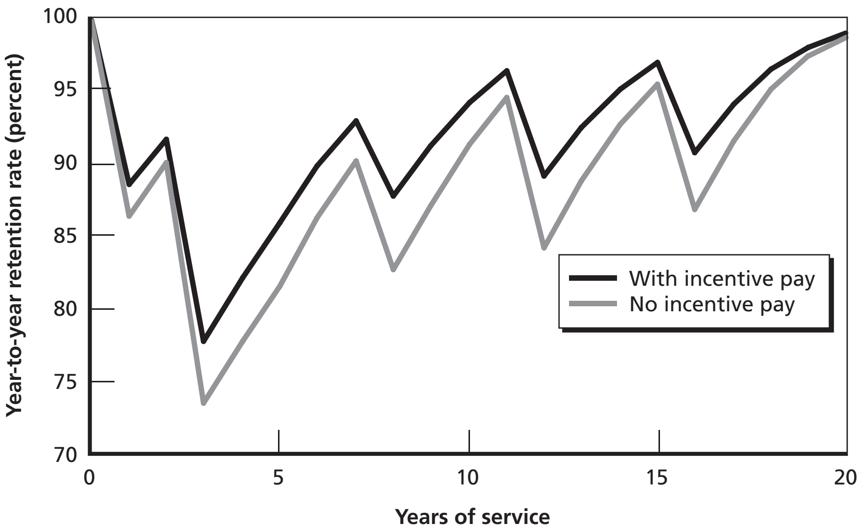
Figure 5.4 shows results from the same simulation, showing the change in year-to-year retention in the presence or absence of incentive pay. Year-to-year retention is calculated by dividing the number of personnel in the current year by the number in the previous year. The cumulative retention curve is the result of accumulating the year-to-year retention over time.

Figure 5.3
Effect of Incentive Pay on SO Cumulative Retention (assuming civilian wage is 140 percent of average)



RAND *MG1174-5.3*

Figure 5.4
Effect of Incentive Pay on SO Year-to-Year Retention (assuming civilian wage is 140 percent of average)



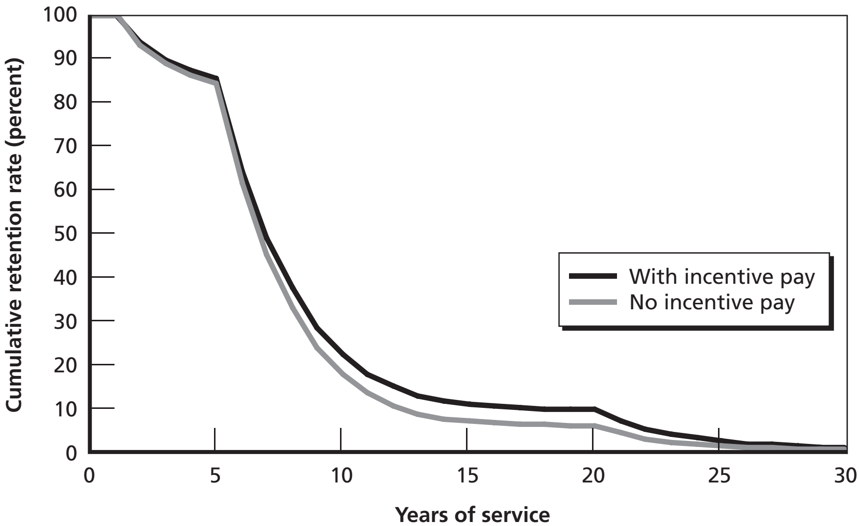
RAND *MG1174-5.4*

The "sawtooth" pattern in Figure 5.4 is caused by the SRB, assumed to be offered in the fourth, eighth, and twelfth years of service. Retention is lower in years in which the SRB is offered, as the service member must decide whether to take the SRB and stay for another term or leave. Retention increases in the years in which an SRB is in effect, because the service member must repay the SRB if he or she leaves before the term of service is concluded.

Figure 5.4 shows a decline in year-to-year retention of up to 5 percent in the absence of incentive pays in the mid-career phase, given the assumed civilian wage of 140 percent of average.

Figures 5.5 and 5.6 show analogous results for 18X RPA pilots. In both figures, incentive pays affect retention, although the effect for 18X RPA pilots is smaller than the effect for SOs. Figure 5.6, showing the change in year-to-year retention, does not show the sawtooth pattern seen for enlisted SOs, because officers do not receive SRBs. Cutting incentive pays for 18X RPA pilots results in a decline of up to 4 percent in year-to-year retention in steady state, provided the wage offered in

Figure 5.5
Effect of Incentive Pays on 18X RPA Pilot Retention (assuming civilian wage is 140 percent of average)

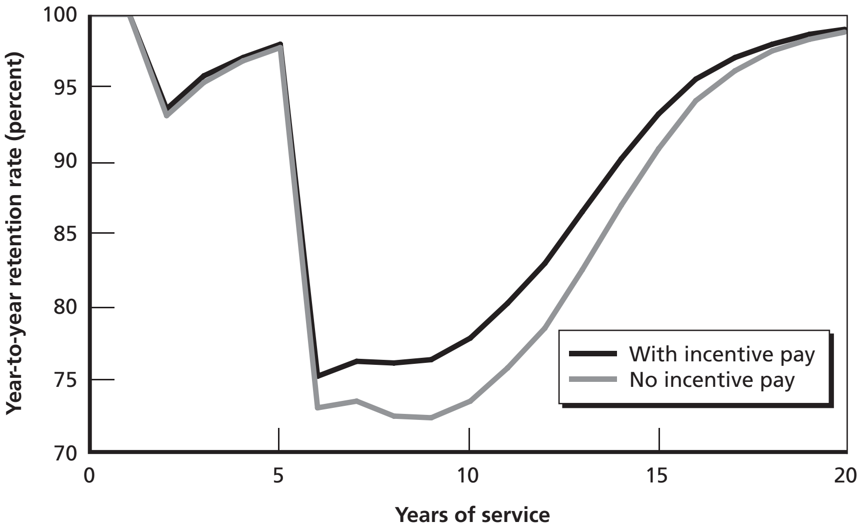


RAND *MG1174-5.5*

the civilian labor market is 140 percent of the average wage available to non-rated Air Force officers.

Tables 5.1 and 5.2 show the decline in steady-state, year-to-year retention if incentive pay is eliminated for SOs and 18X RPA pilots under different assumed civilian wages. In the range of civilian wage offers to SOs reported by RPA industry representatives, the decline in year-to-year retention tops out at 4 to 7 percent. In the range reported for RPA pilots, the decline in year-to-year retention tops out at 3 to 5 percent. The effect of declines in year-to-year retention accumulates over time; thus, for both 18X RPA pilots and SOs, cutting incentive pays will result in a significant decline in retention, as shown in Figures 5.1 and 5.2.

Figure 5.6
Effect of Incentive Pays on 18X RPA Pilot Year-to-Year Retention (assuming civilian wage is 140 percent of average)



RAND *MG1174-5.6*

The Effect of Incentive Pays on Personnel Cost

Different retention profiles have different cost implications. Lower retention rates mean that more people leave, and thus more people have to be recruited and trained to fill losses. With higher retention rates, training costs are lower, but the more senior force that results costs more because of higher compensation and retirement pay.

To assess the effect of incentive pays, we calculated the costs of different retention profiles using data on the following items:

- Regular Military Compensation (RMC)
- Retirement cost (normal cost percentage × basic pay)
- AVIP or CEVIP
- Training cost for SOs and 18X RPA pilots by weapon system (MQ-1 and MQ-9).[2]

2 Recall that RQ-4 costs were not included in this analysis.

Table 5.1
Year-to-Year Decline in Retention of SOs if Incentive Pays Are Eliminated

	Civilian Wage Relative to Average (percent)										
YOS	100	110	120	130	140	150	160	170	180	190	200
1	1	2	2	2	2	2	2	2	2	2	2
2	1	1	1	2	2	1	1	1	1	1	1
3	2	3	4	4	4	4	3	3	2	2	2
4	2	2	3	4	4	4	4	3	3	3	2
5	1	2	3	4	4	4	4	4	4	3	3
6	1	1	2	3	4	4	4	4	4	3	3
7	1	1	2	2	3	3	3	3	3	3	3
8	1	2	3	4	5	6	6	5	5	4	4
9	1	1	2	3	4	5	6	6	6	5	5
10	0	1	1	2	3	4	4	4	5	5	4
11	0	1	1	1	2	2	3	3	3	3	3
12	1	2	3	4	5	6	6	6	6	5	5
13	1	1	2	3	4	5	6	6	6	6	5
14	0	1	1	2	2	3	4	5	5	5	5
15	0	0	1	1	1	2	3	3	3	3	3
16	1	1	2	3	4	5	6	7	7	7	6
17	1	1	1	2	3	3	4	5	6	6	7
18	0	1	1	1	1	2	2	3	4	4	5
19	0	0	0	1	1	1	1	1	2	2	2
20	0	0	0	0	0	0	0	0	0	0	1

Table 5.2
Year-to-Year Decline in Retention of 18X RPA Pilots if Incentive Pays Are Eliminated

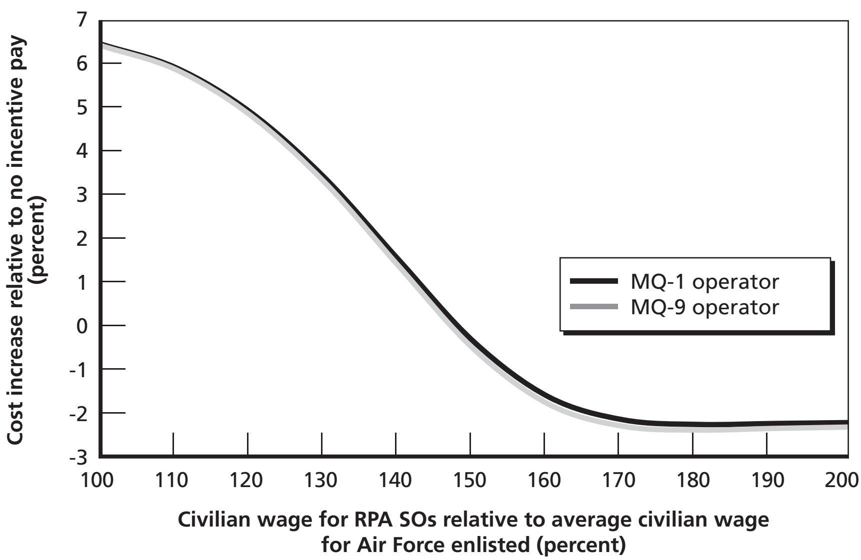
	Civilian Wage Relative to Average (percent)										
YOS	**100**	**110**	**120**	**130**	**140**	**150**	**160**	**170**	**180**	**190**	**200**
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	1	1	1	1	1	1	1	1
3	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	3	3	3	2	2	2	2	2	1	1	1
7	3	3	3	3	3	2	2	2	2	2	2
8	3	3	4	4	4	3	3	3	3	3	2
9	3	3	4	4	4	4	3	3	3	3	2
10	2	3	4	4	4	4	4	3	3	3	3
11	2	3	3	4	4	5	4	4	3	3	3
12	2	2	3	4	4	5	5	5	4	4	3
13	1	2	2	3	4	5	5	5	5	4	4
14	1	1	2	2	3	4	5	5	5	5	5
15	1	1	1	2	2	3	4	4	5	5	5
16	0	1	1	1	2	2	3	3	4	4	5
17	0	0	1	1	1	1	1	2	2	2	3
18	0	0	0	0	1	1	1	1	1	1	1
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0

We summed the individual costs over the entire force profile and divided by the number of fully trained personnel to determine a per-capita cost. We then divided the per-capita cost with incentive pays by the per-capita cost without incentive pays to determine the cost increase per trained person of either CEVIP or AVIP relative to no incentive pay.

Cost Savings with Retention Pay for Enlisted Personnel

Figure 5.7 shows the relative cost of incentive pays as a function of civilian wage, holding the number of fully trained SOs constant. If the market wage for SOs is sufficiently high, using incentive pays can result in cost savings. The basic intuition underlying our findings is simple: It sometimes makes sense (from a purely economic point of view) for the Air Force to offer incentive pays to keep an SO in the service, because incentive pays cost less than training a new operator. Thus, it is preferable to offer the incentive pays, as long as other considerations (e.g.,

Figure 5.7
Cost Savings from SO Incentive Pays as a Function of Civilian Wages



RAND *MG1174-5.7*

fairness, equitability, unit cohesion) do not dominate. For example, if it costs $60,000 to train a new SO, and the Air Force can keep the present SO for $40,000, the Air Force should give serious consideration to paying the incentive.[3]

The cost of training and retaining SOs will depend on the military compensation offered and also on the civilian opportunities available to them. Higher military compensation will lead to higher retention, and better-paying civilian opportunities will result in lower retention. If civilian compensation is sufficiently high, RPA incentive pay will result in cost savings, because it has a lower overall cost per fully trained person-year.

In our analysis, we varied military compensation by the amount of RPA incentive pay and varied civilian pay as a percentage of the average pay available to Air Force enlisted personnel in the civilian labor market. We calculated the cost per fully trained person-year, both with and without incentive pays. As shown in Figure 5.7, as the wages in the civilian market place increase, the attraction to leave becomes greater. The breakeven point—that is, the point at which retention pay starts saving money by retaining those who would leave without it—is reached when the civilian wage available to SOs is 147 percent of the average typically available to Air Force enlisted personnel in the civilian labor market. At 170 percent, cost savings (shown as a negative cost increase) reach 2.3 percent, and 170 percent is very close to the midpoint of the salary range reported by industry representatives for RPA SOs.

The training costs we are using may slightly overestimate or underestimate the true training cost. With this in mind, we conducted some sensitivity analyses for our results. Figure 5.8 shows how cost savings are affected by different training costs. For a broad range of training costs, cost savings result if the civilian wage available to SOs is sufficiently high. Thus our general finding is robust to possible errors in training-cost accounting.

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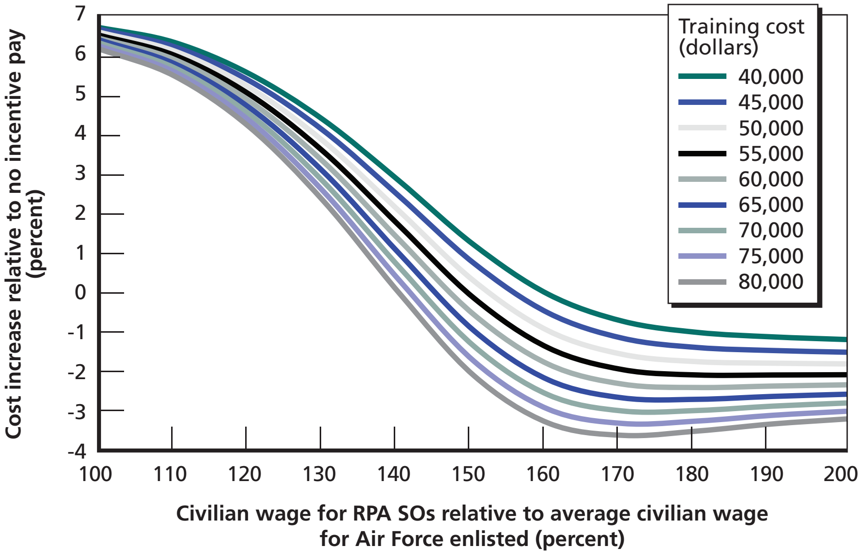
3 This analysis implicitly assumes what is called the Stable Unit Treatment Value Assumption in the econometric-treatment effects literature, i.e., whether you give the incentive to 18X RPA pilots or SOs does not affect others, such as 11U pilots. Since giving different types and amounts of incentive pays to different individuals is common practice in the U.S. military, this is a reasonable assumption for this analysis.

Figure 5.8
Cost Savings from SO Incentive Pays, by Training-Cost Level

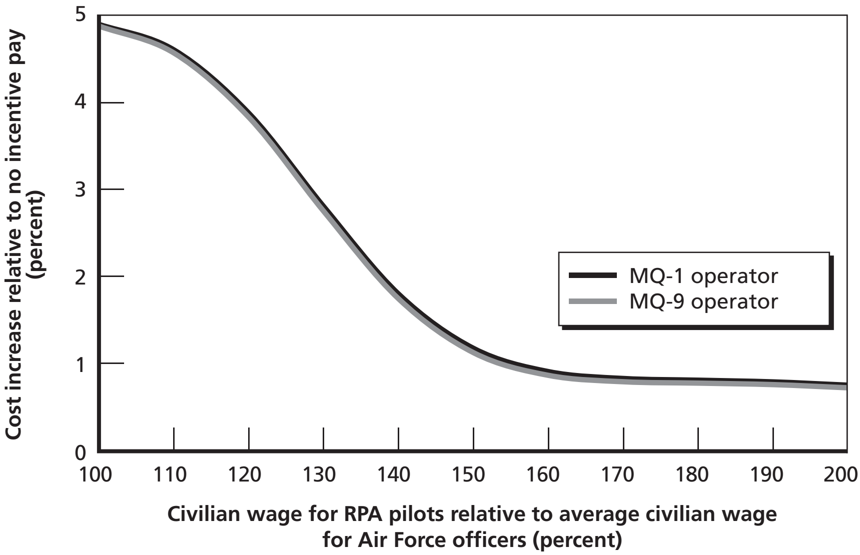


RAND *MG1174-5.8*

Results of Incentive Pays for Officers

In contrast to the results for SOs, incentive pays would probably result in an increase in cost per fully trained 18X RPA pilot (Figures 5.9 and 5.10), for two reasons: (1) officer pay is substantially higher than enlisted pay, and (2) AVIP is substantially higher than CEVIP. These two factors, combined with training costs close to those of enlisted personnel, result in a cost increase compared to the baseline cost with no incentive. This does not mean that giving incentive pays to officers is inherently inefficient, however; it may be well worth paying the 1- to 4-percent premium (over the likely range of civilian wages) to fulfill other requirements, such as maintaining a desired force profile or ensuring an adequate pool of officers with RPA experience for senior leadership positions.

Figure 5.9
Cost Savings from 18X RPA Pilot Incentive Pays as a Function of Civilian Wages

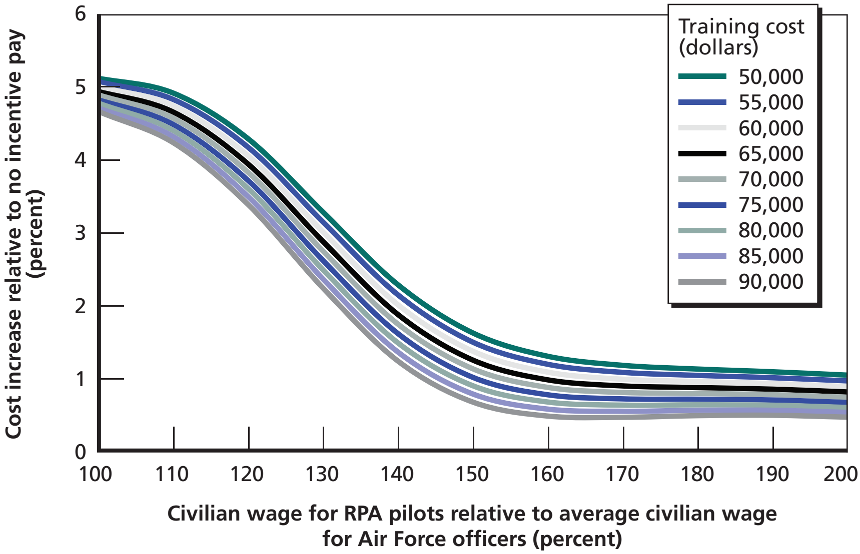


RAND *MG1174-5.9*

Concluding Observations

In this chapter, we have shown that not providing incentive pays results in a significant decline in the cumulative retention of 18X RPA pilots and SOs. We have also shown that if training costs or civilian wages available to airmen with RPA training are sufficiently high, CEVIP results in steady-state cost savings for SOs. While there are no cost savings in steady state, the cost premium associated with offering AVIP to 18X RPA pilots is small over the likely range of wages available to them in the civilian labor market.

Figure 5.10
Cost Savings from 18X RPA Pilot Incentive Pays, by Training-Cost Level



RAND *MG1174-5.10*

CHAPTER SIX

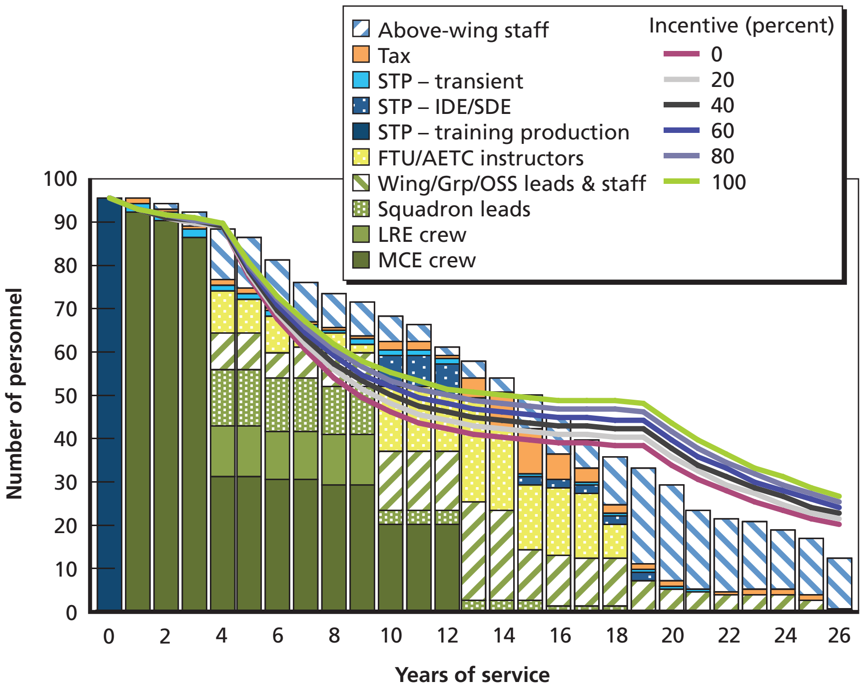
The Impact of Retention on Career-Field Manpower Requirements

Manpower requirements of the normalized career field drive long-term retention requirements. In this chapter, we compare the retention rates estimated with the DRM (i.e., the potential career-field supply) with the civilian opportunities described in Chapter Four and the manpower requirements described in Chapter Three. From this comparison, we identify the levels of incentive pays that are most likely to meet the career-field manning demands.

18X RPA Pilot Retention and Career-Field Demands

Figure 6.1 shows the 18X RPA pilot manpower plan described in Chapter Three, assuming an annual training production of 95 personnel. The vertical bars show the members of the career field distributed among assignments over 26 years. The curves superimposed over the bars show the predicted retention rates for levels of incentives ranging from 0 percent (i.e., no incentive) to 100 percent of the current RPA incentive pay, assuming that the civilian wage opportunities for former Air Force RPA pilots are no better than the average wage potential of other Air Force officers. If the civilian wage opportunities are no different from those of other officers, reducing or eliminating the 18X RPA pilot incentive pays has only marginal impact on the ability to meet requirements.

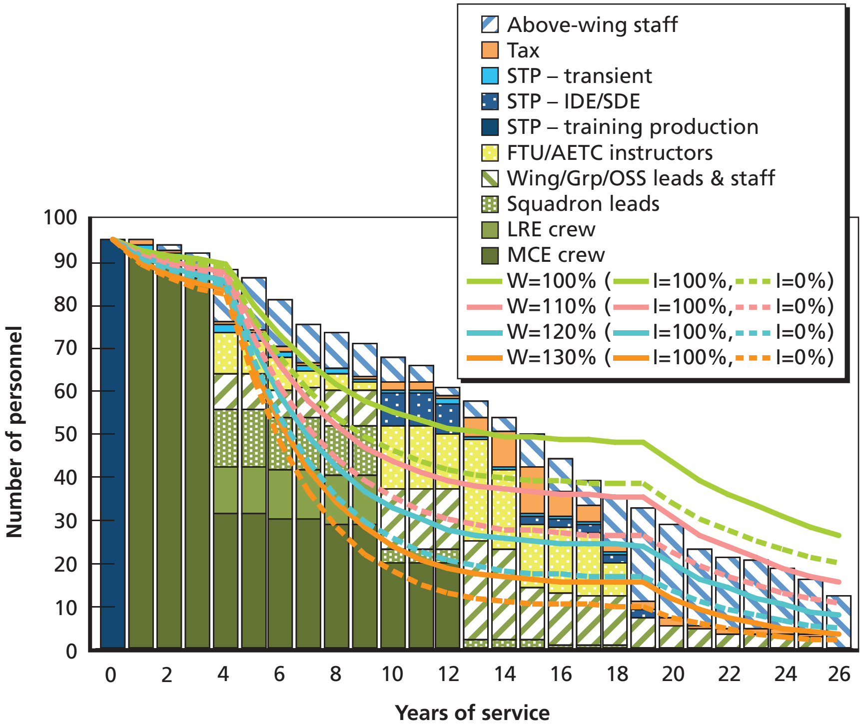
Figure 6.1
18X RPA Pilot Retention with Different Incentive Levels (annual training production assumed to be 95)



RAND *MG1174-6.1*

However, when civilian wage opportunities for RPA pilots are higher than those for other officers, the conclusions regarding incentive pays differ. Figure 6.2 shows the predicted retention lines for increasing levels of civilian wage potential, given either 100 percent of the current incentive pays (solid lines) or no incentive pay (dashed lines). When civilian wage opportunities are 110 percent of those of other officers or higher, the career field may not retain enough personnel to meet the current planned manning requirements without incentive pays. Moreover, even with the current incentive pays, retention will fall short of the planned manning requirement, suggesting that the output of the training base will need to be increased from our original estimate of 95. Table 6.1 shows the estimated MQ-1/MQ-9 FTU production that

Figure 6.2
18X RPA Pilot Retention, by Civilian Wage Opportunities (annual training production assumed to be 95)



NOTE: W is the civilian wage premium where 100 percent, for example, equates to the average civilian wage opportunities for officers, I is the level of incentive pays where 100 percent indicates the full current incentive pays, and 0 percent indicates no incentive pays.
RAND *MG1174-6.2*

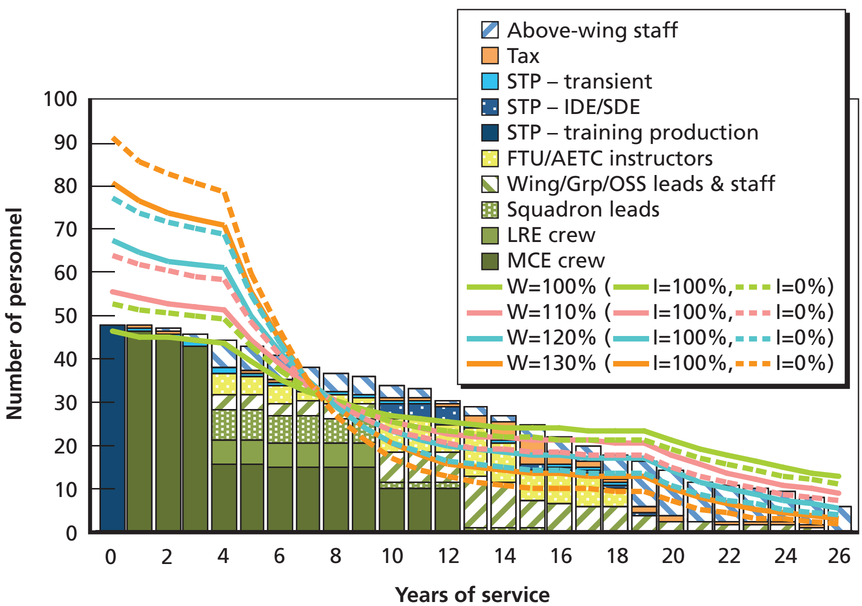
would be required to fill all of the manning requirements, given various levels of civilian wage opportunities and incentive pays.

Figure 6.3 shows the same retention profiles; however, it assumes the FTU production numbers from Table 6.1. For example, if the civilian wage premium is 130 percent and the incentive is 0 percent, the output of the training base would need to double to meet the planned manning requirements.

Table 6.1
18X RPA Pilot MQ-1/9 FTU Training Production Minimums, Using Projected Retention Estimates

	Percentage of Current Incentive					
Civilian Wages (percentage of average officer wage)	0	20	40	60	80	100
100	106	103	100	98	95	93
110	128	125	121	118	115	111
120	154	150	146	142	138	135
130	182	178	174	170	165	161
140	208	204	201	197	193	189
150	231	228	225	221	218	214

Figure 6.3
18X RPA Pilot Training Production Needed to Meet Requirements, by Civilian Wage Opportunities

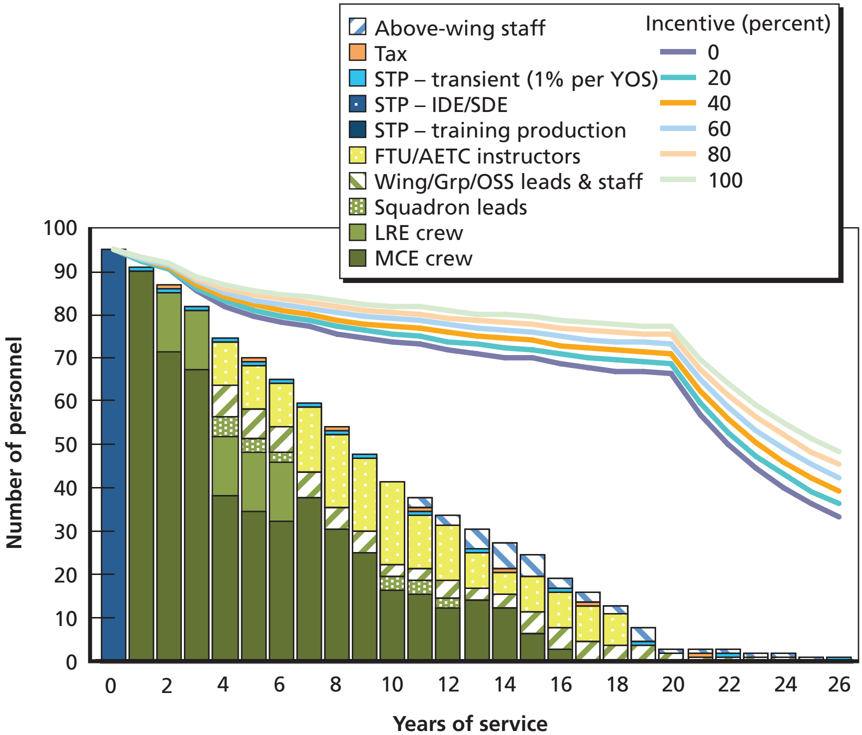


NOTE: W is the civilian wage premium where 100 percent, for example, equates to the average civilian wage opportunities for officers, I is the level of incentive pays where 100 percent indicates the full current incentive pays and 0 percent indicates no incentive pays.
RAND *MG1174-6.3*

SO Retention and Career-Field Demands

Figure 6.4 shows the SO manpower plan described in Chapter Three, along with the predicted retention rates for levels of incentives ranging from 0 percent (i.e., no incentive) to 100 percent of the current RPA incentive pay, assuming that the civilian wage opportunities for Air Force SOs are no better than the average wage potential of other Air Force enlisted personnel. If the civilian wage opportunities do not differ from those of other enlisted personnel, reducing or eliminating the SO incentive has no impact on the ability to meet requirements. In

Figure 6.4
SO Retention with Different Incentive Levels (annual training production assumed to be 95)

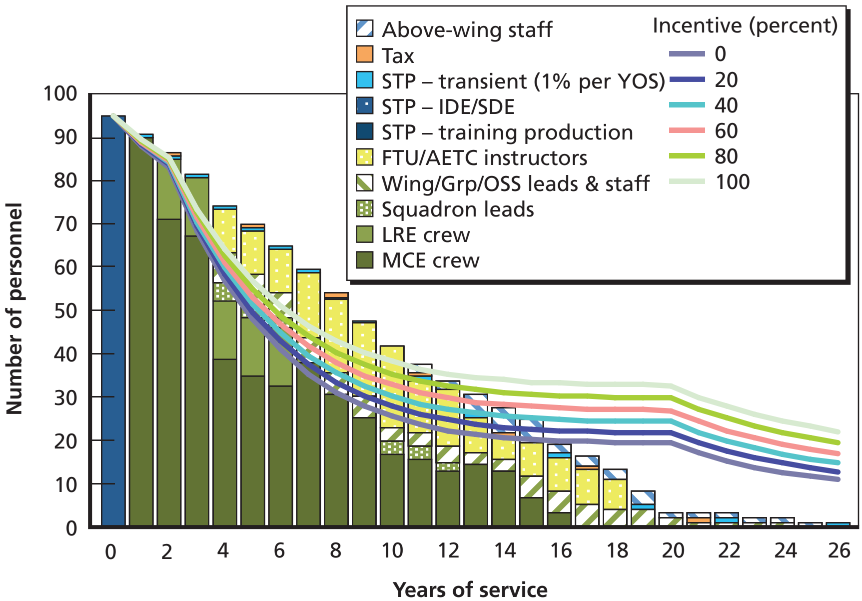


RAND *MG1174-6.4*

fact, the predicted retention rates suggest that the number of personnel retained will far exceed the demand. The difference between the predicted retention of SOs and that of 18X RPA pilots is due entirely to the reenlistment bonuses currently in place for the SOs at various points in their career.

Figure 6.5 shows the retention rates that would be expected without those bonuses. If bonuses and incentive pays are removed, some manpower demands would not be met. The MCE and LRE crew and staff and leadership positions could be filled, but above-wing-staff and tax positions would not be filled, nor would many instructor positions.[1]

Figure 6.5
SO Retention with Different Incentive Levels and No Reenlistment Bonuses (annual training production assumed to be 95)

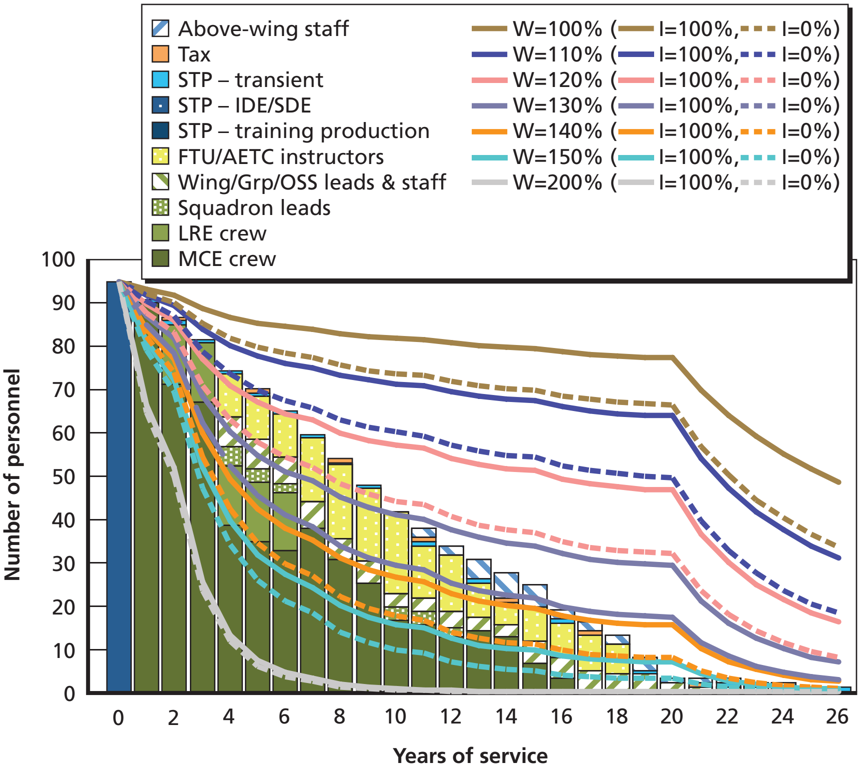


RAND *MG1174-6.5*

[1] With no incentives, a total of 887 personnel are retained. As shown in Table 3.1, 994 are needed to fulfill the planned SO career-field requirement, resulting in a shortfall of 107 people. Excluding above-wing-staff positions, STP, and special duty tax positions (a total of 55), 942 people are needed to fill the remaining requirements (52 more than are available).

If civilian wage opportunities for SOs are higher than those of other enlisted personnel, the conclusions regarding the need for incentive pays change dramatically, even when the enlistment bonuses are in place. Figure 6.6 shows the predicted retention for increasing levels of civilian wage potential, given 100 percent of the current incentive pays (solid lines) or no incentive pay (dashed lines), assuming that the current reenlistment bonuses are in place. When civilian wage opportuni-

Figure 6.6
SO Retention Estimates, by Civilian Wage Opportunities (annual training production assumed to be 95)

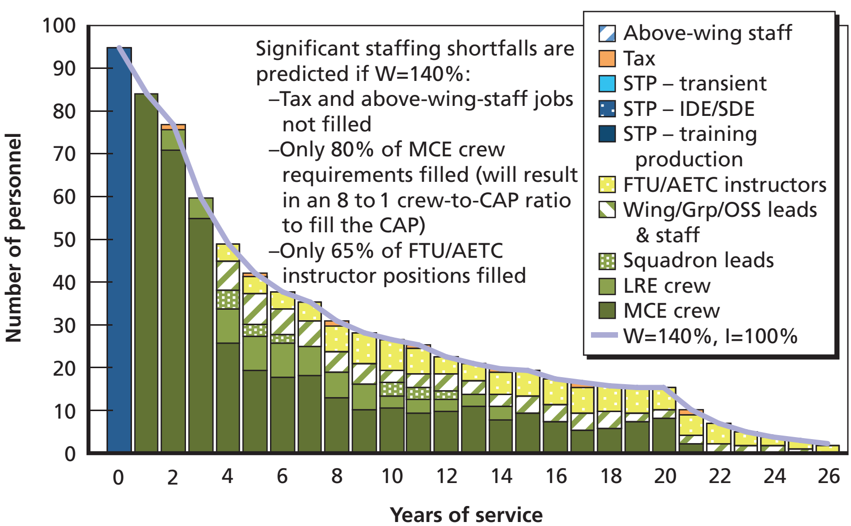


NOTE: W is the civilian wage premium where 100 percent, for example, equates to the average civilian wage opportunities for officers, I is the level of incentive pays where 100 percent indicates the full current incentive pays and 0 percent indicates no incentive pays.
RAND *MG1174-6.6*

ties are 130 percent of those of other enlisted personnel, the career field may not retain enough personnel to meet the current planned manning requirements without incentive pays. At 140 percent of the enlisted civilian wage potential, retention will fall short of the planned requirement even with the current incentive pays and reenlistment bonuses.

Figure 6.7 shows the career-field profile when civilian wage opportunities are 140 percent of the average civilian wage potential and 100 percent of the current RPA incentive pays. Significant manpower shortages would be expected, including an inability to meet the MCE requirements at a 10:1 ratio, having only 65 percent of the needed instructors, and having no staff to fill above-wing or other tax positions.

Figure 6.7
Effect on SO Career-Field Manning When Civilian Wage Is 140 Percent of Average



NOTE: W = 140% indicates 140 percent of the average civilian wage opportunities for officers, I = 100% indicates the full current incentive pays.

RAND *MG1174-6.7*

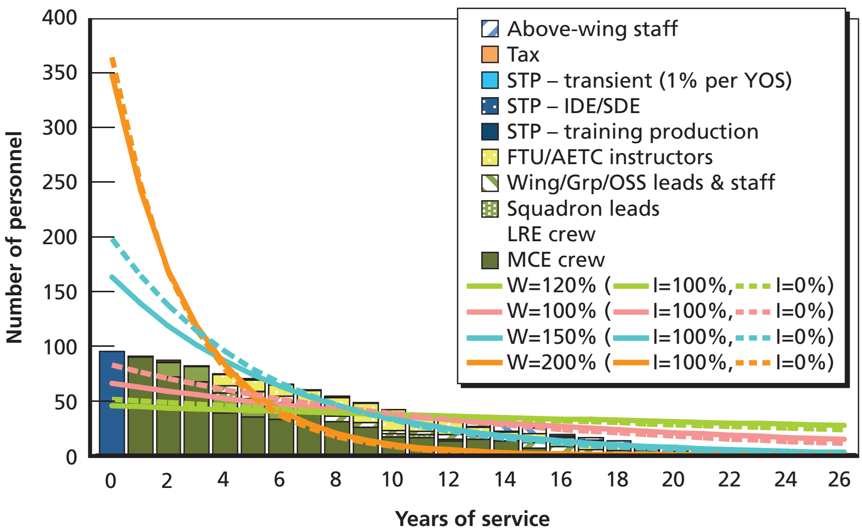
This suggests that the number of SOs produced in training may need to be drastically increased from our original planned estimate of 95. Table 6.2 shows the estimated FTU production that would be required to fill all of the career-field manning requirements, given various levels of civilian wage opportunities and incentive pays (assuming the current reenlistment bonuses).

Figure 6.8 shows the same retention profiles as in the previous figures; however, it assumes the FTU production numbers from Table 6.2. For example, with a 150-percent wage premium and no incentives, training production must more than double.

Table 6.2
SO FTU Training-Production Minimums, Using Projected Retention Estimates

	Percentage of Current Incentive					
Civilian Wages (percentage of average officer wage)	0	20	40	60	80	100
100	51	49	48	47	46	45
110	63	60	58	56	54	53
120	82	78	75	72	68	66
130	113	107	102	97	92	87
140	153	146	139	133	126	120
150	198	191	184	177	170	163
160	241	235	229	222	216	209
170	278	273	268	263	258	252
180	310	306	302	298	293	289
190	338	335	331	328	324	320
200	364	361	358	355	352	348

Figure 6.8
SO Training Production Needed to Meet Requirements with Different Civilian Wage Opportunities



NOTE: W is the civilian wage premium where 100 percent, for example, equates to the average civilian wage opportunities for officers, I is the level of incentive pays where 100 percent indicates the full current incentive pays and 0 percent indicates no incentive pays.
RAND *MG1174-6.8*

Civilian Wage Potential

Because the civilian wage potential has a significant effect on retention rates, it is vital to understand the wage potential of 18X RPA pilots and SOs. In Chapter Four, we reported the annual salary ranges described by representatives of civilian employers. Here, we compare those salary ranges with the average salary potential of any officer or enlisted person leaving the Air Force.

To estimate the average civilian wage opportunities of officers and enlisted personnel, we used a three-year moving average of weekly wages for full-time workers reported in the March 2008, 2009, and 2010 Current Population Surveys (adjusted for inflation using the

Consumer Price Index for All Urban Consumers).[2] For officers, we assumed a wage opportunity comparable to that of men 32 to 36 years of age in professional/technical occupations with four or more years of college. In 2009 dollars, that demographic group earned an average of $1,669.38 per week, or $86,808 per year. For enlisted personnel, we assumed a wage opportunity comparable to that of men 27 to 31 years of age in professional/technical occupations who have completed some college. In 2009 dollars, that demographic group earned an average of $880.99 per week, or $45,811 per year.

Comparing these average wage estimates with the medians of the ranges of the salary figures shown in Table 6.3, we find that deployed RPA-pilot jobs on the low end pay 150 percent of the average wages expected for officers in general. The median high end of the state-side jobs for RPA pilots is also higher than the average wage potential

Table 6.3
Comparison of Civilian Pilot and SO Salaries with Average Civilian Wages

	Civilian Salary Ranges (dollars/year)				Pay Relative to the Average Civilian Wage Potential of All Officers or Enlisted (percent)			
	Lowest Figure Provided	Highest Figure Provided	Low-End Median	High-End Median	Lowest Figure Provided	Highest Figure Provided	Low-End Median	High-End Median
RPA pilot jobs (deployed)	60,000	225,000	130,000	194,000	69	259	150	223
RPA pilot jobs (stateside)	50,000	125,000	63,500	110,000	58	144	73	127
SO jobs (deployed)	83,000	185,000	—	—	181	404	—	—
SO jobs (stateside)	58,000	95,000	—	—	127	207	—	—

NOTE: Average annual civilian wage potential for officers is estimated to be $86,808. Average annual civilian wage potential for enlisted is estimated to be $45,811.

2 A full-time worker is defined as one who worked more than 35 average hours per week and more than 35 weeks. See U.S. Department of Labor, Bureau of Labor Statistics, undated.

of officers (120 percent), although the low-end median of 73 percent suggests that stateside wage opportunities may not differ much from those of other officers. Findings for SO wages are more striking. Only two organizations reported having SO positions, so we did not compute a median salary range; however, even the lowest figure provided was 127 percent of the average civilian wage. This suggests that regardless of whether the jobs are stateside or deployed, wages for SOs are significantly higher than the average potential wage for all enlisted personnel.

Since a civilian wage potential of 110 percent of average officer salaries for 18X RPA pilots and 140 percent for SOs would result in a staffing shortage, these estimates suggest that it would be advisable to continue the full incentive pays for both career fields and the bonus pays for SOs. For SOs, a large increase in the programmed training production may also be needed.

CHAPTER SEVEN

Recommendations

The primary aim of the study reported in this monograph was to evaluate the effectiveness of RPA incentive pays. To do so, we collected information on current and future civilian career opportunities, training costs and training pipelines, and RPA career-field demands. We then used civilian compensation data and projections and varied incentive pays as inputs to the DRM to determine the most cost-effective incentive pays for RPA operators and to predict retention rates under different civilian job market conditions. Finally, we examined the potential effect of various incentive pays on the ability to meet career-field manning requirements.

Our analyses showed that it is more cost effective to retain SOs using the current incentive pays than to train new personnel if civilian wages for SOs are 147 percent or higher than the average available to Air Force enlisted members. While providing the current incentive pays to 18X RPA pilots is more costly overall than training new personnel, the cost increment is modest over the likely range of civilian wages available to RPA pilots. In addition, if the 18X RPA pilot civilian wage potential is around 110 percent or higher than that of all officers, or if the SO civilian wage potential is around 140 percent or higher than that of all enlisted, there is a potential for significant manning shortages. On the basis of these findings, we make the following four recommendations.

Recommendation 1: Retain incentive pays for the 18X RPA pilot and SO career fields, at least until more information on the normalized career fields is available.

The current estimates for civilian wage potential suggest that civilian RPA pilot positions (requiring deployment) pay much higher salaries than the typical civilian salaries officers could expect. The pays for SOs are even higher relative to the average enlisted pay in the civilian market. Combined with predicted low retention rates if even modest civilian wage premiums are available, this suggests that incentive pays are needed. In the case of the SOs, continuing the reenlistment bonuses would also be justified.

These findings are predicated on *estimated* retention based on historical data for typical non-rated Air Force officer and enlisted personnel, in the absence of historical RPA retention information.[1] When data on actual behavior of RPA personnel become available, conclusions and recommendations might differ. Until then, we recommend continuing the incentive pays.

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[1] Rather than assuming that RPA personnel retention behavior would follow that of rated officers, we used a model fit to the observed historical behavior of non-rated personnel. We did this for several reasons: First, the lack of historical information on RPA retention means that we cannot fit the model to RPA. Second, most rated officer personnel have service obligations that are substantially longer than those of RPA pilots, with the exception of CSOs and ABMs. Restricting the sample to CSOs and ABMs would substantially reduce the sample size, making the model more difficult to estimate with precision; in addition, a retention model that correctly accounts for ACIP for particular cohorts would be required (see Mattock and Arkes, 2007). In addition, estimates for the parameters of the taste and shock distributions for mission support officers reported in Mattock and Arkes are substantially similar to those reported for non-rated officers (Asch et al., 2008; Mattock, Hosek, and Asch, forthcoming). Third, using a retention model fit to historical data on rated personnel would mean that we are assuming that the retention behavior of RPA personnel would be similar to that of rated personnel and that RPA personnel have civilian opportunities similar to those of rated personnel. This might be interpreted as assuming the conclusion of the analysis, i.e., assuming RPA personnel behave like rated personnel, they should be compensated like rated personnel. In the absence of historical data on RPA retention behavior and civilian compensation, it seems more reasonable to proceed from the assumption that RPA are more similar to non-rated personnel and to use a model based on that assumption.

Recommendation 2: Reevaluate the training production ramp-up and continue to rely on 11U pilots.

Ramped-up training production in the near term could have a negative effect on opportunities for the initial 18X RPA pilot cohorts to complete second tours in the MCE crew force. But if retention is poor, training-pipeline production would need to be increased to maintain enough personnel to meet operations, training, staff, and leadership requirements. To reconcile the discrepancy, we suggest placing greater emphasis on retaining the initial cohorts to ease the transition to a normalized career field.

To balance the need for filling MCE crew positions quickly and building a healthy and sustainable career field, we suggest retaining the incentive pays and considering a tempered ramp-up with a training production goal at a rate that would fill the MCE crew requirements for 18X RPA pilots by FY 2016 and for SOs by FY 2013. Traditional pilots (with the 11U AFSC designation) could continue to fill MCE crew gaps as the 18X RPA pilots ramp up, with a target end date of 2016. The original ramp-up numbers are compared with our more-tempered numbers in Table 3.2.

Recommendation 3: Study attracting and selecting candidates for the 18X RPA pilot career field.

Air Force personnel must volunteer for rated positions, and all rated jobs have always received the same rated incentive pays. Thus, incentive pay has not been a factor in decisions about which rated position to select when volunteering. Instead, other factors such as interests, prestige, responsibility, civilian career opportunities, danger, and other types of compensation such as bonus pays drive career choices. That could change if RPA positions are not given the same incentive pay as other rated careers. Although we think recruiting is another important consideration in deciding compensation policies, we did not investigate how the incentive pays might affect the quality or quantity of RPA volunteers, for two reasons. First, the short time frame for the completion of this study prohibited collecting data from potential RPA volunteers. Second, full 18X RPA pilot recruiting is set to begin in the 2011/2012 school year. As a result, there are no data on the success of attracting

18X volunteers under regular conditions. Further, because the career field is new, some may be attracted to it or deterred from volunteering simply because there is so much uncertainty about its future. For this reason, even data from the first few years might yield different recruiting estimates than would be obtained after some of the newness has worn off.

Nevertheless, we think that analyzing the effect of incentives and other compensation policies on the Air Force's ability to attract the required number of high-quality candidates would be worthwhile. We therefore recommend investigating data on recruiting success in a few years when at least a few cohorts' worth of data on RPA personnel are available and collecting new data on potential applicants' (e.g., ROTC cadets who are at the point of making career-field choices) reasons for or against volunteering for the RPA career field, along with their final decisions and qualifications for the position.

Recommendation 4: Revisit the issue of RPA incentive pays in three to eight years.

Much of the planning in the two new career fields is still under way, and many aspects remain uncertain. The number of personnel lost to training attrition, difficulties in recruiting, and even the length, content, and costs associated with training are likely to change in the next few years as the Air Force learns more about the career-field requirements and as personnel are selected and developed under more normalized conditions.

In addition, the civilian UAS market is only in its infancy, and the magnitude of the UAS industry is hard to anticipate. At present the FAA will not permit unconstrained RPA operations in commercial airspace, so commercial applications such as remotely piloted cargo planes are still in development. If and when the FAA reverses that decision, RPA commercial applications could grow rapidly. Other countries (including the United Arab Emirates) are beginning to enter the UAS market, however, so the international job market may grow rapidly as well. Because of the many uncertainties in both the U.S. and international markets, the civilian pay estimates and the number of job openings we present in this monograph, while based on the best information available at the present time, could change significantly as the Air Force career fields and civilian markets mature.

For this reason, we strongly advise the Air Force to reexamine the issues of RPA career-field retention, incentive pays, and other RPA compensation policies after at least a few years of normalized data on the career field are available. Until then, we recommend continuing incentive pays for both career fields and retaining the SO bonuses, because failure to retain enough personnel would cause serious staffing problems. Additional information regarding the civilian market could be collected as early as three to five years from now to determine whether the wage potential has changed, and we suggest that as soon as the Air Force has historical data on actual RPA career-field retention, retention predictions be reexamined. Given the minimum six-year commitment of RPA personnel, waiting until after the first few cohorts (i.e., graduating classes) of 18X RPA pilots and SOs have completed their commitment would be reasonable. For SOs, that would be as soon as FY 2016, and for 18X RPA pilots, whose first full production class is being recruited in the 2011/2012 school year, that would be as far off as FY 2018.

APPENDIX A

Additional Details on the FTU Instructor Requirement

Air Force SMEs told us that to accommodate their currently planned ramp-up numbers, they need 153 active-duty FTU instructors. They were, however, unwilling to provide us with a separate, reduced estimate for sustainment after the career field was normalized, because of uncertainty about the number of personnel they will need to train in the future. They cited the following reasons for continuing to need many instructors:

- Active-duty instructors will be used to train Air Force Reserve and Air National Guard personnel in addition to active-duty personnel. The 95 personnel we estimated to be in training annually will be only active-duty personnel. Because additional Reserve and Guard members will also be in the training pipeline, more instructors will be needed. Accounting for the three Reserve and 11 Guard CAPs (14 plus the 51 active-duty CAPs constitute the total force plan of 65 CAPs), at least 120 new Air Force members will be in the training pipeline annually.
- Air Force leadership has indicated that the MQ-1/MQ-9 CAP requirement may increase beyond the current 65 at some point in the future. Exactly when and by how much is unknown, but the Air Force needs to plan to accommodate the increase, and additional instructors will be needed.
- About 5 percent of the instructor positions will be dedicated to leadership overhead (managing the other instructors). This leaves about 145 instructor positions dedicated to actual instruction.

- If retention is poor, more than 95 personnel will need to be trained—in some retention scenarios, two or three times as many trainees will be needed (see Tables 6.1 and 6.2 in Chapter Six).
- Many personnel will return to the FTU after completing a first tour to retrain on a different RPA type (e.g., those trained in MQ-1s will likely return and retrain on MQ-9s later in their careers).
- The final RQ-4 CAP requirement has yet to be established; however, it is certain to add MQ-1/MQ-9 CAPs, rather than replace any of the current 65.
- The other services may turn to the Air Force to provide training for some of their personnel. This, too, would increase the need for instructors.
- Some foreign governments may also send military personnel to be trained by the Air Force.

Given the above possibilities, at least 120 active-duty, Guard, and Reserve trainees would be needed annually to staff the current 65 CAPS, but as many as 200 to 300 might be needed if civilian job opportunities were to cause problems with retention. Adding in the other possible increases in trainees (e.g., retraining personnel prior to their second tour, training other service and foreign military personnel), the number that might be trained in the FTUs annually could more than double in the future, conceivably exceeding 400 students annually.

Given the very real possibility that the number of students in FTU annually could be well into the hundreds, our SMEs were reluctant to establish anything other than a ramp-up figure until they better understand the FTU demands that may exist in a few years. Their perspective is that it is better to plan for too many instructors than to end up having too few. Having too few would have dire consequences, whereas excess personnel could be easily redirected to above-wing-staff positions or special duty assignments (in which there is always a need for more rated personnel). Planning to sustain 153 instructors ensures that these possibilities could be accommodated, if necessary.

APPENDIX B

Interview Questions for Representatives of Civilian Organizations

1. In what markets does your organization provide UAS products or services (e.g., U.S. military defense)?
    - Is your organization planning to expand into other markets in the future? If yes, which ones?
2. What kinds of UAV/RPA employment opportunities does your organization offer?
    - What qualifications or experiences do individuals need (e.g., bachelor's degree) for the different jobs?
    - How many individuals does your organization currently employ who fit into these different job categories?
3. In your organization, how many employment opportunities currently exist for people with UAV/RPA operational experience?
    - How do these numbers break out by type of position?
4. What types of compensation could job candidates expect for these different types of jobs? (NOTE: I am trying to gauge ranges of salaries and benefits, not pinpoint what specific job openings your organization offers.)

APPENDIX C

The Dynamic Retention Model

The DRM is an econometric model of officer and enlisted behavior. It models service members as being rational and forward-looking, taking into account both their own preference for military service and uncertainty about future events that may cause them to value military service more or less, relative to civilian life. At each decision point in an active-duty career, the individual compares the value of leaving the military with the value of staying, taking into account that the decision to stay can be revisited at a later time.

The Behavioral Model Underlying the DRM

The behavioral model underlying the DRM is conceptually very simple. During each period of active service, the individual compares the value of staying in the AC with leaving and bases his or her decision on which alternative has the maximum value. Once an individual leaves the active service during each year, he or she compares the value of participating in the Reserves to the value of leading a purely civilian life and chooses the alternative that yields the maximum value.

Although this model is relatively simple, the implications can be intricate, since an individual can choose to revisit the decision to stay in the AC or participate in RC service at a later date, and that decision will depend on his or her unique circumstances at a given point in time. Those circumstances include relative preference for AC or RC service to a purely civilian life and random events that may affect relative preferences over AC, civilian, and RC alternatives.

In the model, the value of staying depends upon the individual's preference for active military service (or "taste" for active service, which is assumed to be constant over time), the compensation received for active service, and a period- and individual-specific environmental disturbance term (or "shock") that can either positively or negatively affect the value placed on active service in that period. For example, an unusually good assignment would increase one's relative preference for active service, while having an ailing family member who requires assistance with home care may decrease the value placed on active service. The value of staying also includes the value of the option to leave at a later date, that is, the individual knows that he or she can revisit the decision to stay the next time it is possible to make a retention decision.

We make the simplifying assumption that once individuals have left active service, they do not reenter the AC. While there are instances where people do reenter the AC, the vast majority of those who leave do not reenter. (However, active reentrants have recently played an important role in filling pilot slots in the Air Force, so we would like to expand the model to address this possibility in the future.)

An individual who leaves the AC can choose to either be a civilian or combine civilian life with Reserve service. A person can join the RC immediately after leaving active service or can choose to join at a later date. Once a person enters the RC, he or she is free to choose to stay or to leave with the option of reentering at a later date, military regulations permitting.

At the beginning of each year, RC members compare the value of the civilian alternative—that is, leading a purely civilian life for that year—with the value of the Reserve alternative—that is, a first or additional year of Reserve service—and chooses the alternative that yields the maximum value.

The value of the civilian alternative includes the civilian wage, the AC or RC military retirement benefit the individual is entitled to receive (if any), an individual- and period-specific shock term that can either positively or negatively affect preference for the civilian alternative, and the future option to enter (or reenter) the RC, military regulations permitting.

The value of Reserve service includes the civilian wage, the Reserve compensation to which the individual is entitled, given his or her cumulative AC and RC service, an individual- and period-specific shock term that can either positively or negatively affect the preference for the Reserve alternative, and the future option to either continue in the RC or return to a purely civilian life.

Technical Details[1]

In each time period, the active service member compares the value of staying in the AC with the value of leaving and joining the RC or entering civilian life. We use a nested logit approach to capture this decision, where the active service member is modeled as comparing active service to a civilian/Reserve nest.

Active service has the value

$$V_a + \varepsilon_a \quad ,$$

where V_a is the non-stochastic portion of the value of the active alternative, and ε_a is the environmental disturbance (shock) term specific to the active alternative, assumed to be extreme-value distributed.

The civilian/Reserve nest has the value

$$\max\left[V_r + \omega_r, V_c + \omega_c\right] + \upsilon_{rc} \quad ,$$

where V_r is the non-stochastic portion of the value of the Reserve alternative, and V_c is the non-stochastic portion of the value of the civilian alternative; ω_r and ω_c are the shock terms specific to the Reserve and civilian alternatives, respectively, and υ_{rc} is the civilian/Reserve nest-specific shock.

The mathematical symbols for non-stochastic values and shock terms are summarized in Table C.1.

[1] The equations for the behavioral model are presented in this section. Readers primarily interested in policy implications may wish to skip to the next section.

Table C.1
Mathematical Symbols for Non-Stochastic Values and Shock Terms

Symbol	Meaning
V_a	Non-stochastic value of the AC alternative
V_r	Non-stochastic value of the RC alternative
V_c	Non-stochastic value of the civilian alternative
ε_a	Active alternative specific shock term, $\varepsilon_a \sim EV\ 0,\sqrt{\lambda^2+\tau^2}$
ω_r	Reserve alternative specific shock term, $\omega_r \sim EV\left[0,\lambda\right]$
ω_c	Civilian alternative specific shock term, $\omega_c \sim EV\left[0,\lambda\right]$
ϑ_{rc}	Civilian/Reserve nest-specific shock term, $\upsilon_{rc} \sim EV\left[0,\tau\right]$

The value of staying in the AC is the sum of the individual's taste for active service, γ_a; active military compensation, W_a; and the discounted value of the expected value of the maximum of the AC, civilian, and RC alternatives in the following period. Note that to calculate wages, eligibility for retirement benefits, and so on, we need to keep track of time spent in the AC, time in the RC, and time overall. Thus we have three time indexes that are each incremented appropriately to reflect the result of the choice in the following period. For example, if an individual chooses to move from the AC to the RC, both the time in the RC and the "total" time will be incremented:

$$
\begin{aligned}
V_r\left(t_{active},t_{reserve},t_{total}\right)=\gamma_r+W_c\left(t_{total}\right)+W_r\left(t_{active},t_{reserve}\right)\\
+\beta E[\max[V_a\left(t_{active}+1,t_{reserve},t_{total}+1\right)+\varepsilon_a\ ,\\
\max[V_t\left(t_{active},t_{reserve}+1,t_{total}+1\right)+\omega_r\ ,\\
V_c\left(t_{active},t_{reserve},t_{total}+1\right)+\omega_c\ ]+\upsilon_{rc}\ ]]\ .
\end{aligned}
$$

The value of the RC alternative is the sum of the individual's taste for Reserve service, γ_r; Reserve military compensation, W_r; civilian compensation, W_c; and the discounted value of the expected value of the maximum of the civilian and Reserve alternatives in the following period:

$$V_r\left(t_{active},t_{reserve}t_{total}\right)=\gamma_r+W_c\left(t_{total}\right)+W_r\left(t_{active},t_{reserve}\right)$$
$$+\beta E[V_r(t_{active},t_{reserve}+1,t_{total}+1)+\omega_r\ ,$$
$$V_c(t_{active},t_{reserve},t_{total}+1)+\omega_c]+\upsilon_{rc}]\,.$$

Finally, the value of the civilian alternative is the sum of civilian compensation, W_c; any active or Reserve military retirement benefit the individual is eligible for, R; and the discounted value of the expected value of the maximum of the civilian and Reserve alternatives in the following period:

$$V_c(t_{active},t_{reserve},t_{total})=W_c(t_{total})+R(t_{active},t_{reserve},t_{total})$$
$$+\beta E[\max[V_r(t_{active},t_{reserve}+1,t_{total}+1)+\omega_r\ ,$$
$$V_c(t_{active},t_{reserve},t_{total}+1)+\omega_c+\upsilon_{rc}]\,.$$

The mathematical symbols for taste and compensation are summarized in Table C.2.

Table C.2
Mathematical Symbols for Taste and Compensation

Symbol	Meaning
γ_a	Taste for active service relative to civilian alternative $\{\gamma_a,\gamma_r\}\sim N[M,\Sigma]$
γ_r	Taste for Reserve service relative to civilian alternative $\{\gamma_a,\gamma_r\}\sim N[M,\Sigma]$
W_a	Active compensation (RMC)
W_c	Civilian compensation
W_r	Reserve compensation
β	Discount term
R	Military retirement benefit

We also assume that individuals' tastes for active and Reserve service are bivariate normally distributed. Given these distributional assumptions, we can derive choice probabilities for each alternative and write an appropriate likelihood equation to estimate the parameters of the model (the parameters of the probability distribution for the shock terms, the population distribution of taste for active and Reserve service, and the discount factor). These derivations are documented in Asch et al. (2008). The data and estimation procedure used to generate the parameter estimates in the simulations of this study are documented in Mattock, Hosek, and Asch (forthcoming).

Data

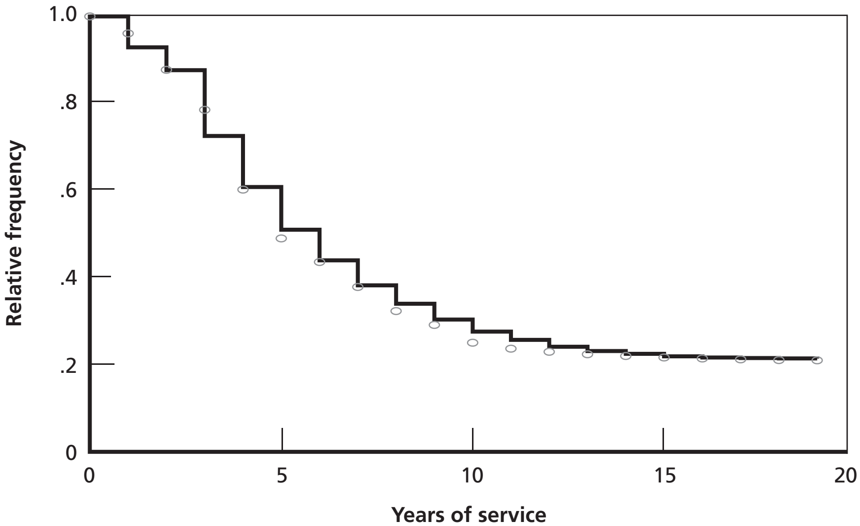
The model was estimated using individual-level data on officer and enlisted careers for the 1990-1991 cohort, derived from Work Experience files provided by the Defense Manpower Data Center. The data included a complete record of active and Reserve service from 1990 to 2010. Data on RMC and Basic Pay were drawn from the OSD "Green Book" on compensation, and OSD provided data on Reserve compensation.

Personnel cost data used to compare alternatives in the simulations were based on RMC, and retirement costs were computed using the normal cost percentage specified by the Department of Defense Actuary. The normal cost percentage specifies a fixed per-person percentage of basic pay that is applied toward retirement costs.

Model Fit

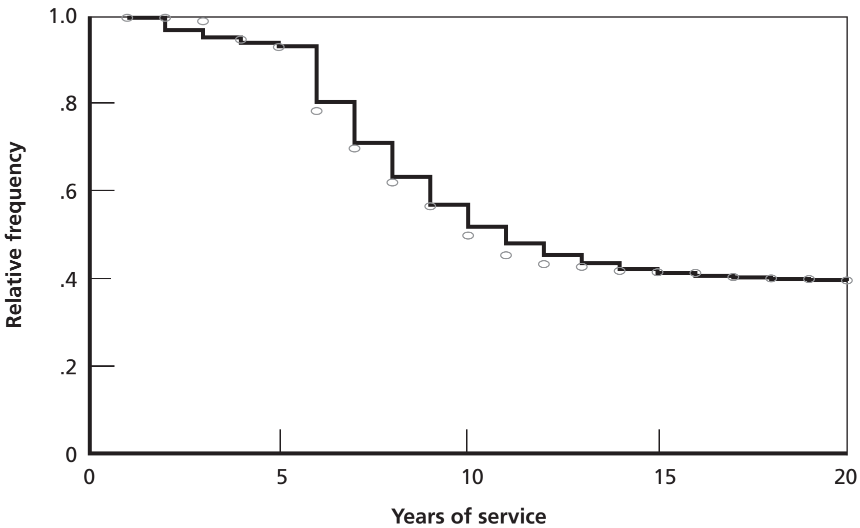
Figures C.1 and C.2 show the model fit for Air Force enlisted personnel and non-rated officers, respectively. The circles in each figure show the population average retention at each year of service, and the lines show the model prediction. In both cases, the model fits the data well.

Figure C.1
Model Fit for Air Force Enlisted Personnel



RAND *MG1174-C.1*

Figure C.2
Model Fit for Air Force Non-Rated Officers



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