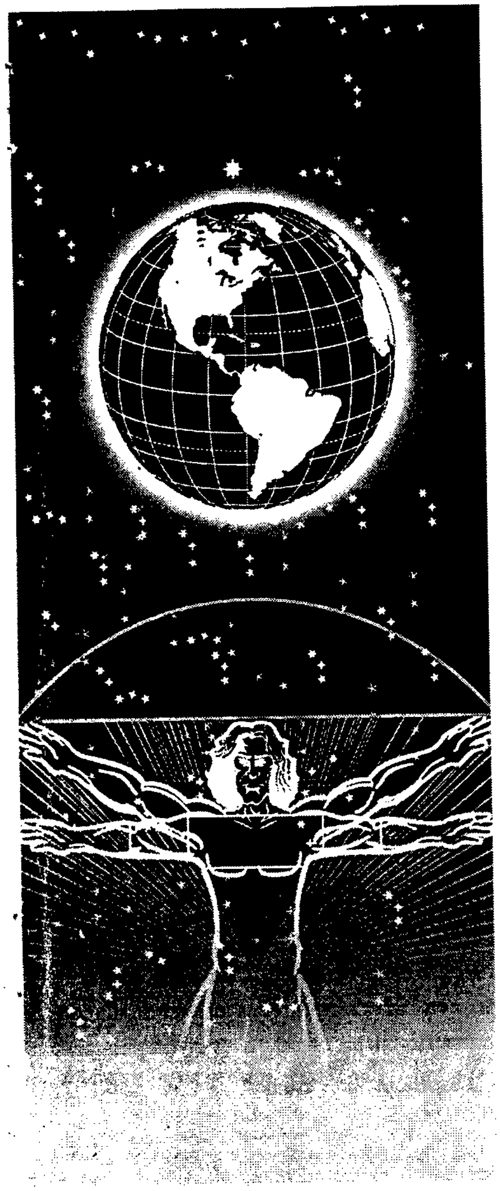
AFRL-HE-AZ-TP-2000-0004



UNITED STATES AIR FORCE RESEARCH LABORATORY

USAF PILOT SELECTION

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April 2000

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This paper has been reviewed and is approved for publication.

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	April 2000	Final - April 1996 to April 1998

4. TITLE AND SUBTITLE

USAF Pilot Selection

5. FUNDING NUMBERS

C - F41624-95-D-5030-0005
PE - 62205F
PR - 1123
TA - B1
WU - 05

6. AUTHOR(S)

Joseph L. Weeks

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

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8. PERFORMING ORGANIZATION REPORT NUMBER

AFRL-HE-AZ-TP-2000-0004

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Air Force Research Laboratory
Human Effectiveness Directorate
2610 Seventh Street, Building 441
Wright-Patterson Air Force Base OH 45433-7901

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

Air Force Research Laboratory Project Scientist: Dr Joseph L. Weeks, AFRL/HEA, 480.988-6561 x-249, DSN 474-6249
This paper was published in the Proceedings of the Shephard Air Power Training Conference, held 2-3 Apr 98, in London UK.

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

For USAF flying training, there are seven points of entry which include the three commissioning sources (i.e., Air Force Academy, AFA; Reserve Officer Training Corps, ROTC; and Officer Training School, OTS), entry from active duty, Air National Guard, Air Force Reserves, and entry from international sources. Pilot qualification and selection standards differ across points of entry. Selection policies for AFA, ROTC, OTS, and active duty are described because these points of entry provide the majority of entrants to pilot training. For these points of entry, selection procedures are described and several studies of selection procedures are outlined. Applicant information provided to selection boards and the applicant attributes that are most important for pilot selection decisions are discussed. The impact of current selection policy on student quality is discussed and the interdependent influences of student quality, pilot production rates, and training difficulty on flying training attrition are examined.

14. SUBJECT TERMS

Aircrew selection; Aircrew selection procedures; Flying training; Flying training attrition; Pilot qualification; Pilot selection; Pilot selection procedures; Pilot training

15. NUMBER OF PAGES

22

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION ABSTRACT
Unclassified	Unclassified	Unclassified	Unlimited

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PREFACE

This research effort was conducted by the Air Force Research Laboratory, Human Effectiveness Directorate, Warfighter Training Research Division (AFRL/HEA), under Work Unit 1123-B1-05, Improvement of the Integrated Decision Modeling System and Application to Aircrew Selection.

In October 1995 the USAF Deputy Chief of Staff for Personnel (HQ USAF/DP), Lt Gen Eugene Habiger, requested research into aircrew selection procedures. HQ USAF/DP issued separate letters in November 1995 to the Commandant of the US Air Force Academy (USAFA/CC) and the Vice Commander of the Air Education and Training Command (AETC/CV) requesting support. A research proposal was prepared and submitted to USAF/DPI in December 1995. In February 1996, Work Unit 1123-B1-05 was approved and in April 1996, Metrica, Inc. was awarded R&D contract F41624-95-D-5030-0005. An interim report, AFRL-HE-AZ-TR-1998-0077, *Entry to USAF Undergraduate Flying Training*, was published in August 1998. The results presented in this final paper were first documented in a manuscript published in the Proceedings of the Shephard Air Power Training Conference, which was held 2-3 April 1998 in London, UK.

Current and past members of AFRL/HEA (Dr Joe Weeks, Maj Warren Zelenski, Capt Anne Duke, and Lt Lisa Harrigan) would like to thank Lt Gen Eugene Habiger (USAF, Retired) for the privilege of conducting this effort. In addition, we want to acknowledge the technical assistance provided by Dr Bryce Stone, Mr Jonathan Fast, Ms Sandra Cartagena, and Mr John Quebe of Metica, Inc., and to thank those individuals who assisted in the collection of information. These individuals include: Lt Gen Paul E. Stein (USAFA/CC); Maj Gen John C. Griffith (AETC/CV); Lt Col Dan Beatty and Maj Mike McLaughlin (AETC/XOTI); Maj Tom Gill (HQ AFROTC/RRFY); Maj Dave Bertrand and Major Mike Warlick (AFRS/ROO); Maj Jim Curtis (AFPC/DPAOY3); Maj Larry Marvin, Maj Steve Tindall, Capt Tim Tremper (619 TRSS); Capt Maurice Newton (USAFA/34 OSS); and Mr Curt Lambert (HQ USAF/DPPR).

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USAF PILOT SELECTION

SUMMARY

The central argument presented here is that the Air Force Academy (AFA) and Reserve Officer Training Corps (ROTC) pilot selection policies may combine with training factors to increase attrition and flying training costs. Today, AFA and ROTC pilot candidate ability levels are lower on the average than what they would be if selection policies assigned equal importance to officership and ability. Current selection policies are contributing to flying training attrition. In addition, plans are to increase pilot production in a resource-limited environment. This will also contribute to increases in attrition. In the late 1980s, the USAF produced over 2,000 pilots per year and average attrition was 29%. It is possible that attrition could climb to that high level again. Avoiding high attrition would be difficult. We cannot decrease pilot production rates but we could increase training resources. We cannot decrease the difficulty of flying training but we could increase training time. Increasing training resources and increasing training time would help reduce attrition. One additional intervention we could adopt to combat high attrition is to increase candidates' average ability levels. We could do this by giving greater emphasis to ability in the AFA and ROTC pilot selection policies so that ability and officership are equally weighted.

USAF PILOT SELECTION

INTRODUCTION

For USAF flying training, there are seven points of entry which include the three commissioning sources (Air Force Academy, AFA; Reserve Officer Training Corps, ROTC; and Officer Training School, OTS), entry from active duty, Air National Guard, Air Force Reserves, and entry from international sources. Pilot qualification and selection standards differ across points of entry. Selection policies for AFA, ROTC, OTS and active duty are described because these points of entry provide the majority of entrants to pilot training (i.e., 65% in 1995). The impact of current selection policy on student quality is discussed and the interdependent influences of student quality, pilot production rates, and training difficulty on flying training attrition are examined.

AIR FORCE ACADEMY (AFA)

For AFA cadets who choose pilot training, qualification includes reference to medical standards, anthropometric standards, and successful performance in a flight screening program. Only the AFA requires applicants to complete flight screening for qualification prior to meeting a selection board. For all other points of entry, individuals complete flight screening after selection. AFA pilot training qualification standards are also unique in the omission of standards used at other points of entry: attainment of minimum qualifying scores on the Air Force Officer Qualifying Test (AFOQT).[1]

AFA cadets who apply for pilot training and satisfy all qualification standards are evaluated for selection during their senior year. The AFA pilot selection board convenes annually in January (and at other times; as needed) on site at the AFA to evaluate applicants and select candidates who will graduate in June. The selection board consists of six or seven AFA faculty members and a non-AFA representative. All members are pilots. Board members are provided instruction on the selection process, then evaluate 300 to 400 applicant information folders over a 3- to 4-day period.

At the AFA, applicant information folders contain evaluations by faculty members, an optional letter written by the cadet and a consolidated personal information sheet. The information sheet provides detailed information in the following categories: personal data, academic performance, military performance, athletic performance, honors data, flight screening performance, participation in airmanship and aviation courses, involvement in clubs, probation

[1] Flight screening and AFOQT scores are both measures of ability which are proven predictors of performance in fast-jet flying training. However, flight screening is the preferred predictor because validation studies have indicated that, on average, job sample tests are the most valid predictors of flying training performance (Hunter & Burke, 1994).

history and scores from the AFOQT. Although AFOQT scores are not used for qualification, pilot training applicants are required to take the AFOQT and these scores are provided to the selection board.

Board members are instructed to adopt the "whole person concept" as the basis for evaluating applicants. The whole person concept requires that evaluation not be based on a single criterion, but rather on all information that describes the cadet's potential as an officer and potential success in pilot training. Board members are instructed to rate each applicant's record on a 6- to 10-point scale using 0.5 point increments. The relative importance of selection factors is not prescribed, but is left to the discretion of individual board members. If a board member rates an applicant much differently than other board members (i.e., greater than 1.5 points difference), the divergent rating is resolved by discussion and re-rating the record. Board member ratings for each applicant are averaged, and average board ratings are used to construct a rank-ordered list of all applicants. Selection status is determined by applying pilot production quotas against the rank-ordered list.

Selection boards review and evaluate applicant data to order candidates in terms of quality. Evaluation of a single application folder can impose a significant information processing burden on each board member. For each applicant, board members consider a combination of biographical data, flying data, educational data and ability data. Approximately 150 selection variables are included in the application folder for each applicant. To add to the information burden, each board member may evaluate several hundred applications over a 2- to 3-day period. In the process, board members may evaluate applications differently due to differences in the perceived importance of various personal attributes. Until recently little was known about which selection variables are most important for the rating process.

To identify the most important selection variables, AFA selection boards participated in a policy-capturing study. To support this study, the AFA provided applicant folders and average board ratings for the classes of 1995, 1996, and 1997. Members of a research team observed the selection process for, at least, two successive selection boards and surveyed board members to identify the most important attributes. With this information, a database was created and policy-capturing analyses were conducted to determine which selection variables were actually used by selection boards. Average board rating was the dependent variable and applicant information was used as independent variables in a series of linear regression analyses. Using input from selection board members, relevant applicant attributes were selected and included in a preliminary selection policy model. Variables that were highly significantly correlated with average board rating were retained and those that were not were discarded. Once a model was developed for a specific board for a specific year, it was applied to the following yearly boards to assess the stability of the policy model across boards. For the AFA, selection models were developed for 1995, 1996, and 1997 and a general model was developed for all years combined.

Results were surprising. Notwithstanding the expectation that there would be several different selection policies, results indicated a great deal of consistency across AFA board members and across selection boards from year to year. There was no statistically significant difference between the models for each of the three years and the general model based on combined data for all three years. The R-square for the general model was .90, suggesting that the model did an excellent job of identifying the most important selection variables used by AFA pilot selection boards. It also means that 90% of the variation in average board rating is explained by the selection variables in the model. The model consisted of cumulative military performance, cumulative grade point average, flight screening performance, participation in any varsity sport, whether or not the applicant had held a commander military position and whether or not the cadet had held a lower military position in the senior year. Table 1 provides an indication of the importance of these selection variables averaged over all three years. These values represent the sensitivity of average board rating to changes in the selection variable where sensitivity is defined as the percentage change in average board rating given a 10% change in the selection variable. The selection variable yielding the greatest sensitivity is cumulative military performance average having a value of 4.78%. This value implies that a 10% increase in military performance average resulted in a 4.78% increase in average board rating. A 10% change in cumulative academic average resulted in a 3.21% increase in average board rating and a 10% increase in flight screening performance rating resulted in a 1.40% increase in average board rating. Increases by as much as 10% for each of the other selection variables resulted in changes to the average board rating of less than 1% indicating these variables were less important in determining selection decisions. For AFA, policy-capturing analyses indicate that military performance, academic performance and flight screening performance are the most important selection variables. Sensitivity analyses indicate that military performance average (i.e., officership) is more important for pilot selection decisions than flight screening performance rating (i.e., ability).

Table 1. Sensitivities of Critical AFA Pilot Selection Variables

Selection Variable	Average Sensitivity
Cumulative Military Performance Average	4.78%
Cumulative Academic Average	3.21%
Flight Screening Performance Rating	1.40%
Athletic Participation	0.07%
Military Commander Position Held	0.04%
Lower Military Leadership Position Held	-0.03%

OFFICER TRAINING SCHOOL (OTS)

For OTS applicants, pilot training qualification includes reference to age limits, medical standards, anthropometric standards, educational achievement and minimum AFOQT scores (Air Force Instructions [AFI] 36-2005 and 36-2013, Air Education and Training Command Instruction [AETCI] 36-2202). Unlike the AFA, OTS requires minimum AFOQT scores for qualification. The AFOQT has been used since 1957 for officer commissioning and pilot selection. New forms are developed about every seven years. The current form has 16 subtests that are combined into five composite scores: verbal, quantitative, academic aptitude (verbal + quantitative), pilot and navigator-technical. The pilot composite consists of tests that measure knowledge of aviation and mechanical systems, the ability to determine aircraft attitude from instruments, knowledge of aeronautical concepts, ability to read scales and interpret tables and spatial abilities. The navigator composite includes tests that measure quantitative ability, spatial ability and knowledge of general science. For OTS, AFOQT minimum scores differ depending on whether or not the applicant possesses a private pilot license (i.e., licensed general aviation pilots can qualify with lower scores). AFOQT minimum scores are specified for the verbal, quantitative, pilot and navigator-technical composites.

As a group, OTS pilot applicants are more diverse than applicants from the AFA or ROTC. Typically they are older, are college graduates, and may have significant civilian flying experience. Many have prior military experience, typically as active-duty Air Force enlisted members. OTS selection boards convene quarterly at Headquarters Air Force Recruiting Service at Randolph AFB, Texas. A rated officer selection panel reviews application folders of individuals who have applied for pilot training. The rated officer selection panel consists of three pilots, all colonels or colonel selects, invited from operational units. Panel members are provided instruction on the selection process, then review and evaluate application folders over a several day period.

Application folders include extensive biographical data, educational information, college transcripts, employment history, history of legal violations, records of civilian flying time, copies of the applicant's civilian pilot certificate and Federal Aviation Administration medical certificate (if applicable), personal recommendations, Enlisted Performance Reports (if active duty enlisted), supervisor's assessment (of enlisted members) or recruiter's interview assessment (if civilian), AFOQT scores, and a Pilot Candidate Selection Method or PCSM score. PCSM is a mathematical model that is designed to predict a candidate's potential to succeed in undergraduate pilot training. The PCSM score is produced by combining three types of information for each applicant: their previous flying experience, their AFOQT pilot composite score, and scores from the Basic Attributes Test or BAT. The BAT includes measures of psychomotor coordination, information processing speed, and attitudes toward risk. Relative to other points of entry, OTS flying training application folders contain the greatest number of documents to describe applicant attributes. Unlike the AFA, where flying training applicants can be evaluated within a common framework of performance in AFA academics and the cadet wing, OTS board members must evaluate applicants with diverse backgrounds, consequently a much greater information processing burden is imposed on selection board members.

OTS board members are instructed to adopt the "whole person concept" as the basis for evaluating applicants. Unlike AFA and ROTC, OTS rated officer selection boards are tasked with simultaneously selecting candidates for suitability for commissioning and for their potential to succeed in flying training. Panel members are instructed to rate applicant records on a 6- to 10-point scale using 0.1 point increments. Panel members are provided with a suggested rating policy indicating relative importance of three selection factors. Board instructions suggest experience (as evidenced by civilian or military employment and outside activities) be rated on a 0- to 3-point scale, education and aptitude (evidenced by academic history and AFOQT scores) be rated on a 0- to 3-point scale, and potential and adaptability (evidenced by recommendations) be rated on a 0- to 4-point scale. Observation of two OTS selection boards indicate board members may reject the suggested weighting scheme in preference for a more holistic approach. Divergent ratings are resolved by discussion and re-rating applicable records. Board member ratings for each applicant are averaged and average ratings are used to construct a rank-ordered list of applicants. Selection status is determined by applying production quotas against the rank-ordered list. After selection, OTS pilot candidates must successfully complete a medical examination, flight screening, and Officer Training School to enter pilot training.

To identify the most important pilot selection variables, OTS selection boards participated in a policy-capturing study. OTS provided applicant folders and average board ratings for the first and second quarters of FY96. Once a model was developed for a specific board, it was applied to the following board to assess the stability of the policy model across boards. For OTS selection boards, we developed models for the first and second quarter and a general model for both quarters combined. The variables occurring in the general model are presented in Table 2.

Table 2. Sensitivities of Critical OTS Pilot Selection Variables

Selection Variable	Average Sensitivity
Grade Point Average	1.91%
Pilot Candidate Selection Method Score	1.10%
Number of Recommendation Letters	0.43%
Interviewer's Recommendation	0.42%
Number of Moving Traffic Violations	- 0.18%
Possession of a bachelor of arts degree	- 0.01%

Note. Interviewer's recommendations were coded 1, if low or poor; 2, if average; or 3, if superior/outstanding.

The R-square for the policy model that combined data for both quarters was .51, suggesting that the model did only a fair job of identifying the selection variables used by OTS pilot selection boards. It means that 51% of the variation in average board rating is explained by the selection variables in the policy model. The remaining 49% would be due to error variance or the influence of applicant information not included in the database. There is a much greater information processing load imposed on OTS selection board members and this probably accounts for the failure to model the OTS selection policy to a greater degree of accuracy. The model consists of grade point average, PCSM score, number of letters of recommendation, interviewer's recommendation, number of moving traffic violations and possession of a bachelor of arts degree. Table 2 provides an indication of the importance of the selection variables expressed as the sensitivity of average board ratings to changes in the selection variable. The variable with the greatest sensitivity is grade point average having a value of 1.91%. This value implies that a 10% increase in grade point average resulted in a 1.91% increase in average board rating. A 10% increase in PCSM resulted in a 1.1% increase in average board rating. For OTS, policy-capturing analyses indicate that grade point average and PCSM are the most important selection variables. Sensitivity analyses indicate that grade point average is more important for pilot selection decisions than PCSM.

ACTIVE DUTY

Individuals may enter flying training from active duty after commissioning from any source. At this point of entry, the pool of individuals eligible for entry to flying training consists of nonrated line officers and navigators who will not exceed age 27 $^1/_2$ by the time they enter flying training and who are not otherwise disqualified (AFI 36-2205). The vast majority of officers in this pool are non-rated line officers holding ranks of second or first lieutenant. Active duty officers may apply for pilot training through the Air Force Personnel Center (AFPC). Qualification is based on age standards, medical standards, anthropometric standards and minimum AFOQT scores (AFI 36-2205).

The AFPC selection board currently convenes twice a year at HQ AFPC, Randolph AFB, Texas. The board consists of a president (the Vice Commander of AFPC), a chairman (a colonel from AFPC) and two lieutenant colonels who are current or former flying squadron commanders. The selection board conducts three application-scoring sessions. In the first session, USAF navigators are considered for pilot training. In the second, nonrated officers are considered for pilot training, and in the third, nonrated officers are considered for navigator training. Board members may review and rate hundreds of application folders.

Application folders contain an Officer Application for Flying Training, Officer Performance Reports (OPRs), training reports, citations accompanying military decorations, a career brief (i.e., a computer-generated document describing the officer's commissioning and assignment history), and the PCSM score. The Officer Application for Flying Training includes descriptive data on the applicant, AFOQT scores, private flying experience, commander's recommendation, OPR senior rater recommendation, and the senior rater's ranking of the applicant among all other applicants from the same organization.

To identify the most important selection variables, active-duty pilot selection boards participated in a policy-capturing study. AFPC provided applicant folders and average board ratings for nonrated line officers and navigators for FY96 and FY97. Once a model was developed for a specific board, it was applied to the following board to assess the stability of the policy model across boards. We developed models separately for nonrated line officers and navigators for FY96 and FY97 and a general model for each category. The variables occurring in the general models are presented in Table 3.

Table 3. Sensitivities of Critical Active-Duty Pilot Selection Variables

Selection Variable	Average Sensitivity
Nonrated Line Officer Model	
Pilot Candidate Selection Method Score	2.09%
2nd Lieutenant Rank	- 0.07%
Positive Endorser's Recommendation	0.05%
Engineering or Mathematics Degree	0.04%
Master's Degree	0.03%
Flying Instrument Rating	0. 02%
Navigator Model	
Pilot Candidate Selection Method Score	1.85%
AFOQT Quantitative Composite Score	0.96%
Positive Endorser's Recommendation	0.77%
Positive Commander's Recommendation	0.33%

For non-rated line officers, the R-square for the model that combined data for both years was .78. For navigators, the R-square for the model that combined data for both years was .72. For both nonrated line officers and navigators, the R-squares suggest that the models did a good job of identifying the more important selection variables. The model for nonrated line officers consisted of PCSM, second lieutenant rank, positive endorser's recommendation, possession of an engineering or mathematics degree, possession of a master's degree, and possession of a flying instrument rating. The model for navigator applicants to pilot training consisted of PCSM, the AFOQT Quantitative composite score, positive endorser's recommendation, and positive commander's recommendation. Table 3 provides indications of the importance of these selection variables expressed in terms of sensitivities. Policy-capturing analyses indicate that ability indicated by PCSM is the most important pilot selection variable for both navigator and nonrated line officer applicant pools.

RESERVE OFFICER TRAINING CORPS (ROTC)

ROTC pilot applicants are evaluated during their junior year of college. Like OTS and active-duty candidates, ROTC candidates must complete flight screening after selection. Therefore, flight screening performance ratings are not available for selection decisions. For ROTC cadets who wish to attend pilot training, qualification is based on age standards, medical standards, anthropometric standards, and minimum AFOQT scores. For pilot training qualification, minimum AFOQT scores are specified for the verbal, quantitative, pilot, and navigator-technical composites (AFROTC Regulation [AFROTCR] 45-13 and AFROTC Instruction [AFROTCI] 36-13, Draft). [2]

There are nearly 150 college and university ROTC detachments that can provide pilot training applicants. The ROTC selection board convenes annually in February (and other times, as needed) at HQ AFROTC, at Maxwell AFB. The board selects cadets who will graduate in the following fiscal year. Board members are rated, field-grade officers from HQ AFROTC. The ROTC approach to selection is unique among all points of entry. ROTC selection board members are not required to manually review and rate hundreds of application folders like members of AFA, OTS, and active-duty boards. The ROTC selection process is supported by computer processing of applicant data to create a preliminary rank ordering of applicants on the basis of a selection policy equation. The selection policy equation is referred to as the Categorization Order of Merit (COM) equation and produces a COM score for each applicant. The COM score is the basis of ranking all applicants from all ROTC detachments. As a result of this process, the information load on selection board members is reduced and selection policy is consistently applied for all applicants.

Selection board members are presented with applicant information in spreadsheet format, with a single row of information for each applicant. Data presented includes applicant name and ROTC detachment, the COM score and its components, all five AFOQT composite scores, an indication of whether the applicant has a civilian pilot license, record of field training awards, academic major, and a PCSM score. Applicants are listed in rank order on the basis of

[2] AFROTCI 36-2013, dated 1 February 1997, reduced the minimum qualifying scores for the pilot composite from the 50th to the 25th percentiles.

COM score. The pilot production quota is applied to produce an initial cut line to identify selects and nonselects. The selection board reviews the list considering all information presented and may accept the rank-ordered listing or adjust the rank ordering. Board members pay particular attention to cadets in the vicinity of the cut line, where fractional differences in COM score can mean the difference between selection and nonselection. Review of ROTC selection board data for FY95, FY96, and FY97 and on-site observations indicated that although the selection board may move one or two cadets above or below the cutline, the COM rank ordering is the basis of selecting candidates for pilot training. As a result, policy capturing of selection board data is not necessary to understand selection policy; we need only examine the components of the COM equation to identify the important selection variables in the ROTC pilot selection process.

The COM components consist of an evaluation of the cadet's officer potential provided by the ROTC detachment commander, grade point average (GPA), verbal (V), and quantitative (Q) scores from the AFOQT, and a physical fitness test score (PFIT). In providing the officer potential evaluation, the detachment commander is instructed to adopt the "whole person concept" and to rank the cadet relative to all other cadets in the detachment. Officership rankings are adjusted to take into account differences in class size across ROTC detachments and the adjusted value is expressed as a Relative Standing Score (RSS). For FY96 ROTC class, the following equation was used to produce COM scores (AFROTCR 45-13; D.S. Hager, personal communication, 5 March 1996):

$$\text{COM} = 6.625\,(\mathbf{RSS}) + 6.8750\,(\mathbf{GPA}) + 0.025\,(\mathbf{PFIT}) + 0.0947\,(\mathbf{V}) + 0.0947\,(\mathbf{Q})$$ [3]

The coefficients in the equation indicate that the components are not weighted equally. However, because the scale and range of COM components differ, the coefficients do not necessarily indicate the relative importance of components. One approach to determining relative importance is to deduce how much each component contributes to the COM score range. Table 4 presents the relative importance of COM component expressed as a percentage of the COM score range. The weighted and summed lower bounds for the COM components result in a minimum COM score of 55.636. The weighted and summed upper bounds result in a maximum COM score of 125.000. The minimum and maximum COM scores have a range of 69.364 points. The question is what percentage of the COM range can be determined by each weighted component. The question is answered by determining minimum and maximum weighted values for each component, the range of these values, and then expressing this range as a percentage of the COM range. The data in Table 4 indicate the relative importance of selection variables used in the ROTC selection process for FY96. These data indicate that a maximum AFOQT quantitative score could increment a COM score by 6.53 points; whereas a

[3] The COM equation was revised in February 1997 to replace the verbal (V) and quantitative (Q) components with the AFOQT pilot composite but the weight for the pilot composite is less than the combined weights previously assigned to the verbal and quantitative components.

maximum RSS could increment the COM score by 33.12 points. The contributions of maximum scores for all COM components are presented in the last column as percentages of the COM score range. For ROTC, officership as indicated by RSS is the most important pilot selection variable and ability indicated by the AFOQT is much less important.

Table 4. Categorization Order of Merit (COM) Component Ranges and Percent Contribution to COM Range

Component	Weight	Range of Score Values	Min & Max Weighted Values	Range of Weighted Values	Percentage of COM Range
Relative Standing Score	6.6250	5.00 - 10.00	33.13 - 66.25	33.12	47.8%
Academic Grade Point Average	6.8750	2.00 - 4.00	13.75 - 27.5	13.75	19.8%
Physical Fitness Test	0.0250	180 - 500	4.5 - 12.5	8.00	11.5%
AFOQT Verbal Score	0.0947	15 - 99	1.42 - 9.75	8.33	11.5%
AFOQT Quantitative Score	0.0947	30 - 99	2.84 - 9.37	6.53	9.4%
Total COM Score		55.636 - 125.000			100%

Note. The RSS variable is formed by transforming cadets' detachment commander assigned ranks and class size to a 5- to 10-point scale. GPA, PFIT, AFOQT-V and Q each have lower bounds established as either commissioning or pilot training qualification standards.

DISCUSSION

Understanding USAF pilot selection is difficult because there are several points of entry and because qualification and selection standards differ across points of entry. Table 5 provides summary information indicating percent entries, qualification standards, and the most important selection variables by point of entry. For OTS and active duty, grade point average and PCSM are the most important selection variables. However these points of entry provided only 11% of the pilot candidates in 1995; ROTC and AFA provided 54%. For the AFA, officership, which is indicated by military performance, is a more important selection factor than ability, which is indicated by flight screening performance. For ROTC, officership indicated by RSS is a much more important selection factor than ability indicated by the AFOQT. For the two points of entry that provide the greatest percentage of entries to pilot training, officership is the most important selection factor and ability is less important.

Table 5. Percent Entries, Qualification Standards, and Key Selection Variables by Point of Entry

Point of Entry	Percent Total Entries 1995[a]	Qualification	The Important Selection Variables
Air Force Academy	23	Flight Screening Performance	Military Performance Average, Academic Performance Average, Flight Screening Performance
Reserve Officer Training Corps	31	Air Force Officer Qualifying Test	Relative Standing Score (ROTC detachment commander's rating)
Officer Training School	2	Air Force Officer Qualifying Test	Academic Grade Point Average, Pilot Candidate Selection Method Score
Active Duty (Navigator)	1	Air Force Officer Qualifying Test	Pilot Candidate Selection Method Score
Active Duty (Non-Rated)	8	Air Force Officer Qualifying Test	Pilot Candidate Selection Method Score

[a] Percent Total Entries 1995 does not include entries from the Air National Guard, Air Force Reserve, and international sources.

The central argument presented here is that the AFA and ROTC pilot selection policies and their de-emphasis on ability may combine with training factors to increase attrition and flying training costs. Flying training attrition can be understood with a three-factor theory. This theory is more of a personal one than one that has been academically developed. The theory states that attrition is a function of student quality, the ratio of production to resources, and training difficulty. Ongoing changes in these factors indicate an increase in flying training attrition. As a result of the de-emphasis in ability for AFA and ROTC selection policies, increases in pilot production in a resource-limited environment and flying training difficulty, increases in attrition are expected. The influence of each of these factors is discussed separately.

The first factor is student quality and the relative value of officership and ability as predictors of flying training success. The value of ability as a predictor of flying training performance has been conclusively demonstrated. Arth, Steuck, Sorrentino, and Burke (1990) demonstrated that the AFOQT is a valid predictor of both pilot and navigator training and that lower scores are associated with lower training performance. Carretta and Ree (1993) analyzed the validity of

PCSM and concluded that although PCSM variables consisting of flying experience, psychomotor skills and attitude toward risk increment prediction, the AFOQT pilot composite is the best single predictor of pilot training attrition. Although Arth et al (1990) and Carretta and Ree (1993) documented the value of ability as a predictor of pilot training performance, the comparative validity of officership and ability has not been documented. If officership is substantially related to training performance so that cadets with higher officership tend to be successful in pilot training, then officership could be substituted for ability as a predictor of training performance. However, the evidence does not support such an expectation.

Analyses of officership represented by RSS and ability represented by the AFOQT were conducted on a sample of over 400 ROTC cadets for whom undergraduate pilot training outcomes were available.[4] Results indicated that the correlation between the AFOQT pilot composite score and pilot attrition was **.14** ($p < .01$; $N = 469$). The correlation between RSS and pilot attrition was **.01** ($p > .05$; $N = 469$). These analyses indicate little or no relationship between officership and pilot training attrition. The strength of the relationship between ability and attrition in this analysis is lower than that usually observed but clearly indicates that ability represents a relative improvement over officership for the selection of candidates likely to succeed in pilot training. So what does this mean for pilot selection policy?

Even though an applicant displays superior officership, the applicant may not possess the ability to be successful in flying training. Even though an applicant possesses superior ability, the applicant may not display the maturity and responsibility to be a successful officer. To minimize flying training attrition, ability and officership should be balanced in pilot selection policy. Such a selection policy would assure that applicants who have a combination of the characteristics necessary to be successful officers and the abilities necessary to be successful in flying training are ranked highest and therefore would most likely be selected. Today, AFA and ROTC pilot candidate ability levels are lower on the average than what they would be if selection policies assigned equal importance to officership and ability. For AFA pilot selection, flight screening performance is less important than military performance. The weights for flight screening and military performance would be equal in an optimal AFA selection policy. For ROTC pilot selection, the AFOQT is much less important than RSS. The COM equation weight for RSS and AFOQT would be equal in a selection policy that balanced the importance of officership and ability. The implications of current selection policies for flying training attrition are clear. As a result of the de-emphasis in ability, applicants who possess lower ability are being selected. Candidates who enter training with lower ability are most likely contributing to attrition. This will be particularly true as pilot production increases over the next few years.

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[4] The sample for analysis included flying training deficiency attrites only; attrites for other reasons were excluded.

Pilot production is the second factor in the three-factor model of attrition. McLaughlin (1996) hypothesized that there is a relationship between attrition and production. In general, attrition increases as pilot production increases when training resources are fixed. When production is high, candidates of lower quality are selected for flying training to satisfy production quotas. At flying training squadrons during times of high production, there is intense competition among students for training resources like special individualized assistance and extra flying training sorties. The hypothesis implies that lower candidate ability and limited training resources combine to increase attrition in times of high production. Support for the link between production and attrition comes from historical production and attrition data. From 1986 to 1990, the USAF produced an average of 2,195 pilots per year and experienced an average annual attrition rate of 29%. From 1991 to 1995, we produced an average of 1,138 pilots per year and experienced an average annual attrition rate of 15% (Tremper, 1997)[5]. Over this ten-year period, the USAF operated five undergraduate flying training bases. Through recent military downsizing, the number of flying training bases has been reduced to three. Currently, plans are to increase annual pilot production up to 1,200 by the year 2000; however, we will do so with fewer flying training bases than we had in the past. As a result of increased production, selection of candidates of lower quality to satisfy production quotas, and reduced flying training resources, it is likely that attrition rates will increase above the 15% level we experienced in the 1991 to 1995 time frame.

Training difficulty is the third factor that may contribute to flying training attrition. I have been asked if selection standards will change as a result of developments in fast-jet, front-line aircraft. I believe the main concern is that training difficulty will increase as complex cockpit systems cascade into training aircraft and that this will imply changes for selection standards. Although selection standards have not changed in the USAF because of these developments, it is possible that they may. Currently, we do not know for certain that complex cockpit systems will result in greater training difficulty. On the surface, it does appear that undergraduate flying training is becoming more difficult because of the introduction of complex cockpits and because of the introduction of mission-oriented training. In 1993, the USAF transitioned from a single-track undergraduate pilot training program to a dual-track program that provides specialized mission-oriented training. Under the dual-track program, students are assigned to one of two training tracks at the completion of primary flight training in the T-37. Students assigned to the bomber-fighter track receive mission-oriented training in the T-38. I understand that there are plans to add training in fighter fundamentals to the end of the bomber-fighter track. Students assigned to the airlift-tanker track receive mission-oriented training in the T-1. The T-1 is a military version of the Beech 400 business jet. The T-1 introduced a "glass cockpit" to undergraduate flying training. It has electronic flight instrumentation systems with pilot configurable multifunction displays, a flight

[5] These production and attrition rates are based on all points of entry; commissioning sources, active duty, Air National Guard, Air Force Reserves, and international sources.

management system, weather radar, and electronic maps and checklists. One could hypothesize that the introduction of the T-1 would result in greater training difficulty and that this increase in difficulty would produce higher attrition. But, this hypothesis is not supported by current evidence. In 1995, the USAF produced over 100 pilots in the T-1 with attrition at 1.9% compared to over 200 pilots in the T-38 with attrition at 3.8% (Marvin & Tremper, 1995). The fact that attrition was lower in the "glass cockpit" T-1 compared to the conventional cockpit T-38 suggests that training may be less difficult with "glass cockpits." Alternatively, there is the hypothesis of no change in training difficulty. It has been argued that the introduction of advanced cockpit technology will simply result in a redistribution of pilot workload among different ability domains. Successfully flying an advanced cockpit aircraft may depend less on spatial abilities than on acquisition and recall of declarative knowledge; less on the ability to manipulate quantitative information than on the ability to monitor multiple sources of data (Weeks, Zelenski & Carretta, 1996). Will training be more difficult, less difficult, or the same in difficulty? USAF undergraduate flying training is changing so much it is too early to know for sure. Plans are to insert an advanced avionics suite into the T-38 and to replace the T-37 primary aircraft trainer with the "glass cockpit" T-6. One approach to get an early understanding of the outcome is to keep in mind that training difficulty results from the confluence of several factors including training aircraft, training objectives, training resources, and the quality of pilot candidates.

CONCLUSION

The central argument presented here is that the AFA and ROTC pilot selection policies may combine with training factors to increase attrition and flying training costs. Today, AFA and ROTC pilot candidate ability levels are lower on the average than what they would be if selection policies assigned equal importance to officership and ability. Current selection policies are contributing to flying training attrition. In addition, plans are to increase pilot production in a resource-limited environment. This will also contribute to increases in attrition. In the late 1980s, we produced over 2,000 pilots per year; average attrition was 29%. It is possible that attrition could climb to that high level again. Avoiding high attrition would be difficult. We cannot decrease pilot production rates but we could increase training resources. I understand there are plans to increase the number of training bases from three to four by teaching the primary phase at Randolph AFB. We cannot decrease the difficulty of flying training but we could increase training time. I understand we plan to extend the duration of bomber/ fighter training by seven weeks as we incorporate fighter fundamentals into training. Increasing the number of training bases and extending training time will help reduce attrition. One additional intervention we could adopt to fight against high attrition is to increase candidates' average ability levels. We could do this by giving greater emphasis to ability in the AFA and ROTC pilot selection policies so that ability and officership are equally weighted. Such an action is within our span of control, is inexpensive, and would combine with increased training resources to help minimize flying training attrition and hold down training costs.

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