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THESIS

**IMPROVING THE EFFICIENCY OF AVIATION
RETENTION BONUSES THROUGH THE USE OF
MARKET MECHANISMS**

by

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June 2014

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THROUGH THE USE OF MARKET MECHANISMS**

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

Aviation Career Continuation Pay (ACCP), the retention bonus for Naval Aviators, has historically failed to meet stated retention goals. For fiscal year 2013 Naval Personnel Command reported that ACCP exceeded retention goals in some communities by more than 60%, while simultaneously falling over 60% short of retention objectives in others. We analyze the potential for using auction mechanisms to improve upon these results by controlling cost, quantity, and quality of aviators retained.

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We find that by implementing a uniform-price auction naval aviation can exactly meet 100% of its retention objectives, while reducing costs in some communities by more than \$2,200,000. Additionally, while we find no significant correlation between officer quality and retention costs, we demonstrate the potential for QUAD auctions to improve upon these results by further reducing retention costs and improving the overall quality of retained aviators. Lastly, our implementation of CRAMs reveals the potential to reduce individual retention costs nearly 20% through the use of non-monetary incentives.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACIP	Aviation Career Incentive Pay
ACP	Aviation Continuation Pay
ACCP	Aviation Career Continuation Pay
ACSB	aviation command screen board
AFQL	all fully qualified list
AOCP	Aviation Officer Continuation Pay
API	Aviation Preflight Indoctrination
ASN(M&RA)	Assistant Secretary of the Navy for Manpower and Reserve Affairs
AV	above-zone
CNO	Chief of Naval Operations
CNP	Chief of Naval Personnel
CNATRA	Chief of Naval Air Training
CRAM	combinatorial retention auction mechanism
DH	department head
DHSB	department head screen board
DIVO	division officer
DOD	Department of Defense
EP	early promote
FITREP	fitness report
FNAEB	Field Naval Aviation Evaluation Board
FRS	fleet replacement squadron
FY	fiscal year
HM	Helicopter Mine Countermeasures Squadron
HS	Helicopter Anti-Submarine Squadron
HSC	Helicopter Sea Combat Squadron
HSL	Helicopter Anti-Submarine Light Squadron
HSM	Helicopter Maritime Strike Squadron
IA	Individual Augmentee
IZ	in-zone
IFS	Introductory Flight Screening

MP	must promote
MSR	minimum service requirement
NAS	naval air station
NAVADMIN	naval administrative message
NFO	naval flight officer
NPC	Naval Personnel Command
NSAWC	Naval Strike and Air Warfare Center
QUAD	quality adjusted discount
PEP	pilot exchange program
PERS-43	Commander Naval Personnel Command, Aviation Officer Assignments Branch
SNA	student naval aviator
SNFO	student naval flight officer
S&I	special and incentive
T/M/S	type/model/series
TPS	test pilot school
TRACOM	Naval Air Training Command
URL	unrestricted line
USD(P&R)	Under Secretary of Defense for Personnel and Readiness
VAQ	Electronic Attack Squadron
VAW	Carrier Airborne Early Warning Squadron
VFA	Strike Fighter Squadron
VP	Patrol Squadron
VRC	Fleet Logistics Support Squadron
VQ(P)	Fleet Air Reconnaissance Squadron (EP-3E)
VQ(T)	Fleet Air Reconnaissance Squadron (E-6B)
WTI	weapons and tactics instructor
YG	year group

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I. INTRODUCTION

A. BACKGROUND

In recent years, the military has increasingly relied on the use of Special and Incentive (S&I) pays to recruit and retain personnel in specialized career paths (Under Secretary of Defense, Personnel & Readiness, 2012). The more than 60 S&I pays used by the Department of Defense are critical to ensure the military maintains the necessary quantities of qualified personnel to support the manning requirements of vital positions (Under Secretary of Defense for Personnel and Readiness (USD (P&R), 2011). A key example of these S&I pays is Aviation Officer Continuation Pay (AOCP), known in the Navy as Aviation Career Continuation Pay (ACCP). It is commonly referred to as the “Aviation Department Head Bonus.” For more than 30 years, Navy Force managers have sought, through the use of retention bonuses, to maintain a balanced supply of experienced Naval Aviators to support the mission requirements of naval aviation (USD (P&R), 2011).

The success of this program, however, has varied not just over time, but within the different naval aviation communities, wherein bonus amounts at times have proven insufficient to meet retention goals in certain communities while resulting in over-retention in others (Aviation Career Continuation Pay Program Manager (ACCP PM), personal communication, March 19, 2014).¹ At the same time, the current fiscal environment has resulted in increased scrutiny of military expenditures, specifically personnel costs, which consume an increasingly larger portion of the Department of Defense’s budget. To that end, President Obama has directed a review of military compensation in an effort to develop a flexible, efficient, and effective system capable of maintaining an appropriately sized, high-quality Force at a fiscally sustainable cost (H. R. Doc No. 113-60, 2013).

¹ This information was communicated via MS Excel spreadsheets containing ACCP performance from 2005 through 2013.

B. RESEARCH SUMMARY

Via the use of auction mechanisms, we explore how aviator retention bonuses might be improved, in terms of cost, quantity, and quality of personnel retained. Specifically, through the implementation of a survey of active duty Naval Aviators, we estimate individual servicemembers' willingness to stay in active duty naval aviation beyond their initial service obligation. Additionally, by using performance metrics identified by Naval Personnel Command (NPC), we establish quality scores for individual aviators based on his or her survey responses. This data is used to compare recent ACCP results against three distinct auction models: 1) a uniform-price auction mechanism, 2) a Quality Adjusted Discount (QUAD) auction mechanism, and 3) Combinatorial Retention Auction Mechanism (CRAM).

In modeling the effects of a uniform-price auction, we find that naval aviation can precisely meet the specific retention objectives of every community. While this results in increased spending to retain the desired number of aviators in communities that have historically under-retained, these costs are partially offset by the savings realized in eliminating the over-retention experienced in other communities. Achieving the exact retention requirements for the communities modeled results in an aggregate increase of 13.5% or \$2,950,000 over the current ACCP program. In correcting for over-retention, however, we find that the amount spent per aviator retained in support of naval aviation requirements actually decreases by 2.6%. Moreover, using two methodologies to measure aviator quality we find no significant correlation between an officer's quality and the cost to retain the officer beyond the initial service obligation.

In modeling two different QUAD auction mechanisms, we find that naval aviation planners can realize improvements in both cost and the overall quality of retained aviators. To improve the retention rates of high-quality aviators, the first model employs a discount of \$25,000 to the top 10% from each community. We find that in comparison to the uniform-price model, this mechanism also meets all retention goals while increasing the average quality of retained aviators by 3.2% and reducing Aggregate Retention costs by 3.4%. A second QUAD simulation—applying a \$50,000 discount to

the top 50% from each category—results in an average quality improvement of 15.5% above the uniform-price model at an increased cost of 3.6% in Aggregate Retention.

In modeling a CRAM, we use two non-monetary incentives (NMIs) to improve retention costs. The first model offers guaranteed duty station as an NMI. In comparison to the uniform-price model, leveraging the utility aviators receive from this NMI in excess of the Navy's cost to provide it results in a savings of more than \$4,800,000 in Aggregate Retention costs. Moreover, this model demonstrates the potential to meet all retention objectives while saving more than \$1,400,000 over the current method. The second CRAM model employs the guarantee of an in-residence graduate program as an NMI. In comparison to the uniform-price model, leveraging the utility aviators receive from this NMI in excess of the Navy's cost to provide it, results in a savings of more than \$2,800,000 in Aggregate Retention costs. This second CRAM model also meets all retention objectives and saves 1.8% in comparison to the current ACCP program.

C. ORGANIZATION OF THE STUDY

This study is organized into six chapters. Chapter II provides background information on naval aviation career progression, as well as performance evaluation and advancement procedures. Additionally, Chapter II details the origins and current implementation of naval aviation retention bonuses. Chapter III discusses the fundamental principles of auction theory and the application to the issue of Naval Aviator retention. Chapter IV explains the specific auction mechanisms used in our research. Chapter V describes the retention survey used to solicit data from Naval Aviators and the metrics used to develop quality scores. In Chapter V, we also detail the sample statistics and the relationship between quality score and reservation price. In Chapter VI, we provide the methodology and results for the auction mechanisms used in our research. Chapter VII summarizes the findings of the previous chapter and we provide recommendations for future study.

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II. BACKGROUND

In this chapter, we discuss the aspects relevant to understanding the nature and intent of the aviator retention bonus program. Section A details the typical aviation officer's career path, as well as the skills and experience expected to be developed as the individual advances in the profession. To better understand how these factors are used to determine what makes a "high-quality" aviator, we also explain the process by which Naval Aviators are selected for both promotion and assignment to key positions in the aviation community.

In section B of this chapter, we summarize the history and evolution of aviator retention bonuses. Additionally, the current system is explained in detail, highlighting several aspects that might be improved using a market-based mechanism. These key parameters include the costs incurred by retaining aviators above Navy requirements (Table 7) and the costs associated with retaining aviators who fail to serve in the capacity for which they were retained (Table 10).

A. NAVAL AVIATOR CAREER PROGRESSION AND EVALUATION

Substantial time and resources are required to develop, standardize, and maintain the skills needed in naval aviation. To more efficiently use these resources and ensure the maximum return on the Navy's investment, the naval aviation community has instituted a relatively rigid career path for aviation officers. The first 12 years can be categorized into five stages: flight training, first sea tour, first shore tour, second sea tour, and department head tour.

From the onset of their aviation careers, Naval Aviators are continuously evaluated and ranked against their peers. Those deemed to be top performers are eligible for career milestone opportunities. Attainment of those milestones is often a *de facto* if not a *de jure* requirement for continued advancement in the aviation community. (See Appendix A for a diagram depicting the typical aviation career path and milestones.)

1. Career Progression and Milestones

This section details the typical career progression for Naval Aviators along with the milestones they are expected to complete as they advance in their careers.

a. *Flight Training*

All Naval Aviators undergo some form of flight training. While it varies in duration and in the specifics taught, flight training can be divided into two general categories: Under graduate flight training and the training completed at Fleet Replacement Squadrons.

(1) Undergraduate Flight Training. All flight training received prior to official designation as a naval pilot or NFO is categorized as undergraduate flight training. This initial training for prospective pilots and NFOs, termed Student Naval Aviators (SNAs) and Student Naval Flight Officers (SNFOs), respectively, falls under the cognizance of the Chief of Naval Air Training (CNATRA), who oversees the five wings and 17 squadrons that make up Naval Air Training Command (TRACOM). Each year, more than 1,500 pilots and NFOs from the Navy, Marine Corps, Coast Guard and various foreign nations complete CNATRA's flight training curriculum (CNATRA, n.d.b).

Flight training for all prospective aviators begins with Introductory Flight Screening (IFS). Designed to reduce attrition rates at more advanced stages of training, IFS attempts to identify prospective Naval Aviators who lack the required "determination, motivation, or aeronautical adaptability" while improving the performance of officers without previous aeronautical experience (CNATRA, p. 4). Once enrolled in IFS, student aviators are given 50 days in which they must first pass the FAA Private Pilot Airplane Airman Test with a minimum score of 80. They then receive up to 15 hours of flight training in which to qualify for and complete a solo flight. Failing to meet either of these requirements will result in the prospective aviator being considered for elimination from naval aviation training. Officers who already possess at least a recreational pilot certificate are exempted from the IFS program (CNATRA, 2012, March 19).

Following IFS, all prospective aviators report to NAS Pensacola for Aviation Preflight Indoctrination (API). Another screening tool, API is a six-week course of instruction that evaluates prospective aviators on fundamental aviation concepts such as aerodynamics, weather, and navigation. Student aviators unable to maintain the minimum academic requirements are considered for redesignation or administrative separation (Naval Aviation Schools Command, 2013).

After successfully completing API, SNAs and SNFOs are separated into distinct training pipelines (i.e., curriculums). These both begin with “primary” flight training (approximately 22 weeks in length for SNAs and half of that for SNFOs). Here, student aviators are instructed in basic flight maneuvers, precision aerobatics, instrument navigation, and formation flight. Upon completing primary, the graduating cohorts are ranked according to their undergraduate flight training performances to date. Then, in accordance with their ranking, they are allowed to “select” individual follow-on pipeline from the quotas available at the time. The type and quantity of quotas are established by projected requirements for the naval aviation community. Some of these pipelines are particular to a single aviation community (e.g., VQ(T) pilot and VP NFO pipelines); others have additional “selection” points where students again compete for quotas leading to a specific aviation community (e.g., the SNA and SNFO Strike pipelines; these later split into VFA and VAQ specific curriculums). (See Appendix B for a diagram depicting flight training progression.)

Once a SNA or SNFO selects a specific community, there is a general commitment to serve in that community for the remainder of one’s Active Duty aviation career.² Table 1 lists the communities and associated Type, Model, and Series (T/M/S) aircraft from which SNAs and SNFOs may select. Depending on the community, SNAs typically complete undergraduate flight training in 18 to 24 months after receiving commission. SNFOs have shorter training pipelines and complete roughly 12 to 18 months after commissioning. It is upon successfully completing this undergraduate flight

² Inter-community transfers are handled internal to PERS-43. As a general policy, PERS-43 does not accept transfers from aviators beyond the First Sea Tour. In FY-2014, only two of the seven transfer requests received were approved.

training that SNAs and SNFOs are “winged”—that is, officially designated as Naval Aviators or Naval Flight Officers.

Community	Formal Name	T/M/S Aircraft
HM	Helicopter Mine Countermeasures	MH-53E
HS/HSC	Helicopter Anti-Submarine/ Helicopter Sea Combat	SH-60F/HH-60H/ MH-60S
HSL/HSM	Helicopter Anti-Submarine Light/ Helicopter Maritime Strike	SH-60B/ MH-60R
VAQ	Electronic Attack	EA-6B/EA-18G
VAW	Carrier Airborne Early Warning	E-2C,D
VFA	Strike Fighter	FA-18C,E,F
VP	Patrol	P-3C/P-8A
VRC	Fleet Logistics Support	C-2
VQ(P)	Fleet Air Reconnaissance	EP-3E
VQ(T)	Fleet Air Reconnaissance	E-6B

Table 1. Active Duty Naval Aviation Communities and Aircraft
(after U.S. Navy, n.d.)

(2) Fleet Replacement Squadron. Despite having earned their wings, newly designated aviators must still undergo training before reporting to an operational squadron. This training is completed at community-specific Fleet Replacement Squadrons (FRSs). Here, aviators learn to employ the T/M/S aircraft they will fly in the fleet. Notable exceptions to this are SNFOs in the VAW, VP, VQ(P), and VQ(T) communities. While these aviators are still considered to be in the undergraduate phase of training, they are transferred out of the TRACOM pipeline and are winged while at their respective FRS. Here again, time to progress through the FRS varies by community, with some aviators completing in as little as six months and others taking over a year. (See Appendix B for a diagram depicting flight training progression.)

b. *Initial Active Duty Service Obligation*

Upon receiving their “wings,” pilots and NFOs incur the Minimum Service Requirement (MSR) associated with completing flight training. This period of obligated service is mandated under Title 10 U.S.C. § 653 (2014), which states, “The minimum

service requirement for all pilots trained to fly fixed-wing jet aircraft shall be eight years ... The minimum service requirement for all other pilots and NFOs shall be six years.” In 2003, the Navy increased the MSR for all pilots to eight years (ACCP PM, personal communication, 2014, January 13).³

Aviators begin serving this commitment from the day they are winged. Based on the timing associated with the current aviation career path, NFOs typically complete their MSR at the end of their First Shore Tour. Because of the additional two-year commitment pilots incur, they are normally obligated to complete a Second Sea Tour before being eligible to separate from the naval service.

c. ***First Sea Tour***

Upon successfully completing the FRS, all Naval Aviators report to a fleet squadron. Depending on a number of factors including community, designation, and training delays, aviators arrive at their first shore tour roughly 18 to 36 months after beginning flight training. Typically 36 months in length, this tour is primarily for young aviators to accumulate experience and attain the tactical qualifications commensurate with their positions (NPC, n.d.b). As this is considered a first Division Officer (DIVO) tour, junior aviators are assigned increasingly significant squadron ground jobs (i.e., primary and collateral duties) as they progress. In addition to their performance in the aircraft, junior aviators are assessed on their ability to effectively manage these ground jobs.

d. ***First Shore Tour***

After completing the First Sea Tour, the aviator normally receives 33-month orders to a First Shore Tour. Unlike their previous assignments, several career options are available to aviators. “The Naval Aviation Community, however, prioritizes production billets. These billets are defined as any flying job which contributes to the support and manning of the Naval Aviation Community. Priority is given to filling these billets first” (Chief of Naval Personnel (CNP), 2013 May 13, para. 4). Given the desirability of these

³ This information was communicated via an internal report on the FY 2013 ACCP program.

limited, production billets to naval aviation and individual aviators, candidates requesting such assignments are screened to ensure the best-qualified aviators are selected. Production billets include instructor duty at an FRS or TACRON squadron; duty at a Test and Evaluation squadron; and Weapons and Tactics Instructor (WTI) positions. Fundamental to these positions is the potential for aviators to 1) contribute to the naval aviation community, 2) further their own experience and skills, and 3) compete against a large peer group (NPC, n.d.b).

Other career options include non-production flying billets, such as Pilot Exchange Program (PEP) tours, or duty at a Search and Rescue Unit. Among non-flying billets, aviators may elect to pursue advanced degrees via the Naval Postgraduate School or some other scholarly program. They may also be nominated to fill various staff positions. Additionally, aviators may serve as company officers at the U.S. Naval Academy or NROTC units (NPC, n.d.b). Because these positions lack at least one of the key facets of production billets, they “can have adverse long-term career implications in future selection boards” (CNP, 2013 May 13, para. 6).

e. ***Second Sea Tour***

Following a First Shore Tour, aviators are generally assigned 24-month orders to a “Second Sea Tour,” also termed a “Disassociated Sea Tour.” Here again, the range of assignments is quite broad, and previous performance plays a large part in determining what options are available to a particular aviator. Aviators are expected to broaden their experience base and earn whatever additional qualifications are available to them (e.g., Officer of the Deck or Tactical Action Officer qualifications). Unlike previous tours, however, and because certain skills may not have been retained or acquired during a previous assignment (specifically, Weapons and Tactics Instructor qualifications), some options may not be available to those who have otherwise demonstrated exceptional performance in their previous assignment (NPC, 2013 July).

As before, those positions that enable aviators to add to their professional development, compete in large summary groups, and contribute back to the naval aviation Community are perceived as the most valued (NPC, n.d.b). Some of the more valued positions include flying duty as a community representative on a Carrier Air Wing

staff or as a squadron Training Officer. Other viable career-advancing opportunities include non-flying staff assignments, as well as aviation-related positions aboard an aircraft carrier or a large-deck amphibious ship. Also available are additional flying opportunities such as a “Super JO”⁴ tour with either an active duty or reserve squadron, or a PEP tour.

f. ***Department Head Tour***

All aviators selected for Operational DH will be assigned 30-month orders back to a fleet squadron following their Second Sea Tour. Those not current in the employment of their community’s aircraft will first proceed to the FRS to complete a modified training syllabus before reporting to their DH Tour.

Unlike the First Sea Tour, where aviators are ranked primarily by the qualifications earned and demonstrated proficiency in the aircraft, every DH is expected to be fully qualified and skilled in the judicious employment of his or her aviation platform. The success, then, of an aviator’s DH tour is measured in large part by the individual’s performance of assigned ground jobs. Specifically, these positions are Squadron Maintenance Officer and Operations Officer. These positions are deemed considerably more vital to both the day-to-day and long-term success of the squadron than any position that might have been held during the First Sea Tour. The duration and performance as either Maintenance Officer or Operations Officer is a primary discriminator in an aviator’s selection for command and subsequent advancement (CNP, 2013 May).

2. Performance Evaluation and Advancement

a. ***Performance Evaluation***

Navy Fitness Reports (FITREPS) are recognized as the best method for documenting and rewarding an aviator’s performance (NPC, 2013, May). Using periodic FITREPS, a reporting senior (typically the Commanding Officer) evaluates and ranks the

⁴ This is a junior officer who returns to an aviation squadron to serve in the same capacity as an aviator in the First Sea Tour.

aviators within each “summary group” (i.e., all the Unrestricted Line (URL) officers of the same pay grade under the cognizance of that reporting senior) according to the metrics relevant to that particular group. These officers are ranked numerically and divided into promotion recommendation categories. Sixty percent of Lieutenant (O-3) summary groups may receive recommendations of Early Promote (EP) or Must Promote (MP), with the higher-ranking EP being reserved for no more than the top 20%. For Lieutenant Commander (O-4) summary groups, 20% may still receive EP recommendations, but the EP/MP recommendations cannot exceed 50% of the group. The remaining officers in these pay grades generally receive recommendations of “Promotable” (some significant issue notwithstanding) (CNP, 2011).

Nearing the end of their tour, aviators will receive a “high-water” FITREP—that is, the final FITREP an aviator will receive during that tour in which the individual will be competitively ranked against one’s peers. The results of this FITREP, in effect, summarize the officer’s performance throughout his or her tour and standing relative to peers. In large part, this FITREP determines what options will be available to an aviator when selecting the next set of orders, with the highest-ranked aviators generally receiving the greatest consideration for billets deemed desirable by the naval aviation community (NPC, 2013, May).

b. ***Statutory Boards (O-4 and O-5)***

Officers are typically selected for promotion to the rank of Lieutenant (Junior Grade) (O-2) and Lieutenant (O-3) via an All Fully Qualified List (AFQL). This process screens all officers who will have completed the statutory 24 months in their current pay grade during the next fiscal year. All officers from this list who have received a FITREP advancement recommendation of at least “Promotable” will be selected for promotion. Barring objection from their commanding officer, these officers will automatically advance to the next pay grade upon satisfying the 24-month time-in-grade requirement (NPC, n.d.a).

Promotions to the ranks of Lieutenant Commander (O-4) and Commander (O-5) are accomplished via a statutory promotion board. These boards convene annually and consider officers within the SECNAV-directed promotion zone for that year. These zones

generally align with an officer's eighth and fourteenth years of commissioned service. Officers failing to select for the next pay grade are again considered for promotion the following year. Officers twice failing to select for Lieutenant Commander are subject to involuntary separation from the Active Duty naval service in accordance with Title 10 U.S.C. § 653. Officers twice failing to select for promotion to Commander are generally selected for continuation if they are within six years of being eligible for retirement. They will, however, no longer be considered for promotion (Secretary of the Navy, 2006).

During statutory promotion boards, aviators compete alongside the other URL communities (i.e., Surface Warfare, Submarine Warfare, Naval Special Warfare, and Explosive Ordnance Disposal) for promotion recommendations. The rate at which eligible officers may be selected for promotion is determined by the Active Duty Naval Officer Promotion Plan. Selection for Promotion rates for URL officers has been limited to 70% of eligible officers for both Lieutenant Commander (O-4) and Commander (O-5) during recent boards (Secretary of the Navy, 2013; Secretary of the Navy, 2014).

In addition to limits on selection rates, the promotion board is given considerable guidance on what to consider when determining what constitutes the "best and fully qualified" officers to recommend for promotion. As the SECNAV guidance explains, "the definitive measure for fitness to promotion is the proven and sustained superior performance in command or other leadership positions in difficult and challenging assignments" (Secretary of the Navy, 2014, para. 4). Because these boards are comprised of officers from various URL communities with limited knowledge regarding other communities, NPC provides additional guidance as to the desired career paths and values for the various communities. (See Appendix A for NPC guidance to boards on typical aviator career progression and Aviation Community values.)

Favorable consideration is also given to officers with skill sets and expertise mandated by current needs, but outside of an officer's operational profession. These include skills such as Financial Resource Management, Operational Analysis, and Joint Experience. Additional consideration is also given to officers who have attained relevant graduate education. This also applies to officers who have displayed superior performance in assignments that may have taken them out of their communities' normal

career progression, such as Individual Augmentee (IA) assignments (Secretary of the Navy, 2014).

c. ***Administrative Selection Boards (Department Head and Aviation Command)***

Conducted separately from statutory boards, administrative selection boards, or screen boards, are community-specific and are convened to select officers for positions in specific career milestones. For the aviation community, these are DH, Aviation Command, and Aviation Major Command.

Officers are only considered for the DH Screen Board (DHSB) one year after being selected for promotion to O-4 and are classified as In-Zone (IZ) for selection. This is considered their “first look.” Officers not selected will receive a “second look” the following year and are categorized as Above-Zone (AZ). AZ officers failing to select on their “second look” will automatically be considered for an Operational-Training DH position. This provides them with a final opportunity to continue in an aviation career path while maximizing the return on naval aviation’s investment in their training (Naval Personnel Comand, 2013).

The Aviation Command Screen Board (ACSB) follows the same basic format as the DHSB. Those eligible will be given two “looks” for selection to Aviation Command; those failing twice will be considered for selection to an Operational-Training Command. Unlike the DHSB, however, consideration for the ACSB is not dependent on an officer already having been selected for promotion. Instead, the same aviators under consideration for promotion to O-5 are considered for Aviation Command before the O-5 promotion results are released (NPC, 2014).

NPC provides additional guidance for selecting aviators via the administrative selection board precept memorandum. This additional guidance is nearly identical to the instructions SECNAV provides to statutory boards (NPC, 2012). In addition, the DHSB is provided the following additional guidance in the convening order for the board:

Naval aviation is first and foremost an aerial combat force, and values the attainment of warfare qualifications and leadership both in the air and on

the ground ... As aviation officers progress in their career, these qualifications should be documented in their official record.

The ultimate measure of success within the aviation community is sustained performance in operational environments. Operational career milestones give every aviation officer the opportunity to develop a pattern of sustained superior performance within an officer's warfare specialty. We continue to highly value the war fighting excellence required for our Operational Department Heads to excel in combat. (Naval Personnel Comand, 2013, para. 4)

Table 2 depicts the selection rates for the FY-2013 ADHSB. In alignment with the selection board precepts, those aviators receiving EPs during the First Sea Tour selected at a rate 22.2% above their peers who only received an MP. Additionally, those aviators who received a WTI qualification demonstrated the highest selection rate at 18% above the mean (NPC, 2013, May).

FY-13 ADHSB	ELIGIBLE AVIATORS	SELECTED AVIATORS	SELECTION RATE
TOTAL	447	320	71.6%
FIRST SEA TOUR			
EP	405	298	73.6%
MP	37	19	51.4%
FIRST SHORE TOUR			
FRS	166	134	80.7%
TRACON	95	60	63.2%
OTHER	186	126	67.7%
OTHER FACTORS			
WTI	106	95	89.6%
GSA / IA	61	40	65.6%
OVERSEAS	120	83	69.2%
FLAG AIDE	23	17	73.9%
Aircraft / Warfare Transition	30	18	60.0%
AMPHIB/CVN/CSG TOUR	147	95	64.6%
1 Competitive EP	91	51	56.0%
2 Competitive EP	194	128	66.0%
3 Competitive EP	159	141	88.7%
0 Competitive EP	3	0	0.0%

Table 2. FY-2013 ADHSB Selection Rates (after NPC, 2013, May)

The guidance the ACSB uses for selecting the “best and fully-qualified” officers is similar to that provided to the ADHSB:

Naval aviation is first and foremost an aerial combat force, and values the attainment of warfare qualifications and leadership both in the air and on the ground. The Naval Aviation Enterprise continues to value the war fighting ability and tactical excellence required for Operational Commanders to excel in combat. Therefore, as an aviation officer progresses in his/her career, achievement of community-specific warfare qualifications should be documented in the officer’s official record. The ultimate measure of success within the aviation community is sustained performance in operational environments. (NPC, 2014, para 4.)

Table 3 illustrates the selection rates for the FY-2013 ACSB. We found that operational performance during an aviator’s DH tour was a key discriminator, i.e., every officer who did not receive a number-one EP during his or her DH tour failed to select for command. Among aviators with a number-one EP, those who had served at the Naval Strike And Air Warfare Center (NSAWC) had selection rates above any other identified group. We discovered that other factors that appeared to have increased selection rates were having served as a Flag Aide or attending Test Pilot School (TPS) (CNP, 2013 May).

FY-13 ACSB	ELIGIBLE AVIATORS	SELECTED AVIATORS	SELECTION RATE
TOTAL	522	135	30.2%
DH TOUR			
#1 EP	300	135	45.0%
Other	222	0	0.0%
RESULTS FOR AVIATORS WITH A #1 EP DURING DH TOUR			
FIRST SHORE TOUR			
FRS	139	67	48.2%
TRACOM	60	16	26.7%
NSAWC	14	10	71.4%
VX/NAVAIR	36	16	44.4%
PEP	3	1	33.3%
Other	48	25	52.1%
OTHER FACTORS			
JPME	243	119	49.0%
CDO/OOD/TAO	187	102	54.5%
OVERSEAS	100	36	36.0%
FLAG AIDE	49	27	55.1%
MAJOR STAFF	188	100	53.2%
JOINT	128	68	53.1%
GSA/IA	62	13	21.0%
MASTERS	199	98	49.2%
TPS	13	8	61.5%
OVERSEAS	100	36	36.0%

Table 3. FY-2013 ACSB Selection Rates (after CNP, 2013 May)

B. NAVAL AVIATION RETENTION BONUSES

1. Origin and Evolution

The concept of providing additional compensation to officers involved in flying duties traces back to the earliest days of naval aviation. The passage of the Navy Appropriation Act of 1914 authorized the Navy to provide a 35% pay increase to not more than 30 officers below the rank of Commander (O-5). They were assigned to aviation duty as “actual flyers of heavier-than-air craft.” While this original “flight pay” has evolved in intent, eligibility, and quantity, this additional monthly compensation, now

called Aviation Career Incentive Pay (ACIP), has been continuously available to Naval Aviators for nearly 100 years (USD (P&R), 2011).

Retention bonuses specifically targeted at aviators, however, are a relatively recent form of compensation. The origins of retention bonuses for Naval Aviators can be traced back to the early 1980s. Having endured aviator retention shortfalls in the 1970s, the U.S. Navy lobbied for an incentive program to provide monetary bonuses to aviators who agreed to remain in active duty service beyond their Minimum Service Requirements (MSRs). Since these retention bonus programs have been implemented, they have undergone significant modifications in response to fluctuating aviator retention rates and changes in fiscal policy (USD(P&R), 2011).

a. ***Aviation Officer Continuation Pay (FY-1981 through FY-1989)***

The authority to offer retention bonuses to Naval Aviators was first granted by the Department of Defense Authorization Act of 1981. Under this law, the Secretary of Defense was authorized to pay up to four month's salary for each year a qualified officer elected to remain in service beyond the initial service obligation, provided said officer:

- was eligible to receive ACIP;
- was below O-7 in pay grade;
- was qualified to perform “operational flying duty;”
- had completed at least six but less than 18 years of aviation service as an officer;
- was in an aviation specialty designated as “critical;”
- was under a written agreement to remain in active service for at least one year; and
- was not to surpass 19 years of aviation service while under contract.

The Navy's interpretation of this law resulted in the Aviation Officer Continuation Pay (AOCP) program. Initially made available to all Naval Aviators who had completed their MSR, AOCP offered contracts of one to four years. These bonuses

were paid as a function of base pay, with junior officers receiving greater compensation (ACCP PM, personal communication, March 19, 2014).⁵

The Uniformed Services Pay Act of 1981 restricted AOCB contracts to requests submitted by Navy officers between October 14, 1981 and September 30, 1982. Furthermore, this law excluded officers on AOCB contracts from receiving the increase in ACIP rates enacted by the same law.

AOCB was not authorized in FY-1983, but would again be implemented under the Defense Authorization Act (1984). Under this legislation, AOCB contracts were limited to pilots with at least six—but fewer than 11—years of active service, who had also completed their MSR and had not previously accepted an AOCB contract. Bonuses were offered for three-, four-, and six-year agreements, with annual payments of \$4,000 for the former and \$6,000 for the latter two. Despite the law’s expressed intention to limit the bonus to “aviation specialties where shortages actually exist,” the Navy, under the authority granted by the 1984 Appropriations Act, made AOCB contracts available to all pilots who met the service requirements and had not already accepted a retention contract (USD(P&R), 2011).

In the following fiscal year’s retention program (FY-1985), the Navy would reverse precedence and offer AOCB contracts only to pilots in communities with identified retention shortfalls. These were primarily carrier-based communities. Additionally, as a means of further increasing the retention of select aviators, a 100% up-front bonus was offered for pilots in carrier-based tactical aviation communities (ACCP PM, personal communication, March 19, 2014).⁶ The AOCB would be reenacted with no changes for Fiscal Years 1986 and 1987.

The National Defense Authorization Act for Fiscal Years 1988 and 1989 (1987) made a number of changes to AOCB. This included re-authorizing retention bonuses for NFOs and reinstating the maximum allowable payment to four months basic pay for each

⁵ This information was communicated via an internal report summarizing the history of aviation retention bonus programs.

⁶ Ibid.

year of additional service. This act also authorized six-year contracts for officers with less than eight years of active duty service. Additionally, it removed the provision that restricted officers under an AOC contract be prohibited from receiving the increased ACIP rates enacted September 30, 1981. These changes enabled the Navy to offer officers long-term contracts with annual payments of \$8,000 at key career decision points. When coupled with the increased ACIP rates, the increased bonus amounts were thought to provide a significant incentive for aviators to remain in the Navy rather than departing for the airline industry (USD(P&R), 2011).

b. *Aviation Continuation Pay (FY-1989 through FY-1999)*

Changes were instituted under the National Defense Authorization Act, Fiscal Year 1989 (1988). This revised program—re-labeled Aviation Continuation Pay (ACP)—shifted the focus of the bonus program to junior officers. ACP reduced the upper eligibility limit from 18 to 13 years of commissioned service. It also authorized annual payments of up to \$12,000 for officers with at least six years of commissioned service who agreed to remain on active duty through year 14. Bonuses were solely targeted at communities with demonstrated retention shortfalls and maximum bonus payments went only to those with the greatest shortages of aviators. The law also enacted a provision for the recoupment of funds from officers who failed to complete the service required in their contract. Although as a matter of policy, the Navy did not seek to recoup all such funds (ACCP PM, personal communication, March 19, 2014).⁷

From 1988 through 1994, the overarching structure of the ACP program remained constant. We found one aspect that did fluctuate: the eligibility of various communities and the amounts offered to them. A number of communities were eliminated from ACP eligibility altogether based on their excess retention or schedule decommissioning (ACCP PM, personal communication, March 19, 2014).⁸

Beginning with the FY-1995 program, available ACP contracts were not authorized for communities deemed “non-critical” due to large inventories of officers in

⁷ Ibid

⁸ Ibid

key Year Groups. The remaining communities, designated as “critical,” were authorized only a fixed number of contracts as determined by their DH requirements. To support this goal, an administrative ACP board was established to screen applicants and award contracts based on individual performance records and community requirements (Chief of Naval Operations (CNO), 1996). The FY-1995 program further reduced ACP eligibility to officers whose MSRMs would expire in FY-1995. By mid-year, however, insufficient applications for ACP would not achieve DH quotas. To achieve quotas, the program was expanded to include officers with MSRMs expiring in both FY-1994 and FY-1995 (ACCP PM, personal communication, March 19, 2014).⁹

In the subsequent year, the FY-1996 program again selected only aviators whose obligated service requirements ended between Fiscal Years 1993 and 1996. Financial constraints, however, would further limit eligibility, resulting in a number of communities that warranted ACP (based on established retention standards) not being authorized for the bonus. By mid-year, under increasing fiscal pressures, the entire ACP program was suspended (ACCP PM, personal communication, March 19, 2014).¹⁰

The retention bonus program was reauthorized and expanded for FY-1997. In addition to increasing the number of communities eligible for ACP, for the first time since the FY-1992 bonus eligibility was reinstated for NFOs—albeit only in specific communities. The program also standardized bonus amounts at \$12,000 per year for all eligible communities with the exception of HS and VQ(P) pilots. They were capped at \$10,000 and \$9,000, respectively (CNO, 1996).

In 1997, the National Defense Authorization Act for Fiscal Year 1998 (1997) raised ACP annual bonus amounts to their current limit of \$25,000 per year. The Navy continued to target specific aviator year groups and communities. The ACP board continued to validate ACP applications. In response to fleet perception that ACP was becoming a pre-screen for DH, however, applicants were no longer ranked according to performance, and contract availability was no longer limited to DH requirements. Still

⁹ Ibid.

¹⁰ Ibid.

under financial constraints, ACP was not offered to VQ(P) NFOs or HSL pilots despite those communities having retention rates that warranted eligibility (ACCP PM, personal communication, March 19, 2014).¹¹

Restrained by current legislation, the FY-1999 ACP program served as a transition to the proposed FY-2000 program and “marked the beginning of a new direction in naval aviation compensation policy, designed to ensure the Navy retains experienced Aviation Officers.” This was done by extending ACP eligibility to all aviators from Year Groups 1987 and junior who would have satisfied their MSR in FY-1999. These cohorts corresponded with the aviators who would soon be asked to complete either their second sea duty or DH tour. Contracts were standardized as two-year agreements with \$12,000 annual payments, regardless of the community (CNO, 1998).

c. *Aviation Career Continuation Pay (FY-2000 to Present)*

Following four years of failing to meet ACP retention goals, the Navy pursued congressional support for a retention program that was not limited to increasing the retention of aviators in communities with a demonstrated inability to meet DH requirements. The Navy argued instead for a need to focus on the larger goal of retaining the experienced aviators necessary to support the Navy's mission and maintain combat readiness (CNO, 1999). These requests were implemented in the National Defense Authorization Act for Fiscal Year 2000 (1999), which brought positive changes to the Navy's retention efforts.

The Redesignated Aviation Career Continuation Pay (ACCP) program was developed to be a sea- and performance-based incentive program aimed at convincing “high quality aviation officers to consider naval aviation as their primary career choice” (CNO, 1999, para. b).” To this end, ACCP would: authorize multiple retention contracts for officers throughout their aviation careers; reinstate eligibility for officers below the rank of O-7; and increase the recently reduced upper service eligibility limit from 14 years to 25 years of commissioned service (CNO, 1999).

¹¹ Ibid.

The Navy's FY-2000 ACCP program specifically used this authority to offer a standardized short-term (two- or three-year) contract. It stipulated paying \$15,000 per year to all eligible aviators on "due course" (i.e., following a career path that was in-line with the Naval Aviation Community's values) through the Post-Command Commander (O-5). Less than desired take-rates, however, led to a mid-year revision that offered long-term (five-year) contracts of \$25,000 per year to first-time eligible pilots and \$15,000 per year to first-time eligible NFOs. Additionally, first-time eligible aviators were authorized to request an up-front, 50% lump sum payment. This revision also extended short-term contract eligibility to Captains (O-6) with fewer than 24 years of aviation service and who served in designated command billets (ACCP PM, personal communication March 19, 2014).¹²

ACCP for FY-2001 would follow the same format as the revised FY-2000 program. One exception was made to allow for a more equitable transition from ACP to ACCP, wherein aviators in Year Groups 1990 and junior who had completed an ACP contract were offered a short-term contract at the long-term rates. Standard short-term contracts were divided into five "due course" categories, offering a standardized \$15,000 per year for contracts of two to five years depending on the assignment (CNO, 2000).

The National Defense Authorization Act of Fiscal Year 2002 (2001) modified ACCP by authorizing "early" eligibility to aviators within one year of completing their MSRs. With an advance notification requirement of nine to twelve months for resignation, this early payment option provided a "substantial additional financial incentive prior to the period when an aviator would be making the critical stay-leave decision" (ACCP PM, personal communication, March 19, 2014).¹³

No changes were made in the FY-2003 ACCP program from the previous year, and the only change to the FY-2004 program was the additional requirement to withhold any lump sum payments until an aviator successfully screened for DH. ACCP for FY-2005 eliminated the short-term contract option for aviators completing their initial MSR,

¹² This information was communicated via internal report summarizing history of ACCP.

¹³ Ibid.

limiting their options to a five-year contract. This ensured that any officers retained would remain in service through their aviation DH screen board. The FY-2005 ACCP program also formally established the Navy's policy for stopping annual payments for officers who twice failed to screen for DH (CNO, 2004).

The FY-2006 through FY-2009 ACCP programs followed the FY-2005 format; there were changes, however. In an effort to increase NFO retention rates, the long-term agreements were set at \$25,000 per year for all aviators. Additionally, the short-term contracts were put into three categories, all paying \$15,000 per year: sea duty, command, and aviation-designated astronauts. The short-term contract for aviation-designated astronauts would be discontinued in FY-2008 and reinstated in FY-2009. A short-term contract for Aviation Engineering Duty Officers (AEDOs) who screened for command was established in FY-2008, only to be discontinued in FY-2009 (ACCP PM, personal communication, March 19, 2014).¹⁴

In FY-2010, changes in Force structure resulted in ACCP changing to offer a more "appropriate incentive." These changes included reducing the NFO long-term contract to \$15,000 per year. The annual payment for the short-term sea duty and command contracts were reduced to \$10,000 and \$12,000, respectively. Additionally, Captains (O-6) and Commanders (O-5) selected for promotion were no longer eligible for ACCP (CNO, 2010).

The ACCP program saw multiple revisions in FY-2011. Based on CNP guidance to reduce the overall cost of the ACCP program, contracts were structured to offer varying bonus amounts based on projected retention rates for individual communities. This resulted in the establishment of nine pilot and six NFO categories. Under this new design, 13 categories saw reductions in bonus amounts; one category remained stable; and one category had the bonus amount increased. As an additional cost savings measure, the lump sum option was discontinued. ACCP continued under the same format for FY-2012 and FY-2013. In response to changes in projected retention, the FY-2012 program increased bonus amounts for eight categories and decreased the bonus offered in one

¹⁴ Ibid.

category. Under this ACCP program, short-term sea duty and command contracts were no longer offered. The FY-2013 ACCP program would again increase the bonuses offered in five categories, while only one category saw a reduction in the bonus offered. The FY-2014 program increased bonus amounts for three communities, but otherwise mirrored the FY-2013 program (ACCP PM, personal communication, March 19, 2014)¹⁵ (CNO, 2013).

2. Current Retention Bonus Implementation

a. *Enactment*

(1) Congressional Legislation. ACCP is legislated under Title 37 U.S. C. §301b (2014). In addition to any other pay and allowances, it authorizes the Secretary of the Navy to pay a retention bonus to any aviation officer who prior to December 31, 2014 executes a written agreement to remain on active duty for at least one year, providing that the officer:

- is entitled to receive ACIP;
- is below the rank of O-7;
- is qualified to perform operational flying duty; and
- has completed, or is within one year of completing, any service commitment incurred for undergraduate flight training.

The amount authorized for this bonus is not to exceed \$25,000 per year of service agreed upon in the contract, and it is to be prorated to ensure the contract does not extend beyond the officer's twenty-fifth year of aviation service. Upon acceptance of the agreement, the Secretary may elect to have the amount paid as a lump sum or in installments. Additionally, these funds are subject to recoupment if the officer fails to complete the agreed upon service requirement.

(2) U.S. Navy Policy. The Navy's current retention program, ACCP, is defined by OPNAV Instruction 7220.9 (CNO, 2005a). Under this instruction, the authority to evaluate, accept, and administer ACCP contracts is delegated to Commander

¹⁵ Ibid.

Naval Personnel Command, Aviation Officer Assignments Branch (PERS-43), provided the aviator submitting the contract meets the provisions of Title 37 U.S. C. §301b and, furthermore:

- is not subject to mandatory separation from active service within one year from the date ACCP would be paid;
- has not twice failed to select for promotion to the next higher pay grade, unless selected for continuation;
- if, having transitioned from NFO to pilot, has completed the service obligation incurred during pilot training; and
- is recommended for ACCP by his or her Commanding Officer (CNO, 2005a).

b. ***Implementation***

Previous versions of ACCP offered retention contracts of differing lengths and amounts to aviators in various career stages. The focus of the current and recent ACCP programs, however, has been the retention of active duty Naval Aviators who have completed their initial MSR and have between seven and 12 years of aviation service. To incentivize these officers to “Stay Navy,” the ACCP program offers five-year contracts, payable in equal annual installments. These contracts are offered at an aviator’s first stay-go decision point and are structured, based on current tour lengths, to retain them through their Department Head tour (ACCP PM, personal communication, January 13, 2014).¹⁶

c. ***Announcement and Eligibility Periods***

The details of each year’s ACCP program are released to the fleet via a Navy-specific Administrative Message (NAVADMIN). Included in these NAVADMINs are eligibility requirements, changes deemed pertinent from the previous year, bonus amounts, and types of contracts offered. Additionally, the dates in which ACCP requests will be accepted are also announced (typically upon release of the NAVADMIN until late in the fiscal year). Table 4 lists the dates on which annual ACCP programs were

¹⁶ This information was communicated via internal report on FY 2013 ACCP performance.

announced and the final dates in which ACCP requests must be received by PERS-43 for all annual ACCP programs since FY-2004.

ACCP PROGRAM YEAR	ACCP ANNOUNCED	FINAL ACCP SUBMISSION DATE	SUBMISSION PERIOD (DAYS)
FY-14	-----	-----	-----
FY-13	27-Feb-2013	30-Aug-2013	184
FY-12	13-Feb-2012	30-Aug-2012	199
FY-11	18-May-2011	30-Aug-2011	104
FY-10	26-Jan-2010	23-Sep-2010	240
FY-09	21-Jan-2009	24-Sep-2009	246
FY-08	15-Dec-2007	25-Sep-2008	285
FY-07	29-Dec-2006	30-Sep-2007	275
FY-06	27-Dec-2005	30-Sep-2006	277
FY-05	9-Dec-2004	30-Sep-2005	295
FY-04	8-Nov-2003	30-Sep-2004	327

Table 4. ACCP Contract Acceptance Periods (after CNO 2003, 2004, 2005b, 2006, 2007, 2009, 2010, 2011, 2012, 2013)

Under these submission periods, aviators have two opportunities in which they may choose to request ACCP. The first, termed early eligibility, occurs the fiscal year prior to the expiration of an aviator’s MSR. An aviator who elects to submit an ACCP contract during early eligibility will be obligated to the additional service once this request is accepted by PERS-43. This includes receiving the currently offered ACCP bonus as six equal, annual installments. The first payment occurs one year prior to the expiration on the aviator’s MSR, and the remaining five payments are made on subsequent anniversaries of this date (CNO, 2013).

The second period, which occurs in the fiscal year the aviator’s MSR expires, is the initial eligibility period. Aviators who submit ACCP requests during their initial eligibility period are also obligated to complete the additional service once the contract has been accepted by PERS-43. Bonuses are paid at the amount offered under the current ACCP program and are divided into five equal, annual payments, with the first payment being made upon the expiration of their MSR or the acceptance of their ACCP contract,

whichever is later. Subsequent payments are made on the anniversary of their MSR expiration (CNO, 2013).

The majority of aviators who do submit ACCP contracts do so during their first eligibility windows. As Table 5 illustrates, 63 to 91% of all officers retained under the ACCP program signed up during early eligibility. Prior to 2011, on average, only 10% of eligible aviators would submit ACCP contracts during their initial eligibility period (NPC, 2014, February 3), although PERS-43 has noted:

With the reintroduction of bonus amounts based on individual community retention needs, a larger percentage of aviators have deferred requesting ACCP until their second eligibility period. To meet fiscal year DH requirements from the large groups of officers in their second year of eligibility has required that the Navy raise the offered yearly dollar amounts. This begins a cycle of large fluctuations in bonus amounts, as once requirements are met the dollar amounts are decreased in subsequent years to minimize excess retention. The resultant sine-wave effect leads to a lack of officer behavioral predictability and detracts from their ability to make informed career decisions. (ACCP PM, personal communication, March 19, 2014).¹⁷

	Community	FY-2010	BONUS Δ	FY-2011	BONUS Δ	FY-2012	BONUS Δ	FY-2013	BONUS Δ	FY-2014
PILOT	HM	\$125,000	-\$75,000	\$50,000	\$0	\$50,000	\$25,000	\$75,000	\$0	\$75,000
	HSC	\$125,000	-\$75,000	\$50,000	\$25,000	\$75,000	\$0	\$75,000	\$0	\$75,000
	HSL/HSM	\$125,000	-\$75,000	\$50,000	-\$25,000	\$25,000	\$50,000	\$75,000	\$0	\$75,000
	VAQ	\$125,000	-\$50,000	\$75,000	\$50,000	\$125,000	\$0	\$125,000	\$0	\$125,000
	VAW/VRC	\$125,000	-\$100,000	\$25,000	\$25,000	\$50,000	\$50,000	\$100,000	\$25,000	\$125,000
	VFA	\$125,000	\$0	\$125,000	\$0	\$125,000	\$0	\$125,000	\$0	\$125,000
	VP	\$125,000	-\$75,000	\$50,000	\$0	\$50,000	\$0	\$50,000	\$25,000	\$75,000
	VQ(P)	\$125,000	-\$75,000	\$50,000	\$25,000	\$75,000	\$0	\$75,000	\$0	\$75,000
	VQ(T)	\$125,000	-\$100,000	\$25,000	\$50,000	\$75,000	\$0	\$75,000	\$0	\$75,000
NFO	VAQ	\$75,000	\$25,000	\$100,000	\$0	\$100,000	\$0	\$100,000	\$0	\$100,000
	VAW/VRC	\$75,000	-\$50,000	\$25,000	\$25,000	\$50,000	\$25,000	\$75,000	\$0	\$75,000
	VFA	\$75,000	-\$25,000	\$50,000	\$0	\$50,000	-\$25,000	\$25,000	\$50,000	\$75,000
	VP	\$75,000	-\$25,000	\$50,000	\$25,000	\$75,000	\$0	\$75,000	\$0	\$75,000
	VQ(P)	\$75,000	-\$25,000	\$50,000	\$0	\$50,000	\$0	\$50,000	\$0	\$50,000
	VQ(T)	\$75,000	-\$50,000	\$25,000	\$50,000	\$75,000	\$25,000	\$100,000	\$0	\$100,000

(Note: Critical Year is defined as the year in which aviators complete their MSR)

Table 5. ACCP Contract “Take-Rates” (FY-2004 to FY-2014) (after ACCP PM, personal communication, 2014, March 19)¹⁸

¹⁷ This information was communicated via internal report on recommendation for FY 2014 ACCP program.

¹⁸ Ibid.

d. **Retention Goals and Performance**

The Navy’s target retention goals for ACCP are set according to annualized fleet aviation DH requirements for both operational and operational training squadrons. This projected annualized requirement through FY-2018 is approximately 330 aviation DHs. Historically, to meet retention demands the Navy has sought to retain approximately 50% of the DH eligible population via ACCP. Allowing for an attrition or DH non-selection rate of nine percent, PERS-43 set aggregate annual take-rate goals of between 350 and 360 aviators for FY-2014 through FY-2018 (ACCP PM, personal communication, 2014, January 13).¹⁹

As Table 6 illustrates, while ACCP appears to have improved in achieving the desired “take-rate” for the naval aviation community as a whole, the “take-rates” of individual communities can vary considerably. Excess retention in several communities (e.g., HSL/HSM pilot, VFA NFO), moreover, has compensated for dramatic under-retention in others (e.g., VAQ pilot, VQ(T) NFO). As aviators at the DH level are largely non-interchangeable, the failure of ACCP to meet targeted fleet requirements is masked by the aggregate “take-rate.”

PILOT			
Fiscal Year	2011	2012	2013
TOTAL	80.1%	97.3%	91.7%
HM	80.0%	100.0%	116.7%
HS/HSC	80.9%	81.4%	120.8%
HSL/HSM	157.1%	102.0%	162.5%
VAQ	75.0%	80.0%	36.4%
VFA	82.3%	105.0%	75.8%
VAW/VRC	55.6%	75.0%	88.9%
VP	57.1%	100.0%	74.2%
VQ(P)	40.0%	100.0%	66.7%
VQ(T)	80.0%	140.0%	75.0%

NFO			
Fiscal Year	2011	2012	2013
TOTAL	76.2%	83.3%	116.1%
VAQ	52.9%	60.0%	88.2%
VFA	121.4%	121.4%	35.7%
VAW/VRC	57.1%	120.0%	194.4%
VP	92.6%	82.4%	146.4%
VQ(P)	87.5%	62.5%	87.5%
VQ(T)	50.0%	33.3%	62.5%

OVERALL			
Fiscal Year	2011	2012	2013
TOTAL	82.3%	92.1%	106.0%

Table 6. Percent Attained of Annualized “Take-Rate” Goals (FY-2011 through FY-2013) (after ACCP PM, personal communication March 19, 2014)²⁰

¹⁹ This information was communicated via internal report on FY 2013 ACCP program.

²⁰ This information was communicated via MS Excel spreadsheets detailing FY 2011 through FY 2013 ACCP performance.

We found that these excesses and shortfalls in targeted retention goals impact naval aviation both financially and operationally. In FY-2011, specific communities retained a total of 19 aviators above their targeted goals at an additional cost to the Navy of \$950,000. At the same time, other communities were a combined 76 aviators short of retention targets. This resulted in a targeted retention (i.e., corrected for retained aviators capable of meeting specific community requirements) shortfall of 24% of the Navy’s goal. In FY-2012, the results were somewhat improved, with only 12 excess aviators retained at an additional cost of \$850,000 to the Navy. Targeted aviator shortfalls fell to 39 for a targeted retention rate of 87%. The trend worsened in FY-2013, with the retention of 71 excess aviators costing the Navy an additional \$5,325,000. Meanwhile, other communities fell 51 aviators short of retention goals for a targeted retention rate of 85%. Table 7 summarizes these results. (See Appendix C for a detailed summary of recent ACCP performance.) In addition to the monetary costs associated with over-retention, the under-retention experienced in specific communities results in DH billets having to be “gapped” (i.e., left unfilled until a suitable replacement can be found) or extending the tour lengths of those selected for DH (ACCP PM, personal communication 2014, March 19).²¹

	% OF ELIGIBLE AVIATORS RETAINED	% OF AGGREGATE RETENTION GOAL MET	% OF TARGETED RETENTION GOAL MET	TOTAL COST	AVIATORS RETAINED ABOVE FLEET RQMTS	AVIATOR SHORTAGE ISO FLEET RQMTS	OVERPAYMENT	OVERPAYMENT TOTAL COST
FY-2013	36.1%	106.0%	76.4%	\$ 28,775,000	71	51	\$ 5,325,000	18.5%
FY-2012	31.2%	92.1%	88.6%	\$ 22,900,000	12	39	\$ 850,000	3.7%
FY-2011	31.5%	82.3%	76.4%	\$ 18,700,000	19	76	\$ 950,000	5.1%

Table 7. Summary of ACCP Performance (FY-2011 through FY-2013) (after ACCP PM, personal communication, March 19, 2014)²²

²¹ This information was communicated via internal report on recommendation for FY 2014 ACCP program.

²² This information was communicated via MS Excel spreadsheets detailing FY 2011 through FY 2013 ACCP performance.

e. ***Bonus Calculation and Amounts***

Despite having specific targeted retention numbers, the Navy does not limit the number of available annual ACCP contracts, and PERS-43 makes no determination as to the suitability of aviators requesting ACCP—accepting all valid submissions (CNO, 2013). Instead, to minimize projected shortfalls or excesses in retention, the bonus amount offered to each community is reviewed and adjusted annually. Taking into account “recent ACCP ‘take-rates,’ community continuation rates, eligible aviator population size, and expected economic climate,” each community is categorized using the following criteria (ACCP PM, personal communication, March 19, 2014):

- Criteria A (reduce bonus to minimize excess retention): A significant number of “initial” eligible aviators are in a Year Group (YG) that had already met or was close to meeting its DH goal, and they were not needed to make later year goals.
- Criteria B (maintain or reduce bonus to balance requirements and minimize excess retention): A significant number of “initial” eligibles are in a YG that is needed to meet DH goals, yet there is also a significant portion of remaining “early” eligibles and aviators who are not yet eligible from the same YG that will have opportunities to take ACCP.
- Criteria C (increase bonus amount): Significant retention from the “initial” eligibles is required.
- Criteria D (maintain or increase bonus to balance requirements and minimize excess retention): Decreasing or sustained retention is indicated by low “early” eligible take rates for a YG (ACCP PM, personal communication, March 19, 2014).²³

Once each community is categorized and retention projections estimated, the amount of ACCP to offer each community is determined in part by the findings of a 2006 CNA report’s suggestion that a “\$1,000-per-year increase in ACCP was associated with a 0.6% increase in retention rates” (Hansen & Moskowitz, 2006). Table 8 lists what the report determined to be the effect on retention rates of a \$1,000-per-year increase in ACCP for three categories of pilots.

²³ This information was communicated via an internal report on recommendation for FY-2014 ACCP program.

Type of Pilot	Increase in Retention Rate with \$1,000-per-year Increase in ACCP
Helicopter	0.2%
Jet	0.4%
Propeller	0.9%

Table 8. ACCP Effects on Pilot Retention (from Hansen & Moskowitz, 2006)

Table 9 illustrates the changes to the five-year bonus amounts since these criteria have been implemented under the current iteration of ACCP. As can be noted, all bonuses have increased back towards or beyond pre-2011 levels. Furthermore, bonus amounts have only been reduced for two communities following the initial conversion to the community-based system: a \$25,000 reduction for HSM pilots in FY-2012 and a \$25,000 reduction for the VFA NFOs in FY-2013. These reductions were negated in the following year with increases of \$50,000.

	Community	FY-2010	BONUS Δ	FY-2011	BONUS Δ	FY-2012	BONUS Δ	FY-2013	BONUS Δ	FY-2014
PILOT	HM	\$125,000	-\$75,000	\$50,000	\$0	\$50,000	\$25,000	\$75,000	\$0	\$75,000
	HSC	\$125,000	-\$75,000	\$50,000	\$25,000	\$75,000	\$0	\$75,000	\$0	\$75,000
	HSL/HSM	\$125,000	-\$75,000	\$50,000	-\$25,000	\$25,000	\$50,000	\$75,000	\$0	\$75,000
	VAQ	\$125,000	-\$50,000	\$75,000	\$50,000	\$125,000	\$0	\$125,000	\$0	\$125,000
	VAW/VRC	\$125,000	-\$100,000	\$25,000	\$25,000	\$50,000	\$50,000	\$100,000	\$25,000	\$125,000
	VFA	\$125,000	\$0	\$125,000	\$0	\$125,000	\$0	\$125,000	\$0	\$125,000
	VP	\$125,000	-\$75,000	\$50,000	\$0	\$50,000	\$0	\$50,000	\$25,000	\$75,000
	VQ(P)	\$125,000	-\$75,000	\$50,000	\$25,000	\$75,000	\$0	\$75,000	\$0	\$75,000
	VQ(T)	\$125,000	-\$100,000	\$25,000	\$50,000	\$75,000	\$0	\$75,000	\$0	\$75,000
NFO	VAQ	\$75,000	\$25,000	\$100,000	\$0	\$100,000	\$0	\$100,000	\$0	\$100,000
	VAW/VRC	\$75,000	-\$50,000	\$25,000	\$25,000	\$50,000	\$25,000	\$75,000	\$0	\$75,000
	VFA	\$75,000	-\$25,000	\$50,000	\$0	\$50,000	-\$25,000	\$25,000	\$50,000	\$75,000
	VP	\$75,000	-\$25,000	\$50,000	\$25,000	\$75,000	\$0	\$75,000	\$0	\$75,000
	VQ(P)	\$75,000	-\$25,000	\$50,000	\$0	\$50,000	\$0	\$50,000	\$0	\$50,000
	VQ(T)	\$75,000	-\$50,000	\$25,000	\$50,000	\$75,000	\$25,000	\$100,000	\$0	\$100,000

Table 9. ACCP Five-Year Contract Bonus (FY-2010 through FY-2014) (after ACCP PM, personal communication, 2014, March 18)

f. *Contract Requirements and Termination*

The intent of the Navy's current implementation of ACCP is to retain qualified aviators through their DH tour. As such, all officers accepting ACCP agree not to voluntarily resign, retire, or terminate the flight status prior to completing the MSR

incurred. In applying for ACCP, aviators are also stating their intent and desire to participate in the DH screening process. Furthermore, officers selected for DH are obligated to accept and complete their entire DH tour, even if it extends beyond their ACCP incurred MSR. Aviators who twice fail to select for DH are authorized to continue receiving ACCP so long as they remain in an aviation-designated assignment (NPC, 2014, February 3).

Failure to satisfy contractual requirements results in the termination and possible recoupment of unearned bonus payments. Additionally, while repayment is not required, Naval Aviators have all future ACCP payments terminated under the following conditions:

- Medical grounding or other suspension of flight status, which is neither the result of misconduct, nor willful neglect, nor incurred during a period of unauthorized absence
- Twice failing to select for advancement to the next pay grade
- Separation from Active Duty by operation of law or Department of Defense (DOD) policy, except separations for cause
- Redesignation, or selection for lateral transfer, after twice failing to select for DH (CNO, 2005a)

While the majority of aviators from the most recent ACCP programs have not yet been subject to statutory and administrative selection boards, the recent historical (FY-2004 through FY-2009) early-termination/revocation rate has been 16.2% of the total contracts issued. While the Navy has been able to recoup some of the ACCP issued, nearly \$4.5 million in ACCP is spent annually on retaining aviators who will not complete the DH tour for which they were retained. We found that the most common reasons for the early termination or revocation of ACCP are failure to promote to the next pay grade or failure to be selected for DH. Other reasons include officers opting out of the DH selection board or declining orders to a DH assignment. Less common reasons include medical-related disqualifications or non-performance-related issues (e.g., family, marital) that result in an aviator not being able to perform his or her duties. Additionally, aviators who are removed from aviation duty as the result of a Field Naval Aviation Evaluation Board (FNAEB) or Detached for Cause make up less than four percent of the

ACCP contracts terminated. Table 10 summarizes these results (ACCP PM, personal communication, 2014, January 13).²⁴

	TOTAL ACCP CONTRACTS	ACCP CONTRACTS REVOKED/TERMINATED	% OF ACCP CONTRACTS REVOKED/TERMINATED	REASON FOR ACCP REVOCATION/TERMINATION					AMOUNT SPENT	AMOUNT SAVED/RECOUPED
				2-TIME FAILURE TO PROMOTE	2-TIME FAILURE TO SELECT	OPT OUT OF DH BOARD/ORDERS	MEDICAL / NON-PERF. ISSUE	FNAEB/ DETACHED FOR CAUSE		
FY-2013	252	0	0.0%	0	0	0	0	0	\$ -	\$ -
FY-2012	277	13	4.7%	11	2	0	0	0	\$ 341,664	\$ 658,336
FY-2011	265	22	8.3%	12	5	2	2	1	\$ 382,500	\$ 1,342,500
FY-2010	252	34	13.5%	24	5	3	1	1	\$ 1,510,841	\$ 1,889,161
FY-2009	495	98	19.8%	42	37	9	5	5	\$ 6,470,790	\$ 5,445,876
FY-2008	426	59	13.8%	21	33	4	1	2	\$ 4,012,525	\$ 3,362,475
FY-2007	381	64	16.8%	12	39	7	4	2	\$ 4,747,946	\$ 3,227,054
FY-2006	395	73	18.5%	4	48	12	5	4	\$ 5,655,088	\$ 3,469,906
FY-2005	394	56	14.2%	3	38	11	3	1	\$ 3,004,951	\$ 2,582,549
FY-2004	441	60	13.6%	7	36	13	3	1	\$ 3,089,398	\$ 2,889,268

Table 10. Causes for Early Termination/Revocation of ACCP (FY-2004 to FY-2013) (after ACCP PM, personal communication, 2014, January 13)²⁵

²⁴ This information was communicated via MS Excel spreadsheet summarizing individual ACCP contracts from FY 2004 to FY 2013.

²⁵ Ibid.

III. INTRODUCTION TO AUCTIONS

In this chapter, we discuss the fundamental principles of Auction Theory and their application to the issue of Naval Aviator retention. Additionally, to better understand how auctions function, in sections B and C we discuss key concepts and features of auctions. Readers with a sufficient understanding of these topics may skip these sections. For additional information on auction theory, refer to Krishna (2009). For additional information on the application of auctions to military Force management refer to Coughlan and Gates (Coughlan & Gates, 2012).

A. BACKGROUND AND APPLICATION

Auctions in the general sense are one of several market mechanisms used to facilitate the transfer of goods and services in a market-based economy. So, while the DOD's interest in the employment of auctions has grown in recent years (USD (P&R), 2008), auctions have in fact been used throughout human history. The range of assets sold at auction varies from irreplaceable works of art to heaping mounds of base metals. Also, they range from the intangible right to broadcast on the electro-magnetic spectrum to the sordid trade of human flesh. Auctions take place at every level of society, from county fairs to dedicated online websites, and they even occur in the high-stakes dealings of Wall Street. A common link in these situations is that the information asymmetry (i.e., one party's uncertainty regarding the value other parties might place on the object) is sufficient to dissuade the parties involved from agreeing on a fixed price at the onset of the transaction (Krishna, 2009).

We assert that the significance of conducting these types of exchanges as a posted-price transaction (i.e., where one party establishes a set price at which they are willing to buy or sell the product or service in question) can be seen in a hypothetical example of the Navy's current aviation retention efforts. As Figure 1 illustrates, in order to reach the retention goal of 50 aviators, the Navy must offer a bonus of \$80,000. This precise amount is not available *a priori* and can result in retention shortfalls for insufficient bonus offerings or excess aviator retention when bonuses are exceedingly generous.

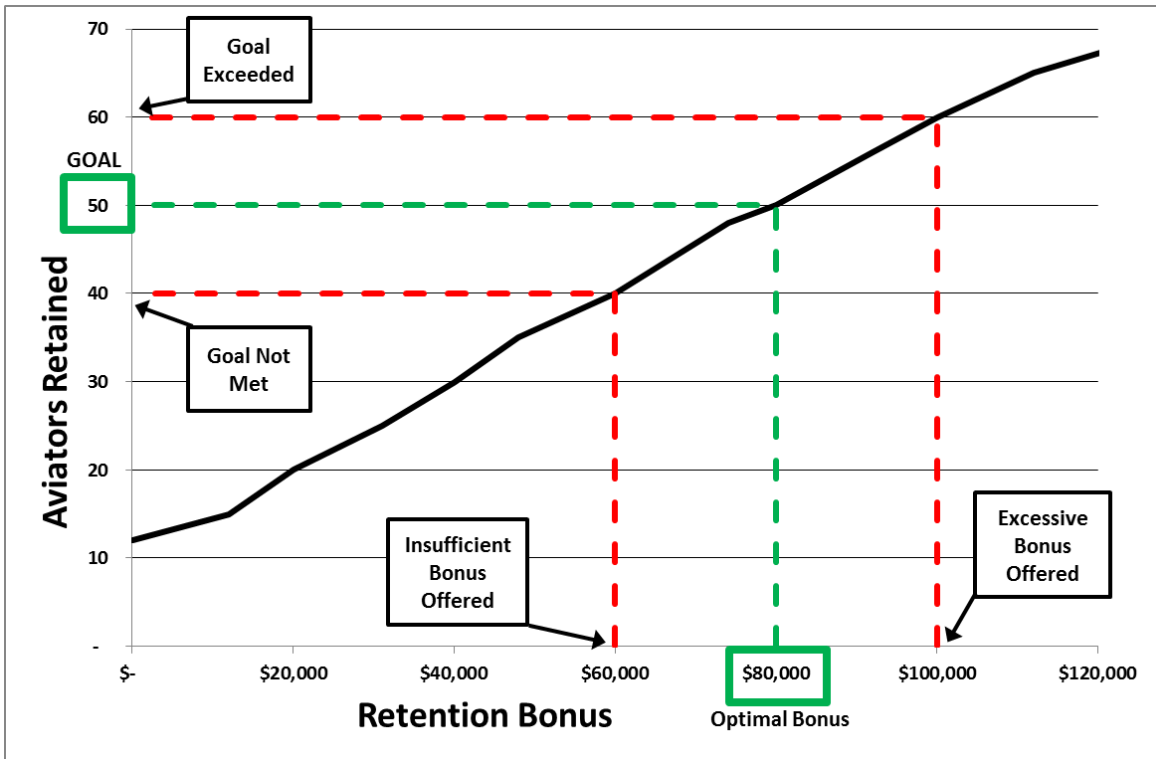


Figure 1. The Importance of Retention Bonus Precision (after Coughlan & Gates, 2012)

As Figure 2 illustrates, these consequences are not limited to the hypothetical. Despite the Navy’s efforts to establish optimal ACCP bonuses based on individual aviation community retention requirements, some communities experienced retention as high as 94% above goals, while others achieved only 36% of desired retention. An analysis of recent ACCP programs reveals that this is a persistent issue for Navy Force managers. (See Appendix C for recent ACCP retention rates.)

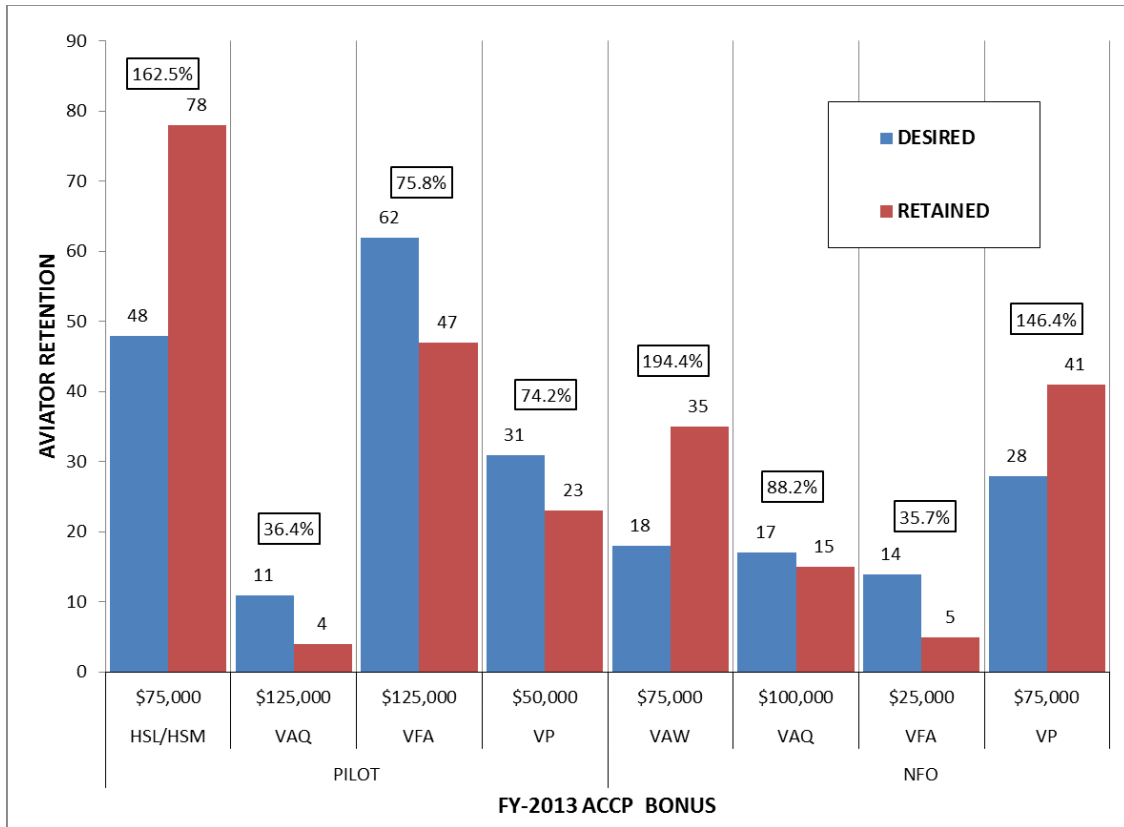


Figure 2. FY-2013 ACCP Bonus Amounts versus Aviator Retention for Select Communities (after ACCP PM, personal communication, 2014, January 13)²⁶

Exploring the potential to remedy the shortcomings of the current retention system with an auction mechanism, Coughlan and Gates (2012) discuss auction design and its application to military retention. Figure 3 depicts several design considerations they deemed important in auction mechanism development. The highlighted elements are features best suited for a mechanism designed to support military retention efforts. These characteristics serve as the foundation for the auction mechanisms used in our research and we discuss them in greater detail in the following sections.

²⁶ This information was communicated via an internal report summarizing the FY-2013 ACCP program.

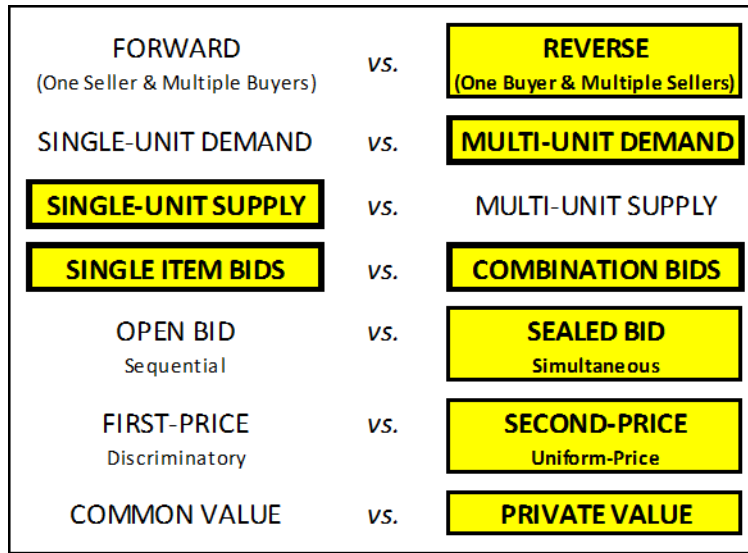


Figure 3. Force Management Auction Design Considerations (from Coughlan & Gates, 2012)

B. AUCTION ROLES AND TERMINOLOGY

In this section, we present a discriminatory compilation of previous NPS theses on Auction Theory. Much of the information here has been provided courtesy of the following theses authors: William N. Filip, Henning Hansen Homb, and Tony K. Verenna.

1. Roles

Auctions can vary significantly depending on their specific rules. There are certain roles and concepts that are integral to all auctions. Among these are the roles of *bidders*, *bid takers*, *sellers*, and *buyers*. *Bidders* are the individuals or interests competing against each other to win the auction. The *bid takers* are the entities who receive the price offers made by the bidders. The *seller* is the participant who offers to provide a good or service for the right price. Conversely, the *buyer* is the entity seeking to obtain the good or service. Additionally, in any auction that is consummated there is at least one *winner*—the bidder awarded either the object being auctioned or the right to provide said object (Filip, 2006).

2. Matching Auctions to Transactions

As we previously noted, Auction Mechanisms may be applied to a wide variety of transactions. Figure 4 summarizes the types of market mechanisms best suited for transactions between various combinations of sellers and buyers. Transactions between single parties are typically completed through negotiation. Those between multiple buyers and sellers are generally conducted through non-auction transaction mechanisms—stock exchanges being notable exceptions. Transactions between single buyers and multiple sellers or single buyers and multiple buyers, however, are typically completed as some form of auction (Coughlan & Gates, 2012).

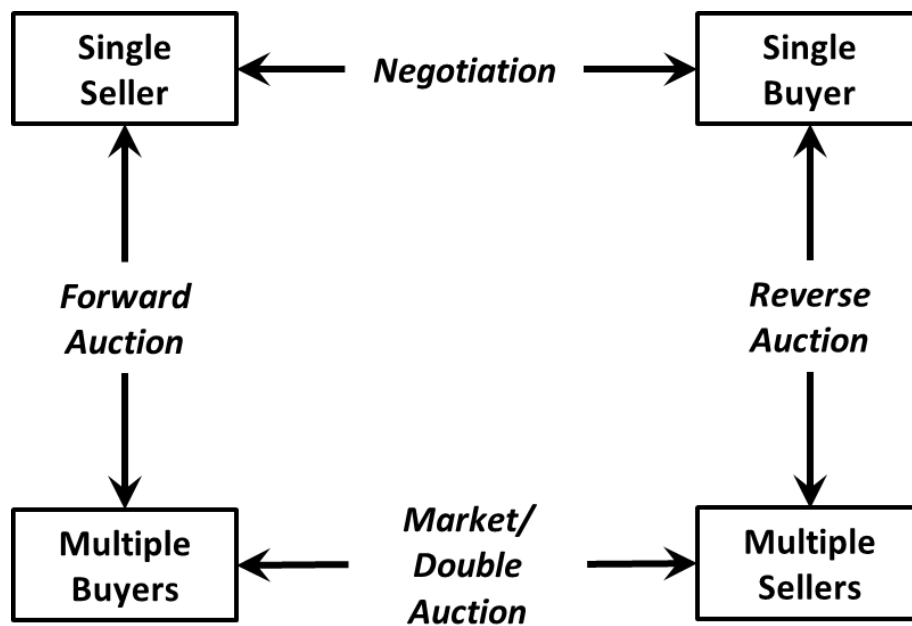


Figure 4. Varieties of Transaction Mechanisms (from Coughlan & Gates, 2012)

a. *Forward versus Reverse Auctions*

(1) **Forward Auction.** A forward auction is the most common and familiar type of auction. This is because it is often associated with famous auction houses and on-line auction sites. It involves a single seller and multiple potential buyers bidding for the right to purchase the good or service at auction. In these auctions, competition among bidders drives prices higher, and winning bidders are those who submit the highest bids (Coughlan & Gates, Auction mechanisms for force management, 2012).

(2) Reverse Auction. A reverse auction consists of one buyer and multiple sellers vying for the right to provide a good or service. This format is often used in the procurement context, in which several contractors bid for the right to sell their products or services to a single buyer. In reverse auctions, therefore, competition among bidders drives prices lower, and the winning bidders are those who submit the lowest bids (Coughlan & Gates, Auction mechanisms for force management, 2012).

b. *Single- versus Multi-Unit Auctions*

(1) Single-Unit Auctions. In a single-unit auction, one good or service is auctioned at any one time. This aspect can be driven by the seller offering only a single good or service (single-unit supply) in a forward auction, or it may be due to the buyer only wishing to acquire a single good or service (single-unit demand) in a reverse auction. While the simple single-object auction has been extensively researched (e.g., McAfee & McMillan, 1987; Krishna, 2009), the impracticality of conducting hundreds of these auctions in any Force management endeavor limits its utility in our research;

(2) Multi-Unit Auctions. Multi-unit auctions involve auctioning several items at one time. This occurs when, in a forward auction, the seller offers multiple units of the same good or service (multi-unit supply) or when in a reverse auction the buyer seeks to obtain multiple units of the same good or service (multi-unit demand). While it may be convenient to treat a multi-unit auction as a number of independent single-unit auctions, this is inappropriate when the value of the item at auction depends on other items for auction that can serve as either complements or substitutes (Verenna, 2007).

C. FACTORS FOR DETERMINING BIDDING STRATEGIES

1. Perceptions of Value

In most cases, participants have imperfect and differing knowledge about either the item for auction or the value others place on said item. The nature of this asymmetric information can be used to describe auctions under two general models. On the one hand are common value auctions where, knowing the true nature of the item at auction, all bidders would assign it the same value. The other class is private value auctions, where each bidder's value is completely independent of the valuations of other bidders. While

most auctions contain aspects of both models, they can be treated as polar cases to explain how bidders establish different measures of value and, ultimately, their bids (Homb, 2007).

a. Common Value Auctions

In common value auctions, the value of the object being auctioned is equally valued by all the participants. Individual participants, however, may have different information about the potential value of the item. An example of this type of auction is the sale of mineral rights to a plot of land. Were the true quantities of minerals to be found on that plot known, all the participants would place approximately the same value on the right to mine those resources. As this cannot be known with absolute certainty, potential buyers are obliged to develop their own estimates as to the value of the mineral rights. The most optimistic bidders place higher bids. Additionally, discovering what value other bidders place on those rights may cause a bidder to change his own valuation. The asymmetric information present in common value auctions can give rise to the winner's curse. This is when auction winners realize that they overestimated the good's value and suffer a loss as a result of their over-bidding (Homb, 2007)..

b. *Independent Private-Values Auctions*

In independent private-values auctions, each bidder establishes a private and intrinsic value for the item. Unlike a common value auction, an individual's estimate is unaffected by any information about the value other bidders place on the object. While in practice a bidder might adjust a bid upon discovering another participant's value of the item for auction, as McAfee and McMillan (1987) explain, this is due to strategic reasons and not because the bidder's value of the object has changed. Common examples of this type of auction include the sale of memorabilia (when not intended for resale) and tickets to attend concerts or sporting events (Homb, 2007)..

2. Reserve and Reservation Prices

a. *Reserve Price*

The reserve price relates to the bid taker in a forward auction and is the minimum price they are willing to accept in exchange for providing the good or service. In a reverse auction, the reserve price is the maximum price a bid taker is willing to pay in exchange for a good or service. In theory, bid takers in a forward auction should not accept any offers below reserve price. This is because they will derive no profit from the transaction. The same follows for bid takers accepting offers above their reserve price in a reverse auction. In a forward auction, the bid taker should accept any offer above the reserve price (the opposite is true for a reverse auction). In all cases, an offer exactly equal to the bid taker's reserve price would result in a scenario in which the bid taker is equally willing to accept or reject the offer (Verenna, 2007).

b. *Reservation Price*

The concept of a reservation price applies to bidders. This is defined as either the maximum value a bidder places on a good or service being auctioned (forward auction) or the minimum value a bidder places on having to provide a good or service (reverse auction). Similarly to a bid taker's reserve price, in theory bidders should not offer any bids above reservation price in a forward auction nor should they offer bids below their reservation price in a reverse auction. In all cases, an offer exactly equal to the bidder's reservation price would result in a scenario in which the bidder is equally willing to have the offer rejected or accepted (Verenna, 2007).

3. Bidding Strategies

a. *Descending-Bid and First-Price Sealed-Bid Auctions*

In these auction formats, the winner pays or receives whatever amount is bid. Therefore, the bidder must estimate what others are likely to bid to maximize any potential profits from winning. Knowing this information, a rational bidder will submit a bid that maximizes the chances of winning while still providing an acceptable level of profit or surplus. "Ultimately, this results in a bidder offering some amount less than their reservation price in a forward auction and some amount more in a reverse auction.

Exactly how much less depends upon the probability distribution of the other bidders' valuations and the number of competing bidders" (Filip, 2006, p. 25).

b. ***Ascending-Bid and Second-Price Sealed-Bid Auctions***

In these auction formats, the highest bid is used to determine the winner. The amount paid or received, however, depends largely (if not entirely) on the bids of others. As such, it is in the bidders' own interests to submit offers equal to their reservation values.²⁷ Figure 5 illustrates this aspect by depicting bidding strategies and their possible outcomes in a second-price forward auction.²⁸ As depicted, in no scenario does under-bidding or over-bidding result in an outcome that is more favorable to a bidder. In any scenario in which the bidder has the winning bid, the same price is paid. Moreover, by not bidding the true reservation value, bidders run the risk of losing the auction to an offer below what they were willing to pay or obligating themselves to pay more than they value the object. The results in a reverse auction are similar, save that the bidder risks committing to a price below the reservation value by under-bidding or not capitalizing on an acceptable price by over-bidding. "Despite the differing bidding strategies employed in the various auction formats, *on average* the revenue generated will be the same" (Krishna, 2009, p. 26).

²⁷ In the case of an ascending bid auction, the buyers (sellers) may begin with bids below (above) their reservation value, but should bid beyond this value. For the pronoun "their" to agree with the nouns here, they have to be plural.

²⁸ Because a bidder in an ascending bid auction need only exceed the bids of others by some incremental amount (in theory by as little as \$0.01), the second-price bidding strategy applies (Krishna, 2009).

		WINNING BID		
		BELOW RESERVATION VALUE	AT RESERVATION VALUE	ABOVE RESERVATION VALUE
		WINNING PRICE		
		PRICE A	PRICE B	PRICE C
BIDDER'S ACTION		RESULTS		
UNDER-BIDS RESERVATION VALUE		LOSE TO PRICE A	LOSE TO PRICE B	LOSE TO PRICE C
		WIN - PAY PRICE A		
BIDS RESERVATION VALUE		WIN - PAY PRICE A	WIN - PAY PRICE B	LOSE TO PRICE C
		WIN - PAY PRICE A	WIN - PAY PRICE B	LOSE TO PRICE C
OVER-BIDS RESERVATION VALUE		WIN - PAY PRICE A	WIN - PAY PRICE B	LOSE TO PRICE C
		WIN - PAY PRICE A	WIN - PAY PRICE B	WIN - PAY PRICE C




	- BIDDER PERCEIVES RESULT UNFAVORABLY
	- BIDDER PERCEIVES RESULT INDIFFERENTLY
	- BIDDER PERCEIVES RESULT FAVORABLY

Figure 5. Second-Price Auction Bidding Strategy (after Myung, 2013)

D. DETERMINING WINNER AND PRICE

Methods for determining a winner and the price paid can be categorized into four general types of auctions: ascending-bid, descending-bid, first-price sealed-bid, and second-price sealed-bid. The fundamental aspect of these auction formats is that they seek, through bids, to elicit a potential buyer's value of an asset, and they then assign the winner and price paid based solely on the information received. In this sense, the specifics of the object(s) for sale are inconsequential. Additionally, details about the particulars of the bidders are irrelevant, as they have no influence on who wins the auction or how much is paid. When combined with the concepts discussed earlier in this chapter, any of these formats can be used to sell any class of good or service. It is therefore possible, even if impractical, to buy fleets of classic automobiles via a reverse, descending-bid auction or to offer any of the dreck sold by on-line auction sites under a second-price sealed-bid auction (Krishna, 2009).

1. Ascending-Bid

Also referred to as English auctions, the ascending-bid format is the most widely recognized and most commonly used for the selling of goods (McAfee & McMillan, 1987). In general, these auctions can be carried out in an interactive turn-based process or in real time, with bids submitted through gestures, orally, electronically, or by almost any other means. The bidders need not be physically present at the auction. What is fundamental to this format is that the price for the object being auctioned continues to increase incrementally until only a single buyer remains. The buyer then pays the final price quoted by the seller. As an open auction format, in an ascending-bid auction each buyer knows the current price and can discern some information as to the value other buyers place on the value of the object by observing the submitted bids (Krishna, 2009).

2. Descending-Bid

A second open format, the descending-bid is sometimes referred to as a Dutch auction. This auction format is structured much like an ascending-bid auction, except that in this format the seller starts at a price, ostensibly above what any bidder is willing to pay, and then the seller incrementally decreases the price until a willing buyer is identified. Here again, buyers have some information as to the value their competitors place on the objects being valued; it can be decidedly less valuable, however, as once a bid is submitted the auction for that particular object is complete (Krishna, 2009).

3. First-Price Sealed-Bid

In this first-price sealed-bid format, potential buyers privately submit a bid for the object being auctioned. This is a closed auction format; that is, unlike the open auction formats, bidders are not made aware of what other potential buyers have bid. Additionally, each bidder may only submit a single bid that cannot be revised. Once all the bids have been collected, the bidder who submitted the highest bid is announced as the winner and pays the bid price (McAfee & McMillan, 1987).

4. Second-Price Sealed-Bid

The second-price sealed-bid auction format is nearly identical to the first-price sealed-bid format: bidders privately submit a single bid for the object being auctioned. All bids are collected before a winner is announced. The winner is the bidder submitting the highest bid. In the second-price sealed-bid, however, the winner pays not the amount bid, but the amount offered in the second-highest bid. This aspect is designed to elicit a bidder's true reservation value (McAfee & McMillan, 1987).

IV. AUCTION MECHANISMS

In this section, we discuss the auction mechanisms used in our research: the uniform-price auction and two variants of the uniform-price auction, the quality adjusted discount (QUAD) auction, and the combinatorial retention auction mechanism (CRAM). This chapter draws extensively from the works of Myung (2013) and Coughlan, Gates, and Myung (CGM, 2013) for the development and description of the uniform-price, QUAD, and CRAM models. We suggest that if more detailed information on these auction mechanisms is desired, these documents should be referenced.

In addition to the favorable characteristics of auctions in general—described in Chapter III—we selected these auction mechanisms for their additional normative features. This makes them viable options for improving the efficiency of the current Naval Aviator retention system. The principles supported by these models include allocative efficiency, cost minimization, and failure freeness. Additionally, these mechanisms support values identified as critical to any DOD retention program, specifically (CGM, 2013):

- Transparency and ease of use: The strategy employed by these mechanisms is designed for ease of understanding and minimizes the incentive for aviators to game the auction in an attempt to garner a strategic advantage.
- Egalitarianism: The military has a long history of providing equal pay to service members of equal rank and position. Therefore, with the exception of QUAD, these mechanisms provide the same bonus amount to all retained aviators.
- Low transaction cost (i.e., minimal time investment participants): Allowing for the dispersed nature and limited connectivity of servicemembers deployed throughout the world, these mechanisms require that aviators only make a single bid. The time allotted for this can be a matter of days, weeks, or months.²⁹ Additionally, the nature of these mechanisms does not require an aviator to collect any information outside personal valuation to make an informed bid (CGM, 2013).

²⁹ The duration of the auction is ultimately a policy-maker decision.

A. UNIFORM-PRICE AUCTION

1. Introduction

A uniform-price auction is a variant of a second-price sealed-bid auction format. In our application, this mechanism is conducted as a single-supply, multi-demand, reverse auction with the Navy serving as the bid taker seeking to retain in the Active Duty service a specified number of Aviation Officers. The sellers are Naval Aviators who submit bids with the price that they are willing to accept in exchange for committing to an additional period of service. By providing the flexibility to precisely select the number of aviators desired, this mechanism enables the Navy to save the financial costs related to over-retention. It also minimizes the risks associated with retention shortfalls. Additionally, on average, this mechanism is able to provide an equitable uniform bonus to the aviators retained at the same cost of a discretionary auction, in which retained aviators are awarded their exact bid.³⁰

In practice, the Navy announces the quantity of Naval Aviators it seeks to retain and collects the sealed bids from individuals willing to be retained. These bids are ranked from lowest to highest and the desired number of aviators to retain is selected from the lowest bids. All retained aviators receive the same payout. This is equal to the cutoff bid—the first excluded bidder’s price.

Uniform-price auctions are weakly dominant incentive compatible; that is, there is no incentive for an aviator to over-bid or under-bid the true reservation value. Table 11 illustrates how this aspect plays out in various scenarios. As depicted, there is no scenario in which over-bidding or under-bidding results in an outcome that is more favorable than bidding truthfully. Moreover, by bidding above or below true reservation value, bidders can subject themselves to outcomes that are less favorable than bidding truthfully.

³⁰ Refer to CGM (2013) for a detailed discussion on the cost equivalence of uniform-price and discretionary auctions.

BIDDER'S RESERVATION VALUE		SCENARIO 1 CUTOFF BID	SCENARIO 2 CUTOFF BID	SCENARIO 3 CUTOFF BID	SCENARIO 4 CUTOFF BID	SCENARIO 5 CUTOFF BID
\$ 75,000		\$ 25,000	\$ 50,000	\$ 75,000	\$ 100,000	\$ 125,000
ACTION	EXAMPLE BID	RESULTS				
UNDER-BIDS RESERVATION VALUE	\$ 50,000	REJECTED AT \$50,000 BELOW RESERVATION VALUE	RETAINED AT \$25,000 BELOW RESERVATION VALUE	RETAINED AT RESERVATION VALUE	RETAINED AT \$25,000 ABOVE RESERVATION VALUE	RETAINED AT \$50,000 ABOVE RESERVATION VALUE
BIDS RESERVATION VALUE	\$ 75,000	REJECTED AT \$50,000 BELOW RESERVATION VALUE	REJECTED AT \$25,000 BELOW RESERVATION VALUE	RETAINED AT RESERVATION VALUE	RETAINED AT \$25,000 ABOVE RESERVATION VALUE	RETAINED AT \$50,000 ABOVE RESERVATION VALUE
OVER-BIDS RESERVATION VALUE	\$ 100,000	REJECTED AT \$50,000 BELOW RESERVATION VALUE	REJECTED AT \$25,000 BELOW RESERVATION VALUE	REJECTED AT RESERVATION VALUE	REJECTED AT \$25,000 ABOVE RESERVATION VALUE	RETAINED AT \$50,000 ABOVE RESERVATION VALUE
		<div style="display: flex; justify-content: space-between; margin: 0;"> <div style="width: 15%; background-color: red; height: 10px;"></div> - BIDDER PERCEIVES RESULT UNFAVORABLY </div> <div style="display: flex; justify-content: space-between; margin: 0;"> <div style="width: 15%; background-color: yellow; height: 10px;"></div> - BIDDER PERCEIVES RESULT INDIFFERENTLY </div> <div style="display: flex; justify-content: space-between; margin: 0;"> <div style="width: 15%; background-color: green; height: 10px;"></div> - BIDDER PERCEIVES RESULT FAVORABLY </div>				

Table 11. Uniform-Price Auction Bidding Strategy (after Myung, 2013)

2. Model Description

Aviators (A_i) are characterized by their bids (b_i) and reservation values (r_i); that is, the minimum bonus they would accept in exchange for agreeing to remain on Active Duty and serve a Department Head Tour. The objective of aviators is to maximize payoff (p_i), in this case a cash bonus, by submitting bids representative of their reservation value. The number of aviators participating in the auction is denoted by N . The Navy's goal is to retain M of aviators.

The sealed bids are collected and ranked from highest to lowest ($\{b_i\}_{i=1}^N$). The M lowest bids are retained. In the event that more than one aviator submits a bid of b_M , the tie will be broken randomly to ensure retention goals are not exceeded.³¹ The cutoff bid is set to b_{M+1} , the first excluded bid. Aviators with $b_i < b_{M+1}$ are awarded a bonus of p_{M+1} (the cash bonus required by the first aviator not selected for retention) and incur the obligated service requirement. Aviators not selected receive no bonus, but are still

³¹ Ultimately, this decision is a policy-maker's choice.

eligible to remain in the aviation community. They may also separate from Active Duty or apply for a lateral transfer at the completion of their MSR.

3. Example Auction

Table 12 is an example of a uniform-price auction seeking to retain eight out of 15 aviators. In this example, the ninth lowest bid of \$131,000 is the cutoff bid. All aviators with bids less than this amount are retained. These aviators are each awarded a \$131,000 retention bonus and incur an additional period of obligated service. The total cost of retaining the required number of aviators is \$1,048,000.

BID	RANK	RETAINED	BONUS PAID
\$ 61,000	1	Yes	\$ 131,000
\$ 68,000	2	Yes	\$ 131,000
\$ 78,000	3	Yes	\$ 131,000
\$ 81,000	4	Yes	\$ 131,000
\$ 104,000	5	Yes	\$ 131,000
\$ 104,000	6	Yes	\$ 131,000
\$ 106,000	7	Yes	\$ 131,000
\$ 129,000	8	Yes	\$ 131,000
\$ 131,000	9	No	\$ -
\$ 132,000	10	No	\$ -
\$ 134,000	11	No	\$ -
\$ 146,000	12	No	\$ -
\$ 150,000	13	No	\$ -
\$ 165,000	14	No	\$ -
\$ 174,000	15	No	\$ -
CUTOFF BID	\$ 131,000	TOTAL COST	\$ 1,048,000

Table 12. Example of Uniform-Price Auction

B. QUALITY ADJUSTED DISCOUNT (QUAD) AUCTION

1. Introduction

The QUAD auction developed by Myung (2013) is a more general form of a uniform-price auction.³² With the exceptions of how bids and payouts are determined, this mechanism is conducted in the same manner as the simple uniform-price auction described in Section A. These key differences enable the buyer to increase the efficiency of the auction by giving preferential treatment to specific classes of bidders. In addition to the benefits of a simple uniform-price auction (i.e., cost savings and retention precision), the QUAD mechanism allows the Navy to control for the quality of aviators selected without necessarily increasing the overall costs.³³

In our application, this added consideration is achieved by discounting the bids of higher-quality aviators (i.e., aviators more likely to be selected for DH). This discount artificially reduces the bids of aviators whose quality scores exceed a threshold established by the Navy. This effect increases the probability of retaining high-quality aviators in comparison to those aviators who do not exceed quality thresholds and, consequently, receive no assistance in reducing the cost of their bids. The adjusted bids are ranked alongside all non-adjusted bids. The pre-announced number of winners is selected from the lowest bids. As with a simple uniform-price auction, all winning bidders are paid the amount requested in the first excluded bid. Those high-quality aviators selected for retention receive an additional sum equal to the amount their bids were discounted.

Like other uniform-price auctions, QUAD auctions are also weakly dominant incentive compatible. Table 13 depicts the possible outcomes associated with the various bidding strategies of aviators receiving discounts to their bids. Here, as with the simple uniform-price auction, in no scenario can the bidder improve the outcome of the auction

³² QUAD is more general than the simple uniform-price auction because QUAD can accomplish everything that the simple uniform-price auction is able to accomplish and more.

³³ Note that Myung's (2013) research on Surface Warfare Officer Retention found no positive correlation between quality and cost to retain.

by bidding other than the true reservation price. Bidding outcomes for aviators not receiving a quality adjustment are the same as the uniform-price auction (Table 11).

BIDDER'S RESERVATION VALUE		QUALITY DISCOUNT	SCENARIO 1 CUTOFF BID	SCENARIO 2 CUTOFF BID	SCENARIO 3 CUTOFF BID	SCENARIO 4 CUTOFF BID	SCENARIO 5 CUTOFF BID
\$ 75,000		\$ 25,000	\$ -	\$ 25,000	\$ 50,000	\$ 75,000	\$ 100,000
BIDDER'S ACTION	EXAMPLE BID	ADJUSTED BID	RESULTS				
UNDER-BIDS RESERVATION VALUE	\$ 50,000	\$ 25,000	REJECTED AT \$50,000 BELOW RESERVATION VALUE	RETAINED AT \$25,000 BELOW RESERVATION VALUE	RETAINED AT RESERVATION VALUE	RETAINED AT \$25,000 ABOVE RESERVATION VALUE	RETAINED AT \$25,000 ABOVE RESERVATION VALUE
BIDS RESERVATION VALUE	\$ 75,000	\$ 50,000	REJECTED AT \$50,000 BELOW RESERVATION VALUE	REJECTED AT \$25,000 BELOW RESERVATION VALUE	RETAINED AT RESERVATION VALUE	RETAINED AT \$25,000 ABOVE RESERVATION VALUE	RETAINED AT \$25,000 ABOVE RESERVATION VALUE
OVER-BIDS RESERVATION VALUE	\$ 100,000	\$ 75,000	REJECTED AT \$50,000 BELOW RESERVATION VALUE	REJECTED AT \$25,000 BELOW RESERVATION VALUE	REJECTED AT RESERVATION VALUE	REJECTED AT \$25,000 ABOVE RESERVATION VALUE	RETAINED AT \$25,000 ABOVE RESERVATION VALUE

- BIDDER PERCEIVES RESULT UNFAVORABLY
 - BIDDER PERCEIVES RESULT INDIFFERENTLY
 - BIDDER PERCEIVES RESULT FAVORABLY

Table 13. QUAD Auction Bidding Strategy (after Myung, 2013)

2. Model Description

Aviators (A_i) are characterized by their bids (b_i), reservation values (r_i), and a quality factor (q_i). The objective of each aviator is to maximize their payoff (p_i), in this case a cash bonus, by submitting a bid representative of their reservation value. The number of aviators participating in the auction is denoted by N . The Navy's goal is to retain M of aviators. Additionally, the Navy is able to assign bid adjustments (X or Y) to bidders with quality levels above minimum quality thresholds (q_X or q_Y) where $Y > X$ and $q_Y > q_X$. In this research, we focus on a simplified three-category model. In practice, the Navy has the flexibility to adjust the number of categories as desired. The adjusted bids (b^*) are calculated in the following manner:

$$b_i^* = \begin{cases} b_i & \text{if } q_i < q_X \\ b_i - X & \text{if } q_X \leq q_i < q_Y \\ b_i - Y & \text{if } q_i \geq q_Y \end{cases}$$

The sealed bids are collected and ranked from lowest to highest ($\{b_i^*\}_{i=1}^N$). The M lowest bids are retained. For the purposes of our model, in the event that more than one aviator submits a bid of b_M^* , the aviators with the highest quality scores will be retained to avoid exceeding retention goals. In the event of a tie in quality score, the tie is randomly broken. The cutoff bid is set to b_{M+1}^* , the first excluded bid. Aviators with $b_i^* < b_{M+1}^*$ are selected for retention, paid a bonus, and incur the obligated service requirement. Bonuses are awarded as follows:

$$p_i = \begin{cases} b_{M+1}^* & \text{if } q_i < q_X \\ b_{M+1}^* + X & \text{if } q_X \leq q_i < q_Y \\ b_{M+1}^* + Y & \text{if } q_i \geq q_Y \end{cases}$$

Note that all retained aviators will receive at least as much as they have requested in their bids. Generally, the retained aviators will receive more than their bids submitted. In economics terminology, this is known as being individual rational.³⁴ Aviators not selected receive no bonus, but are still eligible to remain in the aviation community. They may also separate from Active Duty or apply for a lateral transfer at the completion of their MSR.

3. Example Auction

Table 14 provides an example of a QUAD auction. To illustrate the difference between a simple uniform-price auction and the QUAD auction mechanisms, the bids and retention goals are the same as the example in Table 12. A four-point scale is used to

³⁴ Individual rationality implies that the person has nothing to lose by participating in the process.

determine the quality of the bidders. Bids from aviators with $q_i \geq 4$ are discounted by \$40,000. Bids from aviators with $3 \leq q_i < 4$ are discounted by \$20,000. All other bids receive no adjustments. Factoring in these discounts, the bids are re-ranked and the cutoff bid is established at $b_{M+1}^* = \$104,000$. All retained aviators receive this bonus. Those with $3 \leq q_i < 4$ receive an additional \$20,000 and those with a $q_i \geq 4$ receive an additional \$40,000. Table 14 also highlights that, in comparison to a simple uniform-price auction, using the QUAD mechanism resulted in a 60% increase in the average quality of retained aviators while the total cost to retain the required number of officers decreased by 9.2%.

BID	RANK	QUALITY SCORE	ADJUSTMENT	ADJUSTED BID	ADJUSTED RANK	RETAINED	BONUS PAID
\$ 61,000	1	2	\$ -	\$ 61,000	1	Yes	\$ 104,000
\$ 68,000	2	1	\$ -	\$ 68,000	2	Yes	\$ 104,000
\$ 78,000	3	2	\$ -	\$ 78,000	3	Yes	\$ 104,000
\$ 81,000	4	2	\$ -	\$ 81,000	4	Yes	\$ 104,000
\$104,000	5	1	\$ -	\$ 104,000	9	No	\$ -
\$104,000	6	3	\$ (20,000)	\$ 84,000	5	Yes	\$ 124,000
\$106,000	7	3	\$ (20,000)	\$ 86,000	6	Yes	\$ 124,000
\$129,000	8	1	\$ -	\$ 129,000	12	No	\$ -
\$131,000	9	4	\$ (40,000)	\$ 91,000	7	Yes	\$ 144,000
\$132,000	10	3	\$ (20,000)	\$ 112,000	11	No	\$ -
\$134,000	11	4	\$ (40,000)	\$ 94,000	8	Yes	\$ 144,000
\$146,000	12	4	\$ (40,000)	\$ 106,000	10	No	\$ -
\$150,000	13	1	\$ -	\$ 150,000	13	No	\$ -
\$165,000	14	2	\$ -	\$ 165,000	15	No	\$ -
\$174,000	15	3	\$ (20,000)	\$ 154,000	14	No	\$ -
CUTOFF BID				\$ 104,000	TOTAL COST		\$ 952,000

UNIFORM-PRICE AUCTION		
AVERAGE QUALITY	AVERAGE BONUS	TOTAL COST
1.875	\$ 131,000	\$ 1,048,000

QUAD AUCTION		
AVERAGE QUALITY	AVERAGE BONUS	TOTAL COST
3.00	\$ 119,000	\$ 952,000

Table 14. QUAD Auction Example and Comparison

C. COMBINATORIAL RETENTION AUCTION MECHANISM (CRAM)

1. Introduction

CRAM is also a more general form of the uniform-price auction. As explained by CGM (2013), CRAM is a reverse multi-unit auction. It seeks to elicit sellers' reservation prices as not just cash value, but also a combination of non-monetary incentives (NMIs)³⁵ that the sellers may select in lieu of a specified cash amount. As with the simple uniform-price auction, by employing CRAM the Navy can reduce the cost of retaining aviators while precisely meeting retention goals. Additionally, by offering NMIs CRAM has the potential to further reduce costs to the Navy by retaining individuals who receive greater utility from the NMIs than their simple monetary cost to the Navy.

In practice, each aviator submits a bid for the cash bonus and any NMIs they would require in order to agree to an additional period of obligated service. The sealed bids are collected and each resultant combination of cash and NMIs is assigned a single cost parameter that serves as that seller's bid. The preannounced quantity of offers is selected from the lowest costing bids. In keeping with the uniform-price auction format, the accepted offers receive a bonus equal to the cost of the first excluded bid. The actual composition of each bonus is the cash amount of the cutoff bid, plus the NMIs selected, less the value of those NMIs. Additionally, CRAM maintains the same weakly dominant incentives of a simple uniform-price auction (Table 11).

2. Model Description

Aviators (A_i) are characterized by their bids (b_i) and reservation values (r_i). The objective of each aviator is to maximize payoff (p_i)—in this case a combination of cash and NMIs—by submitting a bid representative of the reservation value. The number of aviators participating in the auction is denoted by N . The Navy's goal is to retain M aviators. While the original CRAM allows for any number of NMIs, this model focuses on a simplified case of three NMIs, which are denoted as e , f , and g . Aviators may select any combination of these NMIs that increases the cost of bids by a predetermined amount

³⁵ Examples of NMIs include choice of duty station, sabbaticals, and educational opportunities. For a more in-depth discussion on the potential of NMIs, refer to Coughlin, Gates, and Myung (2014).

denoted as E_c , F_c , and G_c .³⁶ Each aviator's personal valuation of the NMIs offered is further denoted as E_i , F_i , and G_i . The CRAM bids are calculated as follows:

$$b_i^* = b_i + eE_c + fF_c + gG_c$$

Where e, f, g each = 1 if NMI is selected; 0 if NMI not selected

The sealed bids are collected and ranked from lowest to highest ($\{b_i^*\}_{i=1}^N$). The M lowest bids are retained. For purposes of our model, in the event that more than one aviator submits a bid of b_M^* the aviators with the lowest b_i will be retained. In the event of a tie in b_i , the tie will be randomly broken. The cutoff bid is set to b_{M+1}^* , the first excluded bid. Aviators with $b_i^* < b_{M+1}^*$ are selected for retention, paid a bonus, and incur the obligated service requirement. Bonuses are awarded in two parts: monetary and non-monetary:

$$p_i = b_{M+1}^* + e(E_i - E_c) + f(F_i - F_c) + g(G_i - G_c)$$

Where e, f, g each = 1 if selected; 0 if not selected

As the equation for determining p_i illustrates, the CRAM is designed such that aviators seeking to maximize their payouts would only select an NMI when the value they derive from it exceeds the cost of selecting it. Moreover, the excess utility an aviator derives from an NMI (i.e., the difference between the value of the NMI and the cost of providing it) results in an overall reduction in the Navy's cost to retain said aviator.

Aviators not selected receive no bonus, but are still eligible to remain in the aviation community. They may also separate from Active Duty or apply for a lateral transfer at the completion of their MSR.

3. Example Auction

Table 15 provides a notional example of a CRAM. To illustrate the differences between a simple uniform-price auction and a CRAM, the same retention goal of eight out of 15 aviators is used. Additionally, the reservation prices are held to the same values

³⁶ These values would be set at the Navy's actual cost for providing the NMIs.

as the bids used in Table 12—reflecting a net change of zero in individual reservation values. The three available NMIs are e , f , and g , each with a cost of \$10,000. Aviators selecting any combination of these NMIs have the associated costs added to their CRAM bid. No adjustments are made to the bids of aviators not selecting NMIs. Factoring in these adjustments, the resulting CRAM bids are re-ranked and the cutoff bid is established at $b_{M+1}^* = \$107,000$. Aviators with CRAM bids less than \$107,000 are retained. Retained aviators receive the NMIs requested and \$107,000 less the value of the requested NMIs. In this example, the excess utility aviators received from the NMIs resulted in reducing the total cost (cash plus the cost of the NMIs awarded) to retain eight aviators by \$192,000 for a savings of 18.3% in comparison to the simple uniform-price auction.

RANK	RESERVATION PRICE	VALUE OF NMI			CASH BID	GRAM BID	ADJUSTED RANK	RETAINED	COST OF BONUS				
		E	F	G					CASH	NMI COST			
									E	F	G		
1	\$ 61,000	\$ -	\$ 40,000	\$ 13,000	\$ 8,000	\$ 28,000	1	YES	\$ 87,000	\$ -	\$ 10,000	\$ 10,000	
2	\$ 68,000	\$ -	\$ -	\$ -	\$ 68,000	\$ 68,000	3	YES	\$ 107,000	\$ -	\$ -	\$ -	
3	\$ 78,000	\$ -	\$ -	\$ -	\$ 78,000	\$ 78,000	4	YES	\$ 107,000	\$ -	\$ -	\$ -	
4	\$ 81,000	\$ -	\$ 29,000	\$ -	\$ 52,000	\$ 62,000	2	YES	\$ 97,000	\$ -	\$ 10,000	\$ -	
5	\$ 104,000	\$ -	\$ -	\$ 25,000	\$ 79,000	\$ 89,000	6	YES	\$ 97,000	\$ -	\$ -	\$ 10,000	
5	\$ 104,000	\$ 27,000	\$ 19,000	\$ -	\$ 58,000	\$ 78,000	4	YES	\$ 87,000	\$ 10,000	\$ 10,000	\$ -	
7	\$ 106,000	\$ -	\$ -	\$ -	\$ 106,000	\$ 106,000	8	YES	\$ 107,000	\$ -	\$ -	\$ -	
8	\$ 129,000	\$ -	\$ 48,000	\$ -	\$ 81,000	\$ 91,000	7	YES	\$ 97,000	\$ -	\$ 10,000	\$ -	
9	\$ 131,000	\$ -	\$ -	\$ -	\$ 131,000	\$ 131,000	12	NO	\$ -	\$ -	\$ -	\$ -	
10	\$ 132,000	\$ -	\$ 35,000	\$ -	\$ 97,000	\$ 107,000	9	NO	\$ -	\$ -	\$ -	\$ -	
11	\$ 134,000	\$ 12,000	\$ 13,000	\$ -	\$ 109,000	\$ 129,000	11	NO	\$ -	\$ -	\$ -	\$ -	
12	\$ 146,000	\$ -	\$ -	\$ -	\$ 146,000	\$ 146,000	15	NO	\$ -	\$ -	\$ -	\$ -	
13	\$ 150,000	\$ -	\$ 24,000	\$ -	\$ 126,000	\$ 136,000	13	NO	\$ -	\$ -	\$ -	\$ -	
14	\$ 165,000	\$ -	\$ 44,000	\$ 34,000	\$ 87,000	\$ 107,000	10	NO	\$ -	\$ -	\$ -	\$ -	
15	\$ 174,000	\$ -	\$ 45,000	\$ -	\$ 129,000	\$ 139,000	14	NO	\$ -	\$ -	\$ -	\$ -	
		\$ 39,000	\$ 297,000	\$ 72,000	CUTOFF BID	\$ 107,000			\$ 786,000	\$ 10,000	\$ 40,000	\$ 20,000	

NMI	PROB. OF SELECTING	COST	AVG VALUE WHEN SELECTED	GRAM		UNIFORM PRICE	
				CASH	NMI COST	CASH	NMI COST
E	25%	\$ 10,000	\$ 20,000	\$ 786,000	\$ 70,000	\$ 1,048,000	\$ -
F	40%	\$ 10,000	\$ 30,000	\$ 856,000	\$ 70,000	\$ 1,048,000	\$ -
G	20%	\$ 10,000	\$ 25,000	\$ 856,000	\$ 70,000	\$ 1,048,000	\$ -
				Total Cost	\$ 856,000	Total Cost	\$ 1,048,000

Table 15. CRAM Example and Comparison

D. CHAPTER SUMMARY

In this chapter, we discussed the three auction mechanisms used in our research: a simple uniform-price auction, a QUAD auction, and a CRAM. All employ a reverse second-price format. This encourages Naval Aviators to truthfully bid the bonus they would require in exchange for obligating to remain on Active Duty. These mechanisms were selected for their transparency, ease of use, and equitability. Perhaps most

importantly, however, these mechanisms each provide sufficient flexibility and precision to enable Force planners to accurately and more cost-effectively meet naval aviation retention objectives. In addition to these aspects, the QUAD mechanism, by providing preferential consideration to the bids of high-quality officers, enables the Navy to both control for the quality of aviators retained and reduce overall retention costs further. The CRAM offers potential for additional savings by retaining individuals who receive greater utility from the NMIs than their simple monetary cost to the Navy.

V. AVIATOR RETENTION SURVEY

A. BACKGROUND

A survey of Naval Aviators from Lieutenant (O-3) to Commander (O-5) was conducted to compare the results of the current ACCP program against the three auction mechanisms that were the focus of our research: Uniform-Price Auction, QUAD Auction, and CRAM. The survey data was used to establish both individual performance history and reservation price for agreeing to serve an additional term of service. Additionally, the value individuals associated with specific NMIs was also collected. These parameters were then used to simulate the projected retention rates and costs under the current ACCP system, as well as the auction mechanisms previously listed.

B. SURVEY DEVELOPMENT AND DELIVERY

Using LimeSurvey, an NPS approved open-source survey development and distribution program, we developed an online survey. We designed the questions to elicit the participants' 1) quality, as a function of their performance history, to assess their value to the Navy, 2) reservation price for remaining on Active Duty to complete a DH tour and, 3) perceived value of several NMIs. Drafts of the survey were sent to several groups of Naval Aviators varying in rank and experience. Their inputs, along with those from Naval Personnel Research, Studies, and Technology (NPRST), were incorporated into the final version.

Upon receiving approval from the Naval Postgraduate School (NPS) Institutional Review Board (IRB) and Dean of Students, we sent an e-mail containing a link to the survey directly to NPS students (both on-site and distance learning) identified by the NPS Student Services Office as Naval Aviators (i.e., possessing a 1310 or 1320 designator). The survey was open to participants from April 28, 2014 to May 9, 2014. On May 4, 2014, a reminder e-mail was sent to students who had not yet completed the survey. Each e-mail contained a unique token to ensure that only the students who had been e-mailed could complete the survey and that no duplicate submissions could be made. (See Appendix D for a copy of the survey.)

C. POPULATION AND SAMPLE STATISTICS

Of the 341 Aviation Officers targeted, five students opted out of the survey and 175 provided at least partial responses. Of the respondents, 24 failed to provide data by incompletely answering the questions used to determine reservation value. This brought the useable sample group to 142. Additionally, incomplete responses in the quality rating section further reduced the responses suitable for use in the QUAD model to 98.

Table 16 provides a summary of the sample demographics and their comparison to the naval aviation population statics. We summarize individual communities into three general categories: fixed-wing carrier-based (FW CVN) (i.e., VAQ, VAW, VFA, VRC); fixed-wing land-based (FW Land) (i.e., VP, VQ(P), VQ(T)); and helicopter (HELO) (i.e., HM, HSC, HSM).

	Observations	Survey Population	Naval Aviation Population
FW CVN	55	36.9%	41%
FW Land	37	24.8%	28%
HELO	57	38.3%	31%
Pilot	100	69.0%	71%
NFO	45	31.0%	29%
Male	140	95.9%	94%
Female	6	4.1%	6%

Table 16. Fleet and Survey Demographics Comparison

D. ESTIMATION OF PARAMETERS

1. Uniformed-Price Auction Bids

To establish individual reservation values, a simple uniformed-price auction was briefly explained along with a hypothetical example of how the Navy might employ such an auction. We posed this question: “Assume you are in a group of 140 aviators eligible to receive a retention bonus. If, under the [uniform-price auction] system described above, the Navy's goal is to retain 65 aviators, what is the amount you would likely

submit for your bid (total bonus amount)?”³⁷ The respondents were able to select in \$5,000 increments a value ranging from “\$0/No Bonus Required” to “More than \$175,000/Do not wish to be retained.”³⁸ We further advised, “This value should be the MINIMUM amount you would be satisfied with in exchange for obligating to serve a DH tour.” Table 17 provides a summary of the responses provided by individual communities and the more generalized categories of FW CVN, FW Land, and HELO. Those respondents who selected “More than \$175,000/Do not wish to be retained” were not included in determining the reservation price measures of central tendency.

RESERVATION PRICE								
Community	Observations	>\$175K/Do Not Retain	Viable Bids	Mean Bid	Median Bid	Mode	Std Dev	
PILOT	FW CVN	24	4	20	\$100,000	\$100,000	\$100,000	\$ 51,348
	VAQ	1	-	1	\$ 25,000	\$ 25,000	N/A	\$ -
	VAW	2	-	2	\$ 75,000	\$ 75,000	N/A	\$ 35,355
	VFA	19	4	15	\$109,000	\$125,000	\$125,000	\$ 53,958
	VRC	2	-	2	\$100,000	\$100,000	\$100,000	\$ -
	FW LAND	17	-	17	\$118,611	\$125,000	\$150,000	\$ 39,437
	VP	13	-	13	\$117,308	\$125,000	\$150,000	\$ 43,235
	VQ(P)	4	-	4	\$100,000	\$100,000	\$100,000	\$ 63,738
	VQ(T)	-	-	-	\$ -	\$ -	\$ -	\$ -
	Helicopter	57	3	54	\$ 99,167	\$100,000	\$125,000	\$ 47,848
	HM	3	-	3	\$ 55,000	\$ 75,000	N/A	\$ -
	HSC	32	1	31	\$102,742	\$120,000	\$125,000	\$ 51,443
HSM	22	2	20	\$100,250	\$100,000	\$ 75,000	\$ 40,408	
NFO	FW CVN	28	1	27	\$ 80,741	\$100,000	\$100,000	\$ 49,180
	VAQ	11	-	11	\$ 93,636	\$100,000	\$100,000	\$ 38,671
	VAW	6	1	5	\$ 5,000	\$ -	\$ -	\$ 11,801
	VFA	11	-	11	\$102,273	\$100,000	\$ 75,000	\$ 34,378
	FW LAND	16	1	15	\$ 76,000	\$ 75,000	\$125,000	\$ 40,848
	VP	13	1	12	\$ 82,692	\$ 90,000	\$ 75,000	\$ 37,506
	VQ(P)	1	-	1	\$ -	\$ -	N/A	\$ -
VQ(T)	2	-	2	\$ 82,500	\$ 82,500	N/A	\$ 24,749	
TOTALS	ALL	142	9	132	\$ 95,564	\$100,000	\$125,000	\$ 47,529
	PILOT	98	7	91	\$103,187	\$100,000	\$125,000	\$ 47,507
	NFO	44	2	42	\$ 79,048	\$ 95,000	\$100,000	\$ 45,922

Table 17. Reservation Price by Community

³⁷ 65 out of 140 aviators approximates the retention rate required to meet community DH requirements (ACCP PM, personal communication, 2014, March 19).

³⁸ The Navy is considering pursuing legislation to increase ACCP from a maximum of \$25K/year to \$35K/year which would equate to \$175K for a five-year contract (CNO (MTP&E), unpublished power point presentation, 2014, February 16).

2. QUAD Quality Scores

Determining an Aviation Officer's quality is ultimately a decision for policy-makers. Using factors identified by NPC as affecting the likelihood of an individual being selected for DH, two methods for calculating an aviator's quality rating were explored. Both methods use the same general categories, but vary in some of the specific metrics used and the weights assigned to them. We used the following categories to determine:

- Final FITREP ranking during first sea tour
- First shore tour assignment
- Final FITREP ranking during first shore tour
- An "Other Factors" category comprised of specific qualifications and experiences

Additional factors considered for determining quality ratings included subsequent assignment's (e.g., second sea tour, DH tour) and their associated FITREP rankings. These metrics were listed as "Not Applicable" by 32 of the 98 respondents who did provide sufficient data for the first two quality methods. Without an effective method for normalizing the responses of those 32 respondents, we determined that these factors, though relevant, would not be included in assigning quality ratings.

a. *Quality Method I*

Table 18 illustrates the four categories that were used to determine an individual's quality ranking and the weights assigned to the possible responses. With the exception of the "other factors" category, only a single value may be provided. To determine an individual's quality score, the values from each category are summed. This results in minimum and maximum possible scores of zero and 15, respectively.

FIRST SEA TOUR PERFORMANCE	
#1 EP	4
Other EP	3
NOB	2
#1 MP	1
Other MP	0

FIRST SHORE TOUR PERFORMANCE	
#1 EP	4
Other EP	3
NOB	2
#1 MP	1
Other MP	0

FIRST SHORE TOUR ASSIGNMENT	
FRS/VX/HX/WS/NSAWC	2
OTHER	1
TRACON	0

OTHER FACTORS	
SFTI/WTI	3
FLAG AIDE	2

Table 18. Quality Method I Scale

b. *Quality Method II*

Table 19 illustrates the four categories we used to determine an individual’s quality ranking and the weights assigned to the possible responses. In addition to the factors used in the first method, metrics that have been shown to have a negative correlation in DH selection rates have been included. Using aggregate DH selection rate data from 2010 to 2013, we assigned these metrics as having greater significance when they had been shown to be more highly correlated with DH selection rates. As an example: an individual qualified as a WTI was on average 26.7% more likely to be selected for DH than an individual not possessing that qualification. Thus, that individual was assigned 2.5 points. Conversely, individuals who had been assigned to fill Individual Augment requirements were historically 14.5% less likely to be selected for DH than individuals who had not and, therefore, had 1.5 points deducted from their scores. We applied this logic to all the performance metrics used in Method II. Here again, only a single value may be assigned to each category—with the exception of the “other factors” category. To determine an individual’s quality score, we summed the values from each category. This resulted in minimum and maximum possible scores of negative three and 15, respectively.

FIRST SEA TOUR PERFORMANCE	
#1 EP	4.5
Other EP	3.5
NOB	2.5
#1 MP	2
Other MP	0

FIRST SHORE TOUR ASSIGNMENT	
FRS/VX/HX/ WS/NSAWC	2.5
OTHER	0
TRACON	-0.5

FIRST SHORE TOUR PERFORMANCE	
#1 EP	4.5
Other EP	3.5
NOB	2.5
#1 MP	2
Other MP	0

OTHER FACTORS	
SFTI/WTI	2.5
FLAG AIDE	1
OVERSEAS	-0.5
Aircraft/Warfare Transition	-0.5
GSA / IA	-1.5

Table 19. Quality Method II Scale

c. *Quality Method Scores and Comparison*

Table 20 summarizes the results of the two quality rating systems. Despite the different scores resulting from each method, when applied to the same sample group the resultant correlation between the two methods was .961. Under the quality rating metrics used, aviators would have generally been afforded the same opportunities and competed against only members of their own community. Accordingly, the varying aggregate community quality scores should not be interpreted as an indicator of some disparate quality in the aviators assigned to specific communities.

		Quality Method I				Quality Method II				
Community	Observations	Median Score	Std Dev	Min Score	Max Score	Median Score	Std Dev	Min Score	Max Score	
TOTALS	ALL	98	8.00	2.94	2.00	14.00	8.00	3.28	1.50	14.00
	PILOT	63	8.00	2.75	3.00	13.00	7.50	3.10	2.00	14.00
	NFO	35	8.00	3.20	2.00	14.00	9.50	3.46	2.00	14.00
PILOT	FW CVN	16	9.00	2.87	4.00	13.00	10.25	3.30	3.00	14.00
	VAQ	1	10.00	-	10.00	10.00	11.50	-	11.50	11.50
	VAW	1	9.00	-	9.00	9.00	10.50	-	10.50	10.50
	VFA	12	9.50	2.86	4.00	13.00	10.25	3.54	3.00	14.00
	VRC	2	6.00	-	6.00	6.00	6.25	0.35	6.00	6.50
	FW LAND	13	6.00	2.54	3.00	11.00	6.00	2.69	2.50	10.50
	VP	10	6.00	2.85	3.00	11.00	5.75	2.99	2.50	10.50
	VQ(P)	3	6.00	1.53	5.00	8.00	6.00	1.76	4.50	8.00
	VQ(T)	-	-	-	-	-	-	-	-	-
	HELO	34	7.00	2.62	3.00	12.00	7.25	2.86	2.50	13.00
	HM	-	-	-	-	-	-	-	-	-
	HSC	22	8.00	2.41	3.00	12.00	8.00	2.75	2.50	13.00
	HSM	12	6.00	3.03	3.00	12.00	6.50	3.16	2.50	13.00
NFO	FW CVN	23	9.00	2.89	4.00	14.00	9.50	3.02	4.50	14.00
	VAQ	10	8.50	3.39	4.00	13.00	9.25	3.54	4.50	14.00
	VAW	5	11.00	3.29	7.00	14.00	11.50	4.02	5.00	14.00
	VFA	8	8.50	1.69	8.00	12.00	10.00	1.43	8.00	12.50
	FW LAND	12	7.50	3.45	2.00	13.00	6.50	3.36	1.50	14.00
	VP	9	6.00	3.66	2.00	13.00	6.50	4.26	1.50	14.00
	VQ(P)	1	12.00	-	12.00	12.00	13.00	-	13.00	13.00
	VQ(T)	2	8.00	1.41	7.00	9.00	7.75	3.89	5.00	10.50

Table 20. Quality Score by Community

d. *Relating Reservation Price to Quality Score*

Using the second quality method, we compared individual aviator’s quality ratings against their reservation price using linear regression.³⁹ Table 21 summarizes the results for any category that had at least eight valid observations. As an example: using the data set for all valid observations (i.e., “ALL”), a simple correlation of individual quality scores and their corresponding reservation prices reveals a correlation of -.054. The linear expression that best describes the relationship between quality score and reservation price suggests that an aviator with a quality rating of zero would have a reservation price of \$99,719. Further, this reservation price would decrease by \$862 for

³⁹ Aviators who responded “More than \$175,000/Do not wish to be retained” were not included in determining the correlation between quality rating and reservation price.

every one-point increase in quality rating. An R-squared value of .003 reveals that this relationship explains only 0.3% of variation from the mean. This is in keeping with previous research on service member quality scores and reservation price (Nowell, 2012). As Table 21 depicts, though multiple communities suggest a positive relationship between quality score and reservation price, the coefficient p-values reveal that none of these models, even the community with the lowest p-value (VFA pilots), is not statistically significant above a threshold of 16%. (See Appendix E for the residual plots of quality score and reservation price.)

		Quality Method II						
	Community	Observations	Correlation	R-squared	Intercept	Intercept P-value	Coefficient	Coefficient P-value
TOTALS	ALL	91	-0.054	0.003	\$99,719	0.000	-\$862	0.609
	PILOT	57	0.097	0.009	\$89,925	0.000	\$1,669	0.472
	NFO	34	-0.152	0.023	\$94,090	0.000	-\$2,067	0.379
PILOT	FW CVN	13	0.328	0.108	\$39,092	0.486	\$6,473	0.273
	VAQ	-	-	-	-	-	-	-
	VAW	-	-	-	-	-	-	-
	VFA	9	0.501	0.251	\$7,186	0.919	\$10,472	0.169
	VRC	-	-	-	-	-	-	-
	FW LAND	13	-0.006	0.000	\$119,773	0.002	-\$91	0.984
	VP	10	0.100	0.010	\$109,244	0.010	\$1,399	0.784
	VQ(P)	-	-	-	-	-	-	-
	VQ(T)	-	-	-	-	-	-	-
	HELO	31	0.147	0.022	\$75,875	0.014	\$2,748	0.429
	HM	-	-	-	-	-	-	-
	HSC	21	0.094	0.009	\$83,576	0.052	\$1,941	0.687
HSM	10	0.253	0.064	\$64,800	0.038	\$3,847	0.920	
NFO	FW CVN	23	-0.113	0.013	\$91,482	0.002	-\$1,790	0.352
	VAQ	10	-0.037	0.001	\$96,800	0.038	-\$422	0.920
	VAW	-	-	-	-	-	-	-
	VFA	8	0.265	0.070	\$45,326	0.555	\$4,783	0.526
	FW LAND	11	-0.214	0.046	\$96,543	0.080	-\$2,384	0.833
	VP	8	0.038	0.002	\$81,880	0.272	\$399	0.601
	VQ(P)	-	-	-	-	-	-	-
	VQ(T)	-	-	-	-	-	-	-

Table 21. Relationship between Quality Score (Method II) and Reservation Price

3. CRAM Bids

To determine how NMIs might affect individual bids, we asked survey participants a series of questions relating to two specific NMIs: 1) Guaranteed DH duty station location of choice and 2) the opportunity to attend an in-residence graduate degree program.

a. *NMI I: Duty Station of Choice*

To establish the value participants placed on duty station location, our first survey first posed the statement: “Please specify the location you would prefer to be stationed for your ‘Department Head Tour.’ Possible responses were 1) Not Applicable, 2) CONUS Central, 3) CONUS East Coast, 4) CONUS West Coast, and 5) OCONUS. We then asked respondents, “What is the equivalent cash bonus you would be willing to forgo for the guarantee of serving in your preferred duty station?”

Of the 141 useable responses, 132 provided a preference for a duty station location. Of those 132 with a preference, 70 were willing to forgo some cash amount in exchange for the guarantee of serving in their preferred duty station. Table 22 provides a summary of these respondents and the value they placed on this NMI. For instance, in the ALL category of the 141 Aviators who answered this portion of the survey 70, or 49.6%, would be willing to forgo a portion of a cash bonus for the guarantee of their choice of duty station. The mean and median values these 70 individuals were willing to forego for this NMI are \$41,500 and \$25,000, respectively.

		Duty Station of Choice					
Community	Observations	Value NMI > \$ 0	% Who Value NMI > \$ 0	Mean Value (1)	Median Value (1)	Std. Dev (1)	
TOTALS	ALL	141	70	49.6%	\$ 41,500	\$ 25,000	\$ 41,888
	PILOT	98	55	56.1%	\$ 38,182	\$ 25,000	\$ 33,807
	NFO	43	15	34.9%	\$ 53,667	\$ 25,000	\$ 63,540
PILOT	FW CVN	24	10	41.7%	\$ 33,500	\$ 22,500	\$ 29,255
	VAQ	1	1	100.0%	\$ 10,000	\$ 10,000	\$ -
	VAW	2	2	100.0%	\$ 30,000	\$ 30,000	\$ 28,284
	VFA	19	6	31.6%	\$ 40,833	\$ 37,500	\$ 34,120
	VRC	2	1	50.0%	\$ 20,000	\$ 20,000	\$ -
	FW LAND	17	10	58.8%	\$ 38,500	\$ 22,500	\$ 41,302
	VP	13	7	53.8%	\$ 30,714	\$ 10,000	\$ 33,964
	VQ(P)	4	3	75.0%	\$ 56,667	\$ 25,000	\$ 59,231
	VQ(T)	-	-	-	\$ -	\$ -	\$ -
	HELO	57	35	61.4%	\$ 39,429	\$ 25,000	\$ 33,602
	HM	3	2	66.7%	\$ 47,500	\$ 47,500	\$ 38,891
	HSC	32	18	56.3%	\$ 43,056	\$ 35,000	\$ 28,756
	HSM	22	15	68.2%	\$ 34,000	\$ 20,000	\$ 39,650
NFO	FW CVN	28	10	35.7%	\$ 35,000	\$ 25,000	\$ 26,562
	VAQ	11	7	63.6%	\$ 39,286	\$ 30,000	\$ 31,415
	VAW	6	-	0.0%	\$ -	\$ -	\$ -
	VFA	11	3	27.3%	\$ 25,000	\$ 25,000	\$ -
	FW LAND	15	5	33.3%	\$ 91,000	\$ 50,000	\$ 99,649
	VP	12	5	41.7%	\$ 91,000	\$ 50,000	\$ 99,649
	VQ(P)	1	-	0.0%	\$ -	\$ -	\$ -
	VQ(T)	2	-	0.0%	\$ -	\$ -	\$ -

(1) For Aviators valuing NMI above \$0.00

Table 22. Summary of Value of NMI I: Duty Station of Choice

b. *NMI II: In-residence Graduate Education*

To establish the value participants placed on an NMI that provided an in-residence graduate education opportunity, our survey posed the following situation:

Suppose as part of the “Aviation Bonus” there was the option to attend an in-residence degree program in lieu of some other “due-course” career path option (e.g., shortening or foregoing a “Disassociated Sea Tour” to attend the Naval Postgraduate School). Assume that in addition to a cash bonus you were offered this option. How interested would you be in the in-residence degree portion of the bonus?

Possible responses were 1) Not at all interested, 2) Indifferent/Don't Know, 3) Somewhat Interested, 4) Very Interested, and 5) Extremely Interested. Table 23 provides a summary of the 141 useable responses.

	Number of Responses
Not at All Interested	13
Indifferent/Don't Know	10
Somewhat Interested	29
Very Interested	40
Extremely Interested	43
No Response	6

Table 23. Interest in NMI II: In-residence Graduate Education

Survey participants were then asked, “What is the equivalent cash bonus you would be willing to forgo for the guarantee of attending a Naval Aviation Enterprise (NAE) supported in-residence degree program like the one described?”

Table 24 provides a summary of the value participants placed on this NMI. As an example, of the 141 responses in the ALL category 82, or 58.2%, were willing to forgo some cash amount in exchange for the guarantee of attending an in-residence graduate education program. The mean and median values these 82 individuals were willing to forego for this NMI are \$46,378 and \$30,000, respectively.

		Graduate Education					
Community	Observations	Value NMI > \$ 0	% Who Value NMI > \$ 0	Mean Value (1)	Median Value (1)	Std. Dev (1)	
TOTALS	ALL	141	82	58.2%	\$ 46,378	\$ 30,000	\$ 37,637
	PILOT	98	58	59.2%	\$ 48,897	\$ 35,000	\$ 39,418
	NFO	43	24	55.8%	\$ 40,292	\$ 30,000	\$ 32,913
PILOT	FW CVN	24	14	58.3%	\$ 47,500	\$ 37,500	\$ 36,977
	VAQ	1	1	100.0%	\$ 10,000	\$ 10,000	\$ -
	VAW	2	1	50.0%	\$ 35,000	\$ 35,000	\$ -
	VFA	19	10	52.6%	\$ 57,000	\$ 50,000	\$ 37,874
	VRC	2	1	50.0%	\$ 15,000	\$ 15,000	\$ -
	FW LAND	17	11	64.7%	\$ 60,909	\$ 50,000	\$ 47,530
	VP	13	10	76.9%	\$ 54,500	\$ 50,000	\$ 44,811
	VQ(P)	4	1	25.0%	\$ 25,000	\$ 25,000	\$ -
	VQ(T)	-	-	-	-	-	-
	HELO	57	24	42.1%	\$ 44,417	\$ 30,000	\$ 39,031
	HM	3	1	33.3%	\$ 15,000	\$ 15,000	\$ -
	HSC	32	4	12.5%	\$ 67,500	\$ 50,000	\$ 56,789
HSM	22	15	68.2%	\$ 41,067	\$ 25,000	\$ 39,315	
NFO	FW CVN	28	16	57.1%	\$ 40,063	\$ 40,000	\$ 29,122
	VAQ	11	9	81.8%	\$ 49,000	\$ 50,000	\$ 34,355
	VAW	6	1	16.7%	\$ 50,000	\$ 50,000	\$ -
	VFA	11	6	54.5%	\$ 25,000	\$ 25,000	\$ 14,832
	FW LAND	15	8	53.3%	\$ 40,750	\$ 27,500	\$ 41,733
	VP	12	7	58.3%	\$ 46,429	\$ 30,000	\$ 41,605
	VQ(P)	1	-	0.0%	\$ -	\$ -	\$ -
VQ(T)	2	1	50.0%	\$ 1,000	\$ 1,000	\$ -	

(1) For Avaitors valuing NMI above \$0.00

Table 24. Summary of Value of NMI II: In-residence Graduate Education

VI. ANALYSIS AND RESULTS

A. INTRODUCTION

To analyze the effects of implementing an auction-based retention system, we input the data and quality scores derived from the survey into five models using Microsoft Excel. To facilitate a comparison of these models, we used only the 98 responses that could be used in every model. The first model represents a simple uniform-price auction. The second and third models both simulated a QUAD auction, but varied in the quality level required to receive a discount.⁴⁰ The fourth and fifth models both simulated CRAMs: the fourth using NMI I (duty station location) and the fifth using NMI II (in-residence graduate school).⁴¹ We conducted Iterations of each model for communities containing at least eight valid observations. Additionally, we conducted simulations using the general categories of FW CVN, FW Land, and Helo, as well as the aggregate data sets of all aviators, pilots, and NFOs. We used the results of each simulation to determine the estimated retention costs and quality scores associated with the different auction mechanisms. We evaluated these values against the results of the current system to determine potential cost savings and the impact on the aggregate quality of retained aviators.

B. GENERAL ANALYSIS

To determine the retention requirements and overall performance of the auction models, we used the most recently completed ACCP Program (FY-2013) as a baseline. Table 25 depicts the population sizes and retention requirements of the FY-2013 ACCP Program. Using these parameters, we determined the equivalent retention goals of the sample population. For instance, in FY-2013 there were 137 VFA pilots eligible to receive the bonus. Of the 137, the Navy sought to retain 62 for a desired retention rate of

⁴⁰ Because of the correlation of .961 between the two quality-scoring methods, we only used Method II in this analysis.

⁴¹ Because of the survey's failure to address the sub-additive and super-additive possibilities of offering multiple NMIs, we did not analyze the potential results of bidders being able to select both NMIs simultaneously.

45%. When we applied this rate to the corresponding sample population, each model retained five of the 12 VFA Pilot bids (i.e., observations).⁴²

		Current Method (FY 2013)			Sample Population		
Community		Total Eligible	Retention Goal	Req'd Retention Rate	Eligible Observations	Req'd Retention Rate	Equivalent Retention Goal
TOTALS	ALL	971	331	34%	98	34%	33
	PILOT	649	238	37%	63	37%	23
	NFO	322	93	29%	35	29%	10
PILOT	FW CVN	201	91	45%	16	45%	7
	VFA	137	62	45%	12	45%	5
	FW LAND	161	45	28%	13	28%	4
	VP	125	31	25%	10	25%	3
	HELO	287	102	36%	34	36%	12
	HSC	133	48	36%	22	36%	8
	HSM	138	48	35%	12	35%	4
NFO	FW CVN	174	49	28%	24	28%	7
	VAQ	49	17	35%	10	35%	4
	VFA	56	14	25%	8	25%	2
	FW LAND	148	44	30%	11	30%	3
	VP	107	28	26%	8	26%	2

Table 25. FY-2013 ACCP Parameters and Retention Goals with Corresponding Sample Population Requirements

It should be noted that the categories not associated with a specific community (e.g., FW CVN Pilot, All NFOs), while commonly used to measure ACCP performance, do not necessarily account for individual community retention requirements. Therefore, they may not accurately reflect the true costs of meeting Navy retention goals. As such, we did not use these categories for analytical purposes. We provide them only as a reference. Additionally, due to the limited data for some communities it is not possible to estimate the expected costs and resultant quality levels associated with meeting every

⁴² Because these auction mechanisms allow the flexibility to retain exactly the desired number of bidders, we assumed that retention goals were met any time there were sufficient aviators willing to be retained for \$175,000 or less.

community's retention goal without making additional assumptions. The category "Aggregate Retention," which accounts for the individual retention requirements of seven of the 15 different communities recognized under ACCP, is used to give some estimation of each model's overall effects on ACCP.

C. UNIFORM-PRICE AUCTION

1. Analysis

The uniform-price model ranks each bidder in ascending order from the appropriate data set according to the amount each provided in the survey. Using the retention goals listed in Table 25, the corresponding number of bidders beginning with the lowest reservation prices are assumed to be retained. Where reservation prices were the same, the bidders with higher quality scores (using method II) were retained. The cost to retain the selected aviators was set at the first excluded bid (i.e., the cut-off bid). See Appendix F for the residual plots of this model. To obtain the equivalent cost of implementing a uniform-price auction, the cut-off bid as determined by the model was multiplied by the actual retention goals of the FY-2013 program.

2. Results

Table 26 lists the cut-off bids and resultant costs in comparison to the actual results of the FY 2013 program. As an example, the HSM community had a cut-off bid of \$75,000—which coincidentally equaled the bonus amount offered in FY-2013—however, by limiting retention to the desired retention goal of 48 aviators, the uniform price auction resulted in an equivalent cost of \$3,600,000. When this is compared to the \$5,850,000 spent on retaining HSM pilots in FY-2013, the savings are \$2,250,000 or a cost reduction of 38.5%.

Current Method (FY 2013)					Uniform Price				
Community	Retention Goal	Posted Price	Actual Retention	Actual Cost	Cut-off Bid	Equivalent Cost	Total Cost Δ	% Total Cost Δ	
TOTALS	ALL	331	-	351	\$ 28,775,000	\$ 85,000	\$ 28,135,000	-\$640,000	-2.2%
	PILOT	238	-	243	\$ 20,600,000	\$ 100,000	\$ 23,800,000	\$3,200,000	15.5%
	NFO	93	-	108	\$ 8,175,000	\$ 50,000	\$ 4,650,000	-\$3,525,000	-43.1%
PILOT	FW CVN	91	-	67	\$ 7,975,000	\$ 110,000	\$ 10,010,000	\$2,035,000	25.5%
	VFA	62	\$ 125,000	47	\$ 5,875,000	\$ 125,000	\$ 7,750,000	\$1,875,000	31.9%
	FW LAND	45	-	33	\$ 1,900,000	\$ 100,000	\$ 4,500,000	\$2,600,000	136.8%
	VP	31	\$ 50,000	23	\$ 1,150,000	\$ 125,000	\$ 3,875,000	\$2,725,000	237.0%
	HELO	102	-	143	\$ 10,725,000	\$ 85,000	\$ 8,670,000	-\$2,055,000	-19.2%
	HSC	48	\$ 75,000	58	\$ 4,350,000	\$ 100,000	\$ 4,800,000	\$450,000	10.3%
	HSM	48	\$ 75,000	78	\$ 5,850,000	\$ 75,000	\$ 3,600,000	-\$2,250,000	-38.5%
NFO	FW CVN	49	-	55	\$ 4,250,000	\$ 50,000	\$ 2,450,000	-\$1,800,000	-42.4%
	VAQ	17	\$ 100,000	15	\$ 1,500,000	\$ 100,000	\$ 1,700,000	\$200,000	13.3%
	VFA	14	\$ 25,000	5	\$ 125,000	\$ 75,000	\$ 1,050,000	\$925,000	740.0%
	FW LAND	44	-	53	\$ 3,925,000	\$ 65,000	\$ 2,860,000	-\$1,065,000	-27.1%
	VP	28	\$ 75,000	41	\$ 3,075,000	\$ 75,000	\$ 2,100,000	-\$975,000	-31.7%
Aggregate Retention¹	248	-	267	\$ 21,925,000	-	\$ 24,875,000	\$ 2,950,000	13.5%	
Corrected for Over-Retention¹					Total Cost/Aviator		Total Cost/Aviator	Cost Δ	% Δ
					\$ 102,934		\$ 100,302	-\$2,632	-2.6%

Note: Shaded values do not take into account community-specific retention requirements

¹ Includes data from the following communities: Pilot: VFA, VP, HSC, HSM. NFO: VAQ, VFA, VP.

Table 26. Cost Analysis of Uniform-Price Auction Model

Under the uniform-price auction mechanism the HSM and VP NFO communities, which over-retained aviators under the current method, realized a cost-savings. Because of the bidders' high reservation prices, the HSC community was the only community that retained fewer aviators, but it did not yield a cost savings. The increased costs under the uniform-price mechanism for the remaining communities can be attributed to the additional costs associated with meeting retention goals. As a result, the Aggregate Retention costs associated with meeting retention goals was 13.5% above what the Navy spent in FY-2013 on retaining these communities. Despite these increases in cost, all community-specific categories were able to meet retention goals while maintaining bonus payouts at or below congressionally mandated maximums. Moreover, when correcting the total amount spent on Aggregate Retention for over-retention, the cost per aviator decreased by \$2,632 under the uniform-price model.

D. QUAD AUCTION MODEL I

1. Analysis

Under this model, a discount of \$25,000 was applied to the bids of aviators whose quality scores ranked in the top 10% of their category. Similar to the simple uniform-price model, these adjusted bids were then ranked in ascending order. Using the equivalent retention goal from Table 25, the model then selected the appropriate number of aviators to be retained. Where reservation prices were the same, the bidders with the highest quality score were retained. The cost to retain the selected aviators was set at the first excluded bid (i.e., the cut-off bid). To obtain the equivalent cost of implementing this QUAD auction mechanism the cut-off bid, along with any additional cash payments to high-quality aviators, was compiled into an average cost per individual retained. This value was multiplied by the actual retention goals of the FY-2013 program. To assess the change in the quality of the retained bidders, we compared the mean quality scores from each category against the mean scores of the aviators retained under the uniform-price auction.

2. Results

a. Overall Cost

Table 27 lists the resulting costs of implementing a series of QUAD auctions with the previously stated parameters and compares these results against the actual costs for the FY-2013 program. As an example, the HSM community had a cut-off bid of \$70,000; however, when accounting for the additional bonuses paid to high-quality aviators, the mean cost of retaining an individual was \$81,250. This is more than the bonus offered under the current method. Nevertheless, by limiting retention to the desired retention goal of 48 aviators, this QUAD auction resulted in an equivalent cost of \$3,900,000 for a savings of \$1,950,000, or a 33.3% reduction when compared to the FY-2013 program's actual cost of \$5,850,000.

	Current Method (FY 2013)				QUAD Model II					
	Community	Retention Goal	Posted Price	Actual Retention	Total Cost	Cut-off Bid	Mean Individual Cost	Equivalent Total Cost	Total Cost Δ	% Total Cost Δ
TOTALS	ALL	331	-	351	\$ 28,775,000	\$ 80,000	\$ 84,545	\$ 27,984,395	-\$790,605	-2.7%
	PILOT	238	-	243	\$ 20,600,000	\$ 100,000	\$ 104,348	\$ 24,834,824	\$4,234,824	20.6%
	NFO	93	-	108	\$ 8,175,000	\$ 50,000	\$ 55,000	\$ 5,115,000	-\$3,060,000	-37.4%
PILOT	FW CVN	91	-	67	\$ 7,975,000	\$ 100,000	\$ 103,571	\$ 9,424,961	\$1,449,961	18.2%
	VFA	62	\$ 125,000	47	\$ 5,875,000	\$ 110,000	\$ 115,000	\$ 7,130,000	\$1,255,000	21.4%
	FW LAND	45	-	33	\$ 1,900,000	\$ 100,000	\$ 106,250	\$ 4,781,250	\$2,881,250	151.6%
	VP	31	\$ 50,000	23	\$ 1,150,000	\$ 100,000	\$ 100,000	\$ 3,100,000	\$1,950,000	169.6%
	HELO	102	-	143	\$ 10,725,000	\$ 85,000	\$ 89,167	\$ 9,095,034	-\$1,629,966	-15.2%
	HSC	48	\$ 75,000	58	\$ 4,350,000	\$ 100,000	\$ 103,125	\$ 4,950,000	\$600,000	13.8%
	HSM	48	\$ 75,000	78	\$ 5,850,000	\$ 75,000	\$ 81,250	\$ 3,900,000	-\$1,950,000	-33.3%
NFO	FW CVN	49	-	55	\$ 4,250,000	\$ 50,000	\$ 54,286	\$ 2,660,014	-\$1,589,986	-37.4%
	VAQ	17	\$ 100,000	15	\$ 1,500,000	\$ 100,000	\$ 106,250	\$ 1,806,250	\$306,250	20.4%
	VFA	14	\$ 25,000	5	\$ 125,000	\$ 75,000	\$ 75,000	\$ 1,050,000	\$925,000	740.0%
	FW LAND	44	-	53	\$ 3,925,000	\$ 65,000	\$ 65,000	\$ 2,860,000	-\$1,065,000	-27.1%
	VP	28	\$ 75,000	41	\$ 3,075,000	\$ 75,000	\$ 75,000	\$ 2,100,000	-\$975,000	-31.7%
Aggregate Retention¹	248	-	267	\$ 21,925,000	-	\$ 96,920	\$ 24,036,250	\$2,111,250	9.6%	
Corrected for Over-Retention¹				Total Cost/Aviator		Total Cost/Aviator		Cost Δ	% Δ	
				\$ 102,934		\$ 96,920		-\$6,014	-5.8%	

Note: Shaded values do not take into account community-specific retention requirements

¹ Includes data from the following communities: Pilot: VFA, VP, HSC, HSM. NFO: VAQ, VFA, VP.

Table 27. Cost Analysis of QUAD Auction Model I

Under this QUAD auction mechanism, the HSM and VP NFO communities, which over-retained aviators under the current method, realized a cost-savings. Because of the bidders' high reservation prices, the HSC community was the only community that retained fewer aviators, but it did not result in a cost savings. The increased costs under this QUAD auction mechanism for the remaining communities can be attributed to the additional costs associated with actually meeting retention goals. As a result, the Aggregate Retention costs associated with meeting retention goals was 9.6% above what the Navy spent in FY-2013 on retaining these communities. Despite these increases in cost, all community-specific categories were able to meet retention goals while maintaining bonus payouts at or below congressionally mandated maximums. Moreover, when correcting the total amount spent on Aggregate Retention for over-retention, the cost per aviator decreased by \$6,014, or 5.8%, under this QUAD model.

b. *Quality*

Table 28 lists the average quality score of aviators retained under both the uniform-price model and QUAD Model I, as well as the differences in cost incurred by each model. In no case did using QUAD Model I result in a decrease in the quality of aviators retained. Further, in the case of VAQ NFOs quality was increased. Additionally, the equivalent total costs for the VFA and VP pilot communities were lower under this QUAD model. Furthermore, the Aggregate Retention category resulted in both an overall decrease in cost and an improvement in quality score when compared to the uniform-price model.

		Uniform Price		QUAD Model I				
	Community	Equivalent Total Cost	Mean Qty Score	Equivalent Total Cost	Total Cost Δ	% Total Cost Δ	Mean Qty Score	Qty Score Δ
TOTALS	ALL	\$ 28,135,000	8.44	\$ 27,984,395	-\$150,605	-0.5%	8.62	0.18
	PILOT	\$ 23,800,000	7.77	\$ 24,834,824	\$1,034,824	4.3%	8.33	0.56
	NFO	\$ 4,650,000	10.40	\$ 5,115,000	\$465,000	10.0%	10.40	-
PILOT	FW CVN	\$ 10,010,000	8.36	\$ 9,424,961	-\$585,039	-5.8%	9.50	1.14
	VFA	\$ 7,750,000	9.40	\$ 7,130,000	-\$620,000	-8.0%	9.40	-
	FW LAND	\$ 4,500,000	6.50	\$ 4,781,250	\$281,250	6.3%	7.13	0.63
	VP	\$ 3,875,000	6.00	\$ 3,100,000	-\$775,000	-20.0%	6.00	-
	HELO	\$ 8,670,000	7.88	\$ 9,095,034	\$425,034	4.9%	7.88	-
	HSC	\$ 4,800,000	8.06	\$ 4,950,000	\$150,000	3.1%	8.06	-
	HSM	\$ 3,600,000	8.00	\$ 3,900,000	\$300,000	8.3%	8.00	-
NFO	FW CVN	\$ 2,450,000	10.71	\$ 2,660,014	\$210,014	8.6%	10.71	-
	VAQ	\$ 1,700,000	8.88	\$ 1,806,250	\$106,250	6.3%	11.00	2.12
	VFA	\$ 1,050,000	10.00	\$ 1,050,000	\$0	0.0%	10.00	-
	FW LAND	\$ 2,860,000	9.67	\$ 2,860,000	\$0	0.0%	9.67	-
	VP	\$ 2,100,000	8.00	\$ 2,100,000	\$0	0.0%	8.00	-
	Aggregate Retention ^{1,2}	\$ 24,875,000	8.37	\$ 24,036,250	-\$838,750	-3.4%	8.64	0.27

Note: Shaded values do not take into account community-specific retention requirements

¹ Includes data from the following communities: Pilot: VFA, VP, HSC, HSM. NFO: VAQ, VFA, VP.

² Quality related data is calculated using weighted averages.

Table 28. Uniform-Price and QUAD Model I Cost and Quality Comparison

E. **QUAD AUCTION MODEL II**

1. **Analysis**

To explore the implications of offering quality discounts to a broader set of individuals, this QUAD model applies a discount of \$25,000 to the bids of aviators whose

quality scores ranked in the top 25% of their category. Similar to the uniform-price model, these adjusted bids were then ranked in ascending order. Using the equivalent retention goal from Table 25, the appropriate number of aviators was selected for retention. Where reservation prices were the same, the bidders with the highest quality scores were retained. The cost to retain the selected aviators was set at the first excluded bid. To obtain the equivalent cost of implementing this QUAD auction mechanism, the cut-off bid, along with any additional cash payments to high-quality aviators, was compiled into an average cost per individual retained. This value was multiplied by the actual retention goals of the FY-2013 program. To assess the change in the quality of the retained bidders, we compared the mean quality scores from each category against the mean scores of the aviators retained under the uniform-price auction.

2. Results

a. Overall Cost

Table 29 lists the resulting costs of implementing this series of QUAD auctions and compares them against the actual costs for the FY-2013 program. As an example, the HSM community had a cut-off bid of \$50,000; however, when accounting for the additional bonuses paid to high-quality aviators the mean cost of retaining an individual was \$87,500. This was larger than the bonus amount offered in FY-2013. Still, by limiting retention to the desired retention goal of 48 aviators, this QUAD auction resulted in an equivalent cost of \$4,200,000 for a savings of \$1,650,000, or a 28.2% reduction when compared to the FY-2013 program's actual cost of \$5,850,000.

		Current Method (FY 2013)				QUAD Model II				
Community	Retention Goal	Posted Price	Actual Retention	Total Cost	Cut-off Bid	Mean Individual Cost	Equivalent Total Cost	Total Cost Δ	% Total Cost Δ	
TOTALS	ALL	331	-	351	\$ 28,775,000	\$ 60,000	\$ 88,788	\$ 29,388,828	\$613,828	2.1%
	PILOT	238	-	243	\$ 20,600,000	\$ 100,000	\$ 119,565	\$ 28,456,470	\$7,856,470	38.1%
	NFO	93	-	108	\$ 8,175,000	\$ 50,000	\$ 70,000	\$ 6,510,000	-\$1,665,000	-20.4%
PILOT	FW CVN	91	-	67	\$ 7,975,000	\$ 100,000	\$ 121,429	\$ 11,050,039	\$3,075,039	38.6%
	VFA	62	\$ 125,000	47	\$ 5,875,000	\$ 110,000	\$ 130,000	\$ 8,060,000	\$2,185,000	37.2%
	FW LAND	45	-	33	\$ 1,900,000	\$ 75,000	\$ 100,000	\$ 4,500,000	\$2,600,000	136.8%
	VP	31	\$ 50,000	23	\$ 1,150,000	\$ 75,000	\$ 91,667	\$ 2,841,677	\$1,691,677	147.1%
	HELO	102	-	143	\$ 10,725,000	\$ 75,000	\$ 100,000	\$ 10,200,000	-\$525,000	-4.9%
	HSC	48	\$ 75,000	58	\$ 4,350,000	\$ 85,000	\$ 103,750	\$ 4,980,000	\$630,000	14.5%
	HSM	48	\$ 75,000	78	\$ 5,850,000	\$ 50,000	\$ 87,500	\$ 4,200,000	-\$1,650,000	-28.2%
NFO	FW CVN	49	-	55	\$ 4,250,000	\$ 50,000	\$ 71,429	\$ 3,500,021	-\$749,979	-17.6%
	VAQ	17	\$ 100,000	15	\$ 1,500,000	\$ 80,000	\$ 105,000	\$ 1,785,000	\$285,000	19.0%
	VFA	14	\$ 25,000	5	\$ 125,000	\$ 75,000	\$ 100,000	\$ 1,400,000	\$1,275,000	1020.0%
	FW LAND	44	-	53	\$ 3,925,000	\$ 50,000	\$ 66,667	\$ 2,933,348	-\$991,652	-25.3%
	VP	28	\$ 75,000	41	\$ 3,075,000	\$ 50,000	\$ 50,000	\$ 1,400,000	-\$1,675,000	-54.5%
Aggregate Retention ¹	248	-	267	\$ 21,925,000	-	\$ 99,462	\$ 24,666,677	\$ 2,741,677	12.5%	
Corrected for Over-Retention ¹		Total Cost/Aviator			Total Cost/Aviator	Cost Δ	% Δ			
		\$ 102,934			\$ 99,462	-\$3,472	-3.4%			

Note: Shaded categories do not take into account community-specific retention requirements

¹ Includes data from the following communities: Pilot: VFA, VP, HSC, HSM. NFO: VAQ, VFA, VP.

Table 29. Cost Analysis of QUAD Auction Model II

Under this QUAD auction mechanism, the HSM and VP NFO communities, which over-retained aviators under the current method, realized a cost-savings. Because of the bidders' high reservation prices, the HSC community was the only community that retained fewer aviators, but it did not result in a cost savings. The increased costs under this QUAD auction mechanism for the remaining communities can be attributed to the additional costs associated with actually meeting retention goals. As a result, the Aggregate Retention costs associated with meeting retention goals was 12.5% above what the Navy spent in FY-2013 on retaining these communities. All community-specific categories were able to meet retention goals; however, bonus payment to high-quality VFA pilots exceeded congressionally mandated maximums by \$35,000. Nevertheless, when correcting the total amount spent on Aggregate Retention for over-retention, the cost per aviator decreased by \$3,447, or 3.4%, under this QUAD model.

b. *Quality*

Table 30 lists the average quality score of aviators retained under both the uniform-price model and QUAD Model II as well as the differences in cost incurred by each model. Using this model, average quality scores improved over the uniform-price model for every community-specific category, except for VP NFO, which remained the same. Equivalent total costs, however, increased for every community-specific category with the exception of VP pilot. Furthermore, the Aggregate Retention category saw both an increase in cost and quality score in comparison to the uniform-price model.

		Uniform Price		QUAD Model II				
Community	Equivalent Total Cost	Mean Qty Score	Equivalent Total Cost	Total Cost Δ	% Total Cost Δ	Mean Qty Score	Qty Score Δ	
TOTALS	ALL	\$ 28,135,000	8.44	\$ 28,837,051	\$702,051	2.5%	9.70	1.26
	PILOT	\$ 23,800,000	7.96	\$ 26,128,354	\$2,328,354	9.8%	8.35	0.39
	NFO	\$ 4,650,000	10.40	\$ 5,580,000	\$930,000	20.0%	10.40	-
PILOT	FW CVN	\$ 10,010,000	8.36	\$ 9,750,013	-\$259,987	-2.6%	10.43	2.07
	VFA	\$ 7,750,000	9.40	\$ 8,060,000	\$310,000	4.0%	10.20	0.80
	FW LAND	\$ 4,500,000	6.50	\$ 5,062,500	\$562,500	12.5%	6.50	-
	VP	\$ 3,875,000	6.00	\$ 3,100,000	-\$775,000	-20.0%	6.83	0.83
	HELO	\$ 8,670,000	7.88	\$ 8,712,534	\$42,534	0.5%	8.67	0.79
	HSC	\$ 4,800,000	8.06	\$ 5,100,000	\$300,000	6.3%	8.81	0.75
	HSM	\$ 3,600,000	8.00	\$ 4,200,000	\$600,000	16.7%	9.88	1.88
NFO	FW CVN	\$ 2,450,000	10.71	\$ 2,974,986	\$524,986	21.4%	10.71	-
	VAQ	\$ 1,700,000	8.88	\$ 1,806,250	\$106,250	6.3%	12.50	3.62
	VFA	\$ 1,050,000	10.00	\$ 1,166,662	\$116,662	11.1%	11.50	1.50
	FW LAND	\$ 2,860,000	9.67	\$ 3,226,652	\$366,652	12.8%	9.67	-
	VP	\$ 2,100,000	8.00	\$ 2,333,324	\$233,324	11.1%	8.00	-
Aggregate Retention^{1,2}	\$ 24,875,000	8.37	\$ 25,766,236	\$891,236	3.6%	9.67	1.30	

Note: Shaded values do not take into account community-specific retention requirements

¹ Includes data from the following communities: Pilot: VFA, VP, HSC, HSM. NFO: VAQ, VFA, VP.

² Quality related data is calculated using weighted averages.

Table 30. Uniform-Price and QUAD Model II Cost and Quality Comparison

F. CRAM MODEL USING NMI I

1. Analysis

Under this model, choice of duty station during one’s DH tour was offered as an NMI. All aviators who in the survey stated a valuation of more than \$15,000 for the guarantee of duty station of choice had their bids reduced by the amount stated, less the

\$15,000 assumed to be the cost incurred by the Navy in providing this NMI (e.g., an aviator valuing this NMI at \$25,000 would have the bid reduced by \$10,000).⁴³ Similar to the simple uniform-price model, these adjusted bids were ranked in ascending order. Using the equivalent retention goal from Table 25, the model selected the appropriate number of aviators for retention. Where reservation prices were the same, the bidders with the highest quality scores were retained. The cost to retain the selected aviators was set at the first excluded bid. To obtain the equivalent cost of implementing this CRAM, the cut-off bid was multiplied by the actual retention goals of the FY-2013 program.

2. Results

Table 31 lists the resulting costs of implementing a series of CRAM auctions using guaranteed duty station location as an NMI and compares these results against the actual costs for the FY-2013 program. As an example, the HSM community had a cut-off bid of \$75,000—which coincidentally equaled the bonus amount offered in FY-2013—however, by limiting retention to the desired retention goal of 48 aviators, this CRAM model resulted in an equivalent cost of \$3,600,000 for a savings of \$2,250,000, or a 38.5% reduction when compared to the FY-2013 program’s actual cost of \$5,850,000.

⁴³ The average cost of all moving-related expenses for a Permanent Change of Station (PCS) move of a Naval Officer and any dependents was approximately \$15,000 in FY 2013 (Secretary of the Navy, 2014, March). The fact that some officers might not require a PCS move or that others would have to move regardless was not considered in establishing this value.

		Current Method (FY 2013)			CRAM NMI I				
Community	Retention Goal	Posted Price	Actual Retention	Total Cost	Cut-off Bid	Equivalent Total Cost	Total Cost Δ	% Total Cost Δ	
TOTALS	ALL	331	-	351	\$ 28,775,000	\$ 75,000	\$ 24,825,000	-\$3,950,000	-13.7%
	PILOT	238	-	243	\$ 20,600,000	\$ 90,000	\$ 21,420,000	\$820,000	4.0%
	NFO	93	-	108	\$ 8,175,000	\$ 25,000	\$ 2,325,000	-\$5,850,000	-71.6%
PILOT	FW CVN	91	-	67	\$ 7,975,000	\$ 110,000	\$ 10,010,000	\$2,035,000	25.5%
	VFA	62	\$ 125,000	47	\$ 5,875,000	\$ 115,000	\$ 7,130,000	\$1,255,000	21.4%
	FW LAND	45	-	33	\$ 1,900,000	\$ 90,000	\$ 4,050,000	\$2,150,000	113.2%
	VP	31	\$ 50,000	23	\$ 1,150,000	\$ 75,000	\$ 2,325,000	\$1,175,000	102.2%
	HELO	102	-	143	\$ 10,725,000	\$ 75,000	\$ 7,650,000	-\$3,075,000	-28.7%
	HSC	48	\$ 75,000	58	\$ 4,350,000	\$ 85,000	\$ 4,080,000	-\$270,000	-6.2%
	HSM	48	\$ 75,000	78	\$ 5,850,000	\$ 75,000	\$ 3,600,000	-\$2,250,000	-38.5%
NFO	FW CVN	49	-	55	\$ 4,250,000	\$ 25,000	\$ 1,225,000	-\$3,025,000	-71.2%
	VAQ	17	\$ 100,000	15	\$ 1,500,000	\$ 85,000	\$ 1,445,000	-\$55,000	-3.7%
	VFA	14	\$ 25,000	5	\$ 125,000	\$ 75,000	\$ 1,050,000	\$925,000	740.0%
	FW LAND	44	-	53	\$ 3,925,000	\$ 15,000	\$ 660,000	-\$3,265,000	-83.2%
	VP	28	\$ 75,000	41	\$ 3,075,000	\$ 30,000	\$ 840,000	-\$2,235,000	-72.7%
Aggregate Retention ¹	248	-	267	\$ 21,925,000	-	\$ 20,470,000	\$ (1,455,000)	-6.6%	
Corrected for Over-Retention ¹				Total Cost/Aviator	Total Cost/Aviator	Cost Δ	% Δ		
				\$ 102,934	\$ 82,540	-\$20,394	-19.8%		

Note: Shaded values do not take into account community-specific retention requirements

¹ Includes data from the following communities: Pilot: VFA, VP, HSC, HSM. NFO: VAQ, VFA, VP.

Table 31. CRAM Model (NMI I) Cost Analysis

Under this CRAM model, the HSC, HSM, and VP NFO communities, which over-retained aviators in FY-2013, demonstrated a lower total cost. Additionally, the VAQ NFO community, despite having retained more individuals than the FY-2013 program, still cost less than the current method. The increased costs under this auction mechanism for the remaining communities can be attributed to the additional costs associated with meeting retention goals. Despite these increases in cost, all community-specific categories were able to meet retention goals while maintaining bonus payouts below congressionally mandated maximums. Furthermore, the Aggregate Retention category was able to retain the desired number of aviators in each community at a cost that was 6.6% less than the amount spent under the FY-2013 program in an effort to meet these same retention objects. Additionally, when correcting the total amount spent on Aggregate Retention for over-retention, the cost per aviator decreased by \$20,394, or 19.8%, under this CRAM model.

G. CRAM MODEL USING NMI II

1. Analysis

Under this model, the opportunity to attend an in-residence graduate degree program was offered as an NMI. All aviators who in the survey stated a willingness to forego more than \$45,000 for the guarantee of attending an in-residence graduate degree program had their bids reduced by the stated amount, less the \$45,000 cost incurred by the Navy in providing this NMI (e.g., aviators valuing this NMI at \$75,000 would have their bids reduced by \$30,000).⁴⁴ Similar to the simple uniform-price model, these adjusted bids were then ranked in ascending order. Using the equivalent retention goal from Table 25, the model then selected the appropriate number of aviators for retention. Where reservation prices were the same, the bidders with the highest quality scores were selected for retention. The cost to retain the selected aviators was set at the first excluded bid. To obtain the equivalent cost of implementing these CRAM auctions, the cut-off bid was multiplied by the corresponding retention goals of the FY-2013 program.

2. Results

Table 32 lists the resulting costs of implementing a series of CRAM auctions using an in-residence graduate education program as an NMI and compares them against the actual costs for the FY-2013 program. As an example, the HSM community had a cut-off bid of \$75,000—which coincidentally equaled the bonus amount offered in FY-2013—however, by limiting retention to the desired retention goal of 48 aviators, the uniform price auction resulted in an equivalent cost of \$3,600,000 for a savings of \$2,250,000, or a 38.5% reduction in comparison to the FY-2013 program’s actual cost of \$5,850,000.

⁴⁴ The cost of \$45,000 allows for an additional PCS move (approximately \$15,000) and the costs to the Navy for an officer attending the Naval Postgraduate School for six quarters (\$4,850/quarter). In this research, we did not consider any other costs or Force management implications.

		Current Method (FY 2013)			CRAM NMI II				
Community	Retention Goal	Posted Price	Actual Retention	Total Cost	Cut-off Bid	Equivalent Total Cost	Total Cost Δ	% Total Cost Δ	
TOTALS	ALL	331	-	351	\$ 28,775,000	\$ 75,000	\$ 24,825,000	-\$3,950,000	-13.7%
	PILOT	238	-	243	\$ 20,600,000	\$ 75,000	\$ 17,850,000	-\$2,750,000	-13.3%
	NFO	93	-	108	\$ 8,175,000	\$ 45,000	\$ 4,185,000	-\$3,990,000	-48.8%
PILOT	FW CVN	91	-	67	\$ 7,975,000	\$ 110,000	\$ 10,010,000	\$2,035,000	25.5%
	VFA	62	\$ 125,000	47	\$ 5,875,000	\$ 125,000	\$ 7,750,000	\$1,875,000	31.9%
	FW LAND	45	-	33	\$ 1,900,000	\$ 60,000	\$ 2,700,000	\$800,000	42.1%
	VP	31	\$ 50,000	23	\$ 1,150,000	\$ 70,000	\$ 2,170,000	\$1,020,000	88.7%
	HELO	102	-	143	\$ 10,725,000	\$ 75,000	\$ 7,650,000	-\$3,075,000	-28.7%
	HSC	48	\$ 75,000	58	\$ 4,350,000	\$ 85,000	\$ 4,080,000	-\$270,000	-6.2%
	HSM	48	\$ 75,000	78	\$ 5,850,000	\$ 75,000	\$ 3,600,000	-\$2,250,000	-38.5%
NFO	FW CVN	49	-	55	\$ 4,250,000	\$ 45,000	\$ 2,205,000	-\$2,045,000	-48.1%
	VAQ	17	\$ 100,000	15	\$ 1,500,000	\$ 95,000	\$ 1,615,000	\$115,000	7.7%
	VFA	14	\$ 25,000	5	\$ 125,000	\$ 75,000	\$ 1,050,000	\$925,000	740.0%
	FW LAND	44	-	53	\$ 3,925,000	\$ 45,000	\$ 1,980,000	-\$1,945,000	-49.6%
	VP	28	\$ 75,000	41	\$ 3,075,000	\$ 45,000	\$ 1,260,000	-\$1,815,000	-59.0%
Aggregate Retention¹	248	-	267	\$ 21,925,000	-	\$ 21,525,000	-\$400,000	-1.8%	
Corrected for Over-Retention¹				Total Cost/Aviator	Total Cost/Aviator	Cost Δ	% Δ		
				\$ 102,934	\$ 86,794	-\$16,140	-15.7%		

Note: Shaded values do not take into account community-specific retention requirements

¹ Includes data from the following communities: Pilot: VFA, VP, HSC, HSM. NFO: VAQ, VFA, VP.

Table 32. CRAM Model (NMI II) Cost Analysis

Under this CRAM model, the HSC, HSM, and VP NFO communities, which over-retained aviators under the current method, realized a cost savings. The increased costs under this auction mechanism for the remaining communities can be attributed to the additional costs associated with actually meeting retention goals. Despite these increases in cost, all community-specific categories were able to meet retention goals while maintaining bonus payouts at or below congressionally mandated maximums. Furthermore, under this model the Aggregate Retention category was able to retain the desired number of aviators for 1.8% less than the amount expended in attempting to meet retention goals for these communities in FY-2013. Correcting the total amount spent on Aggregate Retention for over-retention, the cost per aviator decreased by \$16,140, or 15.7%, under this CRAM model.

H. SUMMARY OF MODEL PERFORMANCE

The results of these simulations demonstrate the potential for these models—by controlling for cost, quantity, and in some cases quality—to more efficiently meet the Navy’s retention requirements than the method currently employed by the ACCP program. Each model was able to meet the specific retention goals of the communities analyzed. Additionally, each model eliminated the additional expenses associated with over-retention. The QUAD model demonstrated the potential to simultaneously improve cost and quality. The CRAM models demonstrated the greatest potential of all the models for improving retention costs. Table 33 summarizes these improvements over the uniform-price auction. In general, the first QUAD model improved both quality and cost, while the second QUAD model demonstrated larger improvements in quality, but resulted in higher costs than the uniform-price model. Both CRAM models resulted in overall cost savings; however, using NMI I resulted in greater cost in comparison to the uniform-price model. Moreover, given the results of the Aggregate Retention category, it appears possible that the CRAM model could both meet overall retention goals while actually lowering overall ACCP program costs.

Community	Uniform Price		QUAD Model I Δ			QUAD Model II Δ			CRAM NMI I Δ			CRAM NMI II Δ			
	Equivalent Cost	Mean Qty Score	Cost	% Cost	Qty Score	Cost	% Cost	Qty Score	Cost	% Cost	Qty Score	Cost	% Cost	Qty Score	
TOTALS	ALL	\$28,135,000	8.44	-\$150,605	-0.5%	0.18	\$702,051	2.5%	1.26	-\$3,310,000	-11.8%	-0.09	-\$3,310,000	-11.8%	-0.35
	PILOT	\$23,800,000	7.77	\$1,034,824	4.3%	0.37	\$2,328,354	9.8%	0.39	-\$2,380,000	-10.0%	0.10	-\$5,950,000	-25.0%	0.10
	NFO	\$4,650,000	10.40	\$465,000	10.0%	-	\$930,000	20.0%	-	-\$2,325,000	-50.0%	-0.35	-\$465,000	-10.0%	0.00
PILOT	FW CVN	\$10,010,000	8.36	-\$585,039	-5.8%	1.14	-\$259,987	-2.6%	2.07	\$0	0.0%	0.00	\$0	0.0%	0.00
	VFA	\$7,750,000	9.40	-\$620,000	-8.0%	-	\$310,000	4.0%	0.80	-\$620,000	-8.0%	-0.20	\$0	0.0%	0.00
	FW LAND	\$4,500,000	6.50	\$281,250	6.3%	0.63	\$562,500	12.5%	-	-\$450,000	-10.0%	-0.50	-\$1,800,000	-40.0%	-0.12
	VP	\$3,875,000	6.00	-\$775,000	-20.0%	-	-\$775,000	-20.0%	0.83	-\$1,550,000	-40.0%	-0.67	-\$1,705,000	-44.0%	-0.67
	HELO	\$8,670,000	7.88	\$425,034	4.9%	-	\$42,534	0.5%	0.79	-\$1,020,000	-11.8%	0.41	-\$1,020,000	-11.8%	-0.17
	HSC	\$4,800,000	8.06	\$150,000	3.1%	-	\$300,000	6.3%	0.75	-\$720,000	-15.0%	0.38	-\$720,000	-15.0%	0.50
NFO	HSM	\$3,600,000	8.00	\$300,000	8.3%	-	\$600,000	16.7%	1.88	\$0	0.0%	0.00	\$0	0.0%	-0.37
	FW CVN	\$2,450,000	10.71	\$210,014	8.6%	-	\$524,986	21.4%	-	-\$1,225,000	-50.0%	-0.42	-\$245,000	-10.0%	0.00
	VAQ	\$1,700,000	8.88	\$106,250	6.3%	2.12	\$106,250	6.3%	3.62	-\$255,000	-15.0%	-0.25	-\$85,000	-5.0%	-0.25
	VFA	\$1,050,000	10.00	\$0	0.0%	-	\$116,662	11.1%	1.50	\$0	0.0%	0.00	\$0	0.0%	0.00
	FW LAND	\$2,860,000	9.67	\$0	0.0%	-	-\$366,652	12.8%	-	-\$2,200,000	-76.9%	1.58	-\$880,000	-30.8%	0.00
VP	\$2,100,000	8.00	\$0	0.0%	-	\$233,324	11.1%	-	-\$1,260,000	-60.0%	0.00	-\$840,000	-40.0%	0.00	
Aggregate Retention^{1,2}	\$24,875,000	8.37	-\$838,750	-3.4%	0.27	\$891,236	3.6%	1.30	-\$4,845,000	-19.5%	-0.02	-\$2,825,000	-11.4%	-0.01	

Table 33. Summary of Improvements of QUAD and CRAM over a Simple Uniform-Price Model

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VII. SUMMARY, CONCLUSION AND RECOMMENDATIONS

A. SUMMARY

Our primary objective of this research was to examine the feasibility and potential improvements of implementing a uniform-price auction-based retention program in lieu of the current bonus system used for retaining Naval Aviators who have completed their MSR. Additionally, we examined the impacts of implementing both a QUAD auction and a CRAM. Using the survey results of 175 Naval Aviators enrolled in an NPS in-residence or distance-learning graduate program, we analyzed the effects these auction mechanisms might have on the quantity, cost, and quality of retained Naval Aviators. We used the survey responses along with quality rating scales developed from historical DH selection rates to establish individual quality scores and reservation prices. We then ran multiple simulations using the retention goals and results of the most recently completed ACCP program (FY-2013). We then measured these results against those of the FY-2013 ACCP program.

B. CONCLUSIONS

Our research demonstrated a potential for improvements over the current Naval Aviator retention bonus program in terms of cost, quality, and quality of aviators retained. Our findings support previous research on auctions as retention mechanisms (Nowell, 2012).

With regard to cost, these auction mechanisms demonstrated costs-savings in the retention of communities that experienced over-retention in FY-2013. Using the uniform-price model, individual communities with over-retention in the FY-2013 program saved as much as \$2,250,000 in retention costs. The additional costs associated with meeting retention goals for communities that had under-retained in FY-2013 resulted in Aggregate Retention costs for the uniform-price model exceeding the FY-2013 costs by \$2,950,000, or 13.5%. In correcting for over-retention, however, we find that the amount spent per aviator retained in support of FY-2013 naval aviation requirements actually decreases by 2.6%. Additionally, while not specifically researched in this study, by not exceeding retention goals these mechanisms may serve to provide further savings by

reducing the manning overages of field grade officers currently existing in naval aviation (CNP, personal communication, 2014, February 11).⁴⁵

While the two methodologies we used to measure aviator quality found no significant correlation between an officer's quality and the cost to retain them beyond their initial MSR (Table 20), the QUAD models we employed demonstrated the potential to improve upon the results of the uniform-price model by improving both overall retention costs and the average quality of aviators retained. The first model, which employs a discount of \$25,000 to the top 10% from each community, meets all retention goals while increasing the average quality of retained aviators by 3.2% and reducing Aggregate Retention costs by \$838,750, or 3.4%, when compared to the uniform-price model. The second QUAD model, which applies a \$50,000 discount to the top 50% from each community, further increases average aviator quality by 15.5% over the uniform-price model. This, however, comes at a cost of an additional \$896,236, or 3.6%, in Aggregate Retention costs. In addition to the obvious desire to retain officers who have demonstrated superior performance, these models may further reduce retention costs (financially and operationally). By improving the quality of Naval Aviators retained and thereby decreasing the probability that these officers will fail to select for promotion or screen for DH, the Navy can reduce the expense associated with providing bonuses to personnel who fail to serve in the capacity for which they were retained (Table 10). Furthermore, in minimizing these attritions, Force managers can reduce the number of officers they need to retain in support of naval aviation requirements.

The two CRAM models demonstrated the largest improvements in Aggregate Retention costs. The first model offers guaranteed duty station as an NMI. Leveraging the utility aviators receive from this NMI in excess of the Navy's cost to provide it, results in a savings of more than \$4,800,000 in Aggregate Retention costs when compared to the uniform-price model. Moreover, this model meets FY-2013 retention goals while saving more than \$1,400,000 over the current method. The second CRAM model employs the guarantee of an in-residence graduate program as an NMI. Leveraging the utility aviators

⁴⁵ This information was communicated via an unpublished power point presentation.

receive from this NMI in excess of the Navy's cost to provide it, results in a savings of more than \$2,800,000 in Aggregate Retention costs when compared to the uniform-price model. This second CRAM model also meets all FY-2013 retention objectives and saves 1.8% when compared to the current ACCP program.

The ability of these mechanisms to meet retention goals where the current bonus method does not better supports naval aviation in meeting its mission requirements. This aspect may have a positive impact on retention that is more difficult to quantify. Currently, to manage retention shortfalls Force planners are required to extend personnel in demanding positions or to leave those positions vacant. This increases the strain on those who do elect to remain on Active Duty. By adequately filling these positions and reducing the burden on servicemembers, these mechanisms may reduce the amount required to induce Naval Aviators to continue to serve beyond their MSR.

C. RECOMMENDATIONS

While our study builds on the research of other authors (Nowell, 2012; White 2010), further research may still be required to validate the results found here. A survey that encompasses a larger set of Naval Aviators might be desirable to evaluate if the trends found here are unique to aviators attending a NPS graduate education program. Furthermore, while our research did attempt to explain and assess participants' understanding of an auction-based retention system, a more controlled study could yield a better assessment of how likely participants might behave under an auction-based system. The metrics and system used to determine individual quality scores are believed to accurately model the value naval aviation places on individual aviators. We, however, did not have access to data that might better reflect the correlation between individual performance traits and their value to aviation communities. With the support of Force managers, additional research could better define this relationship enabling a more precise implementation of QUAD auction mechanisms.


Lastly, as participants in this and other surveys (NPRST, 2014) have stated, monetary incentives are but one aspect that influence officers to remain in naval aviation. These sentiments are reflected in the value participants placed on the NMIs used in this

study. We recommend further research into how to implement these NMIs into retention efforts.


APPENDIX A. VALUES, CAREER PATH AND MILESTONES FOR AVIATION OFFICERS

NPC provides the following to promotion and screening boards to inform members of the career path and milestones valued by the naval aviation community:

1. Aviation Officer Community Values

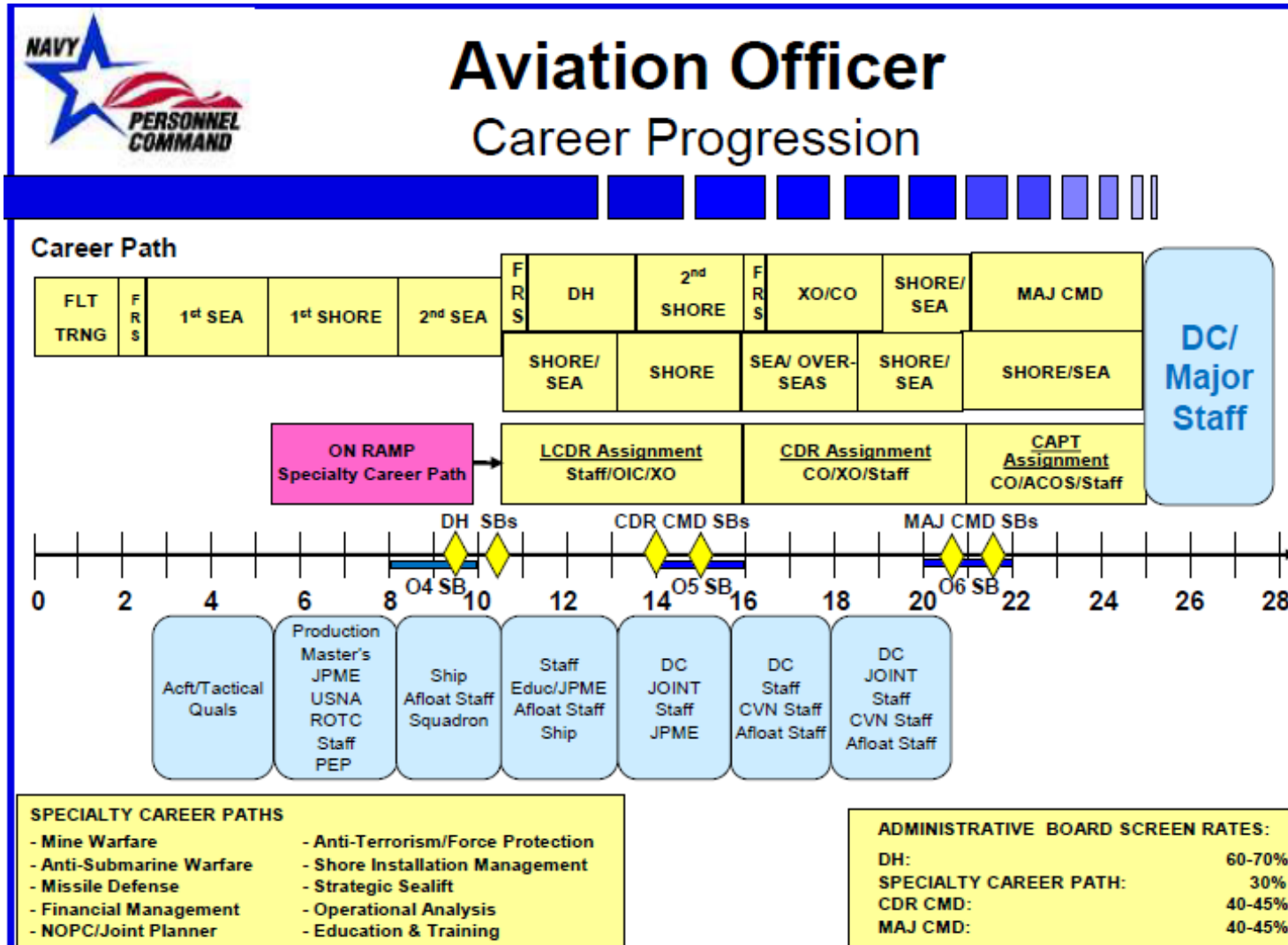


Aviation Officer Community Values



- Sustained Superior Performance in Operational Billets
 - Proven excellence in operational environments is the ultimate test of fitness
 - Value contributions to a sea-centric force, in both peace and war
 - Leadership and Warfare expertise
 - Joint/advanced education and Joint Duty assignments
- Valued achievements prior to LIEUTENANT COMMANDER
 - Successful initial sea and shore tours
 - Attainment of warfare qualifications
- Valued achievements prior to COMMANDER
 - Superior performance as a DH
 - Attainment of advanced warfare qualifications
 - Aviators serving as OP-T DHs develop essential training production skill sets valued by the Aviation community
- Valued achievements prior to CAPTAIN
 - Successful performance as a CO
 - Aviators serving as CO-OP/T are leading afloat tactical air control units and mission essential training squadrons
 - Aviators filling CO-SM missions are leading troops in front-line, operational missions
 - Proven leadership positions in shore and/or Joint assignment
- Specialty Career Path
 - Selected by Flag-led administrative board process
 - Officers may serve in leadership positions in critical specialty areas to provide unique subject area expertise

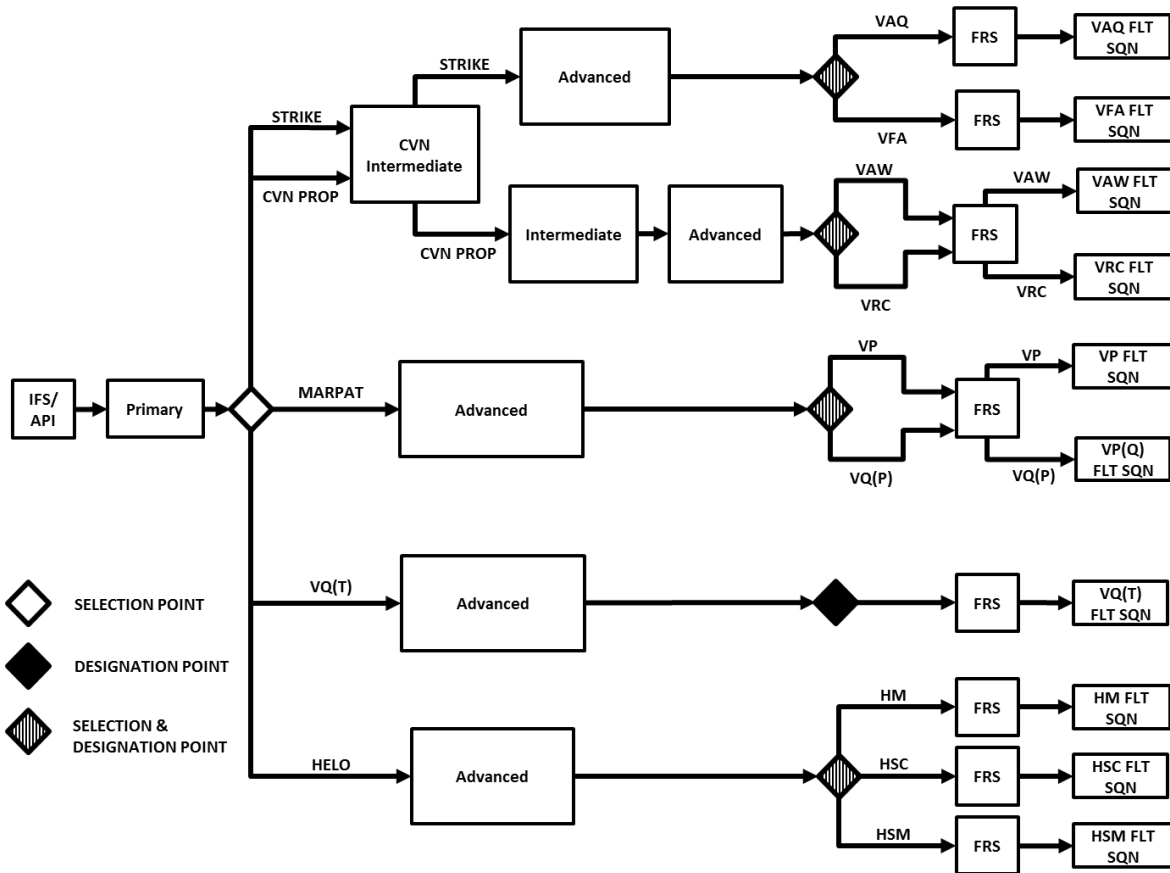
2. Aviation Officer Career Progression and Milestones



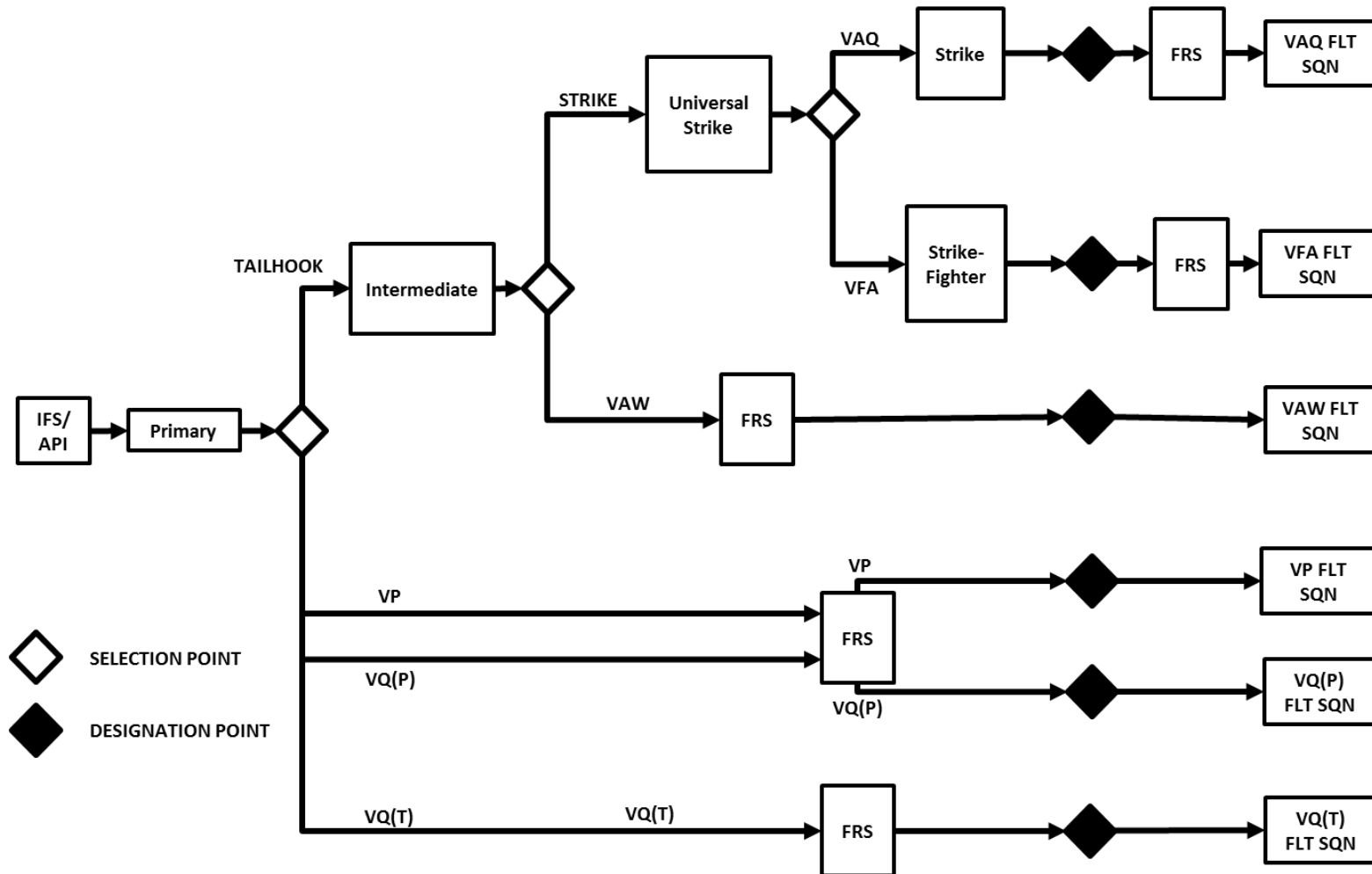
APPENDIX B. NAVAL AVIATOR FLIGHT TRAINING PROGRESSION

The typical training progression for CNATRA trained aviators is depicted in the following charts.

1. Flight Training Progression - Pilot



2. Flight Training Progression - Naval Flight Officer



APPENDIX C. SUMMARY OF PAST ACCP PROGRAM PERFORMANCE

1. Fiscal Year 2011 ACCP Performance Summary

OVERALL RETENTION SUMMARY							
		AVTRS ELIGIBLE	AVTRS REQUIRED	AVTRS RETAINED			
		842	322	265			
% RETAINED	% of RETENTION GOAL	% of TARGETED GOAL	TOTAL COST	AVTRS EXCESS	AVTRS SHRTG	TOTAL OVERPAY	% OVERPAY
31.5%	82.3%	76.4%	\$ 18,700,000	19	76	\$ 950,000	5.1%

PILOTS											
COMM	ELIGIBLE	REQUIRED	RETAINED	% RETAINED	% OF REQ'D	BONUS	COST	PILOT EXCESS	PILOT SHRTG	OVERPAYMENT	% OVERPAY
TOTAL	551	221	188	33.4%	80.1%	-----	\$ 14,200,000	16	49	\$ 800,000	5.6%
HELO	233	80	86	36.9%	107.5%	-----	\$ 4,300,000	16	10	\$ 800,000	18.6%
HM	16	5	4	25.0%	80.0%	\$ 50,000	\$ 200,000	-	1	\$ -	N/A
HSC	106	47	38	35.8%	80.9%	\$ 50,000	\$ 1,900,000	-	9	\$ -	N/A
HSL/HSM	111	28	44	39.6%	157.1%	\$ 50,000	\$ 2,200,000	16	-	\$ 800,000	36.4%
JET	162	87	71	43.8%	81.6%	-----	\$ 8,575,000	-	16	-	-
VAQ	19	8	6	31.6%	75.0%	\$ 75,000	\$ 450,000	-	2	\$ -	N/A
VFA	143	79	65	45.5%	82.3%	\$ 125,000	\$ 8,125,000	-	14	\$ -	N/A
PROP	156	54	31	19.9%	57.4%	-----	\$ 1,325,000	-	23	-	N/A
VAW/VRC	28	9	5	17.9%	55.6%	\$ 25,000	\$ 125,000	-	4	\$ -	N/A
VP	85	35	20	23.5%	57.1%	\$ 50,000	\$ 1,000,000	-	15	\$ -	N/A
VQ(P)	17	5	2	11.8%	40.0%	\$ 50,000	\$ 100,000	-	3	\$ -	N/A
VQ(T)	26	5	4	15.4%	80.0%	\$ 25,000	\$ 100,000	-	1	\$ -	N/A

NFOs											
	ELIGIBLE	REQUIRED	RETAINED	% RETAINED	% OF REQ'D	BONUS	COST	NFO EXCESS	NFO SHRTG	OVERPAYMENT	% OVERPAY
TOTAL	291	101	77	26.5%	76.2%	-----	\$ 4,500,000	3	27	\$ 150,000	3.3%
JET	99	48	35	35.4%	72.9%	-----	\$ 2,650,000	3	16	\$ 150,000	5.7%
VAQ	45	34	18	40.0%	52.9%	\$ 100,000	\$ 1,800,000	-	16	\$ -	N/A
VFA	54	14	17	31.5%	121.4%	\$ 50,000	\$ 850,000	3	-	\$ 150,000	17.6%
PROP	192	53	42	21.9%	79.2%	-----	\$ 1,850,000	-	11	\$ -	N/A
VAW/VRC	46	14	8	17.4%	57.1%	\$ 25,000	\$ 200,000	-	6	\$ -	N/A
VP	107	27	25	23.4%	92.6%	\$ 50,000	\$ 1,250,000	-	2	\$ -	N/A
VQ(P)	27	8	7	25.9%	87.5%	\$ 50,000	\$ 350,000	-	1	\$ -	N/A
VQ(T)	12	4	2	16.7%	50.0%	\$ 25,000	\$ 50,000	-	2	\$ -	N/A

2. Fiscal Year 2012 ACCP Performance Summary

OVERALL RETENTION SUMMARY							
		AVTRS ELIGIBLE	AVTRS REQUIRED	AVTRS RETAINED			
		1013	343	316			
% RETAINED	% of RETENTION GOAL	% of TARGETED GOAL	TOTAL COST	AVTRS EXCESS	AVTRS SHRTG	TOTAL OVERPAY	% OVERPAY
31.2%	92.1%	88.6%	\$ 22,900,000	12	39	\$ 850,000	3.7%

PILOTS												
COMM	ELIGIBLE	REQUIRED	RETAINED	% RETAINED	% OF REQ'D	BONUS	COST	PILOT EXCESS	PILOT SHRTG	OVERPAYMENT	% OVERPAY	
TOTAL	659	241	231	35.1%	95.9%	-----	\$ 17,150,000	6	16	\$ 550,000	3.2%	
HELO	316	116	106	33.5%	91.4%	-----	\$ 5,225,000	1	11	\$ 25,000	0.5%	
HM	19	7	7	36.8%	100.0%	\$ 50,000	\$ 350,000	-	-	\$ -	N/A	
HSC	133	59	48	36.1%	81.4%	\$ 75,000	\$ 3,600,000	-	11	\$ -	N/A	
HSL/HSM	164	50	51	31.1%	102.0%	\$ 25,000	\$ 1,275,000	1	-	\$ 25,000	2.0%	
JET	139	70	71	51.1%	101.4%	-----	\$ 8,875,000	3	2	\$ 375,000		
VAQ	17	10	8	47.1%	80.0%	\$ 125,000	\$ 1,000,000	-	2	\$ -	N/A	
VFA	122	60	63	51.6%	105.0%	\$ 125,000	\$ 7,875,000	3	-	\$ 375,000	4.8%	
PROP	204	55	54	26.5%	98.2%	-----	\$ 3,050,000	2	3	\$ 150,000	N/A	
VAW/VRC	43	12	9	20.9%	75.0%	\$ 50,000	\$ 450,000	-	3	\$ -	N/A	
VP	119	31	31	26.1%	100.0%	\$ 50,000	\$ 1,550,000	-	-	\$ -	N/A	
VQ(P)	22	7	7	31.8%	100.0%	\$ 75,000	\$ 525,000	-	-	\$ -	N/A	
VQ(T)	20	5	7	35.0%	140.0%	\$ 75,000	\$ 525,000	2	-	\$ 150,000	28.6%	

NFOS												
	ELIGIBLE	REQUIRED	RETAINED	% RETAINED	% OF REQ'D	BONUS	COST	NFO EXCESS	NFO SHRTG	OVERPAYMENT	% OVERPAY	
TOTAL	354	102	85	24.0%	83.3%	-----	\$ 5,750,000	6	23	\$ 300,000	5.2%	
JET	135	39	32	23.7%	82.1%	-----	\$ 2,350,000	3	10	\$ 150,000	6.4%	
VAQ	61	25	15	24.6%	60.0%	\$ 100,000	\$ 1,500,000	-	10	\$ -	N/A	
VFA	74	14	17	23.0%	121.4%	\$ 50,000	\$ 850,000	3	-	\$ 150,000	17.6%	
PROP	219	63	53	24.2%	84.1%	-----	\$ 3,400,000	3	13	\$ 150,000	4.4%	
VAW/VRC	71	15	18	25.4%	120.0%	\$ 50,000	\$ 900,000	3	-	\$ 150,000	16.7%	
VP	101	34	28	27.7%	82.4%	\$ 75,000	\$ 2,100,000	-	6	\$ -	N/A	
VQ(P)	34	8	5	14.7%	62.5%	\$ 50,000	\$ 250,000	-	3	\$ -	N/A	
VQ(T)	13	6	2	15.4%	33.3%	\$ 75,000	\$ 150,000	-	4	\$ -	N/A	

3. Fiscal Year 2013 ACCP Performance Summary

OVERALL RETENTION SUMMARY							
		AVTRS ELIGIBLE	AVTRS REQUIRED	AVTRS RETAINED			
		971	331	351			
% RETAINED	% of RETENTION GOAL	% of TARGETED GOAL	TOTAL COST	AVTRS EXCESS	AVTRS SHRTG	TOTAL OVERPAY	% OVERPAY
36.1%	106.0%	76.4%	\$ 28,775,000	71	51	\$ 5,325,000	18.5%

PILOTS												
COMM	ELIGIBLE	REQUIRED	RETAINED	% RETAINED	% OF REQ'D	BONUS	COST	PILOT EXCESS	PILOT SHRTG	OVERPAYMENT	% OVERPAY	
TOTAL	649	238	243	37.4%	102.1%	-----	\$ 20,600,000	41	36	\$ 3,075,000	14.9%	
HELO	287	102	143	49.8%	140.2%	-----	\$ 10,725,000	41	-	\$ 3,075,000	28.7%	
HM	16	6	7	43.8%	116.7%	\$ 75,000	\$ 525,000	1	-	\$ 75,000	14.3%	
HSC	133	48	58	43.6%	120.8%	\$ 75,000	\$ 4,350,000	10	-	\$ 750,000	17.2%	
HSL/HSM	138	48	78	56.5%	162.5%	\$ 75,000	\$ 5,850,000	30	-	\$ 2,250,000	38.5%	
JET	157	73	51	32.5%	69.9%	-----	\$ 6,375,000	-	22	-	-	
VAQ	20	11	4	20.0%	36.4%	\$ 125,000	\$ 500,000	-	7	\$ -	N/A	
VFA	137	62	47	34.3%	75.8%	\$ 125,000	\$ 5,875,000	-	15	\$ -	N/A	
PROP	205	63	49	23.9%	77.8%	-----	\$ 3,500,000	-	14	-	N/A	
VAW/VRC	44	18	16	36.4%	88.9%	\$ 100,000	\$ 1,600,000	-	2	\$ -	N/A	
VP	125	31	23	18.4%	74.2%	\$ 50,000	\$ 1,150,000	-	8	\$ -	N/A	
VQ(P)	20	6	4	20.0%	66.7%	\$ 75,000	\$ 300,000	-	2	\$ -	N/A	
VQ(T)	16	8	6	37.5%	75.0%	\$ 75,000	\$ 450,000	-	2	\$ -	N/A	

NFOS												
	ELIGIBLE	REQUIRED	RETAINED	% RETAINED	% OF REQ'D	BONUS	COST	NFO EXCESS	NFO SHRTG	OVERPAYMENT	% OVERPAY	
TOTAL	322	93	108	33.5%	116.1%	-----	\$ 8,175,000	30	15	\$ 2,250,000	27.5%	
JET	105	31	20	19.0%	64.5%	-----	\$ 1,625,000	-	11	\$ -	N/A	
VAQ	49	17	15	30.6%	88.2%	\$ 100,000	\$ 1,500,000	-	2	\$ -	N/A	
VFA	56	14	5	8.9%	35.7%	\$ 25,000	\$ 125,000	-	9	\$ -	N/A	
PROP	217	62	88	40.6%	141.9%	-----	\$ 6,550,000	30	4	\$ 2,250,000	34.4%	
VAW/VRC	69	18	35	50.7%	194.4%	\$ 75,000	\$ 2,625,000	17	-	\$ 1,275,000	48.6%	
VP	107	28	41	38.3%	146.4%	\$ 75,000	\$ 3,075,000	13	-	\$ 975,000	31.7%	
VQ(P)	26	8	7	26.9%	87.5%	\$ 50,000	\$ 350,000	-	1	\$ -	N/A	
VQ(T)	15	8	5	33.3%	62.5%	\$ 100,000	\$ 500,000	-	3	\$ -	N/A	

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APPENDIX D. COPY OF SURVEY

INFORMED CONSENT FOR PARTICIPATING IN THIS RESEARCH SURVEY

The purpose of this research survey entitled: Market-Based Approach to Aviator Retention is to assess the possibilities for improving the current aviator retention program.

This survey has 41 questions. Depending on your individual aviation career, you may or may not be asked some of the questions. Estimated completion time is 15 minutes.

Your participation in this survey is strictly voluntary. The data collected will NOT become part of your permanent record and will NOT affect your career in anyway. If you do choose to participate in this survey, you may decline to answer any questions and are free to withdraw from taking the survey at any time.

Any data provided will be maintained in accordance with DOD policy. Be assured that any information you provide will be used responsibly and protected from unauthorized access; however, as with any data collection process there is the minor risk that the information collected could be inappropriately disclosed.

If you have any questions regarding this research, contact Dr. Noah Myung at noah.myung@nps.edu or 831-656-2811; alternatively, contact LCDR Eric Kelso at ewkelso@nps.edu. If you have any questions regarding your rights as a research subject, please contact the NPS Institutional Review Board Chair, Dr. Larry Shattuck, at lgshattu@nps.edu or 831-656-2473.

1.

I have read this informed consent document. I understand that, before taking this survey, I may ask questions and have them answered to my satisfaction. I further understand that by selecting "Yes" below I agree to participate in this research, and I do not waive any of my legal rights. *

- Yes
- No

If you wish to retain a copy of this statement for your personal records, please print this screen.

AVIATION CAREER CONTINUATION PAY (ACCP)

ACCP is also referred to as the "Aviation Bonus" or the "Department Head Bonus." ACCP is offered as an incentive to all eligible aviators, who in exchange for a cash bonus, agree to remain on active duty beyond their Minimum Service Requirement and complete an Aviation "Department Head Tour." The following table lists the most recent bonus amounts for individual communities:

COMMUNITY-----TOTAL PILOT BONUS-----TOTAL NFO BONUS

HM-----	\$75,000-----	N/A
HS/HSC-----	\$75,000-----	N/A
HSL/HSM-----	\$75,000-----	N/A
VAQ-----	\$125,000-----	\$100,000
VAW/VRC-----	\$125,000-----	\$75,000
VFA-----	\$125,000-----	\$75,000
VP-----	\$75,000-----	\$75,000
VQ(P)-----	\$75,000-----	\$50,000
VQ(T)-----	\$75,000-----	\$100,000

2. Have you accepted or submitted an ACCP contract?

- Yes
- No

3. (Not asked if Q2=no) What was the total amount for your ACCP contract?

- \$25,000
- \$50,000
- \$75,000
- \$100,000
- \$125,000
- Other

4. How much of an affect does/did ACCP have on your decision to stay in the Navy?

- No affect at all
- Very little affect
- Somewhat affected
- Affected very much

5. (Not asked if Q2=Yes) Assuming the ACCP bonus for your community were to remain the same as listed above, how likely would you be to accept the bonus?

- Very Unlikely (Less than a 15% chance of accepting the bonus)
- Unlikely (Between 15%-30% chance of accepting the bonus)
- Somewhat Unlikely (Between 30%-45% chance of accepting the bonus)
- Neutral / Uncertain (Between 45%-55% chance of accepting the bonus)
- Somewhat Likely (Between 55%-70% chance of accepting the bonus)
- Likely (Between 70%-85% chance of accepting the bonus)
- Very Likely (More than an 85% chance of accepting the bonus)

6. How likely would you accept the bonus and agree to complete a "Department Head Tour" if the following

TOTAL bonus amounts were offered to you (percentages reflect probability of ACCEPTING the bonus)?

	Very Unlikely (< 15%)	Unlikely (15%-30%)	Somewhat Unlikely (30%-45%)	Neutral / Uncertain (45%-55%)	Somewhat Likely (55%-70%)	Likely (70% - 85%)	Very Likely (> 85%)
\$0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$25,000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$50,000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$75,000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$100,000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$125,000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$150,000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$175,000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. Please state how much you AGREE with the following statements about the "Aviation Bonus" program:

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral / No Opinion	Somewhat Agree	Agree	Strongly Agree
Bonus amounts (dollars paid) should be tailored to meet the specific retention goals of individual communities.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In order to provide larger bonus amounts, the number of bonus contracts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral / No Opinion	Somewhat Agree	Agree	Strongly Agree
offered should not exceed retention goals.							
Prior to awarding the bonus, performance records of applicants should be screened to determine suitability for Department Head.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Aviators with records of superior performance should be offered larger bonuses than other aviators in the same community.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. Please provide any additional comments in regard to questions in this section:

MARKET-BASED RETENTION SYSTEM

Suppose the Navy replaces the current ACCP program with one that uses an auction-based system to determine the bonus amount for a specified number of contracts.

This auction-based format would work in the following manner: Suppose there are 100 aviators eligible to receive retention bonuses and the Navy announces it will seek to retain 60 of those aviators. Each aviator would individually and privately submit a bid with the minimum bonus amount he or she would be willing to accept in exchange for agreeing to complete a "Department Head Tour."

The Navy would compile all the bids and award the bonuses to the 60 aviators with the lowest bids, but it would pay each of them the amount listed in the 61st lowest bid (e.g., if the 61st lowest bid was \$75,000 then the 60 winning aviators would each receive \$75,000, even though each had agreed to accept a lower amount). The remaining aviators would not receive bonuses and would not be obligated to serve a "Department Head Tour."

This auction format is designed to be in a bidder's best interest to bid truthfully. That is, there is no incentive to "game" the system by overbidding or underbidding.

9. Assume you are in a group of 140 aviators eligible to receive a retention bonus. If, under the system described above, the Navy's goal is to retain 65 aviators what is the amount you would likely submit for your bid (total bonus amount)?

- \$ 0 / No bonus required
- \$ 5,000
- \$ 10,000
- \$ 15,000
- \$ 20,000
- \$ 25,000
- \$ 30,000
- \$ 35,000
- \$ 40,000
- \$ 45,000
- \$ 50,000
- \$ 55,000
- \$ 60,000
- \$ 65,000
- \$ 70,000
- \$ 75,000
- \$ 80,000
- \$ 85,000
- \$ 90,000
- \$ 95,000
- \$100,000
- \$105,000
- \$110,000
- \$115,000
- \$120,000
- \$125,000
- \$130,000
- \$135,000
- \$140,000
- \$145,000
- \$150,000
- \$155,000
- \$160,000
- \$165,000
- \$170,000
- \$175,000
- More than \$175,000 / Do not wish to be retained

Note: This value should be the MINIMUM amount you would be satisfied with in exchange for obligating to serve a DH tour.

10. How well do you feel you understand the auction-based system described above (e.g., who is retained, how bonus amount is determined, how you should bid)?

- Clearly Understand
- Sufficiently Understand
- Somewhat Understand
- Do not Understand

11. Please specify the location you would prefer to be stationed for your "Department Head Tour":

- Not Applicable
- CONUS Central
- CONUS East Coast
- CONUS West Coast
- OCONUS

12. What is the equivalent cash bonus you would be willing to forgo for the guarantee of serving in your preferred duty station?

13. Suppose as part of the "Aviation Bonus," was the option to attend an in-residence degree program lieu of some other "due-course" career path option (e.g., shortening or foregoing a "Disassociated Sea Tour" to attend the Naval Postgraduate School). Assume that in addition to a cash bonus you were offered this option. How interested would you be in the in-residence degree portion of the bonus?

- Not at all Interested
- Indifferent / Don't Know
- Somewhat Interested
- Very Interested
- Extremely Interested

14. What is the equivalent cash bonus you would be willing to forgo for the guarantee of attending a Naval Aviation Enterprise (NAE) supported in-residence degree program like the one described in question 13?

15. In addition to the two options listed in questions 11 and 13 is there any other non-monetary incentive that might increase your willingness to stay in the Navy after completing your initial service obligation?

16. What is the equivalent cash bonus you would be willing to forgo for the guarantee of the option you listed in question 15?

17. Please provide any additional comments in regard to questions in this section:

CAREER SATISFACTION

Please answer the following questions based on your PERSONAL experience / opinion:

18. Use the following scale to answer how the factors below affect/affected your decision to STAY on Active Duty and serve a Department Head Tour:

	Significantl y Negative	Negativ e	Somewha t Negative	Neutra l/ Does not Affect	Somewha t Positive	Positiv e	Significantl y Positive
Past Career Experience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Current Job Satisfaction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Future Career Opportunitie	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Significantl y Negative	Negativ e	Somewha t Negative	Neutra l/ Does not Affect	Somewha t Positive	Positiv e	Significantl y Positive
s / Requirement s							
Duty Station Location	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time Away From Home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Geographic Stability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employment Opportunitie s in Commercial Aviation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other Employment Opportunitie s Outside the Navy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Career Opportunitie s for Spouse / Significant Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Patriotism / Camaraderie	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Amount of Flight Time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Education / Training Offered by the Navy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quality of Life / OPTEMPO	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Monthly Pay & Compensatio n	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pension / Retirement Plan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Job Security	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Healthcare	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (Please Specify Below)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19. Please provide any additional comments in regard to questions in this section:

FIRST SEA TOUR

The following questions are in regard to your "FIRST SEA TOUR" (i.e., your first operational fleet squadron):

20. What is your parent aviation community?

- HM
- HSC/HS
- HSM/HSL
- VAQ
- VAW
- VFA
- VP
- VQ(P)
- VQ(T)
- VRC
- Other

21. Where were you stationed / homeported for your "First Sea Tour"?

- Not Applicable
- CONUS Central
- CONUS East Coast
- CONUS West Coast
- OCONUS
- Other

22. (Not asked if Q21=N/A) What was your ranking on your final competitive FITREP during your "First SEA Tour"?

- Not Applicable
- #1 EP
- #2 or greater EP / unnumbered EP
- #1 MP
- #2 or greater MP / unnumbered MP

A "competitive" FITREP is any FITREP with a summary group of more than "1" (typically a Periodic or Detachment of Reporting Senior report and not a Detachment of Individual report)

FIRST SHORE TOUR

The following questions are in regard to your "FIRST SHORE TOUR" (i.e., the command you were assigned to immediately following your "First SEA Tour"):

23. What type of command did you serve in for your "First SHORE Tour"?

- Not Applicable
- EWTG
- Flag Aide
- Fleet Replacement Squadron
- GSA / ISA
- HT Squadron
- HX Squadron
- VFC
- VT Squadron
- VX Squadron
- Weapons School
- Other
- Naval Safety Center
- NPC
- NPS
- NSAWC
- OLA
- ONI
- OPNAV
- PEP
- PMRF
- ROTC
- Staff, Base
- Staff, Flag
- Staff, Wing
- Station SAR
- TSC
- USNA

24. (Not asked if Q23=N/A) Where were you stationed / homeported?

- CONUS Central
- CONUS East Coast
- CONUS West Coast
- OCONUS
- Other

25. (Not asked if Q23=N/A) What was your ranking on your final competitive FITREP during your "First SHORE Tour"?

- Not Applicable
- #1 EP
- #2 or greater EP / unnumbered EP
- #1 MP
- #2 or greater MP / unnumbered MP

A "competitive" FITREP is any FITREP with a summary group of more than "1" (typically a Periodic or Detachment of Reporting Senior report and not a Detachment of Individual report)

SECOND SEA TOUR

The following questions are in regard to your "SECOND SEA TOUR" (i.e., Disassociated Sea Tour):

26. What position did you hold during your "Second SEA Tour"?

- Not Applicable
- Amphib, Ship's Company
- CVN, Ship's Company
- Squadron Tactics / Training Officer
- Staff, CVW
- Staff, DESRON
- Staff, Fleet
- Staff, PHIBRON
- Super JO
- Other

27. (Not asked if Q26=N/A) Where were you stationed / homeported?

- CONUS Central
- CONUS East Coast
- CONUS West Coast
- OCONUS
- Other

28. (Not asked if Q26=N/A) What was your ranking on your final competitive FITREP during your "Second SEA Tour"?

- Not Applicable
- #1 EP
- #2 or greater EP / unnumbered EP
- #1 MP
- #2 or greater MP / unnumbered MP

A "competitive" FITREP is any FITREP with a summary group of more than "1" (typically a Periodic or Detachment of Reporting Senior report and not a Detachment of Individual report).

DEPARTMENT HEAD TOUR

The following questions are in regard to your squadron "DEPARTMENT HEAD TOUR":

29. Have you been screened for Department Head?

- Yes
- No (Not Yet Eligible)
- No (1 Time Failure to Select)
- No (2 Time Failure to Select)

30. (Not asked if Q29=No) In what community will/did you serve your "Department Head Tour"?

- | | | |
|--|-------------------------------|-------------------------------|
| • <input type="radio"/> Not Applicable | • <input type="radio"/> VAQ | • <input type="radio"/> VQ(T) |
| • <input type="radio"/> HM | • <input type="radio"/> VAW | • <input type="radio"/> VRC |
| • <input type="radio"/> HSC/HS | • <input type="radio"/> VFA | • <input type="radio"/> VT |
| • <input type="radio"/> HSM/HSL | • <input type="radio"/> VP | • <input type="radio"/> Other |
| • <input type="radio"/> HT | • <input type="radio"/> VQ(P) | |

31. (Not asked if Q30=N/A) Where is/was your assigned duty station?

- CONUS Central
- CONUS East Coast
- CONUS West Coast
- OCONUS
- Other

32. (Not asked if Q30=N/A) What was your ranking on your final competitive FITREP during your "Department Head Tour"?

- Not Applicable
- #1 EP
- #2 or greater EP / unnumbered EP
- #1 MP
- #2 or greater MP / unnumbered MP

A "competitive" FITREP is any FITREP with a summary group of more than "1" (typically a Periodic or Detachment of Reporting Senior report and not a Detachment of Individual report).

DEMOGRAPHIC INFORMATION

The following questions refer to your basic demographic information:

33. Commissioning Source:

- U.S. Naval Academy
- ROTC
- OCS
- STA-21
- ECP
- Other

34. Rank:

- O-3
- O-3E
- O-4
- O-5

35. Warfare Designator:

- Pilot
- NFO

36. Fiscal Year Designated (i.e., "Winged"):

- 1994 or prior
- 1995
- 1996
- 1997
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012 or later

Note: A Fiscal Year runs from 01 October the previous calendar year to 30 September in the same calendar year (e.g., Fiscal Year 2000 was from 01 October 1999 to 30 September 2000)

37. What is the highest level of education you have completed?

- Bachelor's Degree
- Some Postgraduate Education
- Master's Degree
- Doctorate

38. Please select any additional qualifications / experience you have earned (select all that apply):

- CDO
- JPME
- OOD
- SWO Pin
- TAO
- SFTI / WTI
- Flag Aide
- GSA / IA
- Other:

39. Gender:

- Female
- Male

40. Marital Status:

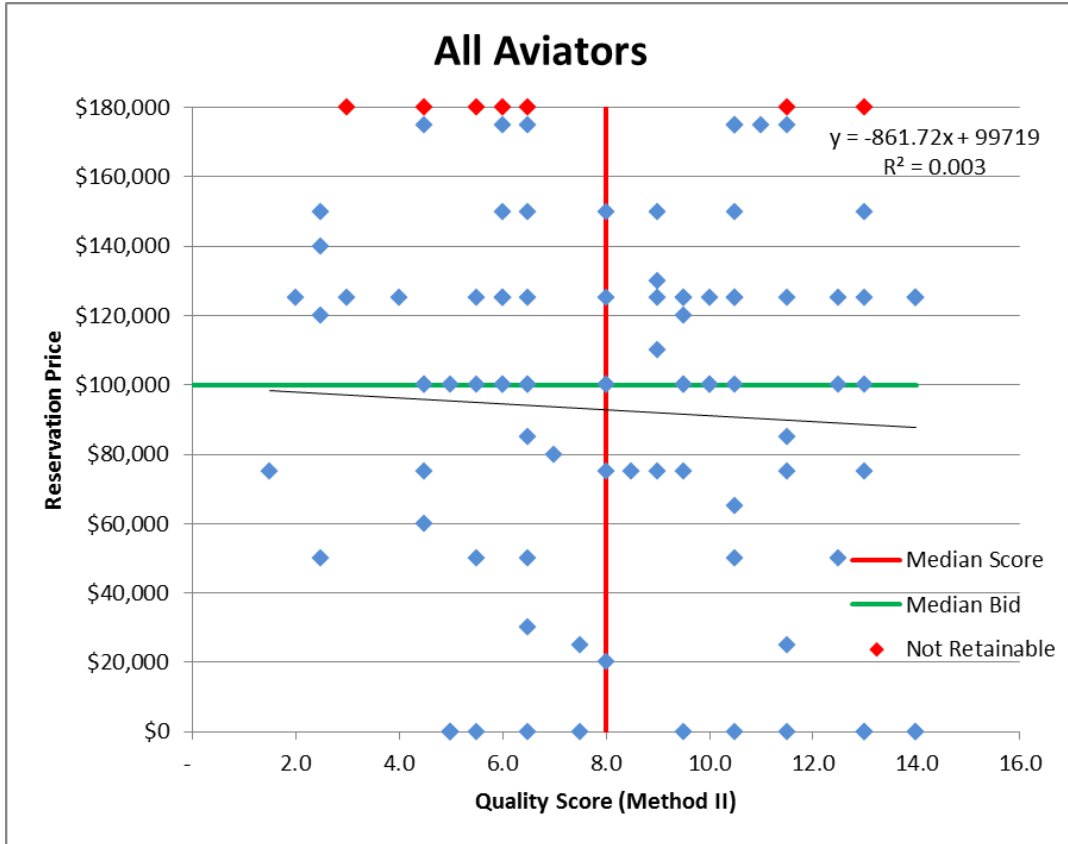
- Single / Never Married
- Married / Civil Union
- Divorced / Separated
- Widowed

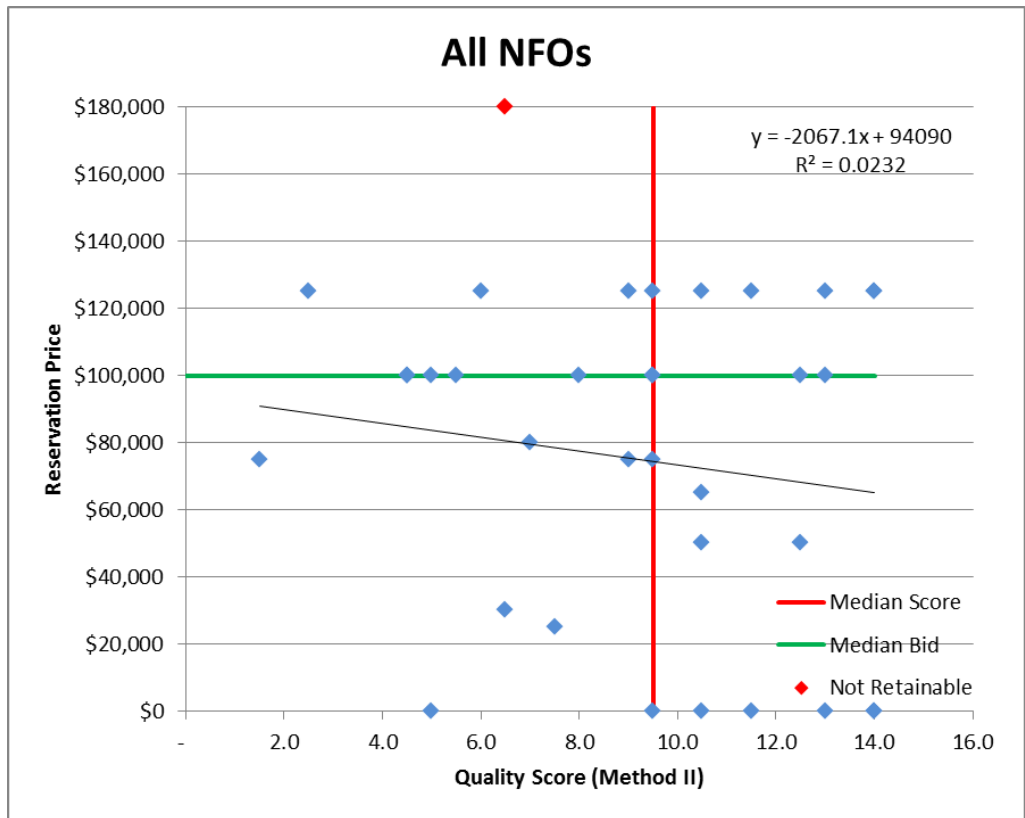
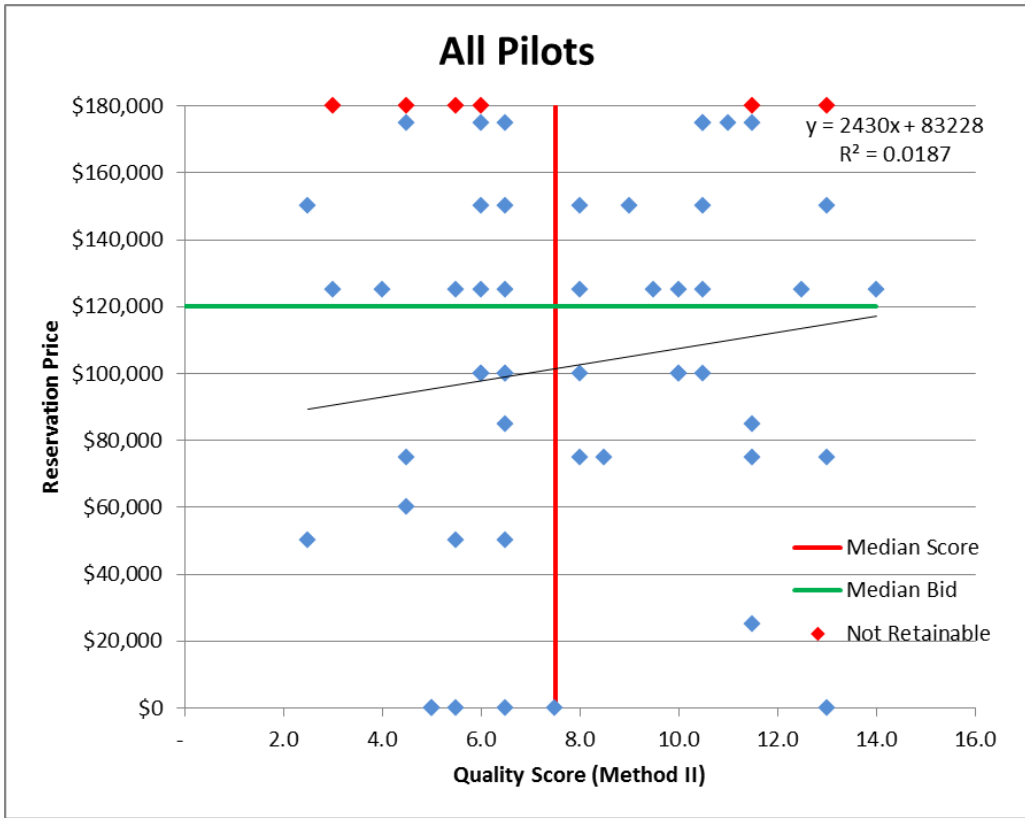
CONCLUSION

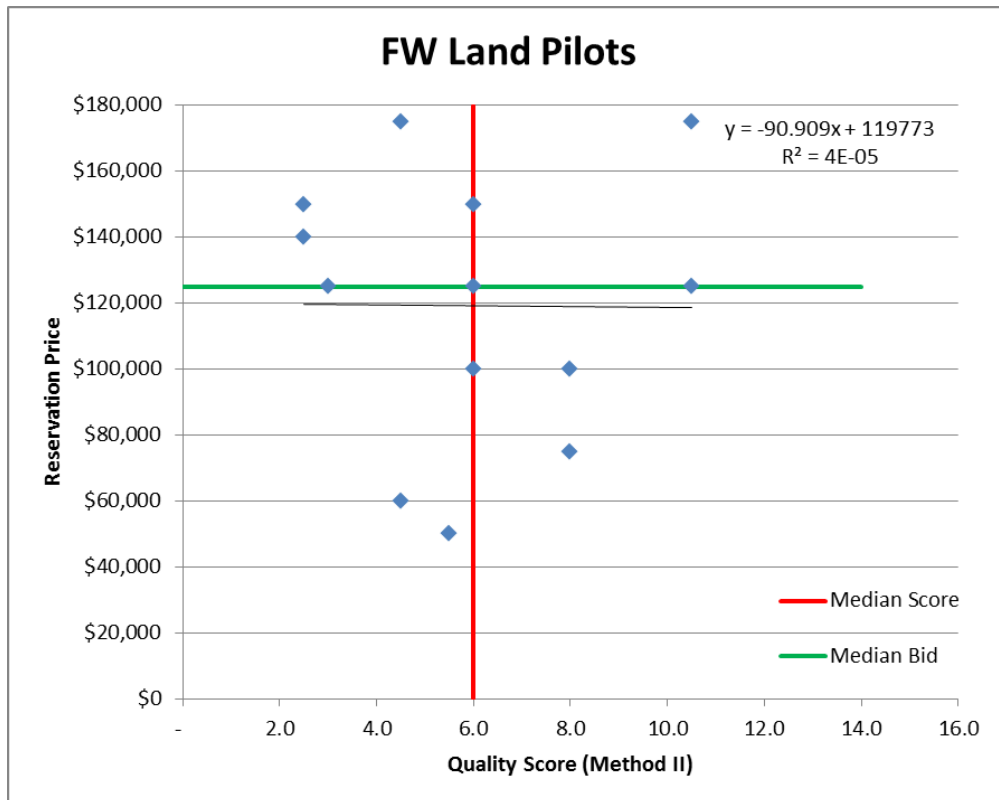
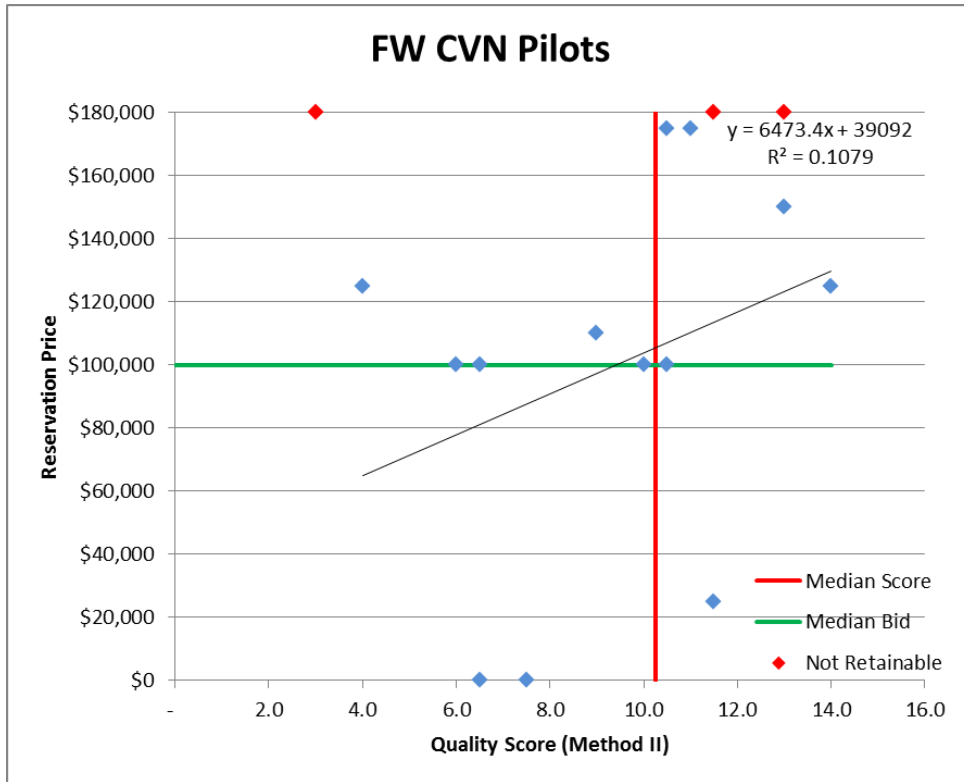
41. Please add any additional comments you wish to share with the researchers:

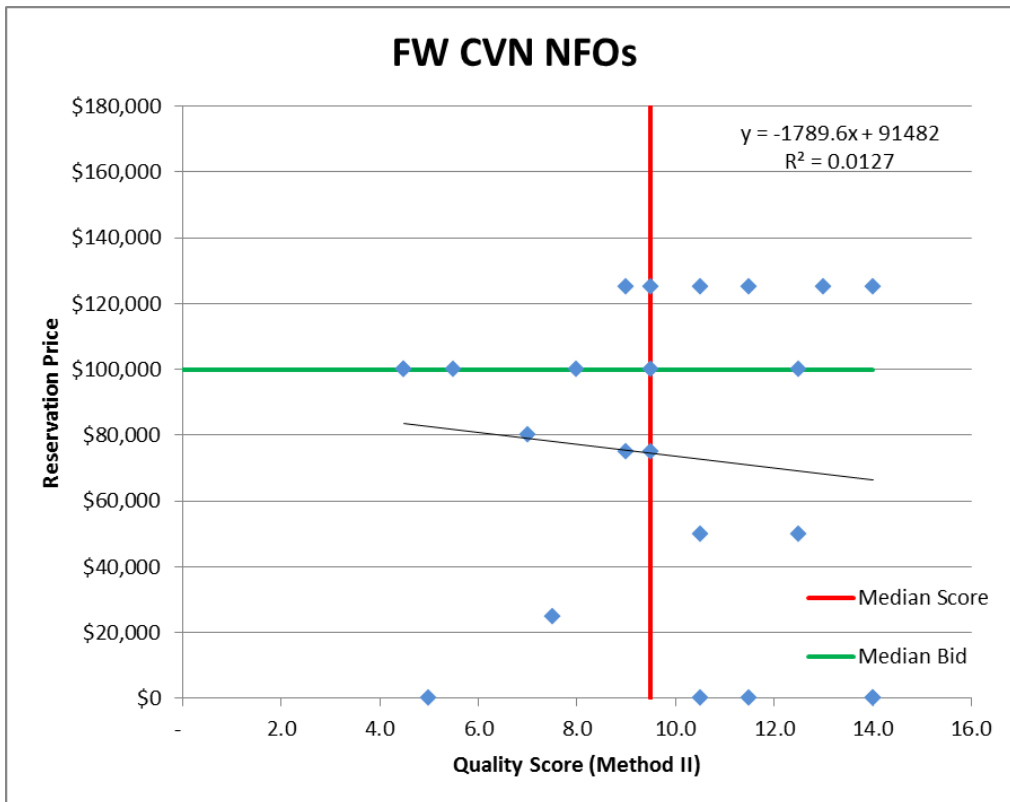
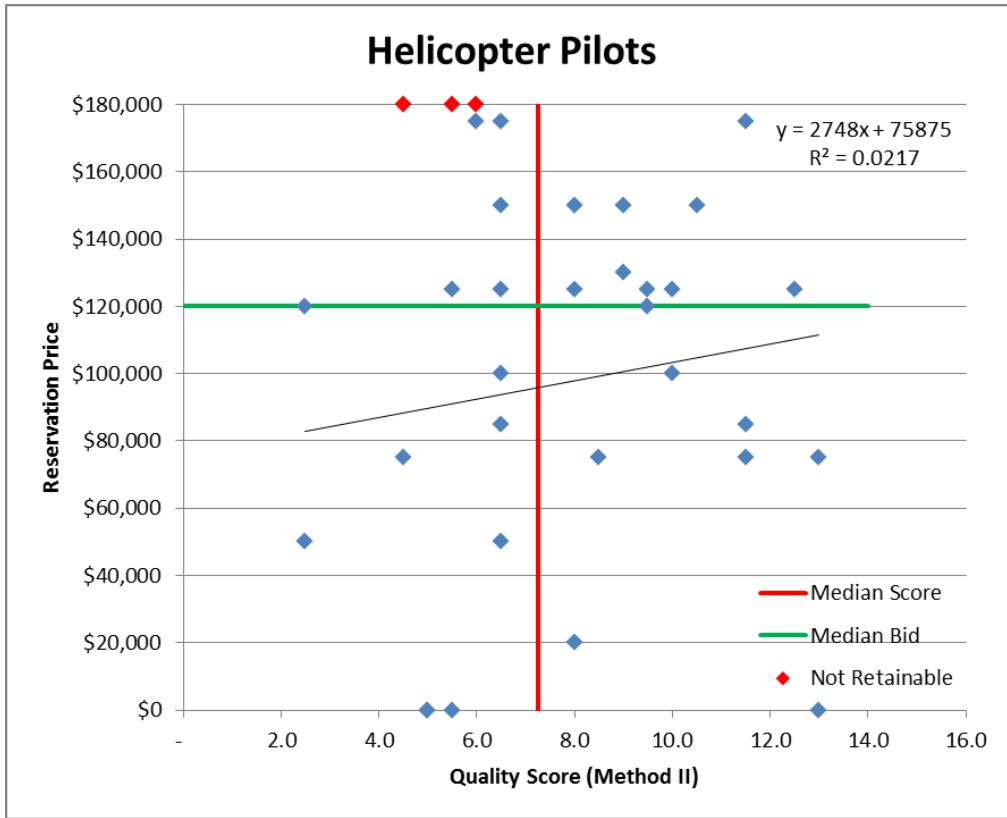
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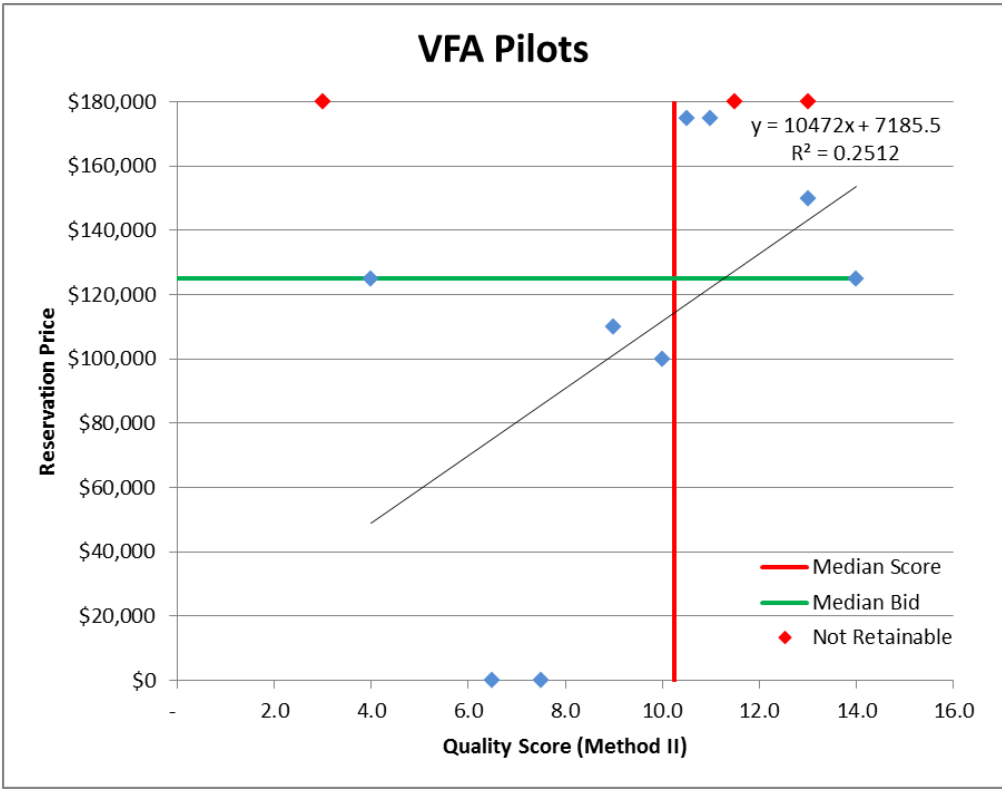
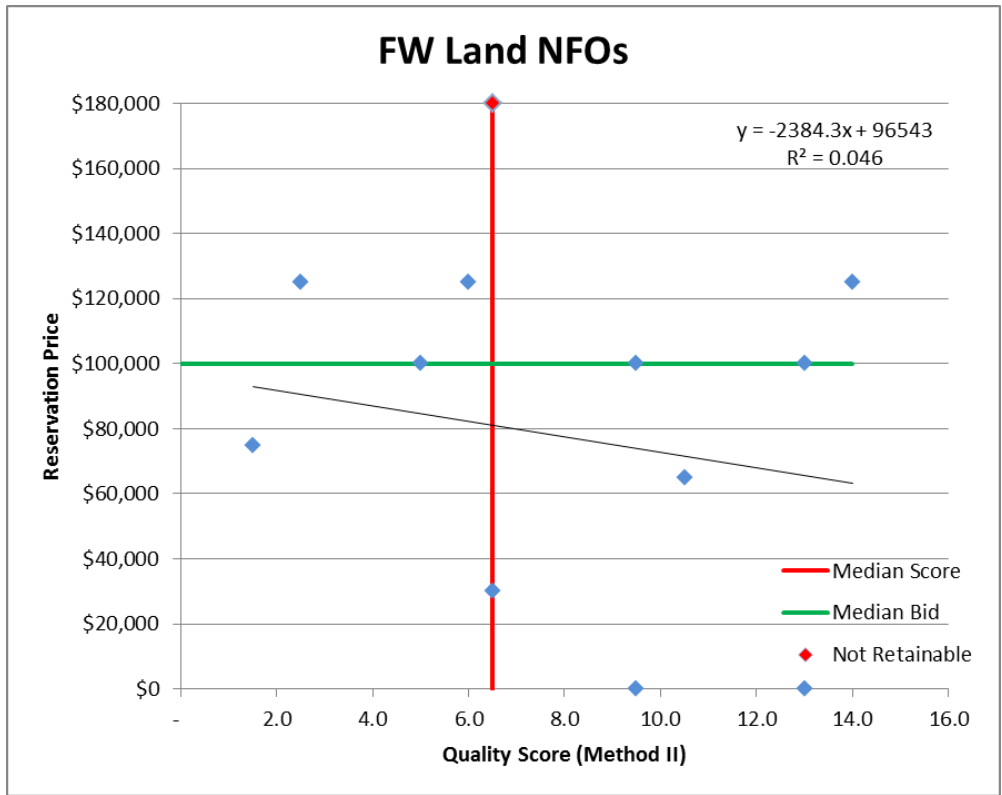
APPENDIX E. RESIDUAL PLOTS OF INDIVIDUAL QUALITY SCORE (METHOD II) AND RESERVATION PRICE

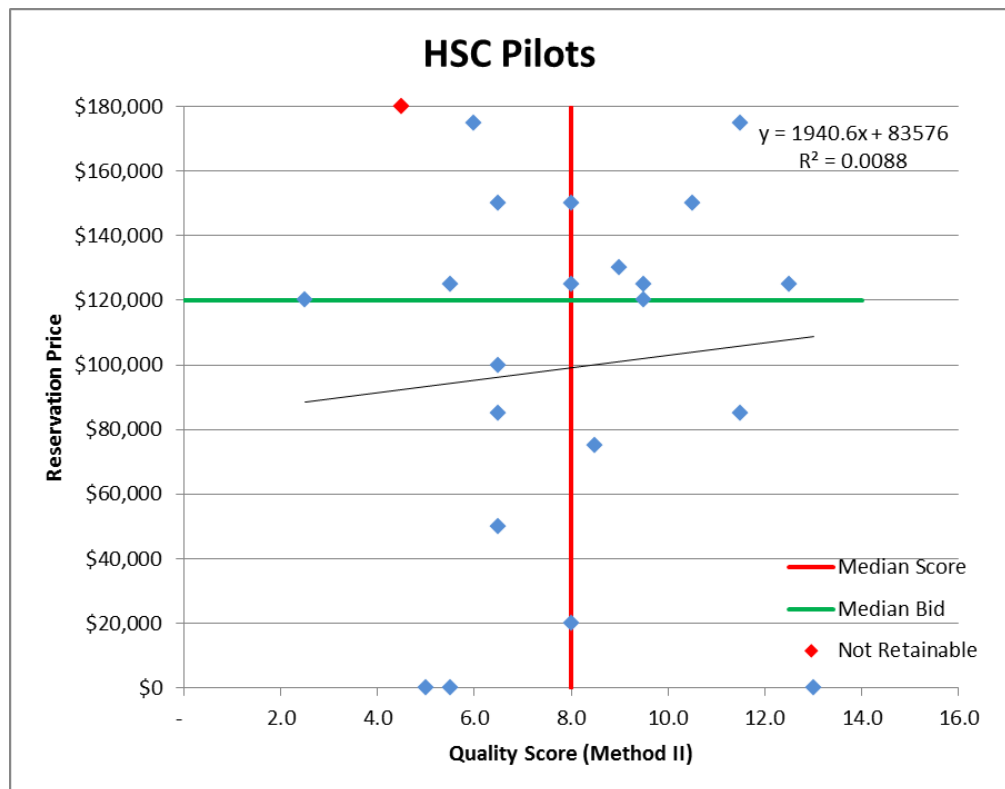
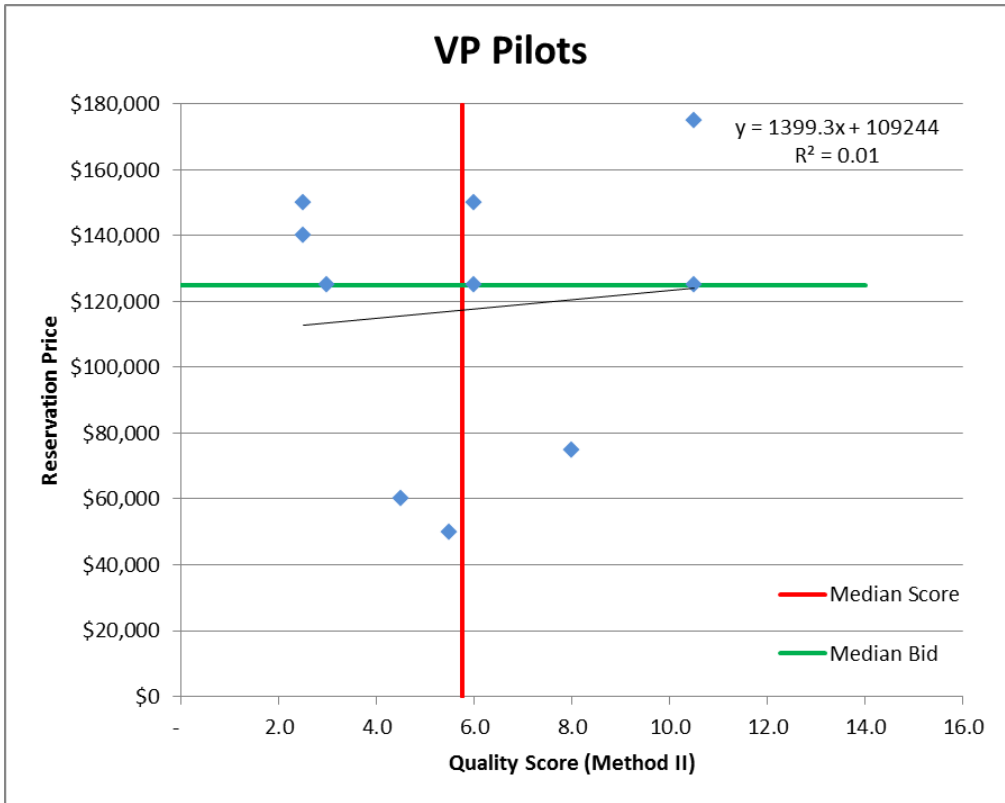


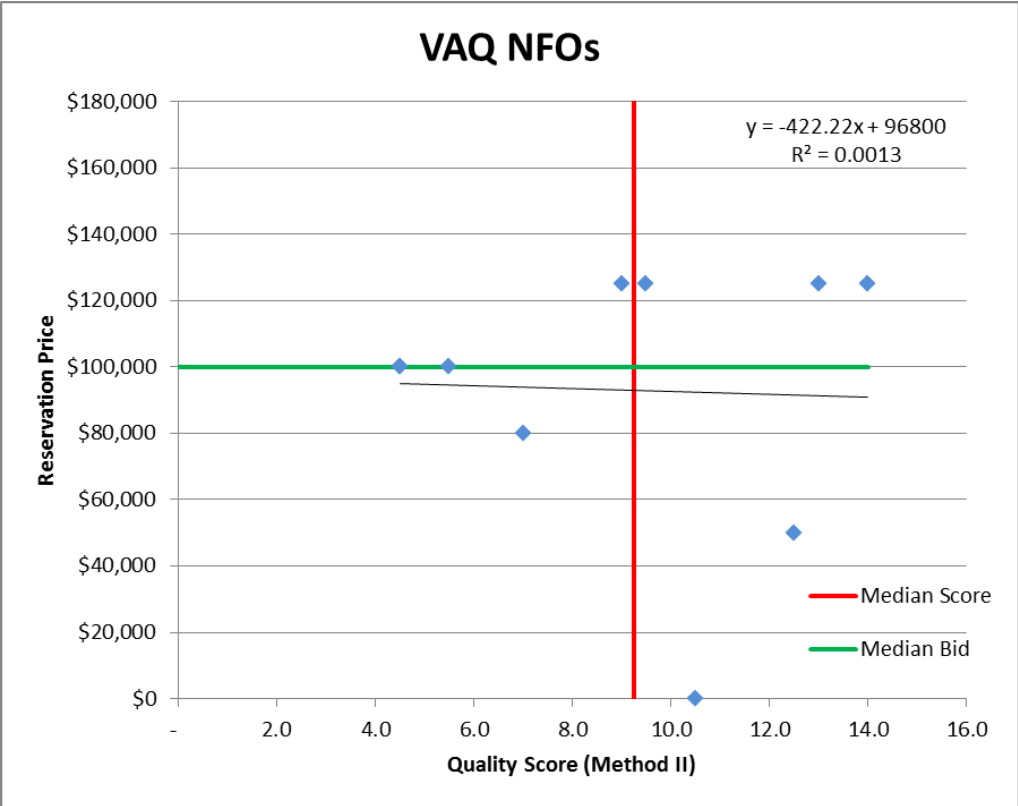
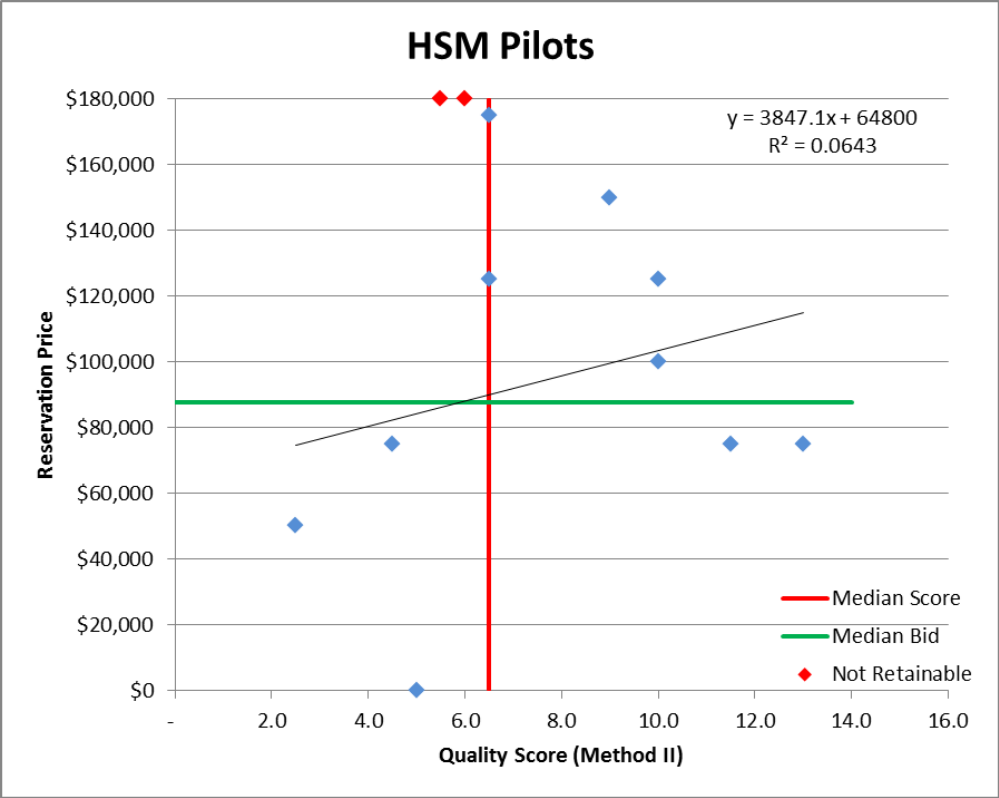


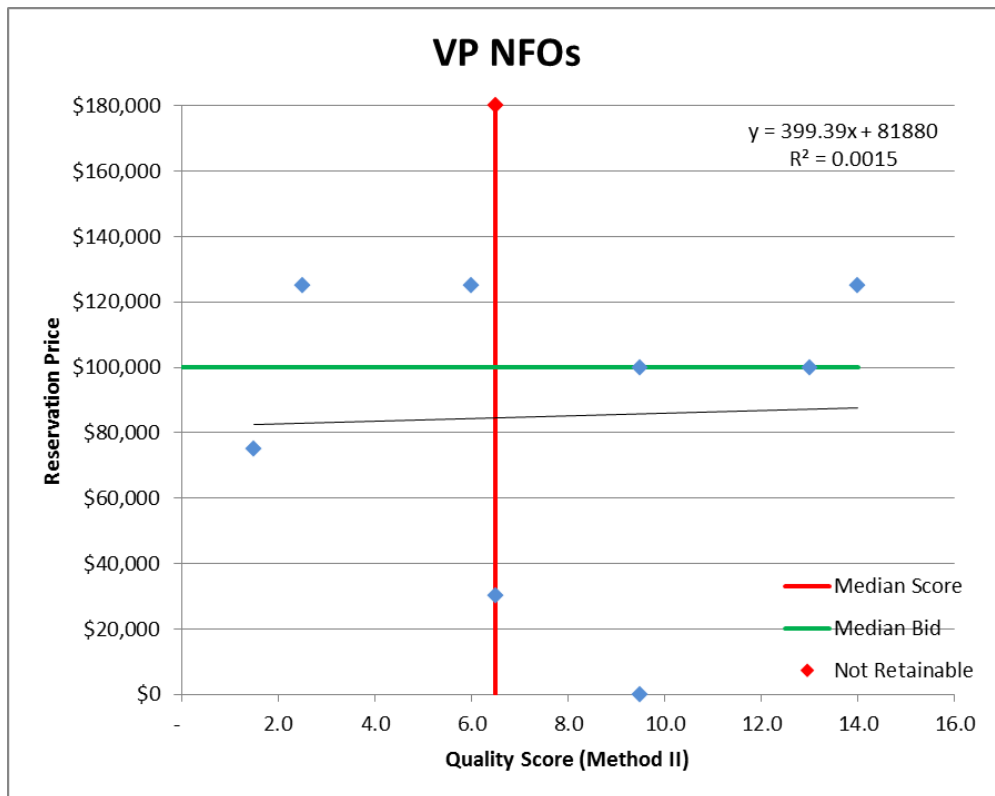
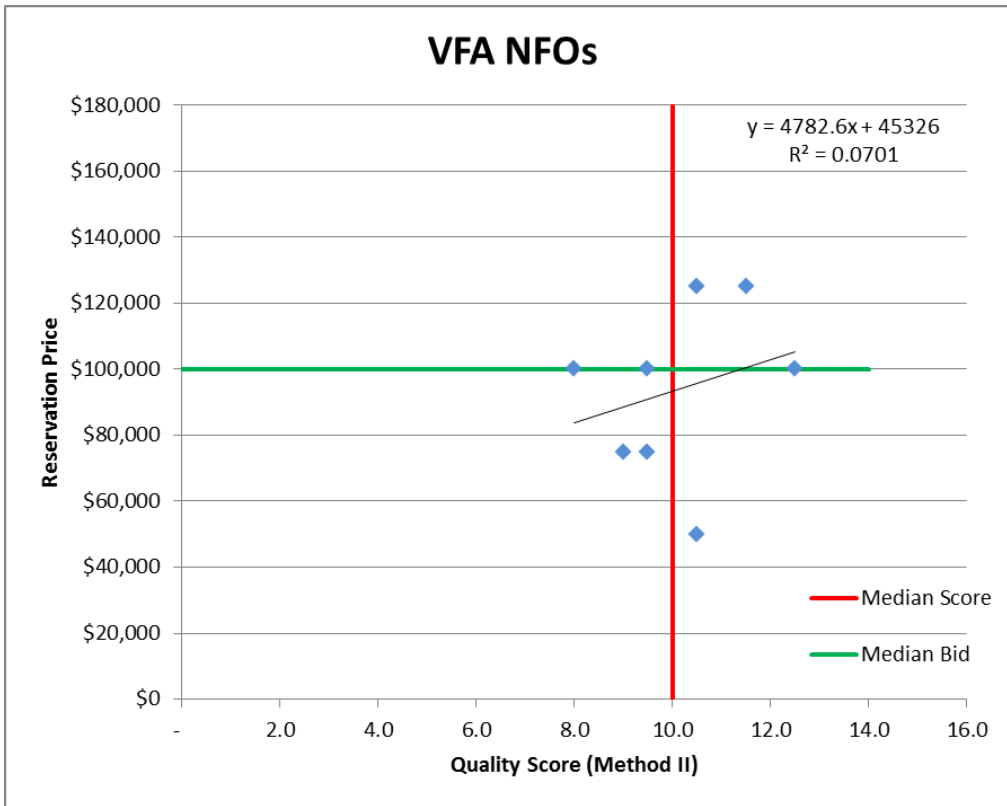




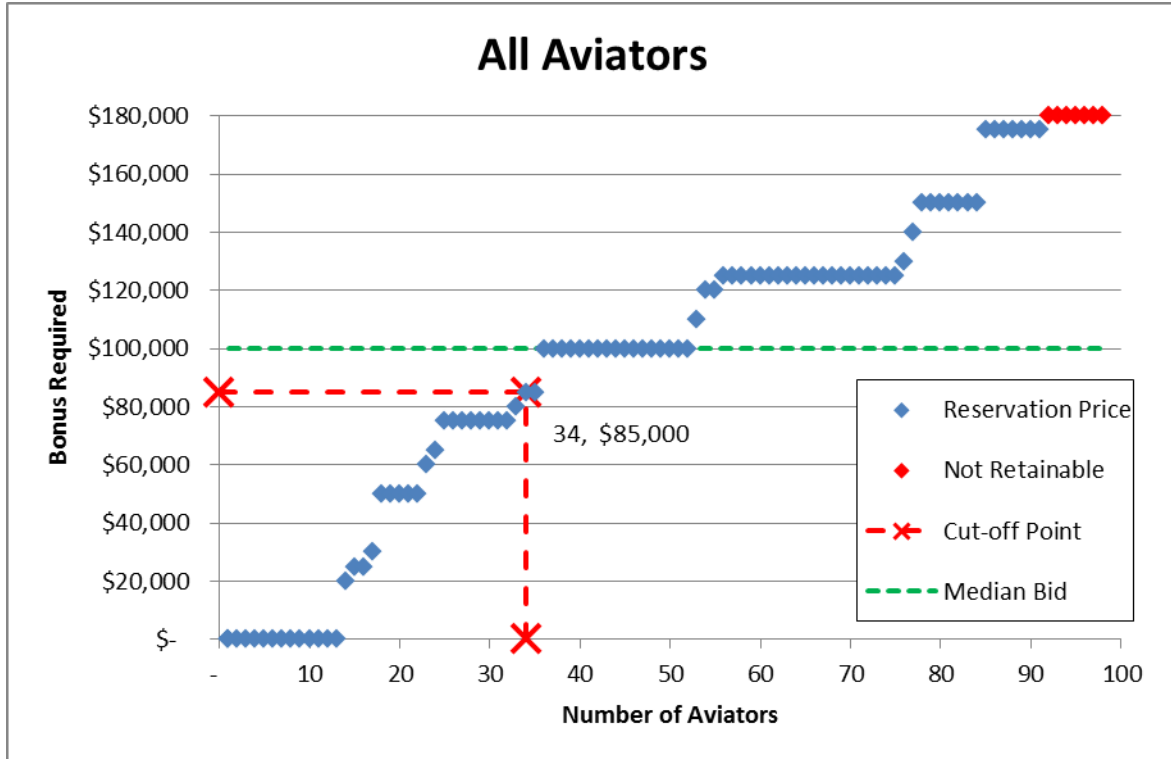


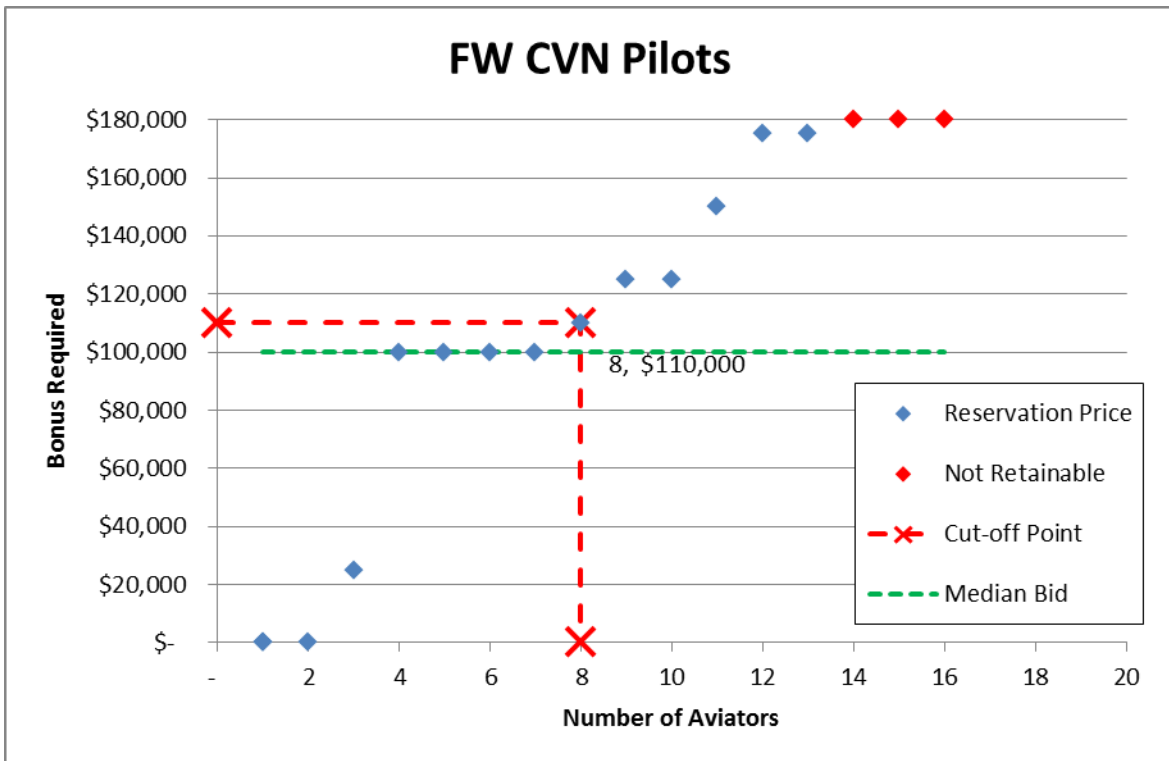
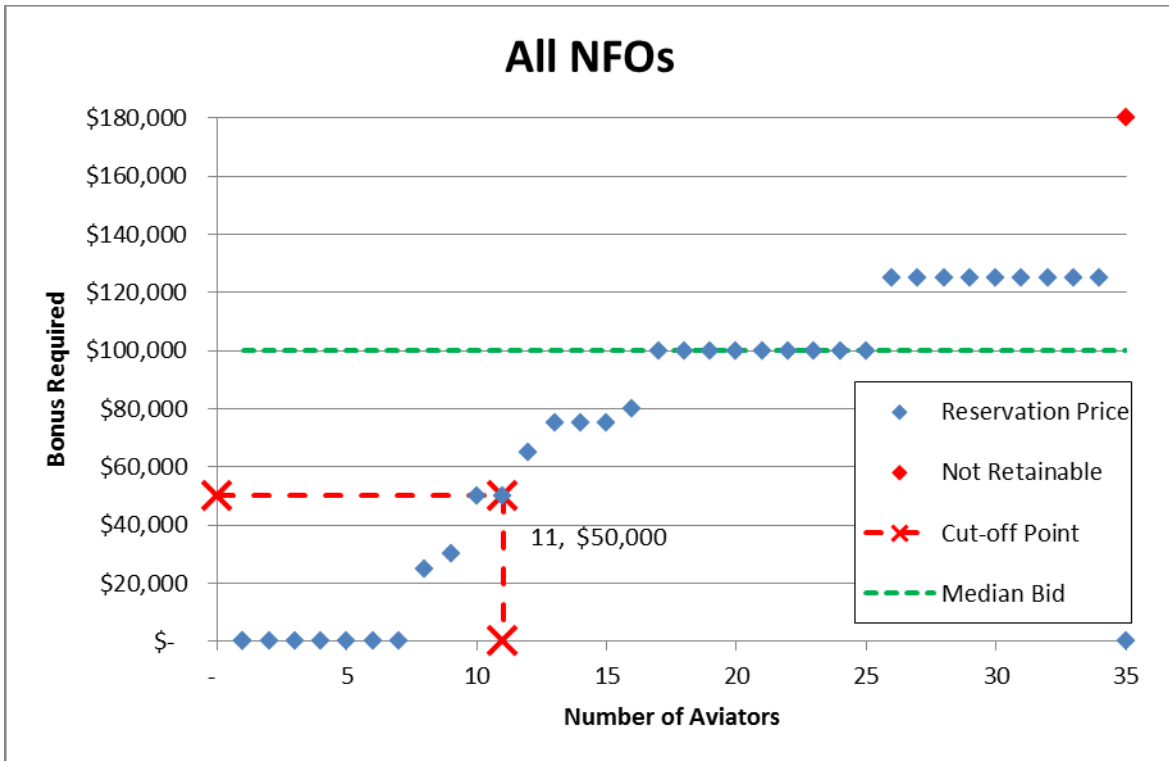


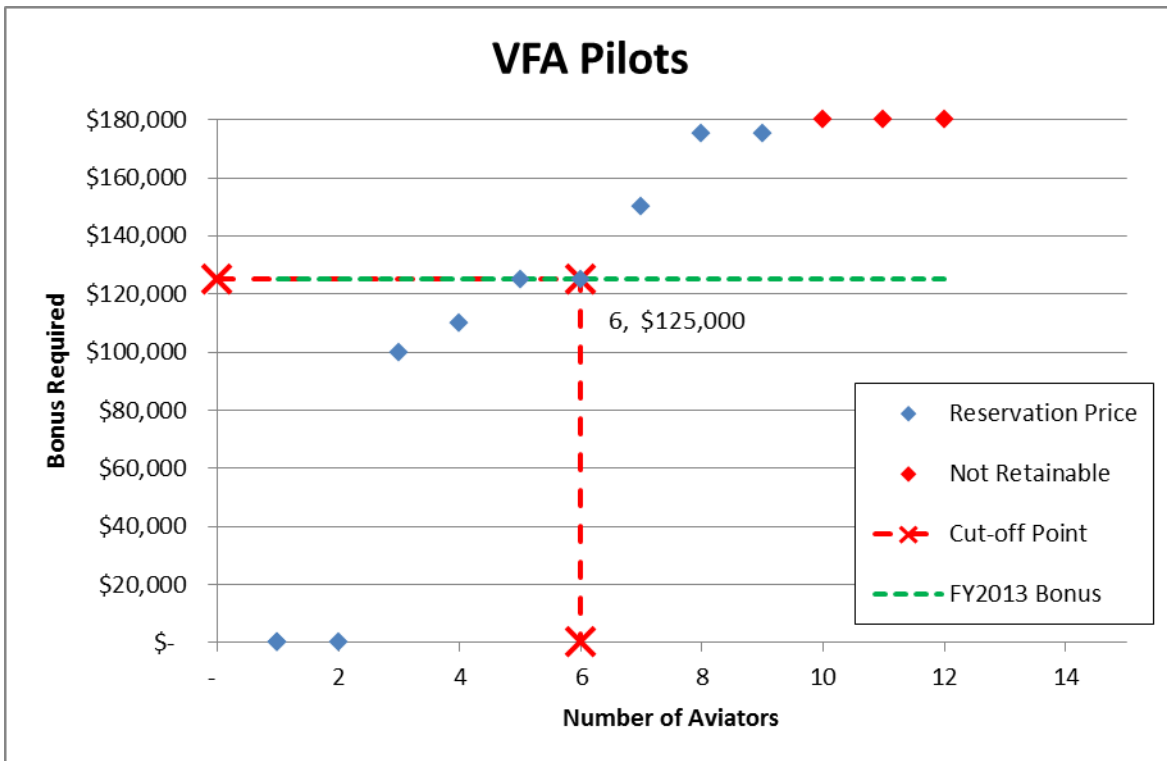
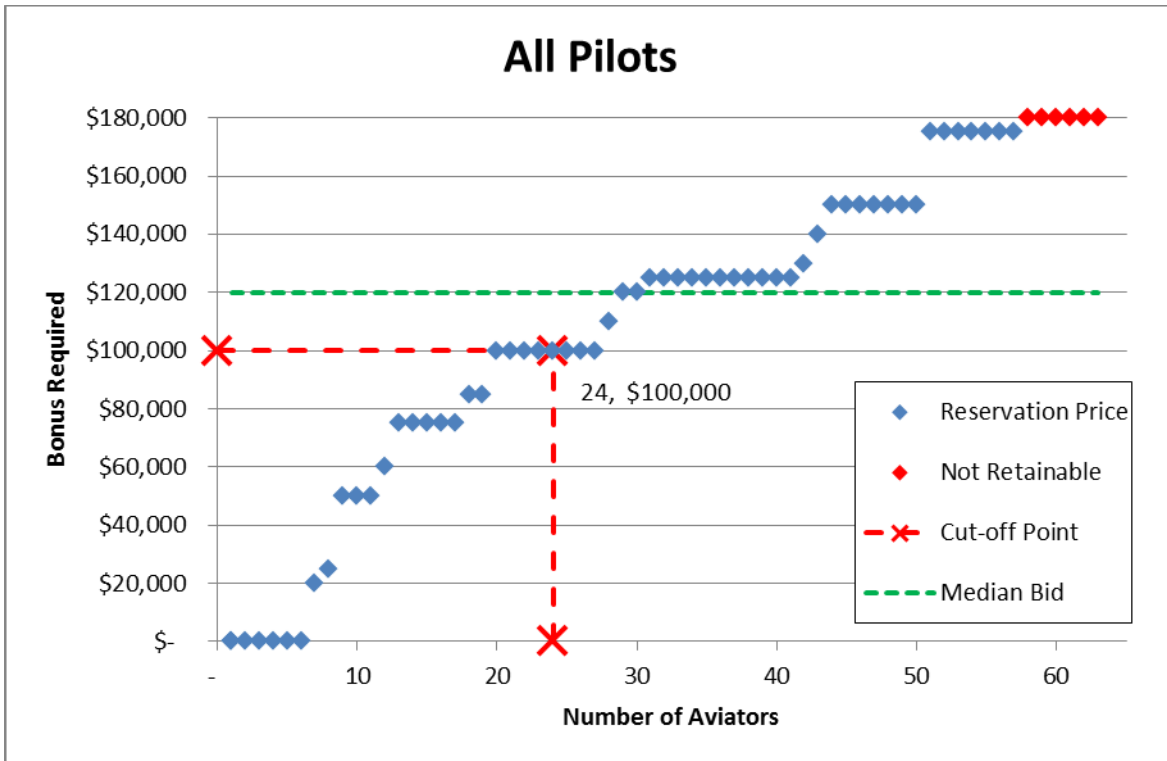


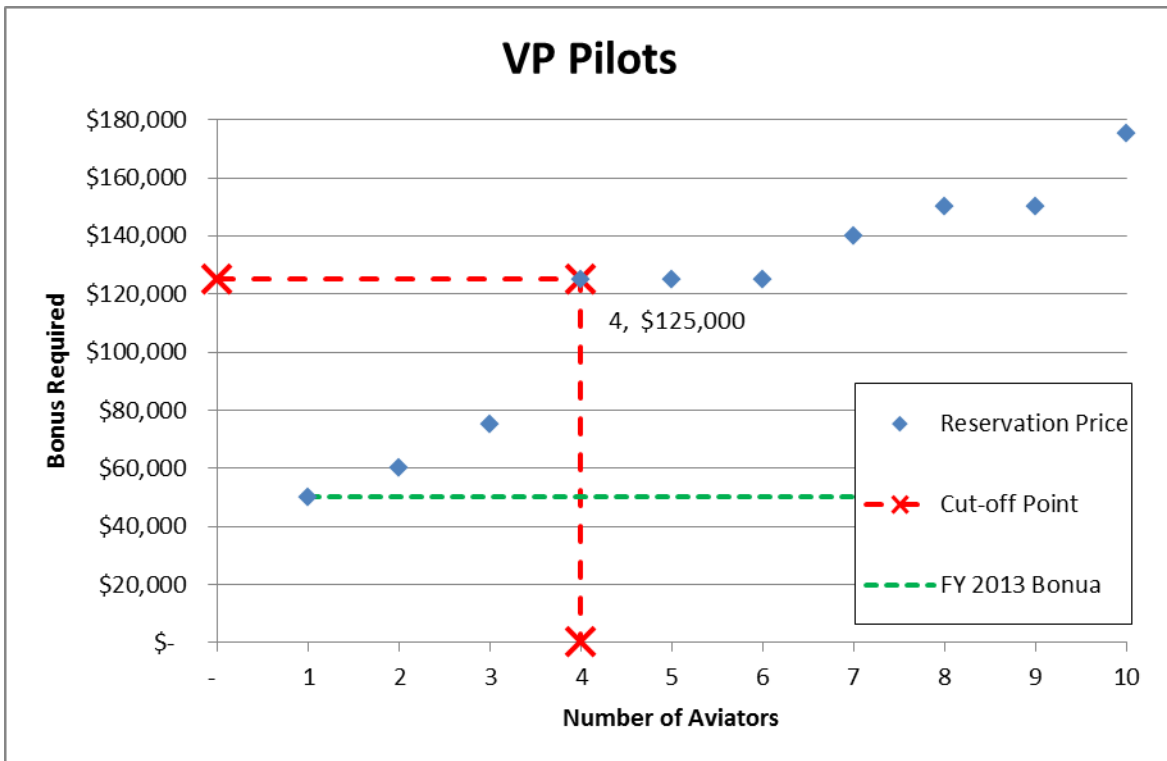
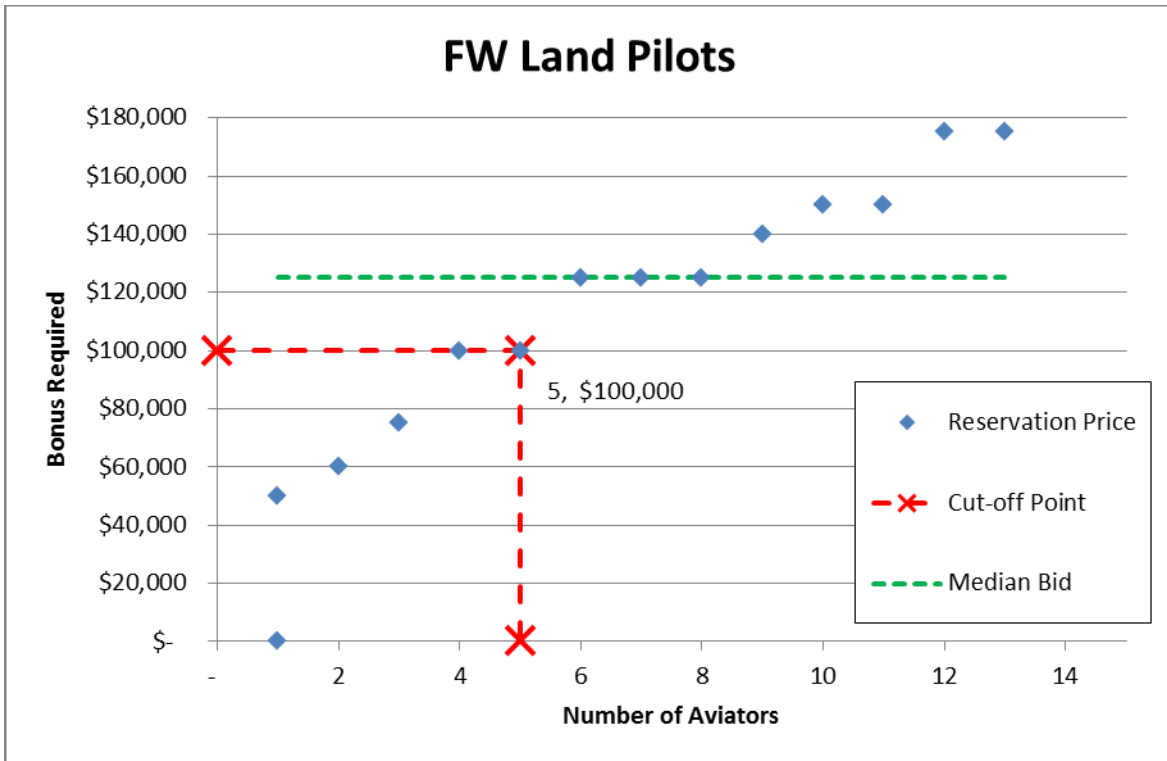


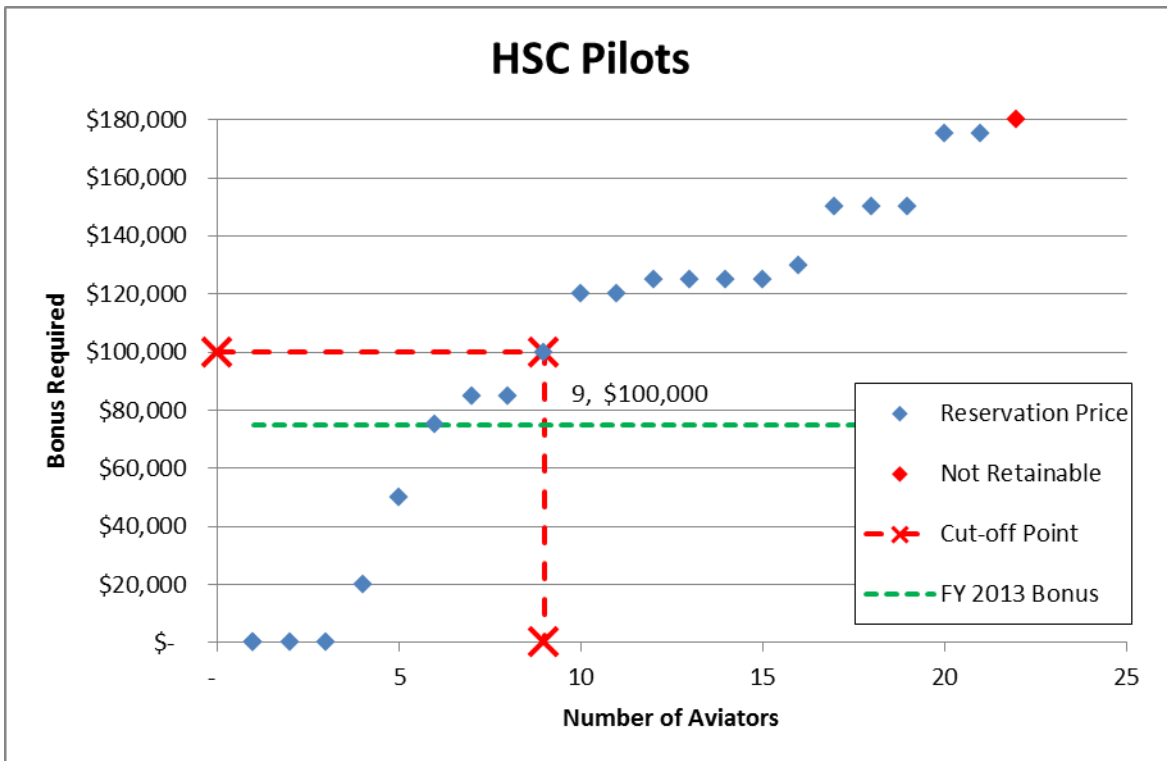
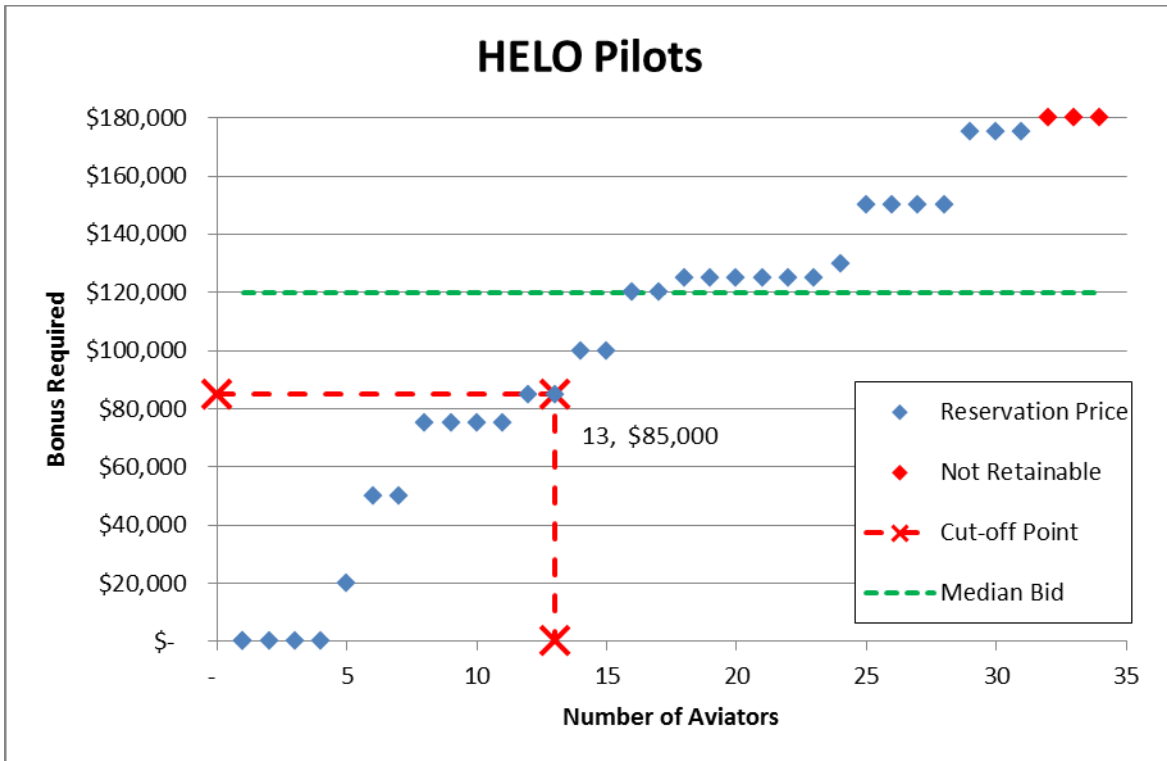
APPENDIX F. RESIDUAL PLOTS OF UNIFORM-PRICE AUCTION MODEL

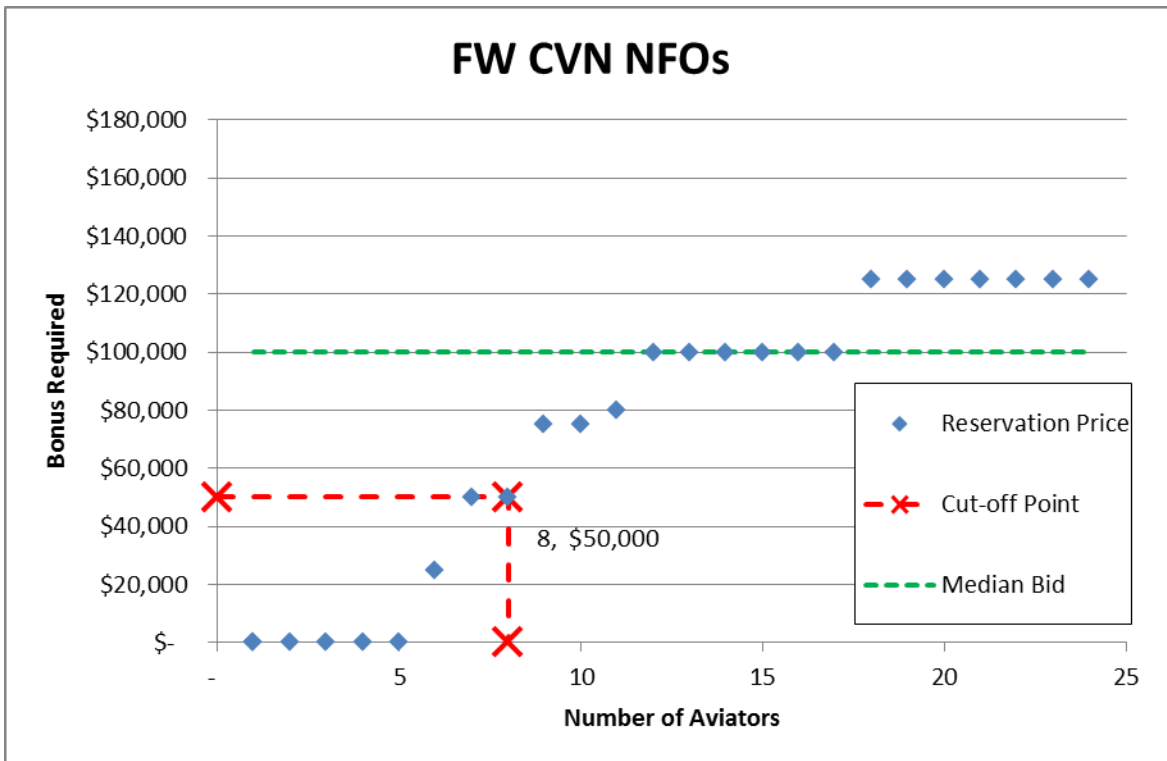
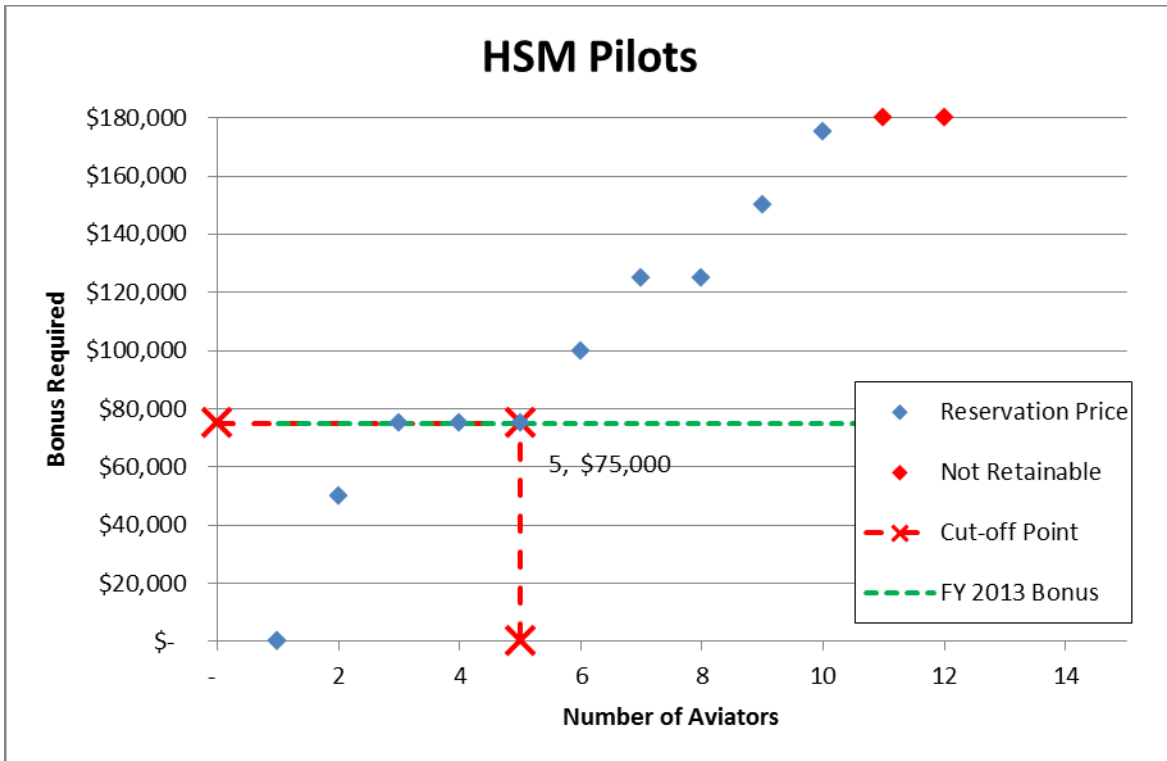


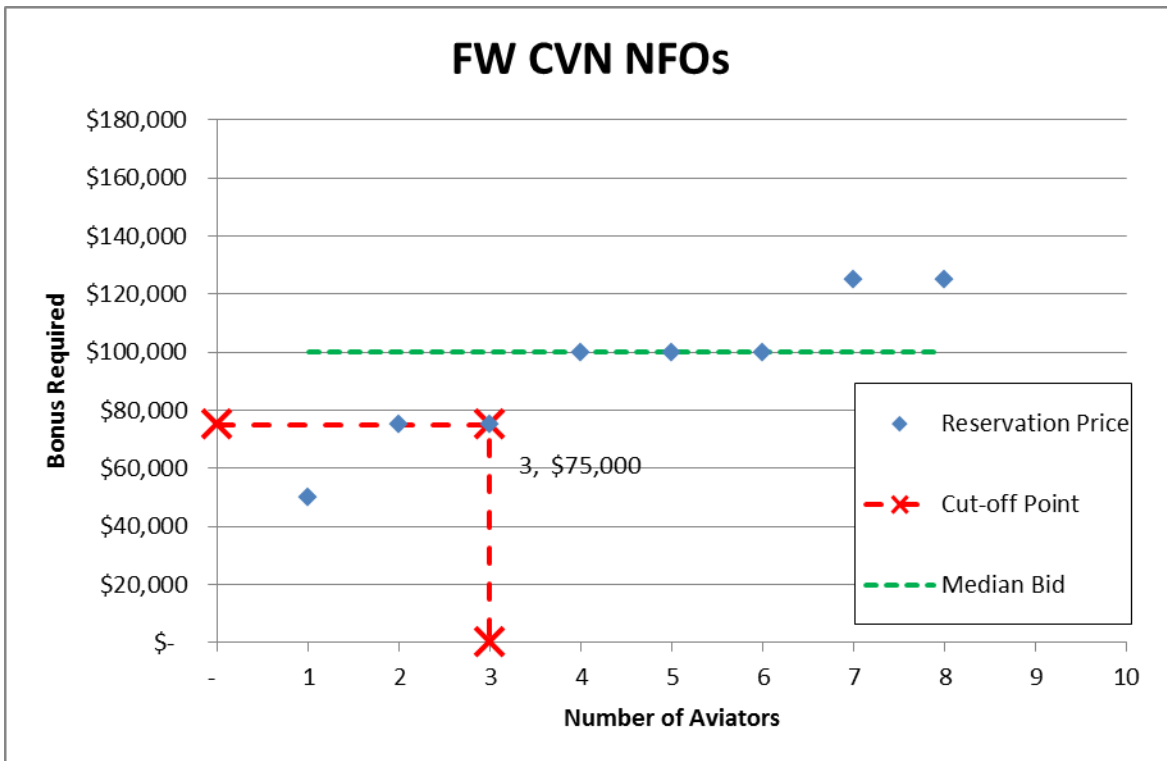
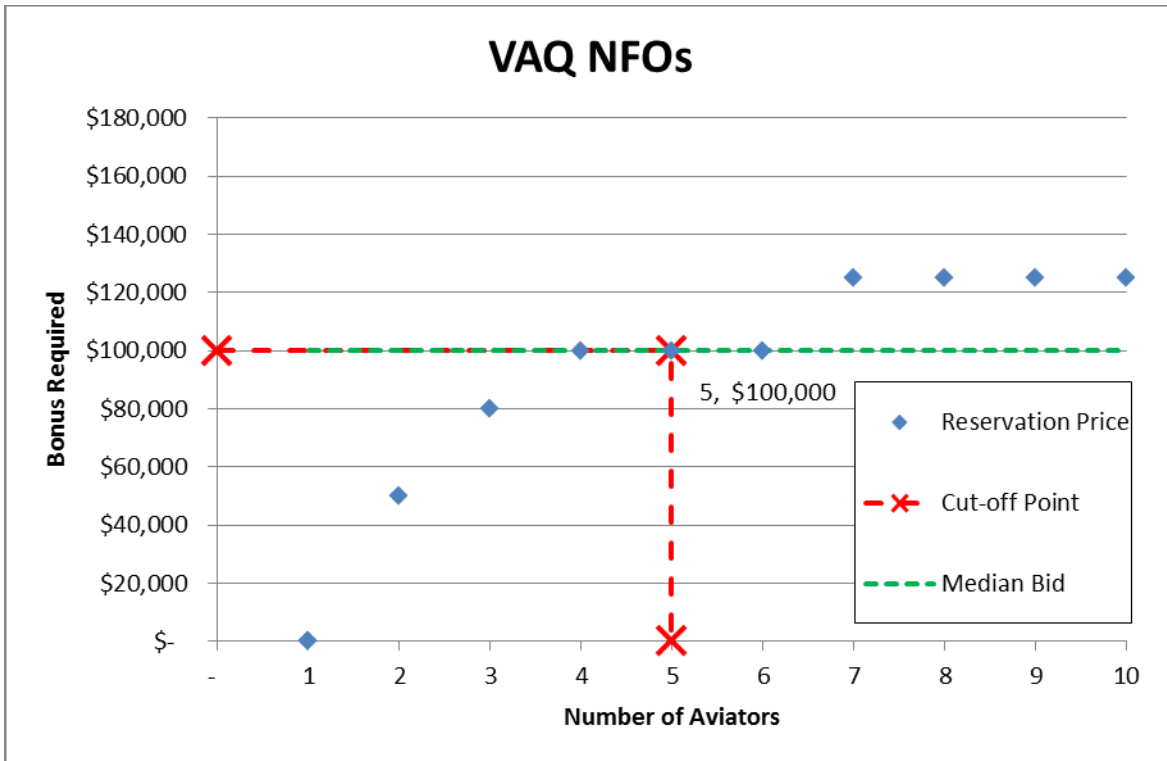


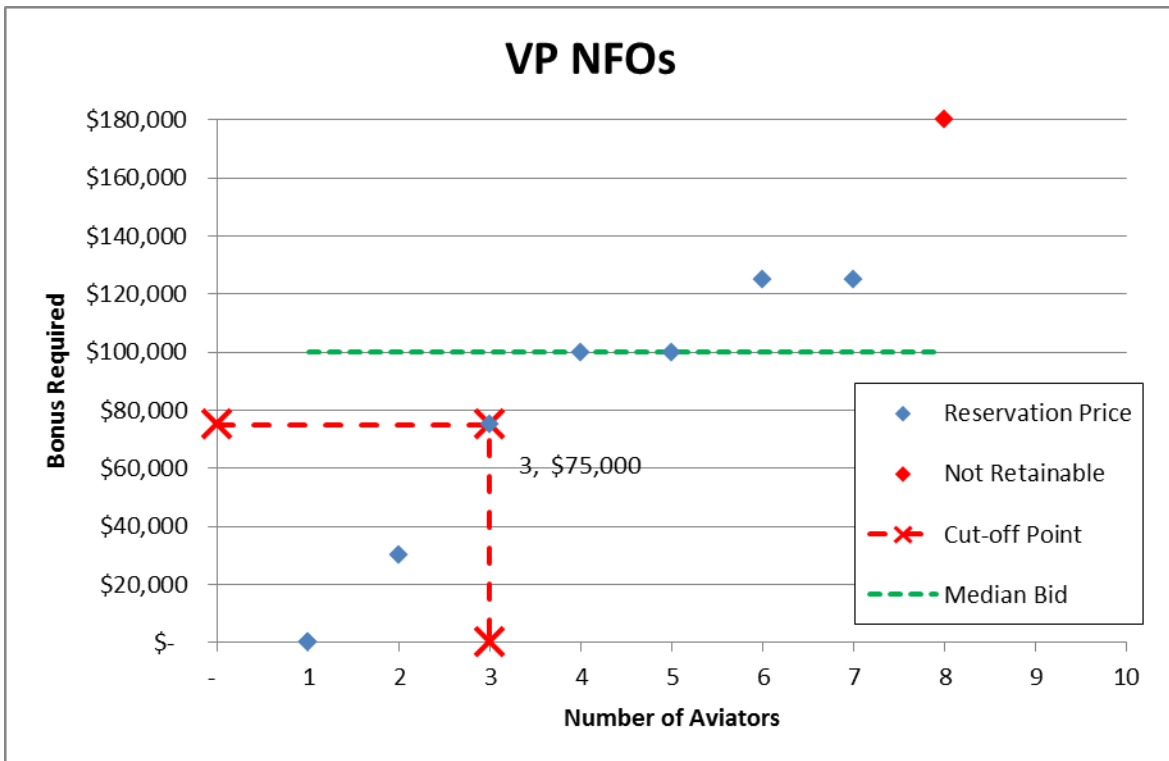
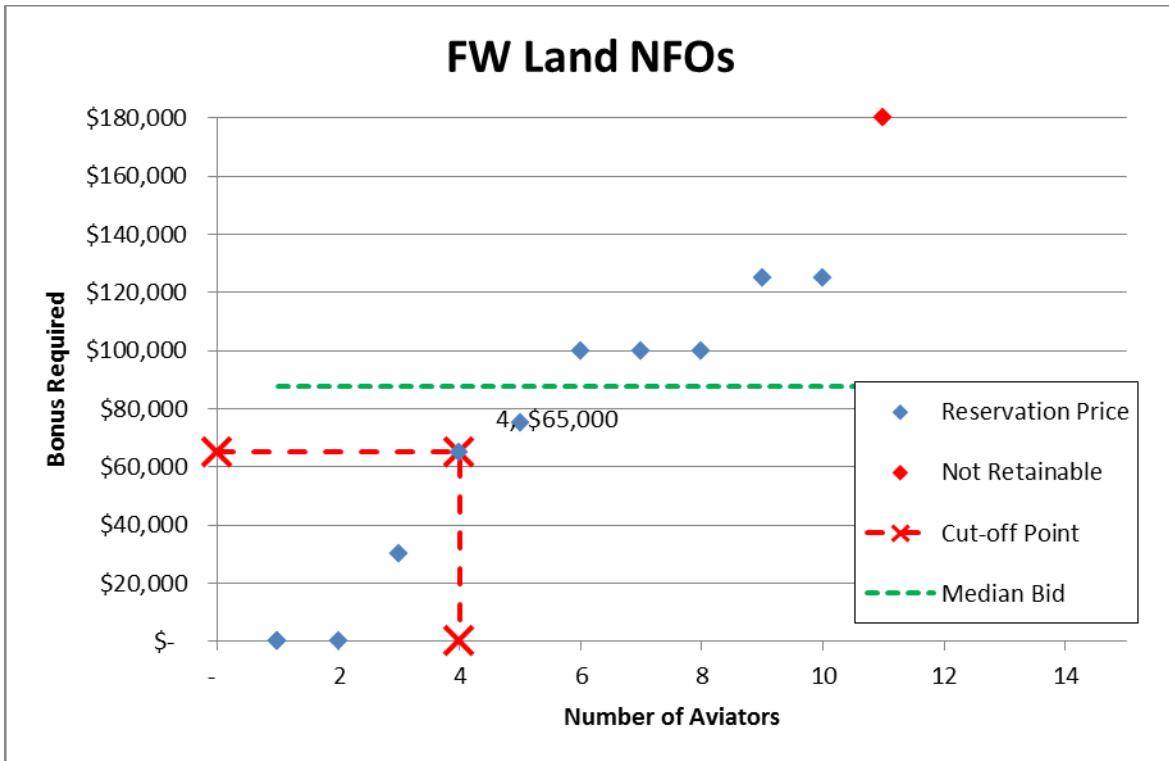












LIST OF REFERENCES

- Chief of Naval Air Training. (2012, March 19). CNATRA Instruction 3501.1C: *Introductory flight screening (IFS) program*. Corpus Christi, TX: Department of the Navy. Retrieved 2014, March 18, from <http://www.cnatra.navy.mil/pubs/folder2/3501.1C.pdf>
- Chief of Naval Air Training. (n.d.a). *Aviator training*. Retrieved 2014, March 25, from Chief of Naval Air Training: http://www.cnatra.navy.mil/training_pilot.htm
- Chief of Naval Air Training. (n.d.b April 8). *CNATRA Homepage*. Retrieved 2014, April 8, from Chief of Naval Air Training: <http://www.cnatra.navy.mil/index.htm>
- Chief of Naval Air Training. (n.d.c). *Flight officer training*. Retrieved 2014, March 25, from Chief of Naval Air Training: http://www.cnatra.navy.mil/training_officer.htm
- Chief of Naval Operations. (1996). *NAVADMIN 250/96: Aviation continuation pay (ACP)*. Washington, DC: U.S. Navy. Retrieved 2014, February 12, via e-mail from BUPERS_WEBMASTER BUPERS_WEBMASTER@nmci-isf.com
- Chief of Naval Operations. (1998). *NAVADMIN 230/98: FY-99 Aviation continuation pay (ACP)*. Washington, DC: U.S. Navy. Retrieved 2014, February 12, via e-mail from BUPERS_WEBMASTER BUPERS_WEBMASTER@nmci-isf.com
- Chief of Naval Operations. (1999). *NAVADMIN 295/99: FY-00 Aviation career continuation pay (ACCP)*. Washington, DC: U.S. Navy. Retrieved 2014, February 12, via e-mail from BUPERS_WEBMASTER BUPERS_WEBMASTER@nmci-isf.com
- Chief of Naval Operations. (2000). *NAVADMIN 258/00: FY-01 Aviation career continuation pay (ACCP)*. Washington, DC: U.S. Navy. Retrieved 2014, February 10, from <http://www.public.navy.mil/bupers-npc/reference/messages/Documents/NAVADMINS/NAV2000/nav00258.txt>
- Chief of Naval Operations. (2003). *NAVADMIN 293/03: FY-04 Aviation career continuation pay (ACCP)*. Washington, DC: U.S. Navy. Retrieved 2014, June 20, from <http://www.public.navy.mil/bupers-npc/reference/messages/Documents/NAVADMINS/NAV2003/nav03293.txt>
- Chief of Naval Operations. (2004). *NAVADMIN 279/04: FY-05 Aviation career continuation pay*. Washington, DC: U.S. Navy. Retrieved 2014, February 10, from <http://www.public.navy.mil/bupers-npc/reference/messages/Documents/NAVADMINS/NAV2004/nav04279.txt>

- Chief of Naval Operations. (2005a). *OPNAV INSTRUCTION 7220.9: Navy aviation career continuation pay* (Navy Instruction). Washington, DC: Department of the Navy. Retrieved 2014, April 20, from <https://doni.daps.dla.mil/Directives/07000%20Financial%20Management%20Services/07-200%20Disbursing%20Services/7220.9.pdf>
- Chief of Naval Operations. (2005b). *NAVADMIN 335/05: FY-06 Aviation career continuation pay*. Washington, DC: U.S. Navy. Retrieved 2014, June 20, from <http://www.public.navy.mil/bupers-npc/reference/messages/Documents/NAVADMINS/NAV2005/NAV05335.txt>
- Chief of Naval Operations. (2006). *NAVADMIN 381/06: FY-07 Aviation career continuation pay*. Washington, DC: U.S. Navy. Retrieved 2014, June 20, from <http://www.public.navy.mil/bupers-npc/reference/messages/Documents/NAVADMINS/NAV2006/NAV06381.txt>
- Chief of Naval Operations. (2007). *NAVADMIN 343/07: FY-08 Aviation career continuation pay*. Washington, DC: U.S. Navy. Retrieved 2014, June 20, from <http://www.public.navy.mil/bupers-npc/reference/messages/Documents/NAVADMINS/NAV2007/NAV07343.txt>
- Chief of Naval Operations. (2009). *NAVADMIN 019/09: FY-09 Aviation career continuation pay*. Washington, DC: U.S. Navy. Retrieved 2014, June 20, from <http://www.public.navy.mil/bupers-npc/reference/messages/Documents/NAVADMINS/NAV2009/NAV09019.txt>
- Chief of Naval Operations. (2010). *NAVADMIN 032/10: FY-10 Aviation career continuation pay* (Navy Administrative Message). Washington, DC: U.S. Navy. Retrieved 2014, June 04, from <http://www.public.navy.mil/bupers-npc/reference/messages/Documents/NAVADMINS/NAV2010/NAV10032.txt>
- Chief of Naval Operations. (2011). *NAVADMIN 296/11: FY-11 Aviation career continuation pay*. Washington, DC: U.S. Navy. Retrieved 2014, June 20, from <http://www.public.navy.mil/bupers-npc/reference/messages/Documents/NAVADMINS/NAV2011/NAV11168.txt>
- Chief of Naval Operations. (2012). *NAVADMIN 055/12: FY-12 Aviation career continuation pay*. Washington, DC: U.S. Navy. Retrieved 2014, June 20, from <http://www.public.navy.mil/bupers-npc/reference/messages/Documents/NAVADMINS/NAV2012/NAV12055.txt>
- Chief of Naval Operations. (2013). *NAVADMIN 047/13: FY-13 Aviation career continuation pay* (Navy Administrative Message). Washington, DC: U.S. Navy. Retrieved 2013, January 13, from <http://www.public.navy.mil/bupers-npc/reference/messages/Documents/NAVADMINS/NAV2013/NAV13047.txt>

- Chief of Naval Personnel. (2011). *BUPERSINST 1610.10C: Navy performance evaluation system* (Navy Instruction). Millington, TN: Department of the Navy. Retrieved 2014, June 4, from <http://www.public.navy.mil/bupers-npc/reference/instructions/bupersinstructions/documents/1610.10c.pdf>
- Chief of Naval Personnel. (2013, May). *Aviation command screen board lessons learned*. (PowerPoint Presentation). Retrieved 2014, April 9, from Naval Personnel Command: <http://www.public.navy.mil/bupers-npc/boards/screenboards/aviation/Pages/default2.aspx>
- Chief of Naval Personnel. (2013, May 13). *Naval personnel command* (Navy Memorandum). Retrieved March 20, 2014, from First Shore Tour Slating Process: VFA Junior Officer Detailer memo to Fleet Junior Officers: <http://www.public.navy.mil/bupers-npc/officer/Detailing/aviation/detailers/Documents/432GVFAJOBBoilerPlate.pdf>
- Coughlan, P. J., & Gates, W. R. (2012). Auction mechanisms for Force management. In J. E. Parco & D. A. Levy, *Attitudes aren't free: Thinking deeply about diversity in the U.S. Armed Forces* (pp. 505-540). Maxwell AFB, AL: Air University Press.
- Coughlan, P. J., Gates, W. R., & Myung, N. (2013, October). *The combinatorial retention auction mechanism (CRAM)* (Technical Report). Monterey, CA: Naval Postgraduate School.
- Department of Defense Authorization Act 1981, Pub. L. No. 96-342, 94 Stat. 1077, 1095-1096. (1980). Retrieved 2014, January 15, from <http://uscodebeta.house.gov/statutes/1980/1980-096-0342.pdf>
- Department of Defense Authorization Act, 1984, Pub. L. No. 98-94, §904(a)(1) and (2), 97 Stat. 614, 635-36. (1983).
- Filip, W. N. (2006). *Improving the Navy's officer bonus program effectiveness* (Master's thesis, Naval Postgraduate School). Retrieved from <http://calhoun.nps.edu/public/handle/10945/2749>
- Hansen, M. L., & Moskowitz, M. J. (2006). *The effect of compensation on aviator retention*. Alexandria, VA: Center for Naval Analysis. Retrieved 2014, April 20, from <http://www.cna.org/sites/default/files/research/d0014925.a2.pdf>
- Homb, H. H. (2006). *Salary auctions and matching asincentives for recruiting to positions that are hard to fill in the norwegian armed forces* (Master's thesis, Naval Postgraduate School). Retrieved from <http://calhoun.nps.edu/public/handle/10945/2880>
- H. R. Doc No. 113-60 (2013). Retrieved January 23, 2014 from: <http://www.gpo.gov/fdsys/pkg/CDOC-113hdoc60/content-detail.html>

- Krishna, V. (2009). *Auction theory* (2nd ed). New York: Academic Press.
- McAfee, R. P., & McMillan, J. (1987). Auctions and bidding. *Journal of Economic Literature*, 699-738.
- Minimum Service Requirement for Certain Flight Crew Positions, 10 U.S.C. §653. (2014). Retrieved 2014, February 18, from <http://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title10-section653&num=0&edition=prelim>
- Myung, N. (2013). Quality adjusted uniform price auction (QUAD). Monterey, CA: Naval Postgraduate School. Mimeo.
- National Defense Authorization Act for Fiscal Years 1988 and 1989, Pub. L. No. 100-180, §622, 101 Stat. 1019, 1100-1101. (1987).
- National Defense Authorization Act, Fiscal Year 1989, Pub. L. No. 100-456, §611, 102 Stat. 1918, 1977-1979. (1988).
- National Defense Authorization Act for Fiscal Year 1998, Pub. L. No. 105-85 §613, 111 Stat. 1629, 1786-1788. (1997).
- National Defense Authorization Act for Fiscal Year 2000, Pub. L. No. 106-65 §613, 113 Stat. 512, 651. (1999).
- National Defense Authorization Act for Fiscal Year 2002, Pub. L. No. 107-107 §614, 115 Stat. 1136. (2001).
- Naval Aviation Schools Command. (2013, November 19). *Aviation preflight indoctrination (API) welcome aboard packet*. Pensacola, FL: U. S. Navy. Retrieved 2014, March 19, from <http://www.netc.navy.mil/nascweb/api/api.htm>
- Naval Personnel Command. (n.d.a). *Active duty officer promotions: Active duty O3 line*. Retrieved 2014, April 09, from Naval Personnel Command: <http://www.public.navy.mil/bupers-npc/boards/activedutyofficer/O3line/Pages/default.aspx>
- Naval Personnel Command. (n.d.b). *FY-15 Active-duty line community brief* (PowerPoint Presentation). Millington, TN: Department of Defense. Retrieved 2014, April 4, from [http://www.public.navy.mil/bupers-npc/boards/activedutyofficer/Documents/FY-14%20COMMUNITY%20BRIEFS/FY-15%20Active%20Line%20\(SECNAV%20Approved\).pdf](http://www.public.navy.mil/bupers-npc/boards/activedutyofficer/Documents/FY-14%20COMMUNITY%20BRIEFS/FY-15%20Active%20Line%20(SECNAV%20Approved).pdf)
- Naval Personnel Command. (2012, October 14). *FY-14 Administrative selection board precept* (Memorandum).

- Naval Personnel Command. (2013). *Order convening the FY-14 aviation department head selection board* (Memorandum). Millington, TN: Department of the Navy. Retrieved 2014, February 12, from <http://www.public.navy.mil/bupers-npc/boards/screenboards/aviation/Documents/FY14%20ADHSB%20SELECTS.PDF>
- Naval Personnel Command. (2013, May). *Aviation screen boards* (PowerPoint Presentation). Retrieved 2014, April 9, from Naval Personnel Command: <http://www.public.navy.mil/BUPERS-NPC/BOARDS/SCREENBOARDS/AVIATION/Pages/default2.aspx>
- Naval Personnel Command. (2013, July). *Helicopter detailer brief* (PowerPoint Presentation). Retrieved 2014, March 18, from Naval Personnel Command: <http://www.public.navy.mil/bupers-npc/officer/Detailing/aviation/detailers/Pages/Helicopter.aspx>
- Naval Personnel Command. (2014, February 3). *FY-13 ACCP program information*. Millington, TN: Department of the Navy. Retrieved 2014, January 12, from <http://www.public.navy.mil/bupers-npc/officer/Detailing/aviation/OCM/Pages/ACCP.aspx>
- Naval Personnel Command. (2014, February 26). *Order convening the FY-15 active aviation command screen board* (Memorandum). Millington, TN: Department of the Navy. Retrieved 2014, March 20, from http://www.public.navy.mil/bupers-npc/boards/screenboards/aviation/Documents/ACSB_fy15_ActiveCO.pdf
- Navy Appropriations Act of 1914, Pub. L. No. 62-433. 37 Stat. 891, 892. (1913).
- Nowell, J. T. (2012). *Application of a uniform price quality adjusted discount auction for assigning surface warfare officer retention bonuses* (Master's thesis, Naval Postgraduate School). Retrieved from <http://calhoun.nps.edu/public/handle/10945/6846>
- Secretary of the Navy. (2006, January 30). *SECNAV instruction 1920.7B: Continuation of active duty regular commissioned and reserve officers on the reserve active status list (RASL) in the Navy and Marine Corps* (Navy Instruction). Washington, DC: Department of Defense. Retrieved 2014, April 9, from <http://doni.daps.dla.mil/Directives/01000%20Military%20Personnel%20Support/01-900%20Military%20Separation%20Services/1920.7B.pdf>
- Secretary of the Navy. (2013, March 29). *Order convening the FY-14 promotion selection boards to consider officers in the line on the active-duty list of the Navy for permanent promotion to the grade of Lieutenant Commander* (Navy Memorandum). Washington, DC: Department of Defense. Retrieved 2014, January 18, from <http://www.public.navy.mil/bupers-npc/boards/activedutyofficer/04line/Documents/FY-14/FY14%20AO4L%20Convening%20Order.pdf>

- Secretary of the Navy. (2014, February 3). *Order convening the FY-15 promotion selection boards to consider officers in the line on the active-duty list of the Navy for permanent promotion to the grade of Commander* (Navy Memorandum). Washington, DC: Department of Defense. Retrieved 2014, April 8, from <http://www.public.navy.mil/bupers-npc/boards/activedutyofficer/05line/Documents/FY-15/FY-15%20AO5L%20Convening%20Order.pdf>
- Secretary of the Navy. (2014, March). *Department of the navy fiscal year (FY) 2015 budget estimates: Justification of estimates: Military personnel, navy*. Washington, DC: Department of Defense. Retrieved 2014, May 18, from http://www.finance.hq.navy.mil/FMB/15pres/MPN_BOOK.pdf
- Special Pay: Aviation Career Officers Extending Period of Active Duty, 37 U.S.C.§301b. (2014). Retrieved 2014, February 18, from <http://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title37-section301b&num=0&edition=prelim>
- Undersecretary of Defense for Personnel and Readiness. (2008). *Tenth quadrennial review of military compensation* (DOD Report). Washington, DC: DOD. Retrieved June 1, 2014, from http://prhome.defense.gov/RFM/MPP/docs/Tenth_QRMC_Feb2008_Vol%20II.pdf
- Under Secretary of Defense for Personnel and Readiness. (2011, November). *Military compensation background papers: Compensation elements and related manpower cost items, their purposes and legislative backgrounds* (DOD Report). Washington, DC: Department of Defense. Retrieved 2013, January 6, from http://militarypay.defense.gov/Docs/MC_All-Combined.pdf
- Under Secretary of Defense for Personnel & Readiness. (2012, June). *Report of the eleventh quadrennial review of military compensation* (DOD Report). Retrieved June 3, 2014, from Military Compensation: [http://militarypay.defense.gov/reports/qrmc/11th_QRMC_Main_Report_\(290pp\)_Linked.pdf](http://militarypay.defense.gov/reports/qrmc/11th_QRMC_Main_Report_(290pp)_Linked.pdf)
- Uniformed Services Pay Act of 1981, Pub. L. No. 97-60, §113, 95 Stat. 989,985. (1980).
- U.S. Navy. (n.d.). *Air squadrons*. Retrieved 2014, June 2, from U.S. Navy (public website): <http://www.public.navy.mil/Pages/AirSquadrons.aspx>
- Verenna, T. K. (2007). *Auction theory and its potential use in the army aviation bonus system* (Master's thesis, Naval Postgraduate School). Retrieved from <http://calhoun.nps.edu/public/handle/10945/3034>
- White, C.S. (2010). The uniform price quality adjusted discount auction for aviation continuation pay: Potential benefits to the U.S. marine corps (Master's thesis,

Naval Postgraduate School). Retrieved from
<http://calhoun.nps.edu/public/handle/10945/5412>

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