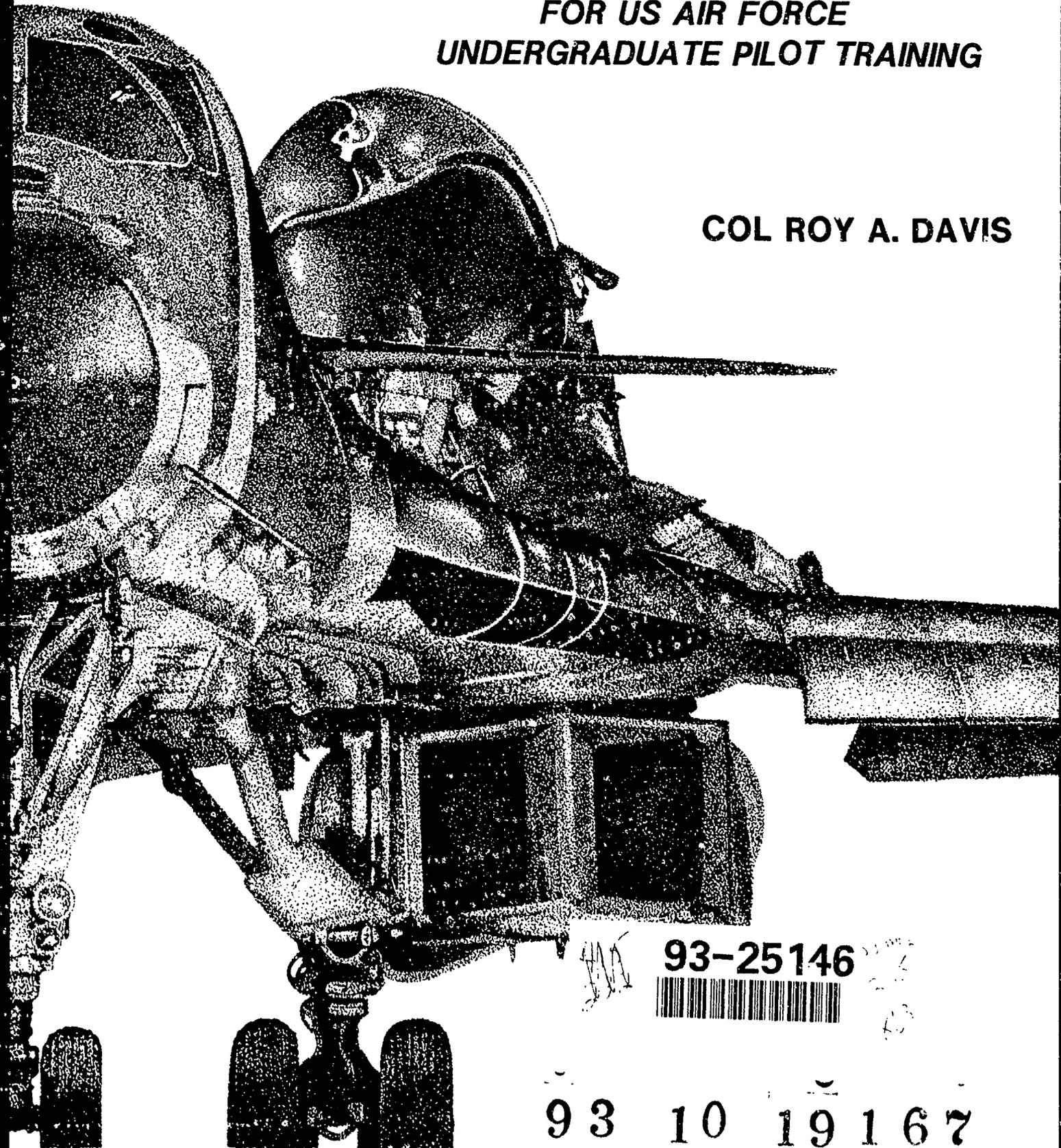


PERSONALITY:

*ITS USE IN SELECTING CANDIDATES
FOR US AIR FORCE
UNDERGRADUATE PILOT TRAINING*

COL ROY A. DAVIS



93-25146



93 10 19 167

PAGES _____
ARE
MISSING
IN
ORIGINAL
DOCUMENT

After you have read the research report, please give us your frank opinion on the contents. All comments—large or small, complimentary or caustic—will be gratefully appreciated. Mail them to: CADRE/RI, Building 1400, Maxwell AFB AL 36112-5532.



PERSONALITY: ITS USE IN SELECTING
CANDIDATES FOR US AIR FORCE
UNDERGRADUATE PILOT TRAINING

Cut along dotted line

Thank you for your assistance



Research Report No. AU-ARI-88-8

PERSONALITY: ITS USE IN SELECTING
CANDIDATES FOR US AIR FORCE
UNDERGRADUATE PILOT TRAINING

by

ROY A. DAVIS, Col, USAF
Research Fellow
Airpower Research Institute

Air University Press
Maxwell Air Force Base, Alabama 36112-5532

February 1989

DISCLAIMER

This publication was produced in the Department of Defense school environment in the interest of academic freedom and the advancement of national defense-related concepts. The views expressed in this publication are those of the author and do not reflect the official policy or position of the Department of Defense or the United States government.

This publication has not been reviewed by security and policy review authorities and is not cleared for public release. It is the property of the United States government and is not to be reproduced in whole or in part without permission of the commander, AUCADRE, Maxwell Air Force Base, Alabama.

Disclaimer

This publication was produced in the Department of Defense school environment and in the interest of academic freedom and the advancement of national defense-related concepts. The views expressed in this publication are those of the author and do not reflect the official policy or position of the Department of Defense or the United States government.

This publication has been reviewed by security and policy review authorities and is cleared for public release.

CONTENTS

<u>Chapter</u>		<u>Page</u>
	DISCLAIMER-----	ii
	FOREWORD-----	vii
	ABOUT THE AUTHOR-----	ix
	ACKNOWLEDGMENTS-----	xi
1	INTRODUCTION-----	1
	The Problem-----	1
	Possible Solutions-----	3
	Research Design-----	6
	Hypotheses-----	6
	Notes-----	7
2	REVIEW OF THE LITERATURE-----	9
	World War I-----	9
	World War II-----	9
	After World War II-----	10
	Recent Research-----	11
	Foreign Use-----	12
	Test Selection-----	12
	General Recommendations-----	13
	Personality Scales-----	13
	Summary-----	17
	Notes-----	18
3	METHODOLOGY-----	21
	The Population-----	21
	The Questionnaire-----	23
	The Statistical Treatment-----	24
	Research Concerns-----	25
	Notes-----	26
4	FINDINGS-----	27
	The Respondents-----	27
	The Data-----	27
	The Implications-----	32
	Notes-----	33

<u>Chapter</u>		<u>Page</u>
5	ADDITIONAL RESEARCH RECOMMENDATIONS-----	35
	Biographical Data and Success at UPT---	35
	Biographical/Personality Data and FAR, TTB, or Fail-----	35

Appendix

A	Potential Predictors of Student Pilot Attrition-----	45
B	Research Questions-----	47
C	Research Questionnaire-----	55
D	Research Cover Letter-----	69
E	Questionnaire Approval Letter-----	71
F	Questionnaire Follow-up Letter-----	73
G	Respondent Profile--Age-----	75
H	Respondent Profile--Grade Point Average-----	77
I	Respondent Profile--Private Pilot License-----	79
J	Respondent Profile--Source of Commission-----	81
	BIBLIOGRAPHY-----	83

ILLUSTRATIONS

Figure

1	UPT Attrition-----	1
2	UPT Production-----	2
3	UPT Sources-----	4

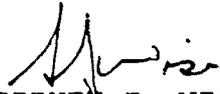
<u>Figure</u>	<u>Page</u>
4 Male/Female Comparison of Respondent Group with Sample-----	28
5 Pass/Fail Comparison of Respondent Group with Sample-----	28
6 Reason for Fail Comparison of Respondent Group with Sample-----	29
7 Pass/Fail Biographical Data-----	36
8 FAR/TTB/Fail and Biographical Data-----	39
9 FAR/TTB/Fail and Personality Trait Mean Scores-----	41

<u>Table</u>	
1 MBTI Definition of Personality Traits-----	16
2 MBTI Preference Scales-----	17
3 FY 1987 UPT Sample-----	22
4 Research Questions-----	24
5 Correlation of Personality Traits to Success in UPT-----	30
6 Multiple Correlation of Personality Traits with Success in UPT-----	31
7 Discriminant Analysis Prediction of Success in UPT-----	31
8 Biographical Data and Success at UPT-----	37
9 Biographical Data and FAR, TTB, or Fail-----	38
10 Personality Traits and FAR, TTB, or Fail-----	40

FOREWORD

In fiscal year 1987 the attrition rate at undergraduate pilot training (UPT) was at its highest rate in the past 10 years. Each of the three commissioning sources--US Air Force Academy, Officer Training School, and Air Force Reserve Officer Training Corps (AFROTC)--has its own UPT selection procedure. Col Roy A. Davis's research was initially focused on AFROTC's attrition problem, but investigation revealed that the problem was not restricted to AFROTC: None of the selection criteria used by any of the commissioning sources have a strong correlation with success at UPT.

Colonel Davis examined the feasibility of incorporating personality testing in the UPT selection process. He developed and distributed a questionnaire to all candidates attending UPT in fiscal year 1987. And though he found no usable relationship between personality test scores and success at UPT, the data gathered may be of use in studies of this type in the future.


 SIDNEY J. WISE
 Colonel, USAF
 Commander
 Center for Aerospace Doctrine,
 Research, and Education

DTIC QUALITY INSPECTED 2

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
	

ABOUT THE AUTHOR

Col Roy A. Davis was born in New York City. He attended the New York University College of Engineering for two years before transferring to Florida State University to complete degree requirements for a bachelor of science degree in meteorology (1963). In 1979 he was awarded a master of science degree in aeronautical science from Embry-Riddle Aeronautical University.

Colonel Davis entered the Air Force in 1965 and was commissioned a second lieutenant through the Officer Training School program. He received his pilot wings after completion of undergraduate pilot training in 1967 at Craig AFB, Alabama, where he received the Outstanding Pilot Award for finishing first in his class. Colonel Davis's first operational assignment was as a C-141 pilot in the 8th Military Airlift Squadron, McChord AFB, Washington. Two years later he was selected to fly the first AC-119K gunship to Phan Rang AB, Vietnam. After completion of his combat tour, he was reassigned to McChord AFB as pilot flight examiner and was assigned to the 62d Military Airlift Wing. In 1977 he was assigned as a VC-135 special missions pilot in the newly formed 58th Military Airlift Squadron at Ramstein AB, West Germany. In 1979 he was selected for assignment to Detachment 1, 89th Military Airlift Wing, Hickam AFB, Hawaii, where he became the unit operations officer. In 1982 he was transferred to Pacific Command as the CINCPAC deputy director of protocol. In 1983 he was selected by Air Training Command to command the Air Force ROTC unit at Montana State University. After completion of this tour of duty in 1986, he was assigned to Air Force ROTC headquarters, Maxwell AFB, Alabama, as chief of staff. In



Col Roy A. Davis

the summer of 1987 he began his current assignment as the command-sponsored research fellow from Air Training Command assigned to the Airpower Research Institute, also at Maxwell AFB. He is currently assigned to Air Force ROTC headquarters, this time as the director of operations and training.

Colonel Davis is married to Dr Paula E. Pascoe, chief of education services, 3800th Air Base Wing, Air University. He has two children, Kim (22 years) and Jon (20 years).

ACKNOWLEDGMENTS

This year has been one of tremendous personal growth for me. Without Air Training Command's confidence in my ability to complete this research project successfully, I would never have had the opportunity to spend a year in concentrated research on a topic I feel is more important now than ever before--the selection of individuals to attend undergraduate pilot training. But the year was not spent entirely on this research project; I was also afforded the opportunity to attend Air War College. The combination of completing this study and attending senior service school made the year a challenging one. I would like to thank the following people for their assistance in helping me with the assignment nomination process, the actual research effort itself, and in writing this report: Col Carl B. Johnson (AFROTC vice commander) for supporting me in the nomination process; Dr Lewis B. Ware (research adviser) for keeping me on schedule; Preston Bryant (research editor) for helping me to say more clearly what I intended to say; Nick Fanks (Data Automation) for patiently creating endless reams of computer products; Darrell Bach (HQ ATC/XPS) for being my constant link to Headquarters Air Training Command; Dr Frederic Siem (Air Force Human Resources Laboratory researcher) for sharing his time and knowledge; Lt Daniel L. Dolgin, USN (Naval Aerospace Medical Research Laboratory psychologist) for sharing his research efforts; and Dr Paula E. Pascoe (my wife) for inspiring me to get involved in a research effort and for her unending support.

CHAPTER 1

INTRODUCTION

Air Training Command (ATC) is faced with a serious problem. Pilots are washing out of undergraduate pilot training (UPT) at a rate higher than any in recent memory. The high attrition rate and the problems associated with it are major concerns. This study addresses these concerns.

The Problem

ATC determines the expected UPT attrition rate and calls it the programmed attrition rate. A comparison of this programmed rate with the actual attrition rate (fig. 1) reveals that the actual attrition rate has exceeded the programmed rate in seven of the last eight years; and when there is a large difference between the rates, as in fiscal year 1987, the US Air Force has great difficulty in meeting its pilot manning requirements (fig. 2).

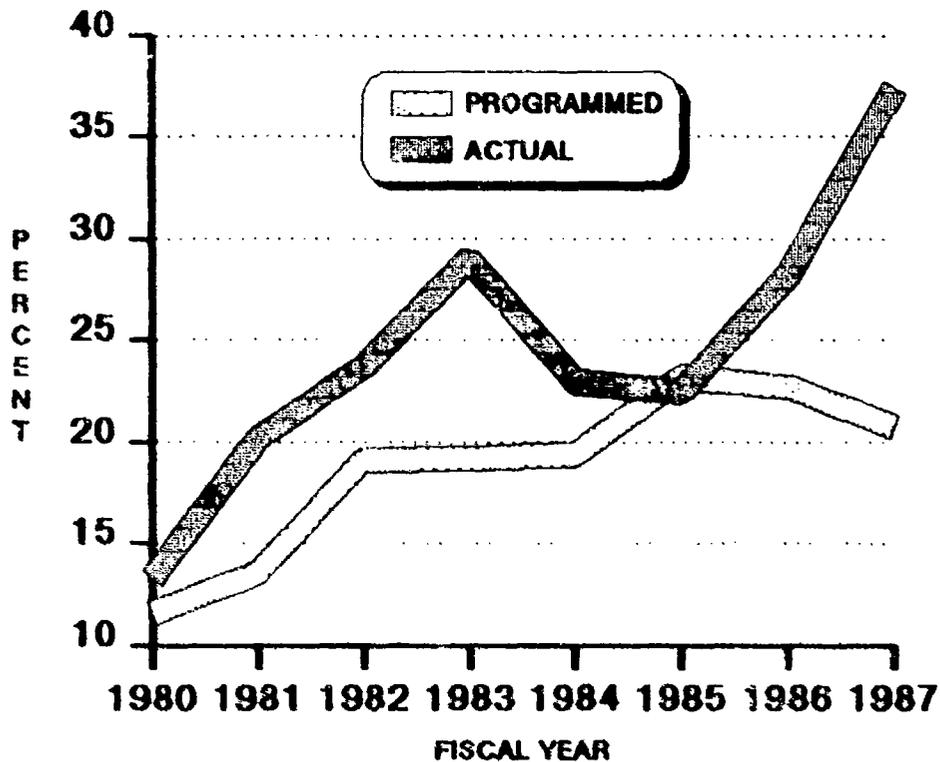


Figure 1. UPT Attrition.

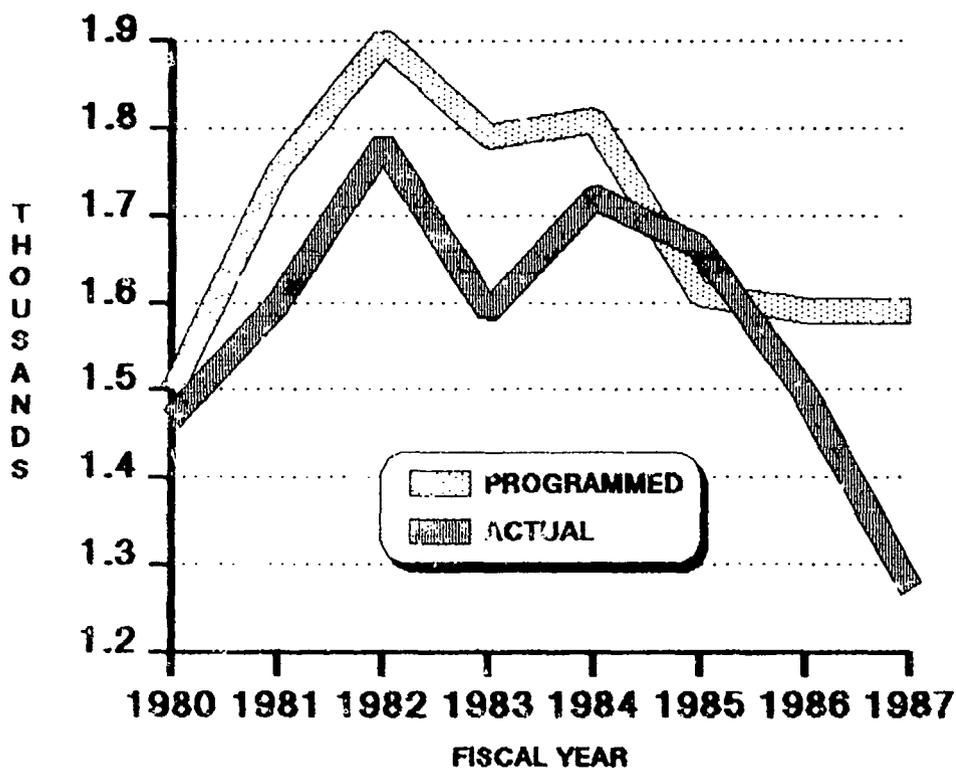


Figure 2. UPT Production.

A second problem is the increased cost associated with a high attrition rate. As attrition rates increase, the cost per student increases; and increased training costs impact the overall Air Force budget. Yet higher than expected attrition has been a persistent problem in recent years.

The Air Force has three commissioning organizations: Air Force Reserve Officer Training Corps (AFROTC), Officer Training School (OTS), and the US Air Force Academy (USFA). UPT candidates from each of these commissioning sources have been selected on the basis of criteria unrelated to success; that is, the three commissioning sources have been selecting candidates for UPT at a success rate little better than random for the past 10 years. Potential predictors of attrition are listed in appendix A.

But there is promise in measuring what this researcher considers to be the three most important areas--the hands, the head, and the heart. Recent studies by researchers at the Air Force Human Resources Laboratory (AFHRL) have shown that there is promise in using a device called the porta-

bat, which measures motor skill and information-processing capability. They have also found a correlation between flying aptitude as measured by the Air Force Officer Qualifying Test (AFOQT) and success in UPT.¹ No relationship has been found between success in UPT and personality traits. The primary purpose of this research study was to find such a relationship.

Possible Solutions

The most obvious way to increase pilot production is to increase the number of candidates selected to enter UPT. With the attrition rate remaining the same, increasing the input to UPT will increase the number of graduates. This solution has a major disadvantage, however. Each UPT failure costs ATC \$65,000 to \$80,000;² and increasing the input will increase both the number of failures and the per capita cost of each successful graduate. Additional funds will also be necessary for increased training facilities and personnel due to the larger input.

Another potential solution is to lower training standards. According to ATC, part of the current high attrition rate is due to pressure brought about by an increased aircraft accident rate that led the major commands to recommend tougher standards for UPT graduation. These increased standards resulted in higher attrition rates, which are very difficult to control precisely and may be higher than really necessary. But the current feeling at ATC is that the standards are appropriate. Reducing the standards, ATC officials believe, would not be a prudent approach.

Another potential solution to the attrition problem is to improve the instructional process. If instructors improve their teaching ability, if the syllabus is enhanced, and if students increase their capacity for learning, the attrition rate might be reduced. But ATC believes it has an excellent syllabus and very capable instructors. There is always room for improvement, of course, as ATC is aware; but the command believes that changes in the current program would probably have little impact on the attrition rate.

Yet another way to reduce attrition is to improve selection. We looked at the selection process of each organization that selects candidates for UPT. In descending order of UPT inputs, they are as follows: AFROTC at 37 percent, OTS at 28 percent, and USAFA at 26 percent. An additional 9 percent comes from the commissioned officer ranks (fig. 3).

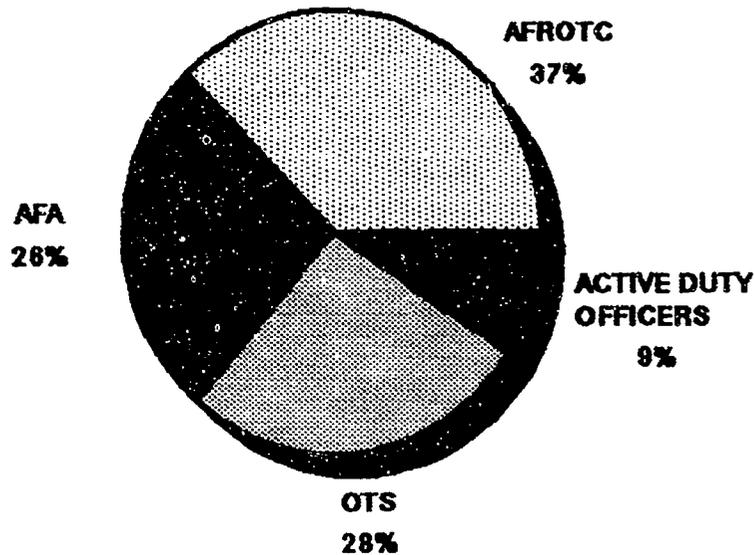


Figure 3. UPT Sources.

The selection processes of AFROTC and OTS are similar. They both use college grade point averages, Scholastic Aptitude Test (SAT) scores or American College Test (ACT) scores, AFOQT scores, and unscored interviews. AFROTC also includes a rating by the candidate's unit commander. To arrive at a score for each applicant, these variables are entered on a worksheet, multiplied by a weighted constant, and totaled.

All USAFA cadets who meet the physical examination requirements and complete the pilot indoctrination program (PIP) are allowed to attend pilot training. Variables used to admit applicants to the USAFA include high school grade point average, SAT or ACT score, and a scored interview.

UPT candidates from the ranks of commissioned officers are selected by their overall performance on active duty as measured by their officer effectiveness reports. OI's include comments by superior officers, education, achievements, professional development, and community involvement.

Of major concern is the correlation between selection criteria and success at UPT. A recent AFROTC study found that only three of 32 variables studied correlated at all with UPT success, and those only slightly. None could be considered significant predictors.³ Variables examined in that study did not include high school grade point average, scored interviews (both used by the USAFA), or OERs (used in selecting commissioned officers).

It is probably safe to assume that since college grade point averages do not correlate with UPT success, neither will high school grade point averages. It is not, however, safe to assume no correlation between the USAFA-scored interview and success at UPT. But that possibility remains for another study to explore. And since the vast majority of UPT candidates do not have OERs, the OER will not be considered here.

There is much room for improvement in the UPT selection process. Both the AFHRL and the Naval Aerospace Medical Research Laboratory (NAMRL) are working on this problem. In fact, AFHRL has completed a study that shows a significant correlation between motor skill testing results and success at UPT.⁴ They have also just completed an evaluation of personality variables that proved to be less than successful as predictors. The NAMRL is currently evaluating personality variables for productive purposes. Both labs continue to stress the potential of personality testing in the UPT selection process.

Several recent studies have suggested that the failure to discover a personality test capable of predicting UPT success has been due to selection of improper criteria, use of inappropriate statistical procedures, and selection of unreliable tests. An attempt was made in this study to avoid the errors of the past.

Two of the tests selected for this research project have been successful in discriminating between pilots considered to be superior and those who are less than average. Another test has shown a difference between general aviation pilots and the general population.⁵ And finally, a test that is currently being used by Air University's Air War College and Air Command and Staff College was selected because the author intuitively felt it would have predictive value.

Psychological testing is currently being used by the Israeli, Danish, Swedish, and Canadian air forces, among others; and recent research has found that personality variables differentiate between pilots and nonpilots. It is

therefore reasonable to believe that personality testing holds promise for improving the UPT selection process.

Research Design

An important part of this study was the selection of psychological tests to be evaluated. Due to time limitations, an off-the-shelf instrument had to be selected. After conferring with AFHRL and NAMRL, this researcher assembled a 250-item questionnaire: part I includes 12 questions concerning biographical data; part II consists of the Myers-Briggs Type Indicator (MBTI) Form G questionnaire of 126 questions; and part III consists of 112 items from three different instruments recently used in pilot-related research along with a dozen social desirability (SD) scale items (appendixes B and C). The MBTI, which is over 40 years old, had been used in job selection and pilot research but has not been evaluated for its suitability in pilot selection. The main purpose of the SD scale was to indicate whether the test taker was "faking" responses. Each individual who participated in this study received the 250-item questionnaire and a cover letter (appendix D). Responses were returned directly to the author.

Hypotheses

The null hypotheses asserts that there is no significant difference between the personality scores of those who pass UPT and those fail UPT. The first step in determining whether the null hypothesis is to be rejected or accepted is analyzing the data collected. Mean scores and standard deviations are calculated on each personality scale for both the pass group and the fail group. A determination is then made as to whether these differences are true differences or might be due to chance. If the difference is a true difference, the degree of relationship between that difference and pass/fail must be calculated.

Based on prior research by Robert L. Helmreich and others, expected results can be stated in two research hypotheses:

1. There will be a significant positive correlation between success at UPT and the following personality trait scale scores: assertiveness, interpersonal orientation, mastery motivation, competitiveness, work motivation, self-control, introversion, sensing, thinking, and judging.

2. There will be a significant negative correlation between the following personality trait scale scores and success at UPT: hostility, verbal aggressiveness, submissiveness, fatalism, extroversion, intuition, feeling, and perception.

Notes

1. Maj V. Paul Bordelon and Jeffrey E. Kantor, Utilization of Psychomotor Screening for USAF Pilot Candidates: Independent and Integrated Selection Methodologies, AFHRL-TR-86-4 (Brooks AFB, Tex.: Air Force Systems Command, 1986), 22.

2. Frederic M. Siem et al., Personality, Attitudes and Pilot Training Performance: Preliminary Analysis, AFHRL-TR-87-62 (Brooks AFB, Tex.: Air Force Systems Command, 1988).

3. Grover Diehl, "Analysis of 32 Potential Predictors of Pilot Attrition," staff study (Maxwell AFB, Ala.: AFROTC/XPX, March 1986).

4. Frederic M. Siem, "The Effects of Aircrew Member Personality in Interaction and Performance" (Unpublished dissertation, University of Texas, Austin, Tex., 1987), 3.

5. Harvey Wichman and James Ball, "Locus of Control, Self-serving Biases, and Attitudes Towards Safety in General Aviation Pilots," Aviation, Space, and Environmental Medicine, June 1983, 508.

CHAPTER 2

REVIEW OF THE LITERATURE

Psychological testing has been around for a long time. As early as 2200 B.C., a Chinese emperor was testing public officials to determine their fitness for office. In the United States, such testing dates back to the late 19th century. Its first use in aircrew selection was in World War I, only 15 years after the advent of powered flight.¹ It is now almost 70 years later, and we still do not have an aircrew selection system that can reliably predict success in pilot training. This chapter will review the literature concerning psychological testing in aircrew selection from World War I through the 1980s. It includes current literature that relates directly to the instruments available for use. Much can be learned from past experience and the studies done on these instruments.

World War I

In 1917, when the United States entered World War I, the Army had no program for selecting and classifying recruits. To facilitate development of such a program, a group of psychologists assembled a series of psychological tests designed to measure training aptitude. After World War I ended, psychological testing expanded. Some researchers were interested in studying the causes of aircraft accidents, many of which were found to have been caused by human error. This discovery led to expanded research efforts. In 1919, at Kelly Field, Texas, V.A.C. Henmon conducted an intelligence test, a test for measuring emotional stability after shooting a handgun, and a test for measuring one's sense of balance.² Psychological testing was taking place in Europe as well. French, English, and Italian researchers became involved in testing after World War I ended.³ By the beginning of World War II, a body of psychological testing knowledge existed.

World War II

The approach to aircrew selection took a dramatic turn in World War II. Large numbers of recruits were needed. No longer would physical qualification and desire to be an aircrew member constitute adequate criteria for selection. The number of crewmembers needed was obviously much greater than that of World War I. A low-cost screening process was needed to select candidates having a high probability of

success in training. This task was given to the Army Air Force School of Aviation Medicine's Department of Psychology. Initially, these tests were only used to select pilots, navigators, and bombardiers. Candidates were first given the Army Air Force Qualifying Examination (AAFQE). The AAFQE tested aptitude, attitude, and motivation. Those successful in this test were then given the aircrew classification battery, which consisted of 14 additional tests. Crude and time-consuming by today's standards, these tests were successful in an environment where quick selection and limited training sessions were necessary.⁴ Use of the AAFQE and the aircrew classification battery reduced by more than 50 percent the number of preflight school entrants necessary to maintain the same number of advanced pilot training graduates.⁵ But these tests were effective when large numbers of candidates were being selected and those unsuited for training were "selected out"; they would not be effective in today's environment where small numbers are being "selected in" from a large number of applicants.

Toward the end of the war, an extensive effort was made to find commercially available written tests to replace the more expensive AAFQE and aircrew classification battery. Over 20 studies were completed, most with disappointing results. Partial explanation for failure lies in the fact that these tests were designed primarily to screen out misfits rather than to predict success among normal applicants. They were reliable when used against psychiatric criteria (to separate those who needed further clinical evaluation), but they were not reliable when used against performance criteria.⁶

After World War II

Personality testing after the war fared little better. According to Glenn R. Griffin and Robert A. North, "A recent review of Navy selection research indicate[s] that approximately 40 different personality paper-and-pencil test devices have been evaluated from 1970 to 1976 for pilot selection without any appreciable impact on the selection of aviator candidates."⁷ One of the major reasons cited for this lack of success is that applicants are prone to select answers that appear appropriate rather than answers that reflect their personalities.

Literature from the past 10 years has been more supportive of the idea of using psychological tests in selecting applicants for flight training. A brief survey of

this literature highlights the successes of recent research efforts.

Recent Research

Are aviators different from the general population? Do they have "different" personalities? Pauline Rossander of the Canadian Forces Research Laboratory indicates that the answer is yes.⁸ She also believes it feasible to validate an inventory for pilot selection purposes. But a review of the literature reveals that since her research in 1980, very little has been done in this country to explore this possibility. Despite the fact that many other modern air forces use psychological evaluations to select pilots. Robert L. Helmreich, Department of Psychology, University of Texas at Austin, agrees that research done in the recent past has failed to establish a consistent link between personality and pilot performance.⁹

One reason for this, according to Daniel L. Dolgin and Gerald D. Gibb, is that most of the predictive studies regarding the use of psychological testing for pilot selection have had methodological problems. They emphasize that very few past researchers have used multiple regression analysis in their treatment of the data.¹⁰ This procedure can relate single variables and combinations of variables to a given criterion. Regression equations are used in predicting one variable from another (e.g., training outcome from personality traits). They believe that without multiple regression analysis, the prediction potential of selection variables is difficult to determine.

As mentioned earlier, personality tests also have some unique difficulties. One such difficulty is the possibility of "faking" answers.¹¹ As Anne Anastasi points out, "Self-report inventories are especially subject to malingering or faking [and] the respondent may be motivated to 'fake good,' or choose answers that create a favorable impression, as when applying for a job."¹² This drawback, and others, is discussed in a later section.

Some of the most promising recent research has been done by Helmreich. His research, which has used personality factors as predictors of flying performance, is also discussed in a later section.¹³ He believes that personality may be a limiting factor on an individual's training potential and that personality research may not only improve selection, but may also help in the design of training.¹⁴

Promising work is also being done by personnel at the Air Force Human Resources Laboratory. In one of their studies, for example,

personality factors were found to predict pilot training outcome measures . . . [and] different combinations of characteristics, rather than the simple presence or absence of a key personality trait, appeared to be a better predictor of pilot training outcomes.¹⁵

The NAMRL has concluded that it is no longer desirable to rely on aptitude alone for pilot selection and that the personality variable is becoming a more important factor.¹⁶ The NAMRL gives credit to the Army's pilot selection program: "The Army has apparently had sufficient success with the use of personality measures to include their use in the Army Fixed and Rotary Wing selection battery."¹⁷

Foreign Use

Many foreign airlines use psychological testing for aircrew selection. The Germans and the British, for example, use psychological testing to select airline pilots.¹⁸ Even the Soviets are interested in psychological testing for pilot selection.¹⁹ The Israeli approach to using personality in a selection process is an interesting one. Whereas the West uses high engineering technology (optimizing equipment), the Israelis use high human technology (improving motivation and state of mind--optimizing the operator). And they use this philosophy in selecting their soldiers as well as their pilots.²⁰ Other foreign air forces currently using psychological testing to select pilots include the Royal Danish Air Force and the Royal Swedish Air Force.²¹

Test Selection

More than 500 psychological tests are available. Yet relatively few personality tests have been used to predict pilot training outcomes. My consideration of tests excluded those that have been rejected by the NAMRL,²² the AFHRL, and Rossander.²³ It included those that have shown promise and were recommended by the AFHRL or the NAMRL.

General Recommendations

A McDonnell Douglas Aeronautics Corporation research report on predicting pilot air combat effectiveness states that "the outlook for the prediction of success in pilot training is . . . positive, perhaps due to the advancements in personality test development."²⁴ After reviewing dozens of personality inventories, Steven Kozlowski concluded that the major reason for their lack of success as selection devices is a failure to maximize four necessary conditions: (1) the selection of traits to be measured should be based on sound research; (2) a clear relationship should be shown between those traits and successful job performance; (3) the test measuring these traits should show high reliability and validity and not be susceptible to response bias (faking); and (4) conclusions should be based on a sound research strategy in order to explain the validity of these personality traits as success predictors.²⁵ This approach is also supported in a recent study by the NAMRL.²⁶

Recent research efforts have identified those personality traits that are good predictors. Helmreich discovered that superior performance in airline pilots correlates positively with assertiveness and interpersonal orientation. Negative correlation was found with competitiveness.²⁷ Harvey Wichman and James Ball have shown that aviators are significantly more internal in the control of their lives than the general population.²⁸ (Individuals believing in external control tend to attribute the outcome of events to luck, chance, or fate. Individuals believing in internal control argue that the outcome of events is under their control.) A study done by L. F. Lester and D. H. Bombaci suggests that perceived locus of control (internal versus external) could be used successfully as a criterion for screening pilot applicants.²⁹

Personality Scales

Robert Helmreich has accounted for much of the recent research surrounding aviation-related psychological testing. Two of the instruments he used, the Extended Personal Attributes Questionnaire (EPAQ) and the Work and Family Orientation Questionnaire (WFOQ), were selected for use in this study. Helmreich (1982, 1986) found a significant relationship between personality traits as measured by his own questionnaires and pilot performance as measured by FAA flight inspectors.³⁰

Also included in this research effort are a locus of control (LOC) personality test and a social desirability (SD) scale. LOC refers to internal versus external motivation; SD attempts to detect response bias.

Another instrument, the Myers-Briggs Type Indicator (MBTI), measures personality type. It is currently in use at both Air War College and Air Command and Staff College.

Extended Personal Attributes Questionnaire. This instrument measures both positive and negative personality traits. Positive traits include assertiveness, interpersonal orientation, and aggressiveness; negative traits include verbal aggressiveness, hostility, and submissiveness.³¹ Assertiveness reflects an individual's feeling for independence, performance under pressure, and decisionmaking ability; interpersonal orientation reflects concern for and interaction with others; aggressiveness reflects a need for security, reaction in a crisis situation, and need for approval of others; hostility reflects arrogance, greed, and cynicism; verbal aggressiveness reflects need to nag and complain; and submissiveness reflects gullibility and servility.

Work and Family Orientation Questionnaire. The WOFO assesses achievement motivation. The three scales used in this study's research questionnaire include mastery, work orientation, and competitiveness. Mastery represents the desire to undertake new and challenging tasks; work orientation is the motivation to do a task well; and competitiveness measures the desire to outdo the performance of others.³² Mastery and work orientation are positive predictors of success and performance; competitiveness has been shown to correlate negatively.³³

Locus of Control. LOC refers to an individual's perception of the control of life events. Those who believe they are in control are said to be internally motivated. Those who believe that control is out of their hands are said to be externally motivated. Wichman and Ball found that pilots were significantly more internal than the general population.³⁴ Individuals who are internal possess

superior mastery . . . [because] they seem to acquire more information, make more attempts at acquiring it, are better at retaining it, are less satisfied with the amount of information they possess, are better at utilizing and devising

rules to process it, and generally pay more attention to relevant cues in the situation.³⁵

The Reid-Ware LOC scale was selected for use in this study.

Social Desirability. A "lie scale" was also included in this research questionnaire. According to Griffin and North, college graduates who are highly motivated to become pilots should have no problem in determining the appropriate responses to a questionnaire used for selection to UPT;³⁶ but a social desirability scale, or "lie scale," can help to determine the extent of faking by an applicant.³⁷ In a situation where an individual is being selected for officer training as well as flying training, ethics and honesty are important. Test-taking instructions should deter faking by making the applicant aware that it can be detected and may result in disqualification. The Crowne-Marlowe social desirability scale was selected for use in this study.³⁸

Myers-Briggs Type Indicator. The MBTI was designed to provide an easily understandable format for personality types described by psychologist Carl G. Jung. His theory explains variations in individual behavior by relating them to preferences for perception and judging. And according to Isabel Briggs Myers and Mary H. McCaulley,

perception involves all the ways of becoming aware of things, people, happenings, or ideas. Judgement involves all the ways of coming to conclusions about what has been perceived. If people differ systematically in what they perceive and how they reach conclusions, then it is only reasonable for them to differ correspondingly in their reaction, interest, values, motivations, and skills.³⁹

The MBTI is of interest to this study because it is capable of measuring these differences. Table 1 provides trait definitions for the MBTI, which uses the four scales in table 2.

Scores for each of the scales can be computed to determine if there is a significant correlation between personality type and UPT success. In this study, the MBTI will be used in its entirety to determine whether there are reliably significant differences between the personality types of those who succeed in UPT and those who do not.

Kozlowski's Criteria. As mentioned earlier in this chapter, Steven Kozlowski identified four conditions necessary to maximize success in research that uses

TABLE 1

MBTI Definition of Personality Traits

Assertive: independent, active (as opposed to passive), competitive, makes decisions easily, does not give up easily, feels superior, self-confident, and stands up under pressure.

Interpersonally Oriented: emotional, devoted to others, gentle, helpful, kind, aware of others' feelings, understanding, and warm in relations.

Aggressive: not submissive, not excitable in a major crisis, worldly, indifferent to others' approval, feelings not easily hurt, never cries, and little need for security.

Hostile: arrogant, boastful, egotistical, greedy, dictatorial, cynical, and looks out for self.

Verbally Aggressive: whiny, complaining, nags, and fussy.

Submissive: spineless, subordinates self to others, and gullible.

Mastery Motivated: likes to do something different and interesting, leader in group planning, likes difficult thought games, persists in mastering difficult tasks, prefers work requiring high level of skill, attempts tasks without guarantee of success, and likes being busy all the time.

Work Motivated: works to full capacity, satisfaction in exceeding past performance, and likes to work hard.

Competitive: enjoys competing with others, prefers performing better than others, winning is important, does not like others to perform better, and works harder when competing.

Self-Control: does things even though undesirable, can control impulses, keeps emotions in check, can behave in a manner different than desired, can restrain reactions, and can resist temptation.

Fatalistic: believes in "right place - right time," believes in luck, and believes in fate.

TABLE 2
MBTI Preference Scales

Scale	Measures
Extroversion/Introversion (EI)	Orientation based mainly on outer world (E) or inner world (I)
Sensing/Intuition (SN)	Perception based mainly on facts (S) or possibilities (N)
Thinking/Feeling (TF)	Type of judgement one trusts when making a decision (T or F)
Judging/Perception (JP)	Preference for using a judging attitude (J) or a perceiving attitude (P) when dealing with the outer world

personality scores as selection criteria. All of the psychological tests used in this study meet those conditions: (1) all except the MBTI have had success in relating personality traits to pilot performance, using sound research procedures; (2) all traits selected for use in this study have an intuitively logical relationship with success or failure in UPT; (3) all scales have been shown to have high reliability; and (4) all tests have been validated through sound research strategy.

But these tests do have a weakness: they may be susceptible to response faking. It is for this reason that a social desirability scale was included in the questionnaire.

Summary

A review of the literature has shown that psychological testing has not been successful in predicting success in pilot training. But recent advances in research on

personality scales and pilot performance have rekindled interest. Therefore, it should be possible to develop a valid and reliable psychological test for use in screening applicants. This study is a step in that direction. Scales selected for inclusion in this research project meet Kozlowski's qualifying criteria.

Notes

1. John R. Graham and Roy S. Lilly, Psychological Testing (Englewood Cliffs, N.J.: Prentice-Hall Inc., 1984), 4.

2. V. A. C. Henmon, "Air Services Tests of Aptitude for Flying," Journal of Applied Psychology 3, no. 2 (1919), 36.

3. Ibid., 4.

4. Maj Marcus F. Cooper, "Application of Operational Pilot Selection Criteria," research study (Maxwell AFB, Ala.: Air Command and Staff College, 1976), 6-7.

5. Robert A. North and Glenn R. Griffin, Aviator Selection 1919-1977, Special Report 77-2 (Pensacola Naval Air Station (NAS), Fla.: Naval Aerospace Medical Research Laboratory, 1977), 10.

6. Pauline Rossander, Personality Inventories and Prediction of Success in Pilot Training: State of the Art (Willowdale, Ontario, Canada: Canadian Forces Applied Research Unit, 1980), 3.

7. North and Griffin, 18.

8. Rossander, 58.

9. Robert L. Helmreich and John A. Wilhelm, "Human Performance in Aerospace Environments: The Search for Psychological Determinants," American Psychologist, 5. In press.

10. Daniel L. Dolgin and Gerald D. Gibb, Personality Assessment in Aviation Selection: Past, Present and Future (Pensacola NAS, Fla.: Naval Aerospace Medical Research Laboratory, 1988), 21.

11. Ibid., 39.

12. Anne Anastasi, Psychological Testing (New York: Macmillan Publishing Company, 1976).

13. Robert L. Helmreich, "Pilot Selection and Performance Evaluation: A New Look at an Old Problem," Proceedings: Psychology in the Department of Defense, USAFA-TR-86-1 (Colorado Springs, Colo.: USAF Academy, 1986), 276.

14. Robert L. Helmreich and John A. Wilhelm, "Evaluating Cockpit Resource Management Training," Proceedings of the Fourth International Symposium on Aviation Psychology (Columbus, Ohio: Ohio State University, 1987), 3.

15. Frederic M. Siem, "Characteristics Associated with Success in USAF Pilot Training" (Brooks AFB, Tex.: Air Force Systems Command). In press.

16. Dolgin and Gibb, 1.

17. North and Griffin, 18.

18. David Hughes, "Airlines Move to Swiftly Expand, Improve Pilot Training Programs," Aviation Week & Space Technology, 9 November 1987, 141.

19. Dolgin and Gibb, 14.

20. Yakof Ravid, "Sociometric Pilot Testing Saves Time, Lives, and Money," Defense System Review, May 1984, 45.

21. Cooper, 30.

22. Dolgin and Gibb, passim.

23. Rossander, passim.

24. E. W. Youngling et al., "Predicting Pilot Air Combat Effectiveness," TR-MDC E1634 (St. Louis, Mo.: McDonnell Douglas Aeronautics Corp., 1977), 3-57.

25. Steven W. Kozlowski, The Validity of Personality Inventories for the Selection of Personnel: A Review of the Literature and Recommendations for Research, special report (State of Pennsylvania: State Civil Service Commission, Personnel Assessment Research Division, 1978).

26. Dolgin and Gibb, 10.
27. Frederic M. Siem, "The Effects of Aircrew Member Personality in Interaction and Performance" (Unpublished dissertation, University of Texas, Austin, Tex., 1987), 3.
28. Harvey Wichman and James Ball, "Locus of Control, Self-serving Biases, and Attitudes Towards Safety in General Aviation Pilots," Aviation, Space, and Environmental Medicine, June 1983, 507.
29. L. F. Lester and D. H. Bombaci, "The Relationship between Personality and Irrational Judgement in Civil Pilots," Human Factors 26, no. 5 (October 1984).
30. Robert L. Helmreich, "Exploring Flightcrew Behaviour," Social Behaviour 2 (1987): 12.
31. Ibid.
32. Ibid., 11.
33. Ibid., 12.
34. Wichman and Ball, 508.
35. E. J. Phares, Locus of Control in Personality (Newark, N.J.: General Learning Press, 1976).
36. North and Griffin, 18.
37. Anastasi, 517.
38. Douglas P. Crowne and David Marlowe, "A New Scale of Social Desirability Independent of Psychopathology," Journal of Consulting Psychology 24, no. 4 (1960).
39. Isabel Briggs Myers and Mary H. McCaulley, A Guide to the Development and Use of the Myers-Briggs Type Indicator (Palo Alto, Calif.: Consulting Psychologists Press, 1986), 1.

CHAPTER 3

METHODOLOGY

One of the most critical steps in successful research is to determine research methodology. In a survey-based study such as this, methodology involves selection of the population to be surveyed, research questionnaire design, and the type of statistical treatment used to analyze the data collected. Each of these steps is discussed in this chapter, as are concerns to be considered in future research efforts of this type.

The Population

The population defined for this study consists of all applicants who have ever been selected to attend UPT. But if we were to survey this entire group, it would be much too large to test. Since 1941, over 350,000 candidates have attended pilot training;¹ and the entire population of all who ever attended UPT is estimated to exceed 500,000. Fortunately, only a sample of this population is needed to determine if there is a relationship between personality traits and success at UPT.

One of the most critical steps in selecting the sample to be tested is to ensure that it is representative of the entire group. Therefore, the sample of UPT attendees had to include: (1) those who have successfully completed; (2) those who were eliminated and remained on active duty; and (3) those who were eliminated and were separated from the Air Force. The sample finally selected was comprised of those who have recently attended UPT.

A second important consideration was to ensure a large response from those who were unsuccessful in training. The larger the percentage of failures in the sample selected, the greater the chance of having an adequate number of failures respond. Those who attended UPT classes 87-01 through 87-07 were not only the most recent UPT attendees but also the group with the largest attrition rate (fig. 1). This sample includes all UPT attendees scheduled to graduate in fiscal year 1987 except for class 87-08, whose address labels were not available when the questionnaires were mailed.

Selecting a sample in a nonrandom manner has the potential for biasing the results of the study. If the sample group selected is significantly different from the

population, it is not appropriate to generalize the findings of the study to the entire population. A recent study completed by Air Force ROTC has shown that Air Force ROTC candidates selected to attend UPT over the past 10 years comprise a relatively homogeneous group.² There were few differences in their academic qualifications, AFOQT scores, or grade point averages. It is logical to assume that those selected to attend UPT in fiscal year 1987 were representative of the population who were selected to attend from 1976 to 1986, the period of this study. It is also logical to assume that applicants selected to attend UPT are in general a relatively homogeneous group.

With this assumption, another important decision is necessary. Would randomly selecting a sample from this group provide adequate data for this study? For two specific reasons, I decided to test the entire 1987 group. The first reason is that "the larger the sample size, the smaller the difference needed to reach a given level of significance."³ The second reason is that when small differences in mean scale scores are expected, it is desirable to select a larger sample than in groups where large differences in scores are expected. And since the sample selected was relatively homogeneous, small differences were expected. In addition, a general rule in statistical research is to use the largest sample size possible.⁴ Therefore, the entire group of 1,648 was selected. A description of this group can be found in table 3.

TABLE 3
FY 1987 UPT Sample

SOURCE	CANDIDATES	GRADUATES	ATTRITION
AFROTC	702	395	307 (43.7%)
Academy	338	244	94 (27.8%)
OTS	467	293	174 (37.3%)
Active Duty Officers	141	102	39 (27.7%)
TOTAL	1648	1034	614 (37.3%)

The Questionnaire

Another important task was to design an appropriate research questionnaire to collect the personality trait data. Personality traits were measured using the Extended Personality Attributes Questionnaire (EPAQ), the Work and Family Orientation (WOFO) questionnaire, the Myers-Briggs Type Indicator (MBTI), and the Reid-Ware Locus of Control (LOC). A social desirability (SD) scale and 12 biographical (BIO) questions were also included. A copy of the research questionnaire used is at appendix C. A summary of the biographical questions, the personality trait scales, and the social desirability scale is shown in table 4.

Developing procedures for questionnaire distribution was the next step. Permission to conduct a survey was obtained from the Air Force Military Personnel Center (AFMPC/DPYMO). A copy of the approval letter can be found in appendix E. Coordination between Air Training Command (ATC/DPOR) and the Air Force Military Personnel Center (AFMPC/DPMD) provided matching UPT class numbers and addresses. Address labels were requested in duplicate--one for the initial questionnaire package, one for the follow-up letter. The initial package contained a cover letter (appendix D), research questionnaire (appendix C), answer sheet, and a postage-paid return envelope.

Development of the mail-out package was considered crucial to the success of the research effort. The cover letter was designed to encourage survey completion. It contained the following information: purpose of the survey, sponsor of the survey, credentials of the researcher, and a promise of anonymity. The answer sheets used were obtained from AFHRL. They included enough space to answer the 250 questions and were computer scoreable. A prepaid return envelope, large enough to return the answer sheet unfolded, was provided.

Questionnaires were mailed directly to each respondent. Three weeks later, a follow-up letter (appendix F) was mailed. The purpose of the follow-up letter was to increase the response rate. The returned answer sheets were scored by AFHRL/MOE. Computerized data analysis was done by the 1973d Communications Squadron Data Automation Division at Maxwell AFB, Alabama, using the Statistical Package for the Social Sciences (SPSS). This analysis is discussed in chapter 4.

TABLE 4
Research Questions

INSTRUMENT	AUTHOR	TRAITS	CODE	NO. OF QUESTIONS
EPAQ	Helmreich	Assertiveness	M+	8
		Interpersonal Orientation	F+	8
		Aggressiveness	M-F	8
		Hostility	M-	8
		Verbal Aggressiveness	Fva-	4
		Submissiveness	Fc-	4
		WOFQ	Helmreich	Mastery Motivation
		Work Motivation	Work	6
		Competitiveness	Comp	5
LOC	Reid-Ware	Self-control	SC	8
		Fatalism	Fat	12
MBTI	Myers-Briggs	Extroversion/ Introversion	EI	19
		Sensing/Intuition	SN	25
		Thinking/Feeling	TF	24
		Judging/Perception	JP	27
		Research Questions (not used in study)		31
		SD	Crowne-Marlowe	Social Desirability
BIO	Davis	Biographical Data	BIO	12
			TOTAL	250

The Statistical Treatment

The next step was selecting the statistical procedure to be used. Statistics are necessary to clarify the relationship between personality traits and performance at UPT. If UPT selectees had no variations in their personalities, there would be little interest in studying

personality and its relationship to flying performance. But individuals do have different personalities, and this researcher is interested in understanding this relationship.

Correlational research consists of collecting two sets of scores and comparing them by computing a correlation coefficient. This correlation coefficient can describe how effectively an individual's scores on one variable (e.g., personality test) can be used to predict success in another variable (e.g., UPT performance). Variables are categorized as either independent or dependent. The independent variables in this study are those personality traits listed in table 4. They are considered to be continuous variables. That is, for any particular trait measured, an individual's score can occur at any point along a continuum. On Helmreich's assertiveness scale, for example, it is possible to score anywhere between zero and 32; and all of Helmreich's trait scales are constructed in the same manner. On the other hand, the dependent variable in this study, performance at UPT, cannot be measured along a continuum. Performance is categorized as either pass or fail. This type of variable is called dichotomous. There are two types of dichotomies--artificial and true. In the case of the pass/fail dichotomy, classification is determined by an arbitrary score; pass/fail is therefore classified as an artificial dichotomy.

After the data were collected, the mean scores on personality scales of the pass group were compared with the mean scores of the fail group. The statistical treatment used to analyze the data included multiple linear regression analysis and discriminant analysis. A more complete description of these processes can be found in chapter 4.

Research Concerns

In most survey-based research, it is critical to maximize the percentage of questionnaires returned because there may be differences between the respondent group and the nonrespondent group; that is, the data could be biased. But in the case of personality research, several studies have shown there is no significant difference in personality dimensions between responding and nonresponding groups.⁵ Therefore, with a response rate of approximately 50 percent, it is assumed that the data will not be biased.

Factors influencing response rate in this study include: (1) the questionnaire was lengthy in size (but took less than 45 minutes to complete in a pilot study); (2) some of the UPT selectees consider the use of personality in

selection processes to be controversial; (3) since all respondents had already been selected for UPT, they would probably not see the selection process as a contributing factor in UPT attrition; and (4) many eliminees did not participate for attitudinal reasons. Some of the respondents provided unsolicited feedback that confirmed these response rate factors. An additional restriction on this research effort was time limitation: only nine months were available while UPT takes 12 months to complete. Therefore, time did not permit a predictive validity study.

A final limitation is the use of pass/fail as the UPT performance criterion. A more precise relationship between variables could be determined if a continuous variable were used.⁶ But UPT class standing is not available and students do not receive an overall numerical score. Therefore, the only possible determinant for success at UPT was pass/fail.

Notes

1. Air Training Command, Major Changes in Pilot Training 1939-1984, Historical Research Paper (Randolph AFB, Tex.: ATC, History and Research Office, 1984), 23.

2. Grover Diehl, "Profile of AFROTC Pilot Designees," staff study (Maxwell AFB, Ala.: AFROTC/XPX, 1987).

3. Walter R. Borg and Meredith D. Gall, Educational Research: An Introduction (New York: David McKay Company, Inc., 1976), 289.

4. Ibid., 123.

5. Carson M. Bennett and Robert E. Hill, "A Comparison of Selected Personality Characteristics of Responders and Nonresponders to a Mailed Questionnaire Study," Journal of Educational Research 58, no. 4 (December 1964); R. G. Cope, "Nonresponse in Survey Research as a Function of Psychological Characteristics and Time of Response," Journal of Experimental Psychology 36 (1968); D. L. Thistlewaite and Norman Wheeler, "Effects of Teacher and Peer Subcultures upon Student Aspirations," Journal of Educational Psychology 57 (1966).

6. Borg and Gall, 329.

CHAPTER 4

FINDINGS

One major purpose of this chapter is to report the results of the research questionnaire and identify major findings. Another major purpose is to relate the results to the hypotheses stated in chapter 1 and to prior research.

The Respondents

Questionnaires were mailed out to 1,648 UPT attendees. Almost 100 of the questionnaire packages were returned as undeliverable. An assumption was then made that 1,550 attendees received the questionnaire. Of these, 732 returned answer sheets--a return rate of 47 percent. Sixty-six answer sheets had more than two blocks left blank and were not used. Thus, a total of 666 answer sheets were used for analysis purposes.

Of major importance to this study is the degree to which the respondents represent the sample surveyed. Any unique subgroup electing not to respond could bias the results. Fortunately, the profiles of the respondents were very close to those of the sample population. The percentages of males versus females, passes versus fails, and reasons for failures are comparable (figs. 4, 5, and 6). Additional information on the respondent group is shown in appendixes G, H, I, and J.

The Data

Mean scores and standard deviations revealed no significant differences in the 15 personality scales measured (table 5). There were small differences in the assertiveness, extroversion/introversion, and sensing/intuition scales. But these differences, even though statistically significant at the .01 level, were unusable because their correlation with success at UPT was extremely small. For example, a variable with a correlation factor of .20 indicates that only four percent (.20 squared) of the variance in pass/fail can be attributed to that variable. The highest single correlation obtained here was .13, which accounts for less than two percent of the variance in pass/fail. Correlations less than .35 have no value in either individual or group prediction.¹

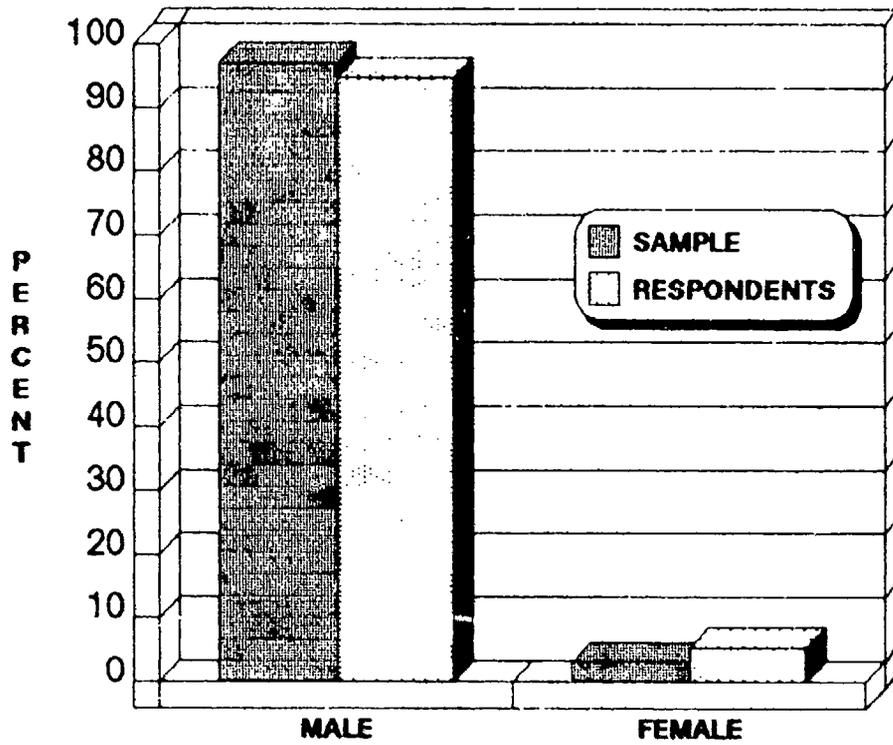


Figure 4. Male/Female Comparison of Respondent Group with Sample.

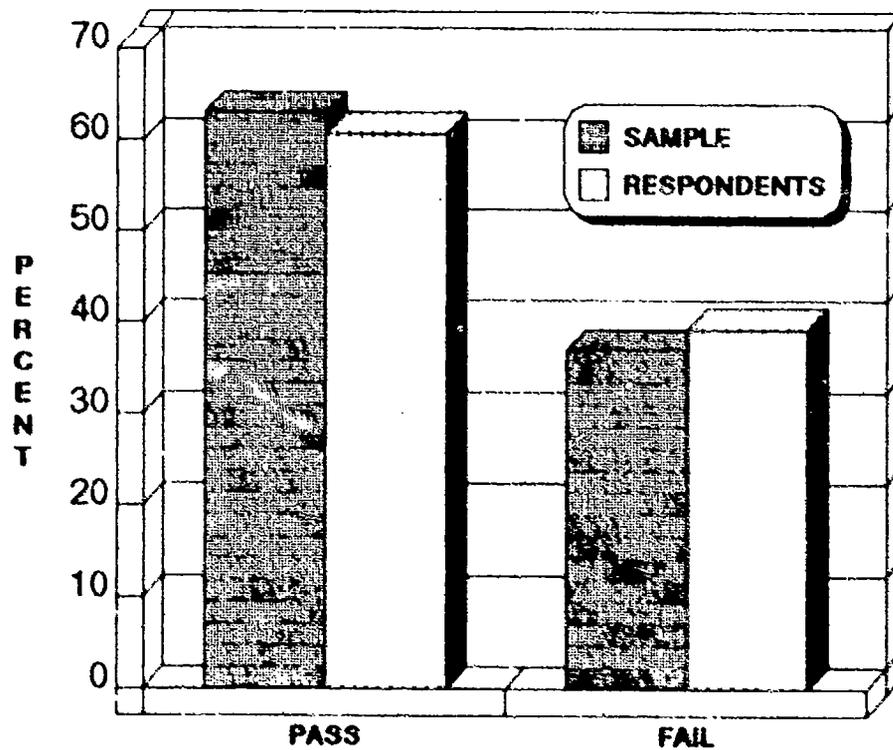


Figure 5. Pass/Fail Comparison of Respondent Group with Sample.

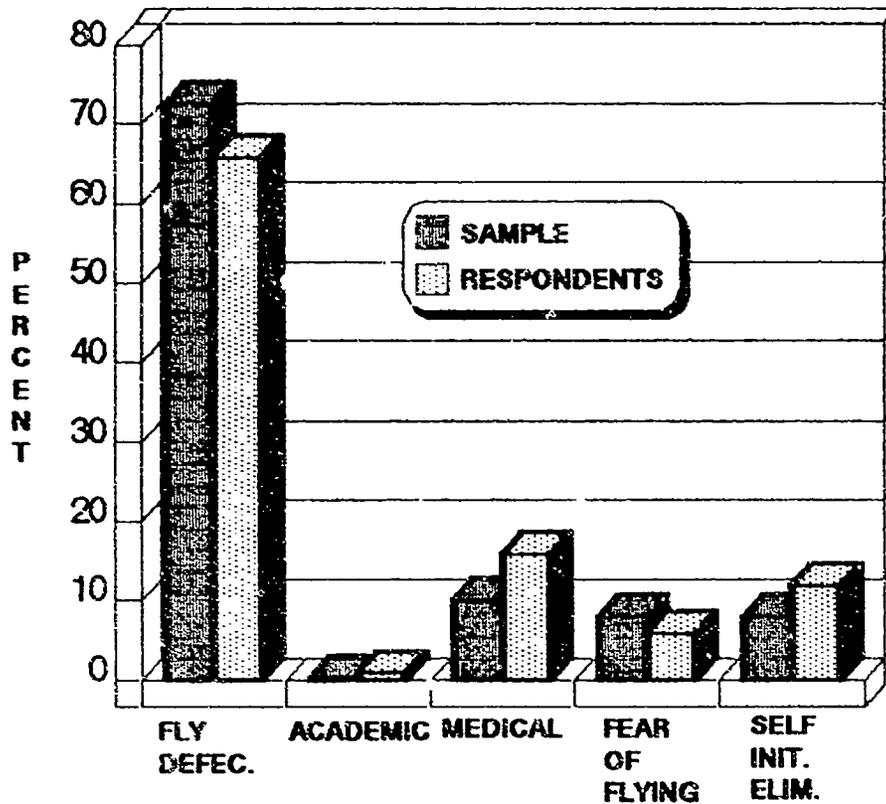


Figure 6. Reason for Fail Comparison of Respondent Group with Sample.

That the correlations of .13, -.11, and .10 were significant means only that the relationships found, however, slight, did not occur by chance; that is, the relationships are "real." That the relationships found were extremely slight means that they have no predictive value, however, "real" they may be.

But it is possible to determine if the combined effect of these variables would yield a higher correlation using multilinear regression analysis. The results of this statistical procedure (table 6) were only slightly more encouraging than those referenced in table: A correlation of .23 was found, still of little value for either group or individual prediction.

TABLE 5

Correlation of Personality Traits to Success in UPT

Trait Scale	PASS		FAIL		PEARSON R***
	Mean	SD	Mean	SD	
<u>EPAQ</u>					
Assertiveness (M+)	33.2	3.6	32.1	4.0	.13**
Interpersonal Orientation (F+)	29.3	3.8	29.8	4.0	-.06
Aggressiveness (M-F)	26.6	3.7	26.0	4.0	.07
Hostility (M-)	20.8	4.5	20.3	4.5	.06
Verbal Aggressiveness (Fva-)	9.0	2.7	9.1	2.7	-.02
Submissiveness (Fc-)	9.2	1.9	9.5	2.3	-.07
<u>WOFO</u>					
Mastery Motivation (Mast)	28.2	4.2	28.7	4.3	-.06
Work Motivation (Work)	27.0	2.8	27.2	2.7	-.02
Competitiveness (Comp)	19.6	3.2	19.2	3.4	.06
<u>LOC</u>					
Self-Control (SC)	27.3	3.6	27.4	3.6	-.01
Fatalism (Fat)	30.0	6.1	30.6	6.7	-.05
<u>MBTI</u>					
Extroversion/ Introversion (EI)	99.4	25.1	94.1	24.8	.10*
Sensing/Intuition (SN)	91.6	25.1	97.4	26.8	-.11*
Thinking/Feeling (TF)	74.3	21.4	74.9	22.0	-.01
Judging/Perceiving (JP)	90.9	26.8	90.4	27.7	.01
*** Correlation					
** Significance less than, or equal to, .001					
* Significance less than, or equal to, .010					

A third statistical procedure, discriminant analysis, builds a prediction formula using those variables that correlate significantly with the criterion variable (pass/fail). The data are then processed through this formula and its predictive value is compared to actual pass/fail. A summary of the results of this discriminant analysis is shown in table 7.

TABLE 6

Multiple Correlation of Personality Traits
with Success in UPT

VARIABLE	R	MULTIPLE R*
Assertiveness (M+)	.13	.13
Extroversion/Introversion (EI)	.07	.20
Mastery Motivation (Mast)	.03	.23

* Cumulative correlation

TABLE 7

Discriminant Analysis Prediction of
Success in UPT

PREDICTIONS	PASS (N=404)	FAIL (N=262)	TOTAL (N=666)
CORRECT	343	82	425 63.8%
INCORRECT	61	180	241 36.2%

The prediction formula correctly classified 63.8 percent of the respondents. Therefore, the probability of being correctly classified is .638. But since the percentage of those passing UPT in the sample used is 60.7, the probability that a given individual will successfully complete UPT--without using this formula--is .607. Therefore, it is again apparent that the personality traits selected would offer little improvement to the UPT selection system. Both research hypotheses postulated in chapter 1 must therefore be rejected.

The Implications

This study has shown that even though three of the 15 traits revealed differences between the two groups, the correlations between these three traits and success in UPT were minimal and could not be used to successfully predict pass/fail.

The findings are similar to those of past studies. There are virtually no differences in personality as measured by the research questionnaire used in this study: On the 15 personality traits measured, the mean scores of the pass and fail groups were almost identical.

This research effort is not totally without positive recommendations, however. I feel that the MBTI shows promise--not as a selection device but as an aid to learning in the UPT environment. According to Powers,

adult learners come to the . . . flight training environment with different personality types and differences in preferred learning styles. Since no objective indicator has been identified to aid in the personalization and individualization of flight instruction; many . . . flight instructors have been using trial and error in adapting curriculum and teaching techniques to their students.

The identification and use of an indicator--an objective measurement instrument--that would profile a student's preferred learning style would aid the instructor to individualize instruction in a more effective and efficient manner.²

A suggestion for future research is a study on whether use of the MBTI in the UPT environment would improve the relationship between student and instructor.

As for the UPT selection process, I feel that ATC should assemble a single body to select candidates to attend UPT. The current system allows each commissioning source to devise its own selection process. Some commissioning sources are more successful at selecting candidates than others. With the implementation of the porta-bat and the AFOQT into a selection model, the overall attrition rate should decline.

The data collected for this study were voluminous and time did not permit statistical analysis beyond the scope of the problem as defined. Chapter 5 presents some data for possible analysis in the future.

Notes

1. Walter R. Borg and Meredith D. Gall, Educational Research: An Introduction (New York: David McKay Company, Inc., 1976), 359.

2. Alan C. Powers, "The Myers-Briggs Type Indicator as a Tool to Identify Flight Students' Learning Styles," Proceedings of the Second Symposium on Aviation Psychology (Columbus, Ohio: Ohio State University, 1983), 385.

CHAPTER 5

ADDITIONAL RESEARCH RECOMMENDATIONS

During the course of this research project, much valuable data were collected but not used. Due to time constraints, statistical analysis of this data was not possible. It is included in this chapter for possible future research implications. Areas recommended for further research include the relationship between biographical data and success at UPT and the relationships between biographical and personality data and whether a candidate was selected for the fighter/attack/reconnaissance (FAR) track, the tanker/transport/bomber (TTB) track, or failed UPT.

Biographical Data and Success at UPT

Table 8 presents the percentage of respondents in various categories: sex, grade point average, source of commission, intercollegiate sport participation, age at UPT entry, possession of a private pilot license, and total flying time at UPT entry. Some interesting correlations might develop from comparing percentages in these categories to the percentages of respondents who passed or failed. From the data in figure 7, for example, it is apparent that the percentage of those individuals participating in collegiate sports, having a private pilot license, and having more than 100 flying hours is higher in the pass group than in the fail group. These data should be statistically analyzed.

Biographical/Personality Data and FAR, TTB, or Fail

In the research questionnaire, successful candidates were asked whether they were selected for the FAR track or the TTB track. It is assumed that the FAR group includes those who finish at the top of their class, the TTB group includes those who finish in the middle of their class, and the remainder are the failures. This allows the respondents to be divided into three groups: the top graduates (FAR), the middle group (TTB), and the bottom group (Fail). Separating the groups allows for a comparison between the best and the failures, and between the FAR group and the TTB

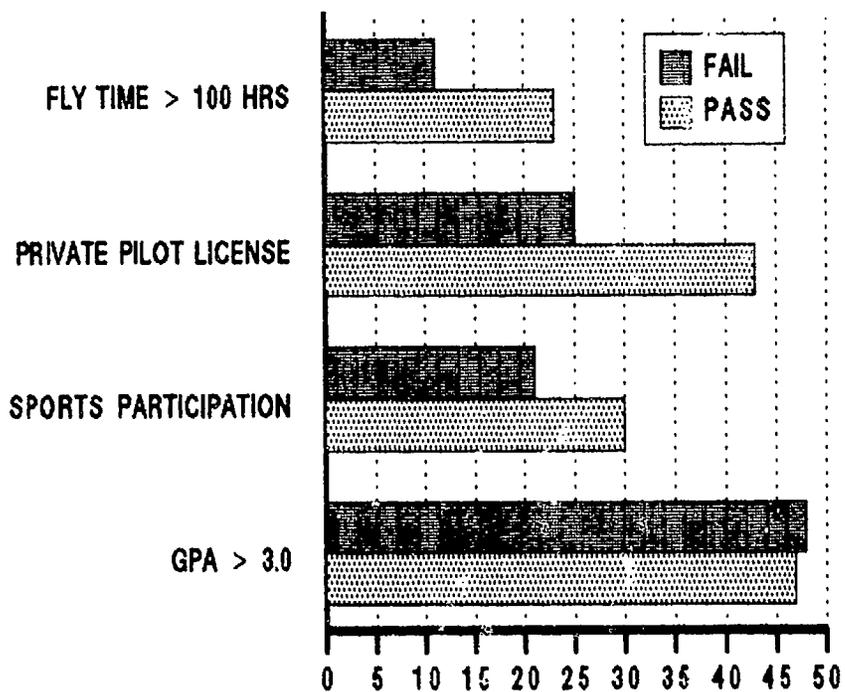


Figure 7. Pass/Fail Biographical Data.

group. Table 9 shows the differences in biographical data between these groups; figure 8 graphically depicts the biographical data in which the three groups differed the greatest. Table 10 presents both the mean scores and the standard deviations of the 15 personality scales used in this study; figure 9 graphically depicts the mean scores of the personality traits measured.

TABLE 8
Biographical Data and Success at UPT

Item	Pass N/%	Fail N/%
Respondents	401/60.4	263/39.6
Sex		
Male	383/60.9	246/39.1
Female	18/51.4	17/48.6
Grade Point Average		
2.00 to 2.49	36/ 9.0	31/11.8
2.50 to 2.99	152/37.9	105/39.9
3.00 to 3.49	162/40.4	84/31.9
3.50 to 4.00	51/12.7	43/16.3
Source of Commission		
OTS	147/36.7	77/29.3
AFROTC	194/48.4	128/48.7
USAFA	58/14.5	58/22.0
Sports Participation		
Yes	122/30.4	55/20.9
No	278/69.3	206/78.3
Age		
<22	149/37.2	96/36.5
23	89/22.2	61/23.2
24	48/12.0	38/14.4
25	44/11.0	30/11.4
>26	71/17.7	38/14.4
Private Pilot License		
Yes	171/42.6	65/24.7
No	230/57.4	198/75.3
Total Flying Time (hrs)		
0 to 20	179/44.6	139/52.9
21 to 40	40/10.0	57/21.7
41 to 100	90/22.4	37/14.1
101 or more	92/22.9	30/11.4

TABLE 9

Biographical Data and FAR, TTB, or Fail

Item	FAR N/%	TTB N/%	Fail N/%
Respondents	164/24.7	237/35.7	263/39.6
Sex			
Male	157/95.7	226/95.3	246/39.1
Female	7/ 4.3	11/ 4.7	17/48.6
Grade Point Average			
2.00 to 2.49	8/ 4.9	28/11.8	31/11.8
2.50 to 2.99	51/31.1	101/42.6	105/39.9
3.00 to 3.49	77/47.0	85/35.9	84/31.9
3.50 to 4.00	28/17.0	23/ 9.7	43/16.3
Source of Commission			
OTS	61/37.2	86/36.3	77/29.3
AFROTC	78/47.6	116/48.9	128/48.7
USAFA	24/14.6	34/14.3	58/22.0
Sports Participation			
Yes	59/36.0	63/26.6	55/20.9
No	104/63.4	174/73.4	206/78.3
Age			
<22	54/32.9	95/40.1	96/36.5
23	42/25.6	47/19.8	61/23.2
24	22/13.4	26/11.0	38/14.4
25	16/ 9.8	28/11.8	30/11.4
>26	30/18.3	41/17.3	38/14.4
Private Pilot License			
Yes	81/49.4	90/38.0	65/24.7
No	83/50.6	147/62.0	198/75.3
Total Flying Time (hrs)			
0 to 20	68/41.5	111/46.8	139/52.9
21 to 40	12/ 7.3	28/11.8	57/21.7
41 to 100	34/20.7	56/23.6	37/14.1
101 or more	50/30.5	42/17.7	30/11.4

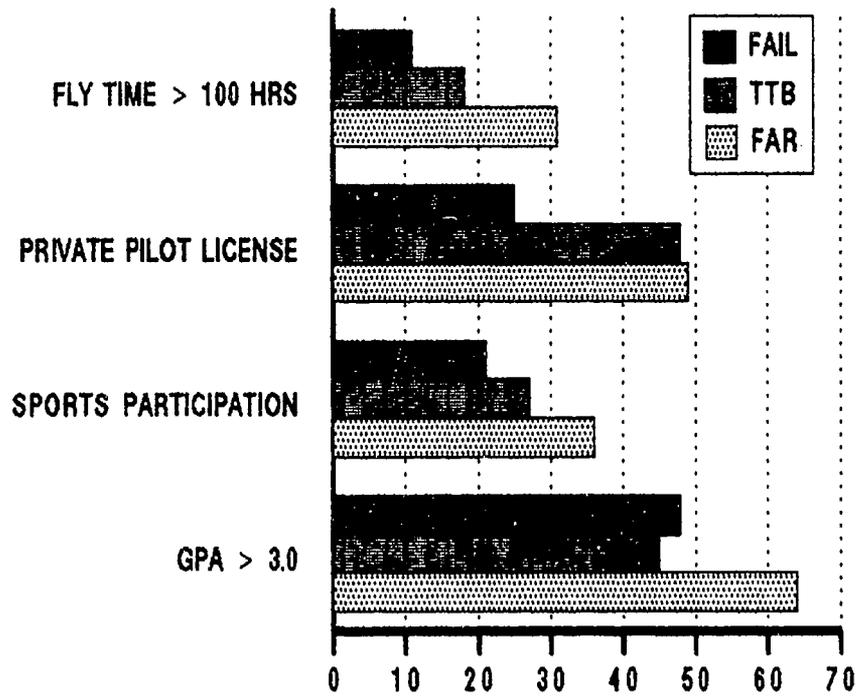


Figure 8. FAR/TTB/Fail Biographical Data.

TABLE 10

Personality Traits and FAR, TTB, or Fail

Trait Scale	FAR Mean/SD	TTB Mean/SD	Fail Mean/SD
<u>EPAQ</u>			
Assertiveness (M+)	33.9/3.4	32.6/3.6	32.1/4.0
Interpersonal Orientation (F+)	28.9/3.8	29.7/4.0	29.8/4.0
Aggressiveness (M-F)	26.9/3.5	26.3/3.7	26.0/4.0
Hostility (M-) Verbal	21.5/4.3	20.4/4.6	20.3/4.5
Aggressiveness (Fva-)	8.7/2.7	9.1/2.7	9.1/2.7
Submissiveness (Fc-)	9.1/1.8	9.3/2.0	9.5/2.3
<u>WOFO</u>			
Mastery Motivation (Mast)	28.5/3.9	28.0/4.3	28.7/4.3
Work Motivation (Work)	26.9/3.0	27.1/2.6	27.2/2.7
Competitiveness (Comp)	20.2/3.0	19.2/3.3	19.2/3.4
<u>LOC</u>			
Self-Control (SC)	27.2/3.5	27.4/3.6	27.4/3.6
Fatalism (Fat)	29.4/6.0	30.3/6.2	30.6/6.6
<u>MBTI</u>			
Extroversion/ Introversion (EI)	99.8/26.3	99.2/24.7	94.0/24.5
Sensing/Intuition (SN)	89.1/24.9	93.3/25.1	97.5/26.7
Thinking/Feeling (TF)	71.2/20.2	76.6/22.0	74.7/21.0
Judging/Perceiving (JP)	91.0/26.5	90.6/27.1	90.5/27.6

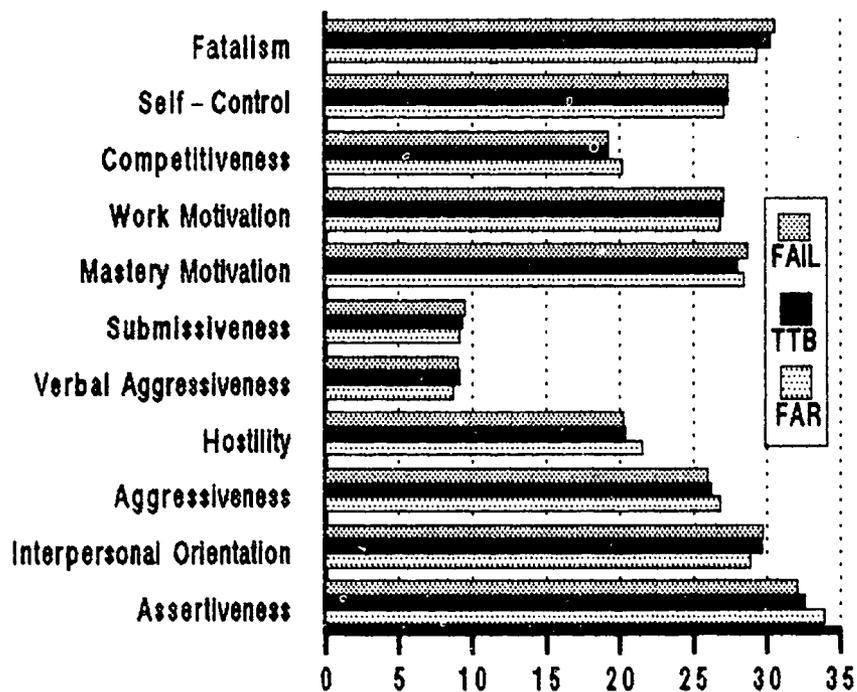


Figure 9. FAR/TTB/Fail and Personality Trait Mean Scores.

A P P E N D I X E S

APPENDIX A

POTENTIAL PREDICTORS OF STUDENT PILOT ATTRITION

Impact of Selected Variables on Attrition of AFROTC
Commissionees in Pilot Training

<u>Variable¹</u>	<u>Correlation</u>	<u>Percent of Impact²</u>	<u>Method of Measurement</u>
1. Sex	.0303	.09	PPMCC ³
2. Race	.0622	.39	ANOVA ⁴
3. SAT Verbal	-.0486	.24	PPMCC
4. SAT Math	.0635	.40	PPMCC
5. SAT Composite	.0090	.00	PPMCC
6. SAT Equivalent	.0226	.05	PPMCC
7. AFROTC Area	.0425	.18	ANOVA
8. Ethnic Group	.0972	.94	ANOVA
9. Academic Area	.0127	.02	ANOVA
10. Scholarship	.0588	.35	PPMCC
11. AFOQT AA	.0431	.19	PPMCC
12. AFOQT PI	.1646*	2.71	PPMCC
13. AFOQT NA	.1585*	2.51	PPMCC
14. AFOQT VE	-.0524	.27	PPMCC
15. AFOQT QU	.1501*	2.25	PPMCC
16. Times Tested	-.0818	.67	PPMCC
17. Pvt Pilot Lic	.0367	.13	PPMCC
18. Det Comdr Rtnng	.0570	.32	PPMCC
19. Grade Pt Avg	.0674	.45	PPMCC
20. Cadet Rank	.0369	.14	PPMCC
21. Compl Calculus	.0343	.12	PPMCC
22. Select QIS	.0364	.13	PPMCC
23. Fld Tng Rtnng	-.0986*	.97	PPMCC
24. No. FT Awards	.0502	.25	PPMCC
25. Marriage	.0393	.15	PPMCC
26. No. Deps (Home)	.0327	.11	PPMCC
27. No. Deps (Total)	.0282	.08	PPMCC
28. FT Athlete Awd	.0166	.03	PPMCC
29. Age	-.0527	.27	Point ⁵
30. Det Production	-.0012	.00	PPMCC
31. HBI Sch	-.0211	NA	r-phi ⁶
32. Military Sch	.0422	NA	r-phi

*Statistically significant at the .05 level.

1. Data for variables 1 through 28 were obtained from a report which did not consider medical attritions as failures; there were 130 medical attritions during 1983-85. For variables 29 to 32 medical attritions are added into the failures count. While this causes minor fluctuations in the counts, it has little effect on proportions and outcome of statistical tests.

2. Percent of impact is the square of the correlation coefficient (i.e., coefficient of determination for PPMCC and point-biserial, and chi-squared for ANOVA).

3. PPMCC--Pearson product moment correlation coefficient used.

4. ANOVA--analysis of variance used (degrees of freedom are not shown).

5. Point--point-biserial correlation used.

6. r-phi--phi correlation used.

Maximum Effect of a Combination of Variables
on Prediction of Pass/Fail among AFROTC Commissionees
in Pilot Training
(Best Fit Model)

<u>Variable</u>	<u>Cumulative Correlation</u>	<u>Cumulative Effect</u>
1. AFOQT PI	.16045	2.57%
2. AFOQT VE	.19186	3.68%
3. AFOQT QU	.21979	4.83%
4. Fld Tng Rtnng	.23247	5.40%

APPENDIX B

RESEARCH QUESTIONS

EPAQ

ASSERTIVENESS (M+)

- | | | |
|------|----------------------------------|------------------------------------|
| 141. | Not at all independent | Very independent |
| 147. | Very passive | Very active |
| 154. | Not at all competitive | Very competitive |
| 164. | Can make decisions
easily | Has difficulty
making decisions |
| 166. | Give up very easily | Never give up easily |
| 169. | Not at all self-confident | Very self-confident |
| 171. | Feel very inferior | Feel very superior |
| 178. | Goes to pieces under
pressure | Stands up well under
pressure |

INTERPERSONAL ORIENTATION (F+)

- | | | |
|------|--|---|
| 143. | Not at all emotional | Very emotional |
| 149. | Not at all able to devote
self completely to others | Able to devote self
completely to others |
| 151. | Very rough | Very gentle |
| 153. | Not at all helpful to others | Very helpful to others |
| 158. | Not at all kind | Very kind |
| 163. | Not at all aware of
feelings of others | Very aware of
feelings of others |
| 173. | Not at all understanding
of others | Very understanding of
others |
| 174. | Very cold in relations
with others | Very warm in relations
with others |

AGGRESSIVENESS (M-F)

- | | | |
|------|--|--|
| 139. | Not at all aggressive | Very aggressive |
| 144. | Very submissive | Not at all submissive |
| 146. | Not at all excitable
in a <u>major</u> crisis | Very excitable
in a <u>major</u> crisis |
| 156. | Very home oriented | Very worldly |
| 159. | Indifferent to
others' approval | Highly needful of
others' approval |
| 161. | Feelings not easily hurt | Feelings easily hurt |
| 168. | Never cries | Cries very easily |
| 176. | Very little need for
security | Very strong need for
security |

D. HOSTILITY (M-)

142.	Not at all arrogant	Very arrogant
145.	Very boastful	Not at all boastful
148.	Not at all egotistical	Very egotistical
157.	Very greedy	Not at all greedy
160.	Very dictatorial	Not at all dictatorial
167.	Very cynical	Not at all cynical
170.	Do not only look out for self; principled	Look out only for self; unprincipled
172.	Not at all hostile	Very hostile

E. VERBAL AGGRESSIVENESS (Fva-)

140.	Very whiny	Not very whiny
152.	Not at all complaining	Very complaining
162.	Don't nag	Nag a lot
165.	Very fussy	Not at all fussy

F. SUBMISSIVENESS (Fc-)

150.	Not at all spineless	Very spineless
155.	Subordinate self to others	Never subordinate self to others
175.	Very servile	Not at all servile
177.	Not at all gullible	Very gullible

WOFO

A. MASTERY MOTIVATION (Mast)

180. I would rather do something at which I feel confident than something which is challenging and difficult.
188. When a group I belong to plans an activity, I would rather direct it myself than just help out and let someone else organize it.
192. I would rather learn easy fun games than difficult thought games.
200. If I am not good at something, I would rather keep struggling to master it than move on to something I may be good at.
204. Once I undertake a task, I persist.

- 208. I prefer to work in situations that require a high level of skill.
- 216. I more often attempt tasks that I am not sure I can do than tasks that I believe I can do.
- 224. I like to be busy all the time.

B. WORK MOTIVATION (Work)

- 232. It is important for me to do my work as well as I can, even if it is not popular with my coworkers.
- 236. I find satisfaction in working as well as I can.
- 240. There is satisfaction in a job well done.
- 244. I find satisfaction in exceeding my previous performance, even if I don't outperform others.
- 246. I like to work hard.
- 248. Part of my enjoyment in doing things is to improve my past performance.

C. COMPETITIVENESS (Comp)

- 184. I enjoy working in situations involving competition with others.
- 196. It is important for me to perform better than others on a particular task.
- 212. I feel that winning is important in both work and games.
- 220. It annoys me when other people perform better than I do.
- 228. I try harder when I am in competition with other people.

LOC

A. SELF-CONTROL (SC)

182. Even when there is nothing forcing me, I have found that I will sometimes do things I really did not want to do.
186. I find that I can keep my impulses in control.
190. There are moments when I cannot subdue my emotions and keep them in check.
194. If they want to, people can always control their immediate wishes and not let these motives determine their total behavior.
198. It is possible for me to behave in a manner very different from the way I want to behave.
202. I frequently find that when something happens to me, I can restrain my reaction.
206. When I make up my mind, I can always resist temptation and keep control of my behavior.
250. Although sometimes it is difficult, I can always restrain my immediate behavior.

B. FATALISM (Fat)

210. For the average person, getting a good job depends on being in the right place at the right time.
214. In my case, getting what I want has little or nothing to do with luck.
218. People do not realize how much they personally determine their own outcomes.
222. For any person, there is no such thing as luck.
226. With fate the way it is, many times I feel that I have little influence over the things that happen to me.
230. In most cases, I try not to depend on luck when I decide to do something.

234. Unfortunately, because of misfortune or bad luck, the average person's wealth often passes unrecognized no matter how hard he or she tries.
238. Quite often, one finds that what happens to people has no relation to what they do; what happens just happens.
242. Sometimes I do not understand how I can have such bad luck.
245. People's misfortunes result from the mistakes they make.
247. When I get a good job, it is always a result of my own ability and/or motivation.
249. I often realize that, despite my best efforts, some outcomes seem to happen as if fate planned it that way.

SOCIAL DESIRABILITY

179. Before voting, I always investigate the qualifications of all the candidates.
181. I never hesitate to go out of my way to help someone in trouble.
183. It is sometimes hard for me to go on with my work if I am not encouraged.
185. I have never intensely disliked anyone.
187. On occasion I have had doubts about my ability to succeed in life.
189. I sometimes feel resentful when I don't get my own way.
191. I am always careful about my manner of dress.
193. My table manners are as good at home as when I eat in a restaurant.
195. If I could get into a movie without paying and be sure I was not seen, I would probably do it.
197. On a few occasions, I have given up doing something because I thought too little of my ability.

199. I like to gossip at times.
201. There have been times when I felt like rebelling against people in authority even though I knew they were right.
203. No matter who I am talking to, I am always a good listener.
205. I can remember "playing sick" to get out of something.
207. There have been occasions when I have taken advantage of someone.
209. I'm always willing to admit it when I make a mistake.
211. I always try to practice what I preach.
213. I don't find it particularly difficult to get along with loudmouthed, obnoxious people.
215. I sometimes try to get even rather than forgive and forget.
217. When I don't know something, I don't at all mind admitting it.
219. I am always courteous, even to people who are disagreeable.
221. At times, I have really insisted on having things my own way.
223. There have been occasions when I have felt like smashing things.
225. I would never think of letting someone else be punished for my wrongdoings.
227. I never resent being asked to return a favor.
229. I have never been irked when people expressed ideas very different from my own.
231. I never make a long trip without checking the safety of my car.
233. There have been times when I have been quite jealous of the good fortunes of others.
235. I have almost never had the urge to tell someone off.

237. I am sometimes irritated by people who ask favors of me.
239. I have never felt that I have been punished without cause.
241. I sometimes think that when people have a misfortune, they only got what they deserved.
243. I have never deliberately said something that hurt someone's feelings.

***RESEARCH
QUESTIONNAIRE***

Col Roy A. Davis

Airpower Research Institute

Maxwell Air Force Base AL
36112

Survey Control Number USAF SCN 87 – 115

Part II of this questionnaire is reproduced by special permission of the publisher, Consulting Psychologists Press, Inc., CA 94306, from Myers-Briggs Type Indicator, Form G. Further reproduction is prohibited without the publisher's consent.

DIRECTIONS

This test consists of three parts. The first part asks questions about your background and pilot training; the second part is the Myers-Briggs Type Indicator; and the last part is a test developed by the Air Force Human Resources Laboratory. Please follow the directions at the beginning of each part.

PART I

Read each question carefully and mark your answer on the answer sheet.

1. What is your sex?
(A) Male
(B) Female
2. What is your cumulative college grade point average (approximate A=4.00 scale)?
(A) 3.50 - 4.00
(B) 3.00 - 3.49
(C) 2.50 - 2.99
(D) 2.00 - 2.49
3. What is your source of commission?
(A) OTS
(B) AFROTC
(C) AFA
4. Did you compete in intercollegiate sports in college?
(A) yes
(B) no
5. What was your age when you entered pilot training?
(A) 22 or younger
(B) 23
(C) 24
(D) 25
(E) 26 or older
6. Did you have a private pilots license when you entered pilot training?
(A) yes
(B) no
7. What was your total flying time when you entered pilot training?
(A) 0 - 20 hours
(B) 21 - 40 hours
(C) 41 - 100 hours
(D) 101 hours or more
8. Did you graduate from pilot training?
(A) yes
(B) no
9. If you did not graduate, what was the reason?
(A) not applicable - I graduated
(B) flying training
(C) academics
(D) medical
(E) SIE
(F) other
10. What is your current status?
(A) on active duty
(B) separated from the Air Force
11. Pilot training graduation category
(A) FAR
(B) TTB
(C) FAIP
(D) not applicable
12. Were you a volunteer for the above category?
(A) yes
(B) no
(C) not applicable

PART II
MYERS-BRIGGS TYPE INDICATOR
Form G

DIRECTIONS

There are no "right" or "wrong" answers to these questions. Your answers will help show how you like to look at things and how you like to go about deciding things.

Read each question carefully and mark your answer on the separate answer sheet. Do not think too long about any question. If you cannot decide on a question, skip it but be careful that the next space you mark on the answer sheet has the same number as the question you are then answering.

PART A

Which answer comes closer to telling how
you usually feel or act?

13. When you go somewhere for the day, would you rather
(A) plan what you will do and when, or
(B) just go?
14. If you were a teacher, would you rather teach
(A) fact course, or
(B) courses involving theory?
15. Are you usually
(A) a "good mixer," or
(B) rather quiet and reserved?
16. Do you prefer to
(A) arrange dates, parties, etc., well in advance, or
(B) be free to do whatever looks like fun when the time comes?
17. Do you usually get along better with
(A) imaginative people, or
(B) realistic people?
18. Do you more often let
(A) your heart rule your head, or
(B) your head rule your heart?
19. When you are with a group of people, would you rather
(A) join in the talk of the group, or
(B) talk with one person at a time?
20. Are you more successful
(A) at dealing with the unexpected and seeing quickly what should
be done, or
(B) at following out a carefully worked out plan?
21. Would you rather be considered
(A) a practical person, or
(B) an ingenious person
22. In a large group, do you more often
(A) introduce others, or
(B) get introduced?
23. Do you admire more the people who are
(A) conventional enough to never make themselves conspicuous, or
(B) too original and individual to care whether they are
conspicuous or not?
24. Does following a schedule
(A) appeal to you, or
(B) cramp your style?
25. Do you tend to have
(A) deep friendships with a very few people, or
(B) broad friendships with many different people?

26. Does the idea of making a list of what you should get done over a weekend
 (A) appeal to you, or
 (B) leave you cold, or
 (C) positively depress you?
27. Is it a higher compliment to be called
 (A) a person with real feeling, or
 (B) a consistently reasonable person?
28. Among your friends, are you
 (A) one of the last to hear what is going on, or
 (B) full of news about everybody?
- [On this next question only, if two answers are true, mark both]
29. In your daily work, do you
 (A) rather enjoy an emergency that makes you work against time, or
 (B) hate to work under pressure, or
 (C) usually plan your work so you won't need to work under pressure?
30. Would you rather have as a friend
 (A) someone who is always coming up with new ideas, or
 (B) someone who has both feet on the ground?
31. Do you
 (A) talk easily to anyone for as long as you have to, or
 (B) find a lot to say only to certain people or under certain conditions?
32. When you have a special job to do, do you like to
 (A) organize it carefully before you start, or
 (B) find out what is necessary as you go along?
33. Do you usually
 (A) value sentiment more than logic, or
 (B) value logic more than sentiment?
34. In reading for pleasure, do you
 (A) enjoy odd or original ways of saying things, or
 (B) like writers to say exactly what they mean?
35. Can the new people that you meet tell what you are interested in
 (A) right away, or
 (B) only after they really get to know you?
36. When it is settled well in advance that you will do a certain thing at a certain time, do you find it
 (A) nice to be able to plan accordingly, or
 (B) a little unpleasant to be tied down?
37. In doing something that many other people do, does it appeal to you more to
 (A) do it in the accepted way, or
 (B) invent a way of your own?
38. Do you usually
 (A) show your feelings freely, or
 (B) keep your feelings to yourself?

PART B

Which word in the pair appeals to you more?
 Think what the words mean, not how they look or how they sound.

39. (A) scheduled unplanned (B)
 40. (A) gentle firm (B)
 41. (A) facts ideas (B)
 42. (A) thinking feeling (B)
 43. (A) hearty quiet (B)
 44. (A) convincing touching (B)
 45. (A) statement concept (B)

46. (A) analyze sympathize (B)
47. (A) systematic spontaneous (B)
48. (A) justice mercy (B)
49. (A) reserved talkative (B)
50. (A) compassion foresight (B)
51. (A) systematic casual (B)
52. (A) calm lively (B)
53. (A) benefits blessings (B)
54. (A) theory uncertainty (B)
55. (A) determined devoted (B)
56. (A) literal figurative (B)
57. (A) firm-minded warm-hearted (B)
58. (A) imaginative matter-of-fact (B)
59. (A) peacemaker judge (B)
60. (A) make create (B)
61. (A) soft hard (B)
62. (A) sensible fascinating (B)
63. (A) forgive tolerate (B)
64. (A) production design (B)
65. (A) impulse decision (B)
66. (A) who what (B)
67. (A) speak write (B)
68. (A) uncritical critical (B)
69. (A) punctual leisurely (B)
70. (A) concrete abstract (B)
71. (A) changing permanent (B)
72. (A) wary trustful (B)
73. (A) build invent (B)
74. (A) orderly easygoing (B)
75. (A) foundation spire (B)
76. (A) quick careful (B)
77. (A) theory experience (B)
78. (A) sociable detached (B)
79. (A) sign symbol (B)
80. (A) party theater (B)
81. (A) accept change (B)
82. (A) agree disagree (B)
83. (A) known unknown (B)

PART C

Which answer comes closer to telling how you usually feel or act?

84. Would you say you
(A) get more enthusiastic about things than the average person, or
(B) get less enthusiastic about things than the average person?
85. Do you feel it is a worse fault to be
(A) unsympathetic, or
(B) unreasonable?
86. Do you
(A) rather prefer to do things at the last minute, or
(B) find doing things at the last minute hard on the nerves?
87. At parties, do you
(A) sometimes get bored, or
(B) always have fun?
88. Do you think that having a daily routine is
(A) a comfortable way to get things done, or
(B) painful even when necessary?
89. When something new starts to be the fashion, are you usually
(A) one of the first to try it, or
(B) not much interested?
90. When you think of some little things you should do or buy, do you
(A) often forget it till much later, or
(B) usually get it down on paper to remind yourself, or
(C) always carry through on it without reminders?
91. Are you
(A) easy to get to know, or
(B) hard to get to know?
92. In your way of living, do you prefer to be
(A) original, or
(B) conventional?
93. When you are in an embarrassing spot, do you
(A) change the subject, or
(B) turn it into a joke, or
(C) days later, think of what you should have said?
94. Is it harder for you to adapt to
(A) routine, or
(B) constant change?
95. Is it higher praise to say someone has
(A) vision, or
(B) common sense?
96. When you start a big project that is due in a week, do you
(A) take time to list the separate things to be done and the order of doing them, or
(B) plunge in?
97. Do you think it more important to be able
(A) to see the possibilities in a situation, or
(B) to adjust to the facts as they are?
98. Do you think the people close to you know how you feel
(A) about most things, or
(B) only when you have had some special reason to tell them?
99. Would you rather work under someone who is
(A) always kind, or
(B) always fair?
100. In getting a job done, do you depend on
(A) starting early, so as to have plenty of time to spare
(B) the extra speed you develop at the last minute?
101. Do you feel it is a worse fault
(A) to show too much warmth, or
(B) not to have warmth enough?

102. When you are at a party, do you like to
 (A) help get things going, or
 (B) let the others have fun in their own way?
103. Would you rather
 (A) support the established methods of doing good, or
 (B) analyze what is still wrong and attack unsolved problems?
104. Are you more careful about
 (A) people's feelings, or
 (B) their rights?
105. If you were asked on a Saturday morning what you were going to do that day, would you
 (A) be able to tell pretty well, or
 (B) list twice too many things, or
 (C) have to wait and see?
106. In deciding something important, do you
 (A) find you can trust your feeling on what is best to do, or
 (B) think you should do the logical thing, no matter how you feel about it?
107. Do you find the more routine parts of your day
 (A) restful, or
 (B) boring?
108. Does the importance of doing well on a test make it generally
 (A) easier for you to concentrate and do your best, or
 (B) harder for you to concentrate and do yourself justice?
109. Are you
 (A) inclined to enjoy deciding things, or
 (B) just as glad to have circumstances decide a matter for you?
110. In listening to a new idea, are you more anxious to
 (A) find out all about it, or
 (B) judge whether it is right or wrong?
111. In any of the ordinary emergencies of everyday life, would you rather
 (A) take orders and be helpful, or
 (B) give orders and be responsible?
112. After being with superstitious people, have you
 (A) found yourself slightly affected by their superstitions, or
 (B) remained entirely unaffected?
113. Are you more likely to speak up in
 (A) praise, or
 (B) blame?
114. When you have a decision to make, do you usually
 (A) make it right away, or
 (B) wait as long as you reasonably can before deciding?
115. At the time in your life when things piled up on you the worst, did you find
 (A) that you had gotten into an impossible situation, or
 (B) that by doing only the necessary things you could work your way out?
116. Out of all the good resolutions you may have made, are there
 (A) some you have kept to this day, or
 (B) none that have really lasted?
117. In solving a personal problem, do you
 (A) feel more confident about it if you have asked other people's advice, or
 (B) feel that nobody else is in as good a position to judge as you are?
118. When a new situation comes up which conflicts with your plans, do you try first to
 (A) change your plans to fit the situation, or
 (B) change the situation to fit your plans?

119. Are such emotional "ups and downs" as you may feel
(A) very marked, or
(B) rather moderate?
120. In your personal beliefs, do you
(A) cherish faith in things that cannot be proved, or
(B) believe only those things that can be proved?
121. In your home life, when you come to the end of some undertaking, are you
(A) clear as to what comes next and ready to tackle it, or
(B) glad to relax until the next inspiration hits you?
122. When you have a chance to do something interesting, do you
(A) decide about it fairly quickly, or
(B) sometimes miss out through taking too long to make up your mind?
123. If a breakdown or mix-up halted a job on which you and a lot of others were working, would your impulse be to
(A) enjoy the breathing spell, or
(B) look for some part of the work where you could still make progress, or
(C) join the "trouble-shooters" in wrestling with the difficulty?
124. When you don't agree with what has just been said, do you usually
(A) let it go, or
(B) put up an argument?
125. On most matters, do you
(A) have a pretty definite opinion, or
(B) like to keep an open mind?
126. Would you rather have
(A) an opportunity that may lead to bigger things, or
(B) an experience that you are sure to enjoy?
127. In managing your life, do you tend to
(A) undertake too much and get into a tight spot, or
(B) hold yourself down to what you can comfortably handle?
128. When playing cards, do you enjoy most
(A) the sociability, or
(B) the excitement of winning,
(C) or don't you enjoy playing cards?
129. When the truth would not be polite, are you more likely to tell
(A) a polite lie, or
(B) the impolite truth?
130. Would you be more willing to take on an extra load of work for the sake of
(A) extra comforts and luxuries, or
(B) a chance to achieve something important?
131. When you don't approve of the way a friend is acting, do you
(A) wait and see what happens, or
(B) do or say something about it?
132. Has it been your experience that you
(A) often fall in love with a notion or project that turns out to be a disappointment - so that you "go up like the rocket and down like the stick", or do you
(B) use enough judgement on your enthusiasm so that it does not let you down?
133. When you have a serious choice to make, do you
(A) almost always come to a clear-cut decision, or
(B) sometimes find it so hard to decide that you do not wholeheartedly follow up on either choice?
134. Do you usually
(A) enjoy the present moment and make the most of it, or
(B) feel that something ahead is more important?
135. When you are helping in a group undertaking, are you more often struck by
(A) the cooperation, or
(B) the inefficiency,
(C) or don't you get involved in group undertakings?

136. When you run into an unexpected difficulty in something you are doing well, do you feel it to be
 (A) a piece of bad luck, or
 (B) a nuisance, or
 (C) all in the 'day's work?
137. Which mistake would be more natural for you:
 (A) to drift from one thing to another all your life, or
 (B) to stay in a rut that didn't suit you?
138. Would you have liked to argue the meaning of
 (A) a lot of these questions, or
 (B) only a few?

PART III

PERSONALITY ATTRIBUTE INDICATOR

PART A

DIRECTIONS

The following questions ask about what kind of person you think you are. Each question consists of a pair of contradictory characteristics. Choose a letter, "A" through "E", to describe where you fall on the scale. A sample scale follows:

Not at all artistic					Very artistic	
A	B	C	D	E		
not artistic	slightly artistic	somewhat artistic	moderately artistic	very artistic		

You would answer "A" if you were not very artistic, "E" if you were very artistic, or "C" if you were somewhat artistic. Please answer all questions, even if you are not sure how you feel.

- | | | | | | |
|------|---|---|---|--|---|
| 139. | Not at all aggressive | | | Very aggressive | |
| | A | B | C | D | E |
| 140. | Very whiny | | | Not very whiny | |
| | A | B | C | D | E |
| 141. | Not at all independent | | | Very independent | |
| | A | B | C | D | E |
| 142. | Not at all arrogant | | | Very arrogant | |
| | A | B | C | D | E |
| 143. | Not at all emotional | | | Very emotional | |
| | A | B | C | D | E |
| 144. | Very submissive | | | Not at all submissive | |
| | A | B | C | D | E |
| 145. | Very boastful | | | Not at all boastful | |
| | A | A | C | D | E |
| 146. | Not at all excitable
in a <u>major</u> crisis | | | Very excitable
in a <u>major</u> crisis | |
| | A | B | C | D | E |
| 147. | Very passive | | | Very active | |
| | A | B | C | D | E |
| 148. | Not at all egotistical | | | Very egotistical | |
| | A | B | C | D | E |
| 149. | Not at all able to devote
self completely to
others | | | Able to devote
self completely to
others | |
| | A | B | C | D | E |
| 150. | Not at all spineless | | | Very spineless | |
| | A | B | C | D | E |
| 151. | Very rough | | | Very gentle | |
| | A | B | C | D | E |

152.	Not at all complaining A B C		Very complaining D E
153.	Not at all helpful to others A B C		Very helpful to others D E
154.	Not at all competitive A B C		Very competitive D E
155.	Subordinate self to others A B C		Never subordinate self to others D E
156.	Very home oriented A B C		Very worldly D E
157.	Very greedy A B C		Not at all greedy D E
158.	Not at all kind A B C		Very kind D E
159.	Indifferent to others' approval A B C		Highly needful of others' approval D E
160.	Very dictatorial A B C		Not at all dictatorial D E
161.	Feelings not easily hurt A B C		Feelings easily hurt D E
162.	Don't nag A B C		Nag a lot D E
163.	Not at all aware of feelings of others A B C		Very aware of feelings of others D E
164.	Can make decisions easily A B C		Has difficulty making decisions D E
165.	Very fussy A B C		Not at all fussy D E
166.	Give up very easily A B C		Never give up easily D E
167.	Very cynical A B C		Not at all cynical D E
168.	Never cries A B C		Cries very easily D E
169.	Not at all self-confident A B C		Very self-confident D E
170.	Do not only look out for self; principled A B C		Look out only for self; unprincipled D E
171.	Feel very inferior A B C		Feel very superior D E
172.	Not at all hostile A B C		Very hostile D E
173.	Not at all understanding of others A B C		Very understanding of others D E
174.	Very cold in relations with others A B C		Very warm in relations with others D E
175.	Very servile A B C		Not at all servile D E
176.	Very little need for security A B C		Very strong need for security D E

- | | | | | | |
|------|-------------------------------|---|---|-------------------------------|---|
| 177. | Not at all gullible | | | Very gullible | |
| | A | B | C | D | E |
| 178. | Goes to pieces under pressure | | | Stands up well under pressure | |
| | A | B | C | D | E |

PART III

PERSONALITY ATTRIBUTE INDICATOR

PART B

DIRECTIONS

The following items describe reactions to conditions of work and challenging situations. Use the scale below to indicate how much you agree or disagree with each statement. The scale below will appear at the top of each page.

- | | A | B | C | D | E |
|------|--|----------------|----------------------------|-------------------|-------------------|
| | strongly agree | slightly agree | neither agree nor disagree | slightly disagree | strongly disagree |
| 179. | Before voting, I always investigate the qualifications of all the candidates. | | | | |
| 180. | I would rather do something at which I feel confident than something which is challenging and difficult. | | | | |
| 181. | I never hesitate to go out of my way to help someone in trouble. | | | | |
| 182. | Even when there is nothing forcing me, I have found that I will sometimes do things I really did not want to do. | | | | |
| 183. | It is sometimes hard for me to go on with my work if I am not encouraged. | | | | |
| 184. | I enjoy working in situations involving competition with others. | | | | |
| 185. | I have never intensely disliked anyone. | | | | |
| 186. | I find that I can keep my impulses in control. | | | | |
| 187. | On occasion I have had doubts about my ability to succeed in life. | | | | |
| 188. | When a group I belong to plans an activity, I would rather direct it myself than just help out and let someone else organize it. | | | | |
| 189. | I sometimes feel resentful when I don't get my own way. | | | | |
| 190. | There are moments when I cannot subdue my emotions and keep them in check. | | | | |
| 191. | I am always careful about my manner of dress. | | | | |
| 192. | I would rather learn easy fun games than difficult thought games. | | | | |
| 193. | My table manners are as good at home as when I eat in a restaurant. | | | | |
| 194. | If they want to, people can always control their immediate wishes and not let these motives determine their total behavior. | | | | |
| 195. | If I could get into a movie without paying and be sure I was not seen, I would probably do it. | | | | |
| 196. | It is important for me to perform better than others on a particular task. | | | | |
| 197. | On a few occasions, I have given up doing something because I thought too little of my ability. | | | | |
| 198. | It is possible for me to behave in a manner very different from the way I want to behave. | | | | |
| 199. | I like to gossip at times. | | | | |
| 200. | If I am not good at something, I would rather keep struggling to master it than move on to something I may be good at. | | | | |

- | | A
strongly
agree | B
slightly
agree | C
neither agree
nor disagree | D
slightly
disagree | E
strongly
disagree |
|------|--|------------------------|------------------------------------|---------------------------|---------------------------|
| 201. | There have been times when I felt like rebelling against people in authority even though I knew they were right. | | | | |
| 202. | I frequently find that when something happens to me, I can restrain my reaction. | | | | |
| 203. | No matter who I am talking to, I am always a good listener. | | | | |
| 204. | Once I undertake a task, I persist. | | | | |
| 205. | I can remember "playing sick" to get out of something. | | | | |
| 206. | When I make up my mind, I can always resist temptation and keep control of my behavior. | | | | |
| 207. | There have been occasions when I have taken advantage of someone. | | | | |
| 208. | I prefer to work in situations that require a high level of skill. | | | | |
| 209. | I'm always willing to admit it when I make a mistake. | | | | |
| 210. | For the average person, getting a good job depends on being in the right place at the right time. | | | | |
| 211. | I always try to practice what I preach. | | | | |
| 212. | I feel that winning is important in both work and games. | | | | |
| 213. | I don't find it particularly difficult to get along with loudmouthed, obnoxious people. | | | | |
| 214. | In my case, getting what I want has little or nothing to do with luck. | | | | |
| 215. | I sometimes try to get even rather than forgive and forget. | | | | |
| 216. | I more often attempt tasks that I am not sure I can do than tasks that I believe I can do. | | | | |
| 217. | When I don't know something, I don't at all mind admitting it. | | | | |
| 218. | People do not realize how much they personally determine their own outcomes. | | | | |
| 219. | I am always courteous, even to people who are disagreeable. | | | | |
| 220. | It annoys me when other people perform better than I do. | | | | |
| 221. | At times, I have really insisted on having things my own way. | | | | |
| 222. | For any person, there is no such thing as luck. | | | | |
| 223. | There have been occasions when I have felt like smashing things. | | | | |
| 224. | I like to be busy all the time. | | | | |
| 225. | I would never think of letting someone else be punished for my wrongdoings. | | | | |
| 226. | With fate the way it is, many times I feel that I have little influence over the things that happen to me. | | | | |
| 227. | I never resent being asked to return a favor. | | | | |
| 228. | I try harder when I am in competition with other people. | | | | |
| 229. | I have never been irked when people expressed ideas very different from my own. | | | | |
| 230. | In most cases, I try not to depend on luck when I decide to do something. | | | | |
| 231. | I never make a long trip without checking the safety of my car. | | | | |
| 232. | It is important for me to do my work as well as I can, even if it is not popular with my coworkers. | | | | |
| 233. | There have been times when I have been quite jealous of the good fortunes of others. | | | | |

- | | A | B | C | D | E |
|------|---|-------------------|-------------------------------|----------------------|----------------------|
| | strongly
agree | slightly
agree | neither agree
nor disagree | slightly
disagree | strongly
disagree |
| 234. | Unfortunately, because of misfortune or bad luck, the average person's wealth often passes unrecognized no matter how hard he or she tries. | | | | |
| 235. | I have almost never had the urge to tell someone off. | | | | |
| 236. | I find satisfaction in working as well as I can. | | | | |
| 237. | I am sometimes irritated by people who ask favors of me. | | | | |
| 238. | Quite often, one finds that what happens to people has no relation to what they do; what happens just happens. | | | | |
| 239. | I have never felt that I have been punished without cause. | | | | |
| 240. | There is satisfaction in a job well done. | | | | |
| 241. | I sometimes think that when people have a misfortune, they only got what they deserved. | | | | |
| 242. | Sometimes I do not understand how I can have such bad luck. | | | | |
| 243. | I have never deliberately said something that hurt someone's feelings. | | | | |
| 244. | I find satisfaction in exceeding my previous performance, even if I don't outperform others. | | | | |
| 245. | People's misfortunes result from the mistakes they make. | | | | |
| 246. | I like to work hard. | | | | |
| 247. | When I get a good job, it is always a result of my own ability and/or motivation. | | | | |
| 248. | Part of my enjoyment in doing things is to improve my past performance. | | | | |
| 249. | I often realize that, despite my best efforts, some outcomes seem to happen as if fate planned it that way. | | | | |
| 250. | Although sometimes it is difficult, I can always restrain my immediate behavior. | | | | |

THANKS VERY MUCH FOR YOUR TIME. I SINCERELY APPRECIATE
YOUR ASSISTANCE IN THIS RESEARCH PROJECT.

Appendix D



DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
CENTER FOR AEROSPACE DOCTRINE, RESEARCH, AND EDUCATION
MAXWELL AIR FORCE BASE, AL 36112-5532

REPLY TO
ATTN OF RIC

21 October 1987

SUBJECT Research Questionnaire

TO UPT Survey Participant

1. I have been selected by the Commander of the Air Training Command, Lt Gen John A. Shaud, to investigate the possibility of using psychological testing as part of the UPT pilot selection process. With overall attrition rates approaching 40 percent, a revision of the selection system is necessary. The attached questionnaire consists of questions selected from validated off-the-shelf tests and will take less than 45 minutes of your time.

2. This survey is your opportunity to influence the UPT selection process. Your response will remain anonymous. Please do not put your name or social security number on the answer sheet. Mark your answers with a number two pencil. When you have completed the questionnaire, please return it in the enclosed postage paid envelope with any comments you may have as soon as possible, but in any event, no later than 13 November 1987.

3. I sincerely appreciate your participation. If you would like any feedback on the results of this study please write or call (AV 875-5429) and let me know. Thanks again for your help.

A handwritten signature in cursive script that reads "Roy A. Davis".

ROY A. DAVIS, Colonel, USAF
Command Sponsored Research Fellow

1 Atch
Research Questionnaire

Appendix E

CONSULTING PSYCHOLOGISTS PRESS, INC.

577 College Ave. (P.O. Box 60070), Palo Alto, California 94306 (415) 857-1665

Roy A. Davis, Colonel, USAF
Department of the Air Force
Air University
Center for Aerospace Doctrine, Research
and Education
Maxwell Air Force Base, AL 36112-5532

In response to your request of October 2, 1987 permission is hereby granted you to
(Date)

reproduce approximately 1750 questionnaires containing the MBTI questions
for use in research you are conducting to determine the possibility of
using psychological testing as a part of the Air Force pilot selection
process, as per your letter to me,

subject to the following restrictions:

- (a) Any material used must contain the following credit lines:

"Reproduced by special permission of the Publisher, Consulting Psychologists Press, Inc.,
Palo Alto, CA 94306,
from Myers-Briggs Type Indicator, Form G
(publication)
XX
By (author)
Further reproduction is prohibited without the Publisher's consent."

- (b) None of the materials may be sold or used for purposes other than those mentioned above.
(c) One copy of any material reproduced will be sent to the Publisher.
(d) Payment of a reproduction fee of \$.20 x 1750 = \$350.00 is due. I have
given you a \$.05 per reproduction break off our usual permission fees.
(e) Enclosed are the scoring keys you requested. The total due for these
is \$11.50 + \$1.15 postage and handling = \$12.65. Thank you.

Please remit without further notice and mail to my attention. Be sure to identify material
for which payment is made.

CONSULTING PSYCHOLOGISTS PRESS, INC.

By Pamela Griffin Contracts Supervisor

Date 10/8/87

Appendix F



DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
CENTER FOR AEROSPACE DOCTRINE, RESEARCH, AND EDUCATION
MAXWELL AIR FORCE BASE, AL 36112-5532

REPLY TO
ATTN OF RIC

13 November 1987

SUBJECT Research Questionnaire

TO UPT Survey Participant

1. If you have recently completed my UPT research questionnaire, thanks very much. If you have not, let me provide you with some additional information.

a. The questionnaire was designed to be completed by both successful and unsuccessful UPT students.

b. Many of the world's best Air Forces, such as the Israeli, Danish and Swedish, currently use psychological testing as a part of their selection process.

c. The US Air Force used psychological testing for pilot selection up to approximately 10 years ago.

d. If psychological testing is again used for selection, it will most likely be a part of an integrated selection process also including motor skill testing and pilot aptitude testing.

2. If you have any additional concerns regarding the purpose of my research, please call (AV 875-5429). Your completed questionnaire is a vital input in determining the feasibility of using psychological testing as an integrated part of a future pilot selection process.

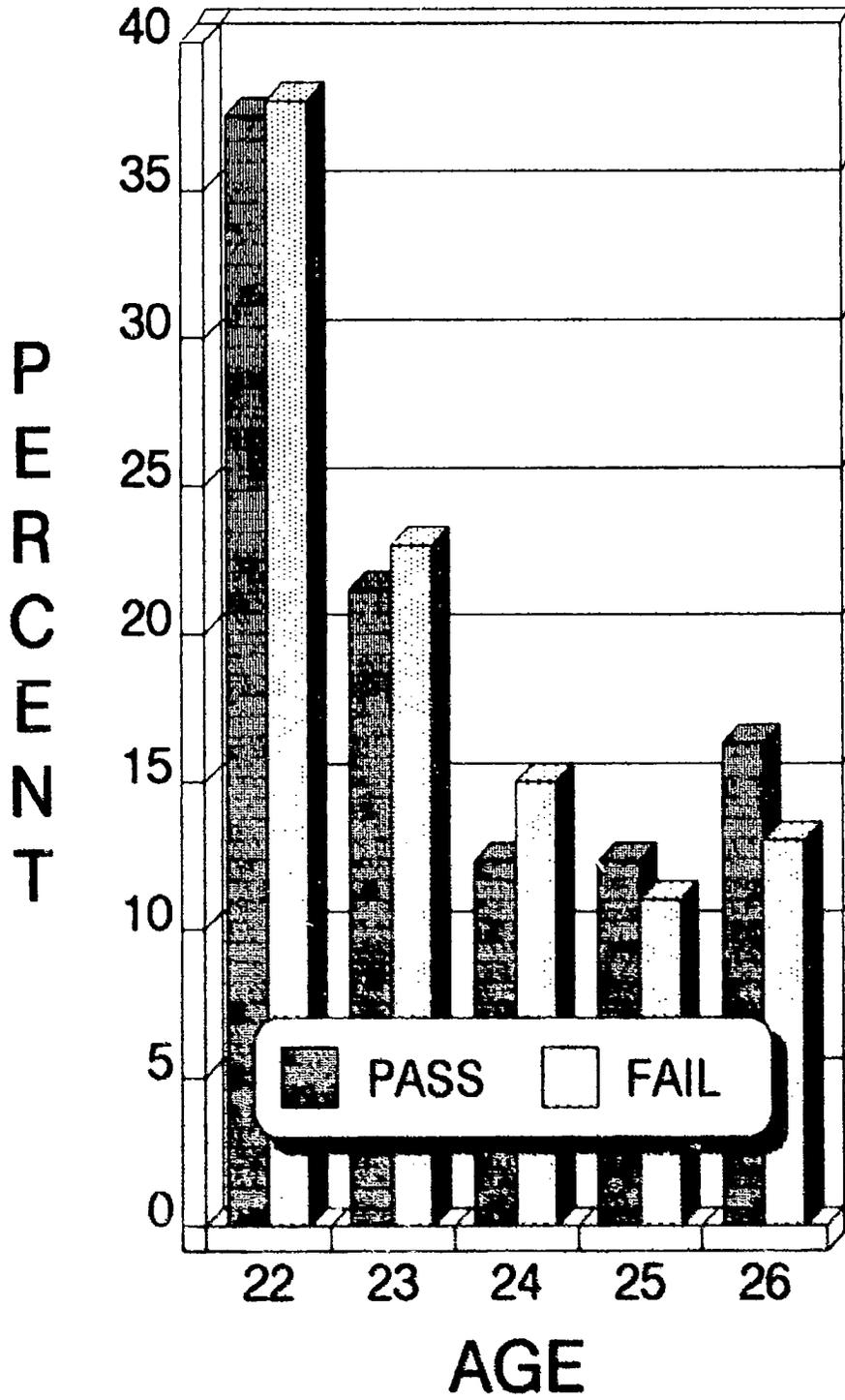
3. If you need another booklet and/or answer sheet let me know. Again, your response and comments are important and will make a difference in the pilot selection process of the future.

A handwritten signature in cursive script that reads "Roy A. Davis".

ROY A. DAVIS, Colonel, USAF
Command Sponsored Research Fellow

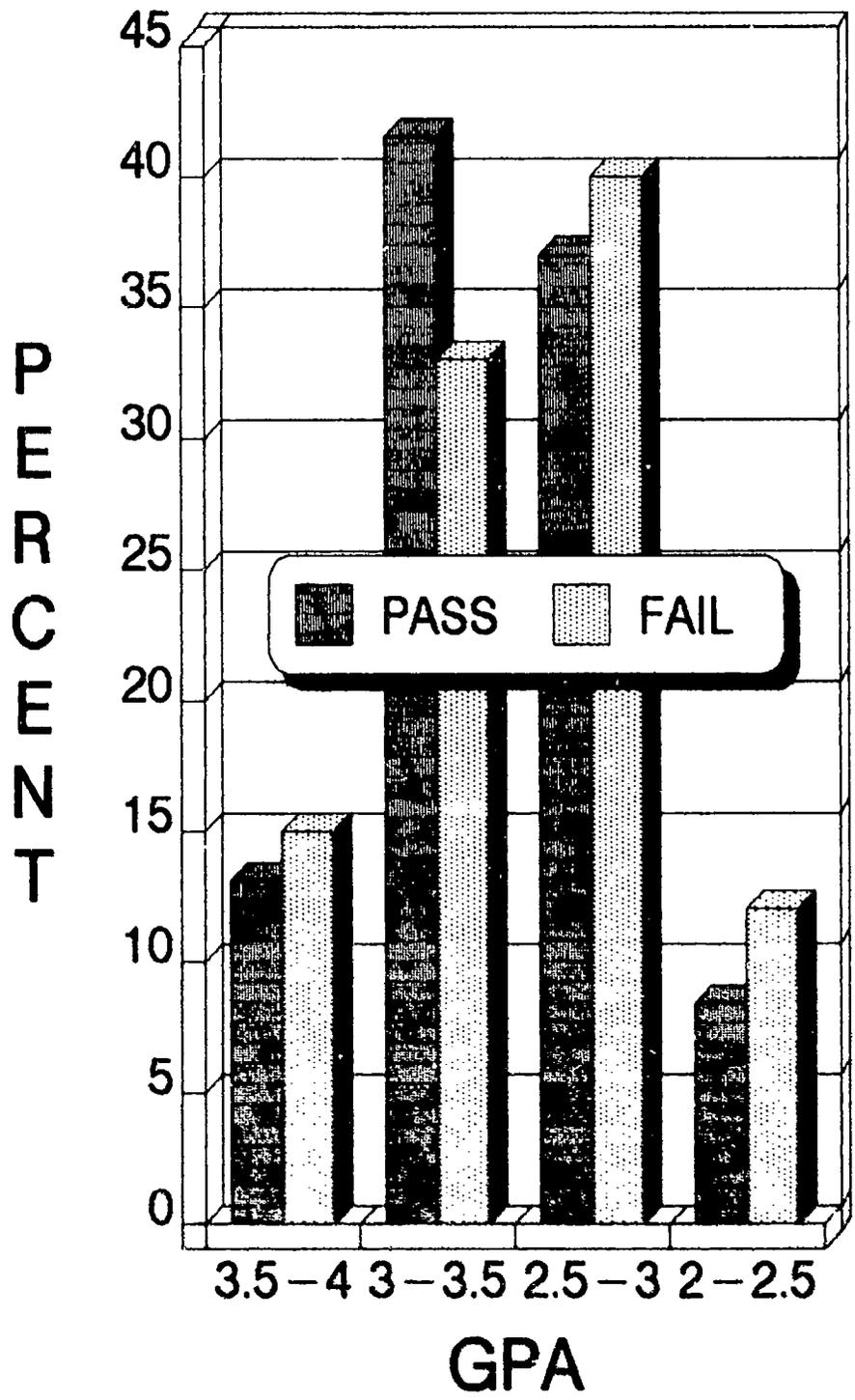
Appendix G

Respondent Profile--Age



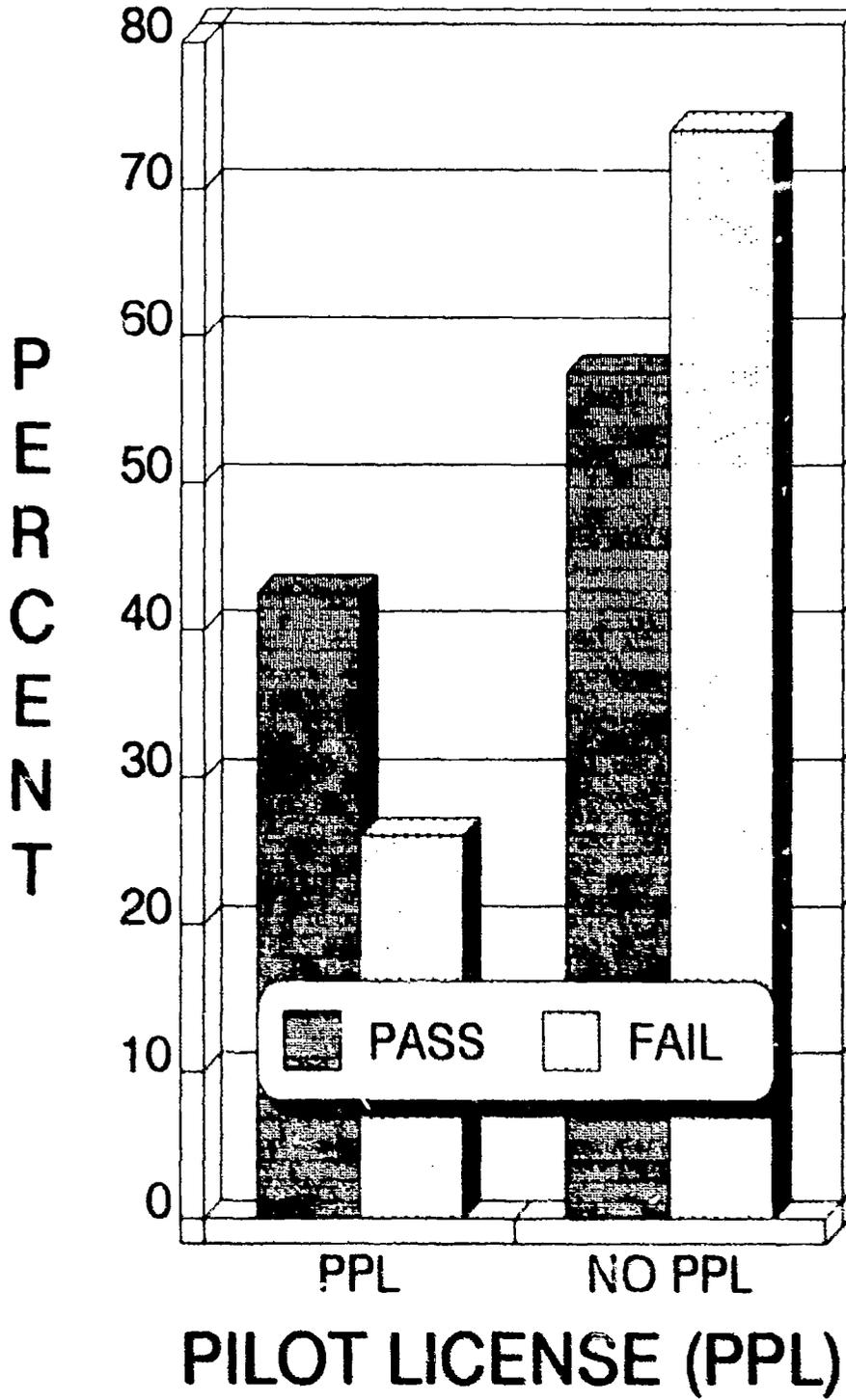
Appendix H

Respondent Profile--Grade Point Average



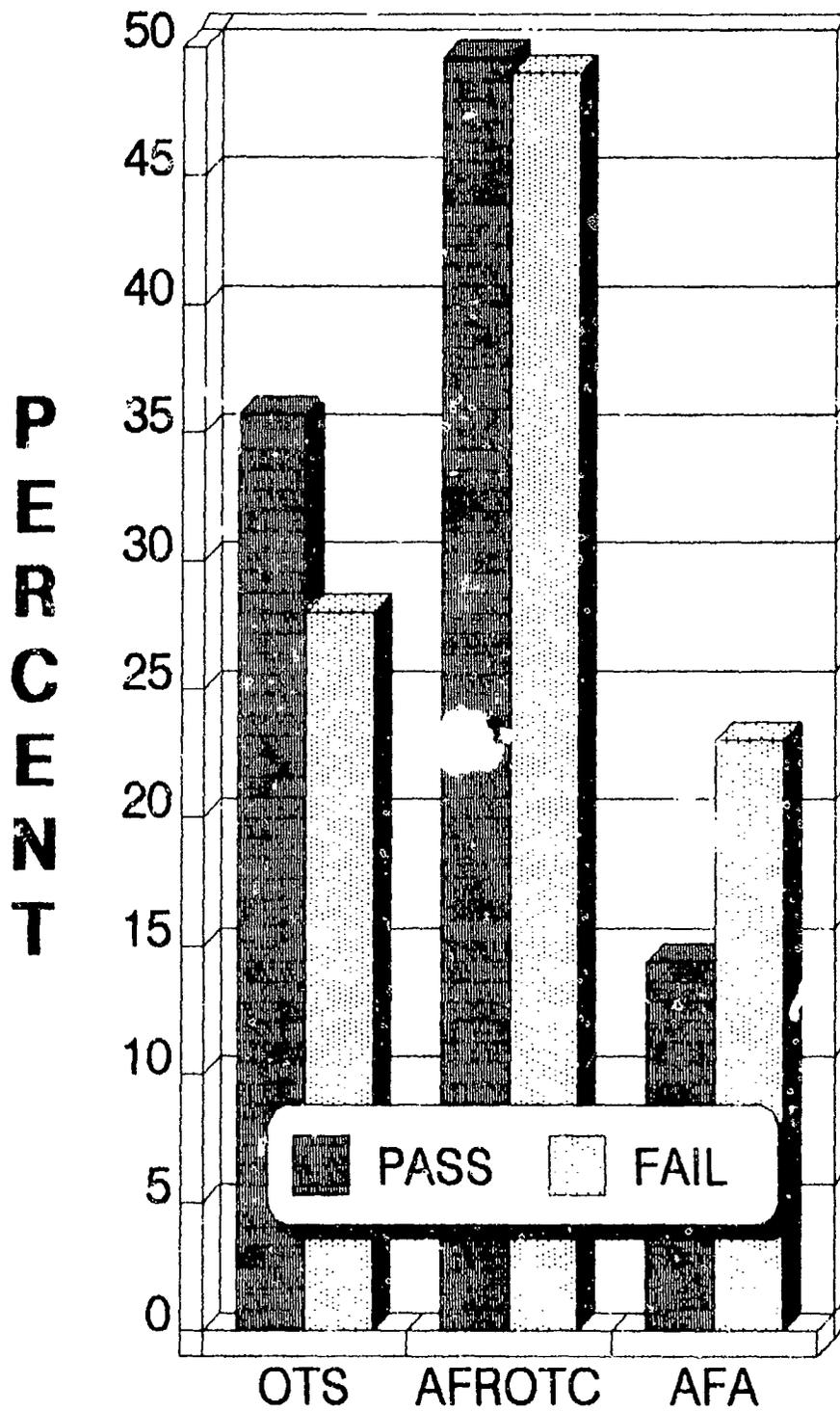
Appendix I

Respondent Profile--Private Pilot License



Appendix J

Respondent Profile--Source of Commission



BIBLIOGRAPHY

- Air Training Command. Historical Research Paper, Major Changes in Pilot Training 1939-1984. Randolph AFB, Tex.: Air Training Command, History and Research Office, October 1984.
- Air Training Command Research Objectives Plan. Randolph AFB, Tex.: Air Training Command, 1987.
- Alkov, Robert A., Michael S. Borowsky, and John A. Gaynor. "Personality and Motivational Factors of Naval Academy Graduates as Indicators of Aviation Mishap Potential." Proceedings of the Human Factors Society--27th Annual Meeting. Annapolis, Md.: US Naval Academy, 1983.
- Anastasi, Anne. Psychological Testing. New York: Macmillan Publishing Co., 1968.
- _____. Psychological Testing. New York: Macmillan Publishing Co., 1976.
- Ashman, A., and R. Telfer. "Personality Profiles of Pilots." Aviation, Space, and Environmental Medicine, 10 October 1983.
- Bennett, Carson M., and Robert E. Hill. "A Comparison of Selected Personality Characteristics of Responders and Nonresponders to a Mailed Questionnaire Study." Journal of Educational Research 58, no. 4, December 1964.
- Boot, Maj Robert L. Dual Track: Mid-Course Prediction for Tanker/Transport/Bomber Pilot. Maxwell AFB, Ala.: Air Command and Staff College, 1986.
- Bordelon, Maj V. Paul, and Jeffery E. Kantor. Utilization of Psychomotor Screening for USAF Pilot Candidates: Independent and Integrated Selection Methodologies. AFHRL-TR-86-4. Brooks AFB, Tex.: Air Force Systems Command, 1986.
- Borg, Walter R., and Meredith D. Gall. Educational Research: An Introduction. New York: David McKay Company, Inc., 1976.
- Carretta, Thomas R. "The Basic Attributes Tests (BAT) System: A Preliminary Evaluation of Three Cognitive Subtasks." Proceedings of the Human Factors Society--30th Annual Meeting, 1986.

- _____. Basic Attributes Systems: Development of an Automated Test Battery for Pilot Selection. AFHRL-TR-87-9. Brooks AFB, Tex.: Air Force Systems Command, 1987.
- Cloninger, C. Robert. "A Systematic Method for Clinical Description and Classification of Personality Variants." Archives of General Psychiatry 44 (June 1987).
- Cooper, Maj Marcus F. "Application of Operational Pilot Selection Criteria." Research study, Maxwell AFB, Ala.: Air Command and Staff College, 1976.
- Cope, R. G. "Nonresponse in Survey Research as a Function of Psychological Characteristics and Time of Response." Journal of Experimental Psychology 36 (1968).
- Cronbach, Lee J. Essentials of Psychological Testing. New York: Harper & Rowe, 1949.
- Crowne, Douglas P., and David Marlowe. "A New Scale of Social Desirability Independent of Psychopathology." Journal of Consulting Psychology 24, no. 4 (1960).
- Dalton, Pat. "Pilot Training Attrition Down from 1987 Peak." Air Force Times 24 (25 January 1988).
- Diehl, Grover. "Analysis of 32 Potential Predictors of Pilot Attrition." Staff study, Maxwell AFB, Ala.: AFROTC/XPX, 1986.
- _____. "Profile of AFROTC Pilot Designees." Staff study, Maxwell AFB, Ala.: AFROTC/XPX, 1987.
- Dolgin, Daniel L., and Gerald D. Gibb. Personality Assessment in Aviation Selection: Past, Present and Future. Pensacola NAS, Fla.: Naval Aerospace Medical Research Laboratory, 1988.
- Dolgin, D. L., R. N. Shull, and G. D. Gibb. "Risk Assessment and the Prediction of Student Pilot Performance." Proceedings of the 4th International Symposium on Aviation Psychology, 1987.
- Fitschen, Maj Charles K. Cost Impact: Should Improved Screening Methods Be Implemented in the Undergraduate Pilot Training Program? Maxwell AFB, Ala.: Air Command and Staff College, 1981.

- Graham, John R. and Roy S. Lilly. Psychological Testing. Englewood Cliffs, N.J.: Prentice-Hall Inc., 1984.
- Guinn, Nancy, Bart M. Vitola, and Sandra A. Leisey. Background and Interest Measures as Predictors of Success in Undergraduate Pilot Training. AFHRL-TR-76-9. Brooks AFB, Tex.: Air Force Systems Command, 1976.
- Guion, R. M., and R. F. Gottier. "Validity of Personality Measures in Personnel Selection." Personnel Psychology 18 (1965).
- Helmreich, Robert L. "Cockpit Management Attitudes." Human Factors 26, no. 5 (1984).
- _____. "Explorations in Achievement." Paper presented at the Annual Meeting, American Psychological Association. Washington, D.C., 24 August 1982.
- _____. "Exploring Flightcrew Behaviour." Social Behaviour 2 (1987).
- _____. "Personal Attributes Questionnaire." Catalogue of Selected Documents in Psychology 4 (Ms 617) (Spring 1974).
- _____. "Pilot Selection and Performance Evaluation: A New Look at an Old Problem." Proceedings: Psychology in the Department of Defense. USAFA-TR-86-1. Colorado Springs, Colo.: US Air Force Academy, 1986.
- _____. "Pilot Selection and Training." Paper presented at the American Psychological Association Annual Meeting. Washington, D.C., 24 August 1982.
- _____. "What Changes and What Endures: The Capabilities and Limitations of Training and Selection." Paper presented at the Irish Air Line Pilots/AER Lingus Flight Operations Symposium. Dublin, Ireland, 19-20 October 1983.
- Helmreich, Robert L., and Janet T. Spence. "Making It in Academic Psychology: Demographic and Personality Correlates of Attainment." Journal of Personality and Social Psychology 39, no. 5 (1980).

- _____. "The Work and Family Orientation Questionnaire: An Objective Instrument to Assess Components of Achievement Motivation and Attitudes Toward Family and Career." JSAS Catalog of Selected Documents in Psychology 8 (1978).
- Helmreich, Robert L., and John A. Wilhelm. "Evaluating Cockpit Resource Management Training." Proceedings of the Fourth International Symposium on Aviation Psychology. Columbus, Ohio: Ohio State University, 1987.
- _____. "Human Performance in Aerospace Environments: The Search for Psychological Determinants." American Psychologist. In press.
- Helmreich, Robert L., Linda L. Swain, and Alan L. Carsrud. "The Honeymoon Effect in Job Performance: Temporal Increases in the Predictive Power of Achievement Motivation." Journal of Applied Psychology 71, no. 2 (1986).
- _____. "Cockpit Resource Management: Exploring the Attitude-Performance Linkage." Aviation, Space, and Environmental Medicine, December 1986.
- _____. "Making it in Academic Psychology: Demographic and Personality Correlates of Attainment." Journal of Personality and Social Psychology 39, no. 5 (1980).
- Henmon, V. A. C. "Air Services Tests of Aptitude for Flying." Journal of Applied Psychology III, no. 2 (1919).
- Holman, Milton G., and Richard Doctor. Educational and Psychological Testing. New York: Russell Sage Foundation, 1972.
- Hughes, David. "Airlines Move to Swiftly Expand, Improve Pilot Training Programs." Aviation Week & Space Technology, 9 November 1987.
- Imhoff, David L., and Jerold M. Levine. Perceptual-Motor and Cognitive Performance Task Battery for Pilot Selection. AFHRL-TR-80-27. Brooks AFB, Tex.: Air Force Systems Command, 1980.

- Kantor, J. E., and B. S. Bordelon. "The USAF Pilot Selection and Classification Research Program." Aviation, Space, and Environmental Medicine, March 1985.
- Kiersey, David, and Marilyn Bates. Please Understand Me. Del Mar, Calif.: Prometheus Nemesis Books, 1978.
- Kozlowski, Steven W. The Validity of Personality Inventories for the Selection of Personnel: A Review of the Literature and Recommendations for Research. Special report, State of Pennsylvania: State Civil Service Commission, Personnel Assessment Research Division, 1978.
- Lester, L. F., and D. H. Bombaci. "The Relationship between Personality and Irrational Judgement in Civil Pilots." Human Factors 26, no. 5 (October 1984).
- Melton, Richard R. "Studies in the Evaluation of the Personality Characteristics of Successful Naval Aviators." The Journal of Aviation Medicine 25, no. 6 (December 1954).
- Myers, Isabel Briggs. Introduction to Type. Palo Alto, Calif.: Consulting Psychologists Press, 1986.
- Myers, Isabel Briggs, and Mary H. McCaulley. A Guide to the Development and Use of the Myers-Briggs Type Indicator. Palo Alto, Calif.: Consulting Psychologists Press, 1986.
- North, Robert A., and Glenn R. Griffin. Aviator Selection 1919-1977. Special Report 77-2, Pensacola NAS, Fla.: Naval Aerospace Medical Research Laboratory, 1977.
- Novello, Joseph R., and Zakhour I. Youssef. "Psychosocial Studies in General Aviation: 1. Personality Profile of Male Pilots." Aerospace Medicine, February 1974.
- Phares, E. Jerry. Introduction to Personality. Columbus, Ohio: C. E. Merrill, 1984.
- _____. Locus of Control in Personality. Newark, N. J.: General Learning Press, 1976.
- Piotter, Maj Alison L. "Performance Comparison: USAF T-41 Pilot Indoctrination Program versus USAF Pilot Training." Research study, Maxwell AFB, Ala.: Air Command and Staff College, 1987.

- Powers, Alan C. "The Myers-Briggs Type Indicator as a Tool to Identify Flight Students' Learning Styles," Proceedings of the Second Symposium on Aviation Psychology. Columbus, Ohio: Ohio State University, 1983.
- Ravid, Yakof. "Sociometric Pilot Testing Saves Time, Lives, and Money." Defense System Review, May 1984.
- Reid, D. W., and E. E. Ware. "Multi-dimensionality of Internal/External Control: Implications for Past and Future Research." Canadian Journal of Behavioural Science 5 (1973).
- Roscoe, Stanley N. Aviation Psychology. Ames, Iowa: Iowa State University Press, 1980.
- Rossander, Pauline. Personality Inventories and Prediction of Success in Pilot Training: State of the Art. Willowdale, Ontario, Canada: Canadian Forces Applied Research Unit, 1980.
- Rotter, J. B. "Generalized Expectancies for Internal versus External Control of Reinforcement." Psychological Monographs: General and Applied 80 (1966).
- Siem, Frederic M. Characteristics Associated with Success in USAF Pilot Training. Brooks AFB, Tex.: Air Force Systems Command. In press.
- _____. "The Effects of Aircrew Member Personality in Interaction and Performance." Unpublished dissertation, Austin, Tex.: University of Texas, 1987.
- Siem, Frederic M., Thomas R. Caretta, and Theresa A. Mercantante. Personality, Attitudes and Pilot Training Performance: Preliminary Analysis. AFHRL-TR-87-62. Brooks AFB, Tex.: Air Force Systems Command, 1988.
- Spence, Janet T., Robert L. Helmreich, and Carole K. Holahan. "Negative and Positive Components of Psychological Masculinity and Femininity and Their Relationships to Self-Reports of Neurotic and Acting Out Behaviors." Journal of Personality and Social Psychology 37, no. 10 (October 1979).
- Stokes, Richard W., Jr. Preserving the Lament Flame: Traditional Values and the USAF Officer Accession Program. AU-ARI-83-8. Maxwell AFB, Ala.: Air University, September 1984.

The Sixth Mental Measurements Yearbook. Highland Park, N.J.: Gryphon Press, 1965.

Thistlewaite, D. L., and Norman Wheeler. "Effects of Teacher and Peer Subcultures upon Student Aspirations." Journal of Educational Psychology 57 (1966).

Wichman, Harvey, and James Ball. "Locus of Control, Self-serving Biases, and Attitudes Towards Safety in General Aviation Pilots." Aviation, Space, and Environmental Medicine, June 1983.

Willis, Grant. "New 'Porta-Bat' Helps Predict Successful Pilots." Air Force Times, 17 November 1986.

Youngling, E. W., et al. "Predicting Pilot Air Combat Effectiveness." TR-MDC E1634. St. Louis, Mo.: McDonnell Douglas Aeronautics Corp., 1977.