SECURITY CLASSIFICATION OF THIS PAGE

DTIC FILE COPY

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

AD-A217 397

1a. REPORT SECURITY CLASSIFICATION	UNCLASSIFIED
1b. RESTRICTIVE MARKINGS	NONE
3. DISTRIBUTION/AVAILABILITY OF REPORT	APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.
5. MONITORING ORGANIZATION REPORT NUMBER(S)	AFIT/CI/CIA- 88-220
6a. NAME OF PERFORMING ORGANIZATION	AFIT STUDENT AT UNIV OF TX AT AUSTIN
6b. OFFICE SYMBOL (If applicable)	
7a. NAME OF MONITORING ORGANIZATION	AFIT/CIA
6c. ADDRESS (City, State, and ZIP Code)	
7b. ADDRESS (City, State, and ZIP Code)	Wright-Patterson AFB OH 45433-6583
8a. NAME OF FUNDING/SPONSORING ORGANIZATION	
8b. OFFICE SYMBOL (If applicable)	
9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8c. ADDRESS (City, State, and ZIP Code)	
10. SOURCE OF FUNDING NUMBERS	PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO / WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification)	(UNCLASSIFIED) BIOGRAPHICAL DATA AS PREDICTORS OF SUCCESS IN MILITARY AVIATION TRAINING
12. PERSONAL AUTHOR(S)	JUDY DENNIS ROOMSBURG
13a. TYPE OF REPORT	THESIS/DXXXXXXXXXX
13b. TIME COVERED	FROM ____ TO ____
14. DATE OF REPORT (Year, Month, Day)	1988
15. PAGE COUNT	87
16. SUPPLEMENTARY NOTATION	APPROVED FOR PUBLIC RELEASE IAW AFR 190-1 ERNEST A. HAYGOOD, 1st Lt, USAF Executive Officer, Civilian Institution Programs
17. COSATI CODES	FIELD / GROUP / SUB-GROUP
18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
19. ABSTRACT (Continue on reverse if necessary and identify by block number)	
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS
21. ABSTRACT SECURITY CLASSIFICATION	UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL	ERNEST A. HAYGOOD, 1st Lt, USAF
22b. TELEPHONE (Include Area Code)	(513) 255-2259
22c. OFFICE SYMBOL	AFIT/CI

DD Form 1473, JUN 86 — Previous editions are obsolete. — SECURITY CLASSIFICATION OF THIS PAGE

AFIT/CI "OVERPRINT"

90 02 01 039

BIOGRAPHICAL DATA AS PREDICTORS OF SUCCESS IN MILITARY AVIATION TRAINING

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BIOGRAPHICAL DATA AS PREDICTORS OF SUCCESS IN MILITARY AVIATION TRAINING

by

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THESIS

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

MASTER OF ARTS

THE UNIVERSITY OF TEXAS AT AUSTIN

December 1988

ACKNOWLEDGMENTS

The author gratefully acknowledges the assistance, cooperation and support of Drs. Joseph Horn and Robert Young (The University of Texas at Austin) and Dr. Jeffrey Kantor (The United States Air Force Systems Command/Human Systems Division, Brooks Air Force Base, Texas).

My thanks also to the men and women of the United States Air Force Human Resources Laboratory whose help and encouragement made this effort possible. In particular Major John Quebe, USAF (Ret), who suggested the research and Sergeant Mark J. Mathahs who provided technical support.

Finally, to Bernd Willkomm who developed the Autobiographical Inventory.

December 1988

TABLE OF CONTENTS

CHAPTER I

BACKGROUND OF THE PROBLEM AND REVIEW OF THE LITERATURE

Personnel selection is based on the predictability of job success. In the typical selection procedure, characteristics of individuals are measured, and an attempt is made to predict job success from them. Tests and test technology used in employment procedures can markedly reduce the frequency and degree of wasteful selection error.

When a valid predictor is used, people chosen on the basis of these test scores do better than average on some criterion measure of job success. Basically, attempts to predict the individual's relative standings in one set of numbers (criterion) on the basis of their standings in another set of numbers (predictor) are made (Bond, Bryan, Rigney and Warren, 1968 and Ghiselli, Campbell & Zedeck, 1981). Variation along some trait dimension is related to variation along a job performance dimension (Guion, 1965).

Research focussing on personnel selection has commonly utilized a predictive validation model which seeks to link predictors (based on research of individual characteristics) and selection criteria (usually of performance tasks or successful outcome measures). The correlation coefficient is commonly used to measure the amount of association between the predictors and the criteria.

The importance of the criterion side of the selection process is often overlooked and readily available criterion measures may be unreliable and/or of limited validity. In addition, criterion dimensions are not static. A predictor-criterion relationship that has existed in the past must be periodically reexamined to insure that it is still useful. Using results from similar or related job situations is a good way to select tests for tryout. However, each situation must generally be analyzed for the particular purpose under the specific circumstances (Lawshe & Balma, 1966). Although recent studies have made a case for cross-situational validity generalization (Schmidt & Hunter, 1977; McCormick, DeNisi & Shaw, 1979; and Taylor, 1978), for highly complex and specific jobs it is advisable to "test the test" in each situation. A pertinent example is the differences in the criterion as measured in the early days of military flight training and the criterion for present day technologically advanced fighter aircraft. The same criterion applied to the successful pilot in 1937 would not even begin to measure the successful pilot of 1988.

In most selection methods, the criterion used is success in some sort of training. As a result, the majority of selection research fails to deal with performance in the operational or "real world" setting which has been classified as the "ultimate criterion" (Thorndike, 1949). The ultimate criterion is an abstract notion and for all practical purposes unmeasureable. For example, the ultimate criterion for a successful military pilot would be some abstract concept that describes the ability to perform successfully in a combat situation. "Success" in peacetime cannot be solely determined by any concrete measurement, it is even difficult to factor in all the predictor variables that describe a combat pilot. In fact, confirmation of an ultimate criterion may well be only possible retrospectively and individually.

Miller, in 1947, believed that flying was such a complex skill that the scientific language did not contain the words and concepts for summarizing briefly and accurately the demands of such a skill. Even today, any attempt to describe this task results in either describing an exceedingly long series of specific details or making broad generalizations which may be off target.

Based on the difficulties of measuring the ultimate criterion, "immediate" or "intermediate" criteria are often selected as the research goal. Training success is therefore often the intermediate criterion chosen. If so, it is then necessary to ensure that the training accurately reflects as many components of successful performance requirements as possible. This may be the most direct (and only) method of approaching an ultimate criterion measure.

The relative cost of wrong decisions must also be taken into account since they greatly affect personnel decision strategy. The two kinds of errors that may occur are false accept (FA) errors and false reject (FR) errors. In order to insure that people who are selected will not eventually fail (FA error), procedures would have to be implemented that would reject many who would have also succeeded (FR error). Only when the applicant pool is unlimited would there be no problem with this method. Very rarely (if ever) will any organization have this luxury. In addition, if everyone selected were successful on the job, the selection criteria might be too stringent. Any selection program will let some eventual failures slip through and reject some who would have succeeded if they had been accepted however, with valid predictors these events are reduced. The optimal goal is to develop a program which eliminates the maximum number of eventual failures while at the same time rejecting the minimum number of those who would have passed the course. Cost savings are realized when fewer people are put through training while still achieving successful graduate quotas.

Narrowly specified training prerequisites for military pilots make selection extremely difficult. The group of candidates that remains to actually enter into pilot training is highly homogenous on the abilities that were tapped by vigorous selection measures.

The original group of people eligible for selection is known as the applicant pool. The selection ratio (SR) is the proportion of people who score above a critical cutoff score on a test. The hiring rate (HR) is the percentage of people who are actually hired. The base rate (BR) is the percentage of those people hired who are actually successful on the job.

Generally, the goal of test validation is to achieve high correlations between the test scores and the eventual job performance. However, the use of a test with _any_ validity greater than zero is generally believed to be better than random selection of people for jobs. The exception to this case is when the SR is 1.00. If the employer is selecting everyone then any test will be rejected for use, regardless of how valid, because it cannot improve the SR.

Alexander, Barrett & Doverspike (1983) have investigated the confusion due to the use of SR and HR values. They designate SR as the original applicant population parameter whereas HR pertains to the sample in question. When researchers do not differentiate between SR and HR (and in fact often use HR in place of SR) more FA and FR selection decision errors occur. The disparity between the SR and HR increases when factors such as self-selection in the original applicant population exists or when initial screening processes have been implemented. When one of these artifacts correlate perfectly with the decision to hire, the _HR_ would be 100% and if the HR was being used in place of the SR, the wrong conclusion would be that the test was useless and therefore should be abandoned.

Common belief holds that the lower the SR, the more favorable it is for the organization. The lower SR results from setting the critical cutoff score of the selection measure higher. This is turn results in the organization being able to be more critical of the people it selects and a higher quality of people being hired from those who applied. However, using the Alexander, et. al. argument, if the HR is being used as a substitute for the SR, this is not always true. In a fixed population situation, once the employer has made an initial pass through to attract potential applicants, there remains fewer "high-quality" applicants left for future selection. This will have an minimal effect on the SR but could, in fact, decrease the HR by a substantial amount. Another major error can occur when the utility of a test is estimated. If the HR is interchanged with the SR and the HR underestimates the proportion of people above the critical cutoff score on the predictor, the expected gain in utility from selection will be overestimated.

The result of introducing a test into the selection system is better if validity is higher, however a lower SR can compensate somewhat for low validity (Lawshe & Balma, 1966). Manipulation of the SR changes the number of recruits scoring above the critical cutoff score and thus redefines the selection population. The pattern of validity also changes with reformation of the population. One result of a lower SR is the decrease in the number of possible recruits. The smaller the total number of selectees, the greater the restriction in range of abilities on the test used to set the SR.

Attenuation due to restriction in range reduces the magnitude of the correlation coefficient. Guion (1965) discusses the expectation of low correlations in personnel selection. He states that the average validity coefficients are in the .30s and low .40s with .50s being rare. A more quantitative interpretation is believed to be based on the coefficient of determination (r^2). The coefficient of determination assesses the proportion of the variance in either variable that is associated with the variance in the other variable. The coefficient of determination is helpful when deciding whether or not to continue use of the test in question.

Military Personnel Selection History

The need for efficient selection and training of large numbers of recruits was recognized as far back as World War I. Many of the young men who were accepted into the Army Air Services had to be eliminated before they completed flight training due to lack of flying aptitude that was not recognized until after their entry into training.

Because of this, a group of psychologists at Kelly Field, in San Antonio, Texas, was asked to devise new techniques for selecting pilot trainees and to evaluate the appropriateness of the the selection procedures that were currently being used. They found that some of the techniques being used did not capture necessary predictors of school success or

Instructor Pilot (IP) ratings given to pilot trainees. A battery of psychological tests which included such things as measures of emotional stability were found to be related to ultimate school success. A positive correlation was found between these composite scores and aptitude for flying. Aptitude for flying was measured by pooled ratings of IP's. Accurate predictions could be made for success for those who made extreme (high or low) scores.

The early work in selecting military pilots was in many ways successful. However, almost no follow-up or refinement of the selection procedures was accomplished during the post war period. A few small studies to investigate the possibility of using psychomotor coordination in predicting flying school success were the only efforts continued between the World Wars.

A renewal of interest in selection issues and testing programs occurred as international tensions worsened in the late thirties. Lawshe and Balma (1966) report that during the peak of World War

II pilot training, for every dollar spent on pilot training, the research and testing program of the Air Force saved the taxpayer $1,000 in wasted pilot candidate attrition. Pilot candidates were chosen through a mass selection program which was extremely costly and the testing research enabled large cost reductions. The Civilian Pilot Training Program (CPT) was the first program of pilot selection associated with World War II. It was established to provide basic flying training to selected college students.

Soon after organizing its selection research group at Pensacola, Florida in 1940, the Navy also realized an urgent need to reduce its high student attrition rate which was comparable to that of the Army Air Services. The CPT tests served as a basis for a battery of tests which was administered to a group of 919 incoming Naval cadets. The group of cadets was then tracked to determine if any of these test scores were related to training success. A composite score based only on a single intelligence test and one psychomotor test would have eliminated 44% of those who eventually failed (FA error). Also, the same composite score would have only eliminated about 12% of those who successfully completed the training an example of a FR error (Bond, et al. 1968).

Because of these research findings, a routine testing program was established for all new naval cadets. Battery development was a continuing process that was updated when new data were received. The composite score from this battery came to be known as the Flight Aptitude Rating (FAR). During the war the selection criteria were modified by raising and lowering the critical cutoff score to accommodate the needs of the service. There was a positive relationship between the scores on the selection tests and success in flight training. The attrition rate was clearly lower for students receiving the higher grades.

About this same time, from 1941 through 1945, the Army Air Services, now called the Army Air

Force (AAF), was also conducting psychological research. Pilot graduates ranged from a low of 186 in 1937 to 82,487 in 1944. This was an increase of more than forty-four thousand percent (Miller, 1947).

Before World War II, the main AAF criterion for pilot training was the requirement for applicants to complete two full years of college before being considered. During the war, the demand for pilots became so great that the number of potential trainees who possessed the necessary college training was far lower than military recruiting requirements. Selection criterion shifting was utilized by dropping the college education requirement.

Since the main criterion factor was eliminated, the AAF developed another means of screening applicants. In an effort to continue a valid screening process that would predict successful outcome of training, the STANINE tests were created. This battery of psychological tests was so named because of the abbreviation of the standard nine-point scale which was used to report the test results. A STANINE composite score of 9 reflected the highest score and, 1, the lowest. The pilot stanine predicted the score on the pilot information achievement test even better than did previous education level of the applicant (Miller, 1947). The test battery consisted of fourteen printed tests and six apparatus tests which measured traits such as psychomotor abilities and personality.

It was necessary to put 397 trainees into a pilot training class in order to realize 100 graduates prior to the introduction of the STANINE tests. When the tests were used, graduation of 100 trained pilots was assured for every 156 trainees enrolled (Bond et al., 1968). Thus the STANINE increased the BR from 25% to 64%.

The United States Air Force was established as a separate and distinct branch of the Armed Forces in 1947. At the same time, portions of separate selection research by the Navy and the Air Force were combined into the Pilot Candidate Selection Research Program. Upon entering training, 2,100 midshipmen were administered 35 printed tests and 20 apparatus tests to measure cognitive, psychological and psychomotor abilities. Unique in this approach was the evaluation of performance measures in the operational environment -- not just success in training. The program was a success in that it laid the foundation and established a database for continued research in operationally defined criteria of selection predictors. This was an early attempt to capture the ultimate criterion construct of the combat pilot.

Air Force Pilot Selection

The high costs associated with training military pilots and their importance in modern warfare emphasizes the selection of the best pilot candidates. It can be said that the Air Force invests more in the training of one pilot than it does on any other single non-pilot officer. The possibility of entering combat with a numerically inferior force, coupled with the increases in fuel and aircraft costs have made the optimal selection of military pilots of primary concern to the Air Force (Kantor and Bordelon, 1985).

In today's Air Force, there are specific "chains of responsibility" that delegate requirements for pilot selection quotas and criteria. Communication flows upward as well as down these chains of responsibility and operational need requirements are forwarded by the service departments through headquarters. Ultimately, however, the Congress and the President establish guidelines for maintaining the military at authorized strengths. These guidelines, issued as directives, are forwarded to the Department of Defense which in turn partitions the requirements out to each branch of the service.

Many anecdotal accounts of errors in placement exist in military circles. Tales of the Phd assigned to peel potatoes or drive in the motor pool continue to be told. Guion (1965) states that errors in placement are more dramatic in the military services (as compared to civilian jobs) because a military person improperly placed cannot be fired for incompetence, nor can the person quit. Although his statement is somewhat exaggerated, the military environment does possess some unique situations not found in civilian employment situations. One such factor that is unique to the military is that errors in selection and measurement can greatly exceed usual problems of organizational embarrassment. Correct selection and placement of potential aviators can determine the difference between great cost (in lives and multi-million dollar aircraft) and a prepared, skilled flying force. In addition, the military has a responsibility to itself and to the society that supports it to be sure that it uses test technology competently and wisely (Guion, 1965).

If failures can be identified early, then a great deal of time and money will be better used on selection and training of those people who can be identified as having a better chance for success. Of interest also are the variables which contribute most to the separation of trainees who succeed and those who do not.

Not unlike many civilian organizations, the Air Force uses a process in which the decision rests essentially upon rejection. If an applicant is not rejected at some point in the succession of hurdles, then he or she becomes a pilot. "Reject" in this case does not necessarily mean rejection from the Air Force since trainees who fail often are "recycled" into non-flying jobs. In this instance, it designates those candidates that are rejected from continuing in the process to become a pilot.

The military pilot population represents a highly selected, homogeneous group. Those with lower intelligence and poorer educational background have been weeded out by the qualifying examination. Additional hurdles (selecting for different traits) continue the restriction in range process by rejecting those who cannot meet the progressively more stringent standards. Greater homogeneity on those traits that have been used as successful predictors ensures the best pilots.

The selection of pilot candidates employed in the modern Air Force utilizes the "whole person" concept. This is a composite of the Air Force Qualifying Test (AFOQT), academic history, military record (for prior enlisted military applicants) a stringent physical evaluation and selection board scores. Various flight screening programs are utilized by the different methods of accession. In addition to obtaining a broader base of predictors, the whole person concept is designed to capture a combination of traits that will result in a successful officer and pilot.

The United States Air Force Academy conducts its own pre-flight training while some ROTC units use the Pilot Indoctrination Program (contracted civilian flight training). The remainder of ROTC cadets participate in the Flight Screening Program (FSP). The FSP which is the primary method of pre-pilot screening for Officer Training School (OTS) candidates will be described in some detail since its outcome has been established as the criterion measure for this study. The following information comes from the Syllabus of Instruction for Flight Screening Program T-41 (Headquarters Air Training Command, 1985).

The FSP is a 14-hour, light-aircraft (T-41) flying course used to train/screen applicants on basic flight skills. The length of the current FSP program was based primarily on subjective assessments of previous trainees' experience of screening programs in various Air Forces. The purpose of the FSP is "to provide a selection process to identify trainees who possess the potential to enter and successfully complete (the) USAF Undergraduate Pilot Training (UPT)." All trainees that enter FSP are either commissioned officers (cross training from another Air Force specialty) or officer candidates. They will be either commissioned through OTS, already commissioned, or a portion of ROTC cadets that were selected to go through the FSP. ROTC cadets usually attend FSP between their sophomore and junior years of college. OTS candidates report three weeks early and complete FSP prior to OTS. Trainees who have already been identified as UPT candidates and who generally do not already have a private pilot's license (PPL) attend. Possession of a PPL does not disqualify a person from attending FSP but it does allows the person to request a waiver of FSP.

FSP includes flying training to teach the principles and techniques common to all aircraft and ground training to supplement and reinforce flying training. The duration is 16 flying training days which includes actual flying hours in the military T-41 (civilian Cessna 172 equivalent), a light piston-engined aircraft.

FSP graduates who are already commissioned officers of this course are entered directly into the USAF UPT, Pilot Training-Helicopter (UPT-H), or the Euro-Nato Joint Jet Pilot Training Program (ENJJPT). FSP graduates who are Officer Trainees and ROTC cadets enter into UPT, UPT-H, and ENJJPT upon graduation from the Officer Basic Military Training Precommissioning Course (OTS) or college (for ROTC). All graduates of this course are awarded a

Certificate of Training. However, even successful completion of this training does not guarantee entry into pilot training for all graduates due to possible elimination from OTS, college or other attrition reasons.

The reasons for elimination from FSP with a brief description follow:

a. Medical: This includes anything medical such as eyesight problems, congenital defects and in some strange anecdotal accounts of growth spurts that rendered the trainee unable to physically fit in the aircraft. Medical elimination occurs when conditions after entry into FSP are detected. These may have manifested in training or existed prior to the beginning of training and were overlooked.

1. Manifestations of Apprehension (MOA): Anxiety or nervousness is common among students learning to fly. Real fear of flying, however, can interfere with a trainee's physical ability to control the aircraft, judgment, and decision making ability. MOA can include such things

as passive or active airsickness, insomnia, loss of appetite, anxiety and tension related to the flying environment. Whenever the above signs are exhibited to a degree that seem to impair flight-line performance, the trainee is referred to the Flight Surgeon for evaluation.

2. Airsickness: Trainees who experience airsickness are given individual attention and a reasonable opportunity to adapt to the flying environment. The definition of airsickness is "active" (vomiting) or "significant passive" (disabling or disruptive nausea). Airsickness is usually of brief duration and due to multiaxial accelerations, the pulling of Gs (gravity forces), unfamiliar positional orientations of the aircraft, with or without anxiety.

b. Academic Training Deficiency: The minimum passing score on the Airmanship Examination is 85%.

c. Flying Training Deficiency (FTD): Satisfactory scores are required in all phases of the training.

d. Self-Initiated Elimination (SIE): This option allows the trainee to voluntarily drop out of the training program. It can be for almost any reason. It should be noted that SIE may be regarded, to some extent, as a process of self-screening. Trainees who find that they do not like flying are able to withdraw from flying training before they reach UPT.

e. Military Standards: Regardless of how good a pilot is (or any specialist for that matter) if the person cannot uphold the standards set forth in military regulations, then that person is considered unfit for Air Force service. The Air Force pilot is first an officer and then a pilot. Failure in military standards may also result in elimination entirely from the Air Force.

f. Mortality: Many redundant safety factors have been built into military aviation training over the years. However, it is inevitable that, with the numbers of trainees that proceed through any form of dangerous training, some will become casualties.

Only rarely is complete information about the relative odds of success for candidates available. Stoker, Hunter, Kantor, Quebe, and Siem (in press), investigated FSP effect on UPT employing a unique experimental groups design that countered this common problem. Their study included one group of pilot candidates that were allowed to enter directly into UPT without the FSP screening. This in effect established the benefit of including FSP in the pilot selection process as well as an evaluation of the optimal length of FSP and its use to predict success in UPT.

Future Directions of Air Force Pilot Selection

One of the decisions concerning a change in the current 14-hour FSP is due in part to a finding of the Stoker et al. study. Regression analyses showed that a UPT screening decision could be made after FSP lesson 8 if psychomotor test scores were included, however, additional prediction could be made from a longer FSP. The FSP is projected to be expanded to a 20-hour program in the near future and a reemergence of psychomotor skills testing for prediction of success in aviation training is being incorporated.

In the recent past, USAF pilot candidates who completed UPT were assigned to their operational aircraft type based on their Air Training Recommendation Board scores. These scores are given by fully qualified pilots based upon test scores and flight performance in UPT.

In Fiscal Year 1988, the Air Force is initiating research in support of the decision to make major changes from its current form of UPT (where all candidates receive the same generalized training), to a Specialized Undergraduate Pilot Training (SUPT) system. After selection for SUPT, students will be chosen for specialized continuing training in one of two tracks related to their eventual operational assignment. After this selection is made, they will complete a common primary phase and then proceed through the predetermined track. These specialized training tracks are designated as fighter/bomber and tanker/transport.

Selection decisions will have to be made much earlier with less predictive information available. Due to the standing difficulty of increasing the performance predictability of a highly homogeneous group this will be no easy task. A logical method would be to fully utilize all available information. Even with the change in decision point, the same background biographical data will be available. The selection procedures may be enhanced by more indepth research into predictors using already existing data, a possibility that is explored in this research project.

Just as original pilot selection research was expanded and transferred to other areas of personnel selection, the research of today will be incorporated in the selection of operational spaceflight crews. As more military missions are performed in space, the greater the need for comprehensive and effective criterion measures that will predict mission success.

History of Biographical Predictors of Success

There is generally a large amount of biographical and personality data available on job applicants. The difficulty with personality measurement has been its failure in predicting subsequent job behavior. This could, however be due to the fact that personality tests currently used in clinical settings may possess different specifications than those that would be helpful in an employment setting.

People do things that interest them. Interests may be defined as attitudes toward activities or habitual activities. Interest measures are typically inventories, either requiring some kind of rating of an activity or a choice between alternative activities.

The earliest type of biographical inventory was known as the weighted application blank. This is the simplest and easiest form of inventory. Such biographical factors as: age, amount of previous job training, specific job skills possessed, hobbies, specific type of hobbies, and preferred leisure-time activities have been found to be predictive of general job success (Lawshe & Balma, 1966). Even in some hard-to-predict areas, such as management, sales success and creativity, inventories of biographical information have proven to be good predictors. Turnover rates have also been successfully predicted by the use of biographical information.

Inventories of biographical information can be developed, statistically validated, standardized and systematically applied. Since information on these inventories can usually be verified the concern with intentional faking by the respondents may be reduced. Pure biographical inventories seldom ask for perceptions of fact, only for the facts themselves.

Measurement of personality, interest and biographical data tries to determine what the person is likely to do in an non-controlled, non-formal test situation. At least half of the variance in most jobs can be attributed to characteristics that the employee possesses when he or she first applies for the job (Guion, 1965). If half of the variance can be attributable to presumably biographical factors then continued indepth research is warranted.

One of the first efforts in the military to utilize biographical information for prediction was undertaken during the AAF Psychological Research Project. Miller (1947) reported on an inventory measuring factors such as an officer's interests, fears, and social adjustment. Its purpose was to predict a number of qualities considered to be desirable in a flight instructor. In connection with the collection of criterion data for the validation of instructor selection tests, personal data items were obtained on instructors who were subsequently rated by their students for instructor proficiency.

A student's scale was developed and, when analyzed, showed reliable differences in reference to the personal data items. The fact that these differences resulted in logical patterns suggested to the researchers that the scale should be useful in further research on instructor pilot selection. The main findings on each of the personal data items which yielded significant results were: length of time as flying instructor, combat service, military rank. age, educational level, and instructor job satisfaction.

An individual's present and previous behavior is the best predictor of future behavior. Inventories are often developed with questions that are designed to determine how a person says they have behaved in past situations or how they feel or think presently about specific situations. With valid questions which sample traits or habits in question, quantitative statements of that tendency can be made.

<u>The Autobiographical Inventory (ABI)</u>

Bernd W. Willkomm, a research psychologist with the Flugmedizinisches Institut der Luftwaffe, translated and administered the Autobiographical

Inventory (ABI) during the summer of 1984 (Appendix A). (The ABI had originally been administered to a German military subject pool). The research was conducted while he was on an exchange program with the United States Air Force Human Resources Laboratory at Brooks Air Force Base, Texas. The ABI was initially given to 137 AFROTC cadets at Lackland Air Force Base. The ABI (see Appendix A) is essentially an inventory that examines previous background and interest in aviation-related matters. Preliminary analysis (ABI(1)) was conducted by Willkomm (reported by Fiedler and Cato, 1985) with later analyses (ABI(2)) conducted by Fiedler and Cato (1985) and ABI(3) by Roomsburg (1987).

ABI(1): In the Willkomm (1985) summary, a Pearson correlation analysis was performed on the data. This preliminary analysis of the ABI used FSP outcome as the dependent variable and was scored according to three categories:

a. Failure due to FTD (score = "0").

b. Success (score = "1").

c. Failure due to other reasons (score = "9").

Errors in scoring technique produced incorrect correlations that did not replicate in subsequent analysis.

ABI(2): In the Fiedler and Cato (1985) examination, the scoring key for the dependent variable was changed so that all FSP failures were scored as "0" while FSP successes were scored as "1". The use of this subsequent scoring technique, found the following items to be some of those significantly correlated to a successful FSP outcome:

a. three aviation information items

b. five aviation experience items

c. the total overall aviation experience of the cadet

Fiedler and Cato concluded that the current version of the ABI has significant correlations to flight screening outcome only to the extent that the inventory is sensitive to cognitive and behavioral expressions of a cadet's motivation to learn to fly. Specifically, aviation information and previous experience are positively and significantly related to successful FSP outcome.

Length, reason for, or intensity of interest in aviation items were not significantly related to FSP outcome. They suggested that one reason for the failure to find significant correlations could be that AFROTC cadets were self-selected. The ABI may not be sensitive to more subtle internal individual differences among cadets.

Fiedler and Cato suggested that the ABI may be a more useful screening device earlier in life, before the individual has chosen ROTC. Differences may not manifest due to a self-selection process. The ABI may be more useful in differentiating between students who choose Air Force ROTC over other ROTC or civilian programs.

ABI(3): The present author (1987) investigated the Fiedler and Cato findings by grouping items of the ABI into "predictor scales" and using discriminant analysis to classify subjects into pass and fail groups. Results of the analysis provided evidence that biographical data could be used to predict successes and failures in the FSP.

CHAPTER II

STATEMENT OF PROBLEM AND METHOD

The present study was conducted to elaborate on the issues raised by Fiedler and Cato (1985) and Roomsburg (1987) and to attempt the establishment of criterion related validity for the ABI.

Summary of Design

Particular interest was in whether this survey instrument containing various items relating to biographical data, including interests and aviation experience, would be useful in addition to the present method of pilot selection. In previous analyses, only one group of subjects (ROTC cadets) was examined. For this analysis, the original group of ROTC cadets was used as well as an additional group of OTS candidates.

Subjects

The original group (137 male subjects) were ROTC cadets assigned to the FSP during the summer of 1984. During this analysis, two of the original subjects who had missing data were discarded leaving

135 ROTC subjects. The second group (1 female and 144 male subjects) were OTS candidates who had reported three weeks early (to OTS) to attend the FSP, also in 1984. They completed the survey as part of a larger battery of tests taken prior to training. The individual criterion scores for members of both groups were established upon their completion of the FSP (approximately three weeks after taking the ABI).

Procedure

The 280 subjects were each administered the 29-item ABI which consisted of three fairly defined areas:

a. aviation interest/activity
b. aviation knowledge
c. aviation experience

The ABI was a mixture of nominal and ordinal scales as well as "fill in the blank" questions. In an attempt to recode the items for improved statistical manipulation, a frequency and descriptive statistics procedure was performed. The frequencies showed various outliers and these were handled by collapsing them into next higher or next lower values with the appropriate value labels changed.

A correlation matrix was then created to show all correlations between items. The largest magnitude of any coefficient was .86 between the variables of Commissioning Method (OTS or ROTC) and Age. This would be expected since the OTS group had already finished college and the ROTC group had two years left to completion. Correlations were examined to see if there were any of significant magnitude to infer a relationship between any individual test item and the criterion variable - the overall FSP grade. Since none of the correlations were large, all were retained for use in the discriminant analysis.

One item (B1) had 18 possible responses (choice of up to 5). These 18 responses were combined into the mini-scales which follow (see Appendix B for individual items that made up each of the mini-scales). For example, the MILMIND mini-scale consisted of selecting responses dealing directly with military-related items. The scales were:

a. Military Mind Focus (MILMIND)

b. Technology Focus (TECNOLG)

c. Adventure Focus (ADVNTUR)

d. Security/Career Focus (SECCAR)

e. Risk Taking Focus (RSKTAK)

All other item responses were weighted and scores for each item were assigned to each subject. Items and weights are listed in Appendix B.

Identification of Predictor Variables (TG1)

Random assignment of the cases into two groups resulted in 141 cases (50.36% of the total sample) assigned to TG1. Of the 141, 110 were successes (GRAD) and 31 were failures (ALL OTHERS). All variables were initially entered into the discriminant analysis procedure. Classification information, was obtained and is listed in Appendix C(1).

The Wilks stepwise variable reduction method retained the following eight predictor variables in a single discriminant function that was highly significant ($p < .00005$): aircraft model competition participation, experience in small aircraft, knowledge of aerodynamic laws concerning wing lift, the mini-scales of technology focus and security/career focus, length of time since wanting to fly, parental attitude and knowledge of modern transport aircraft.

Cross-validation (CV1)

(TG1 Predictor Variables Applied to TG2)

For the first cross-validation, the eight TG1 predictor variables were used on TG2 through the direct method of entry. This forced all of the variables that had been retained in TG1 to be used in the cross-validation using TG2. The Direct Method as opposed to a further reduction (such as Wilks') method was used because eight predictor variables found in TG1 significantly distinguished between the criterion groups. Helmstadter (1970) prefers the direct method because the same exact predictors used in the identification sample will then be used in the cross-validation sample.

The first cross-validation resulted in a highly significant discriminant function score ($p < .0002$). Classification information was obtained and is listed in Appendix C(2).

Identification of Predictor Variables (TG2)

139 cases (49.64%) of the total sample) were assigned to TG2. One of these was excluded from the analysis due to missing grouping codes. Of the 138, 107 were successes (GRAD) while 31 were failures (ALL OTHERS). Preliminary variable selection was accomplished using all original variables. Classification information was obtained and is listed in Appendix C(3).

The Wilks stepwise method of variable reduction resulted in the retention of the following 13 variables which resulted in a discriminant function score was equaled the significance found in TG1 ($p < .00005$): the mini-scales of military mind, adventure, technology and risktaking focuses, total pilot hours, passenger hours in transport aircraft, knowledge of aerodynamic laws concerning wing lift, tail rotor action, and modern fighter aircraft, attitude of significant other, main influence to fly, model aircraft competition and building participation.

Cross-validation (CV2)

(TG2 Predictor Variables Applied to TG1)

The direct method of variable entry was again used during the second cross-validation which forced all 13 predictor variables created in TG2 to be utilized for TG1. This discriminant function score was also found to be highly significant ($p < .00005$). Classification information was obtained and is listed in Appendix C(4).

Present Study Focus

The population selection rate (.40) was calculated from information provided by the Air Force Recruiting Service for the years 1983 through 1987. The best estimate of the selection rate was an average of the five years since selection for FSP and UPT occurs through selection boards that are held throughout the year prior to attendance. The selection boards are based on a Board Year (April to March) and quotas are based on a Fiscal Year (October to September).

"Existing Method" (EM) refers to the present sample when discussing selection procedures before the introduction of the "ABI Method" (ABIM). Calculations of the EM using a SR of .40 infers an original applicant pool of 700 of which 280 were selected resulting in this sample. Since all 280 were entered into FSP, no precise determination can be made of those 420 not entered. Although VA (218) and FA (62) can be determined there is no way of determining the FR and VR values and therefore they were set at zero.

Separate discriminant function scores (DFS) were assigned to the two groups (pass and fail) based upon the discriminant analysis procedure. Subjects were then classified to a predicted (pass or fail) group based upon their DFS. Use of these classifications resulted in calculations of VA, VR, FA, and FR values for the ABIM.

Original interest was in knowing whether any relationship existed between the biographical data reported in the ABI (in its entirety) and aviation training outcome. Discriminant analysis was used to see if, based on a derived discriminant function score, success and failure could be predicted on cases with known outcomes. Additional interest was in whether an increase in the number of successful pilots could be attained through use of the ABI or if fewer, more potentially successful, people could be entered into training while still making graduation quotas.

CHAPTER III

RESULTS

In addition to determining predictability of failure and success, the practical significance of using the ABI in addition to the present selection methods was of interest. Results for the total ABI sample will be given here. Classification results were obtained and are listed in Appendix C(5). Results of all analyses are given in Appendix D. Since both cross-validations identified significant discriminant function scores, a discriminant analysis was performed using all 280 subjects of the sample. The Wilks' Lambda reduction method resulted in the retention of the following twelve variables for the total sample: number of pilot hours, model aircraft competition and building participation, attitude of significant other and parents, experience in flying gliders/small civilian aircraft or helicopters/parachute jumps, knowledge of modern military helicopters, commissioning method, where the first interest in aviation came from and the mini-scale of military mind focus.

The discriminant function score which resulted was highly significant ($p < .00005$). The use of the entire sample gives a closer approximation to the actual population of interest. The results of the analysis of the total sample will be used in comparison with the EM of selection.

Table 1 shows the results of the analysis:

	Existing Method	ABI Method
N	280	280
SR	.40	.40
HR	100%	△ HR 93%
BR	.78	△ BR .80
r	.16 (bis)	.35 (phi)
VA	218/280	209/280
%	.78	.75
FA	62/280	52/280
%	.22	.18
VR	0/0	10/280
%	0	.04
FR	0/0	9/280
%	0	.03

Table 1. Analysis Results (N=280)

Where:

HR	= Hiring Rate (HR): FA + VA/N
BR	= Base Rate (BR): VA + FR/(N)HR
△ HR	= Delta HR: FA + VA/N
△ BR	= Delta BR: VA + FA/N(△ HR)

The selection ratio was the same for both methods since it has been previously defined as a population parameter. Since this validation concerns the present sample, hiring rates were used to determine test efficiency (Alexander, et al, 1983). Since, in effect the sample had all "been selected" it represents an EM HR of 100%. It can be seen that the ABIM resulted in a $\triangle$ HR of 93%. Table 1 also shows that the EM BR of .78 was increased to a $\triangle$ BR of .80 when the ABIM was employed. This shows that although the percentage of people actually hired is less - of those hired a larger percentage are successful. Note that $\triangle$ BR can be considered as the incremental validity reported by Anastasi (1988). It is the increase in predictive validity attributable to the ABIM. In other words it is the increase in satisfactory employees with the use of the ABIM.

The validity of the ABIM determined by the phi coefficient is .35. The EM validity was determined by the biserial correlation of .16 (Roach, 1983b).

As can be seen from Table 1, VA were reduced in the ABIM. This is compensated for by the subsequent reduction of 10 false accepts using the ABIM as noted in the FA row.

The following utility formula modified from Alexander, Barrett and Doverspike, 1983, was used to determine the gain in productive employees with use of the ABIM:

$$\bar{U}/\text{selectee} = SDy(rxy) \times \frac{h}{SR}$$

Where:

$\bar{U}$/selectee: change in productivity per selectee

SDy: dollar value of performance (40% of wages per selectee)

rxy: the validity coefficient (phi) of the ABIM

h: is the height of the ordinate of the normal curve at the selection ratio.

SR: is the population selection ratio.

Substituting the values of the present study in the equation gives:

$$\bar{U}/\text{sel} = \$8443.68(.35) \times \frac{.3863}{.40} =$$

$2854.07 per selectee

ABI Method ‡

Autobiographical Inventory ‡

CHAPTER IV

DISCUSSION AND SUMMARY

The present study has shown important evidence for the incorporation of biographical predictors of success in military aviation training selection. Through the use of discriminant analysis, the ABI was shown to be a valid predictor of success and failure in military aviation training. The main findings using the ABIM with the present sample were:

Flight Screening Program ‡

1. A 2% increase in the base rate of success in FSP which translates to three more successful pilots than would have resulted from the use of the EM or four less people being entered into training to obtain 100 qualified pilots.

Existing Method ‡

2. In addition, an annual cost savings of over $314,000 was calculated with use of the ABI in addition to the existing selection methods. Both of these findings will be addressed in the following discussion.

This study conformed to the traditional approach to selection error reduction which is in the the direction of reduction of false accepts ~~(Siegel &~~

51

~~Lane (1987)~~ Reducing the number of applicants that will fail is in the best interest of the organization.

It has been reported that without FSP training, the success rate in UPT drops to .52 (Stoker, et al, in press). With FSP, the success rate is approximately .85 in UPT (Roach, 1983b). Since FSP is a valid indicant of success UPT one can apply the above findings directly to a model of increase in successful pilots.

The first finding may be more easily understood graphically:

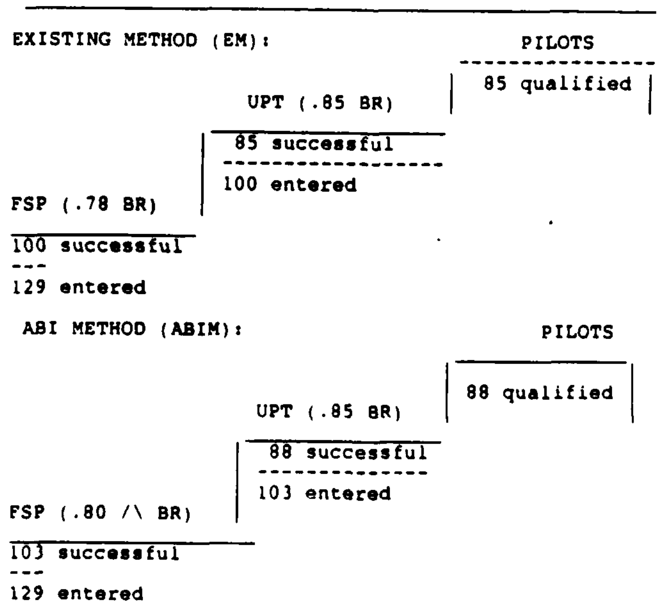


Figure 1. Increase in Qualified Pilots

For every 129 persons entered under the EM, 85 qualified pilots are produced. The ABIM (by increasing the base rate to .80) results in 88 qualified pilots for the same 129 entered.

Additionally, a reduction in the number of people in training could be realized through the use of the ABIM and is shown in Figure 2:

EXISTING METHOD (EM):

PILOTS

100 qualified

UPT (.85 BR)

100 successful
----
118 entered

FSP (.78 BR)

118 successful
---
151 entered

ABI METHOD (ABIM):

PILOTS

100 qualified

UPT (.85 BR)

100 successful
----
118 entered

FSP (.80 /\ BR)

118 successful
---
147 entered

Figure 2. Reduction in Number Entered Into Training

The Existing Method requires that 151 applicants be put into FSP to achieve 100 qualified pilots. Through the addition of biographical data, only 147 applicants would have to enter FSP to achieve the end result of 100 qualified pilots. This realizes training, recruiting and selection cost savings by a decrease of four people entered into training.

The calculation of the second finding will now be discussed. The number of subjects included in the present sample represents, equivalently, one-quarter of the annual trainees entered into FSP (15 FSP classes per year with an average of 75 trainees per class = 1125). Through the use of the ABIM a dollar gain of $8562.21 ($2854.07 per selectee X 3) would have been realized for this sample alone. A conservative estimate of 12 additional qualified pilots per year equates to a total dollar amount gain of productive employees of $34,248.84 annually ($2854.07 X 12).

One would probably be tempted to say that, for the United States Air Force and its extensive budget, a gain of a little over $34,000 per year is insignificant. However, when one takes into account that the gain results from an minimal, almost no-cost selection procedure, it would be senseless not to consider the benefits.

In addition to the dollar gain of additional qualified pilots, the training costs saved by decreasing false accepts can also be considered. The average cost of FSP training alone is $7000.00 per trainee. The reduction in false accepts in the ABIM resulted in ten valid rejects. $70,000 in training costs alone for the present sample would have been saved if biographical data had been included in the selection process. Averaging 40 valid rejects per year (10 valid rejects for every 280 trainees entered into FSP annually) results in a training cost savings of $280,000.00 annually.

Combined, the annual benefit dollar value of $314,248.84 warrants further investigation into increased selection efficiency using biographical data.

One possible method in support of the

Fiedler and Cato (1985) suggestion to administer the ABI earlier in life, would be to make the ABI (or a revised form) readily available to high school seniors and entering college students. The Armed Forces Vocational Aptitude Battery (the enlisted equivalent of the Air Force Officer Qualifying Test) has been provided for use in school counselors' offices for some time. Although there would be some self-selection (causing restriction in range) younger people may not be as likely to discount a military career as those who are older and have already selected a career path.

Since this study utilized the discriminant analysis procedure the individual predictor variables can not be neatly separated from the rest to determine exactly which variables are the most "important". Discriminant analysis emphasizes variables considered simultaneously, not individually. The variables that were identified in all of these separate analyses were (1) participation in aircraft model competitions and (2) knowledge of the aerodynamic laws of wing lift. However, because they were identified in each cross-validation based upon their value in relation to the other variables in that particular analysis, their evaluation alone by use of a discriminant function would not necessarily be of use in these predictions.

For further analyses of biographical data as predictors of successful military aviators, more ordered and perhaps interval scales would be used as well as more relevant items concerning American pilot candidates. Since the original ABI applied to the West German military, loss of information in translation has to be considered. One point for example, is that it is very rare for an American pilot candidate to have more than 50 hours flying as a pilot without having acquired a private pilot's license.

The results of this study show the possibility that, given a specifically designed biographical data inventory for the United States Air Force, biographical data could be used as a virtually no cost method of increasing the number of successful pilots produced by UPT or decreasing the number of people required to enter into training. This would result in substantial selection cost reduction by selecting a fewer number of people (who possess a greater prediction of success) while still achieving desired pilot quotas.

There is a massive database of biographical data available on all members of the Air Force. It is collected in the process of application and is relatively inexpensive to obtain. Further study into biographical data research in the aviation arena may lead to the establishment of more valid profiles of potentially successful aviators.

APPENDIX A

THE AUTOBIOGRAPHICAL INVENTORY

FULL NAME________________________ AGE__________________

COLLEGE___________________ ACADEMIC MAJOR_____________

AIR FORCE HUMAN RESOURCES LABORATORY
AIRCREW BACKGROUND INVENTORY

This questionnaire is part of an AFHRL study to improve Air Force pilot selection. The purpose of this questionnaire is to evaluate your interests, attitudes, and experience regarding aviation. The information you provide will be used for research purposes only and will in no way affect your training or career in the Air Force. The information will be held in confidence and will not be entered into any personnel files. Please answer all items honestly since your cooperation is essential in the success of this research project.

For each item below, select the most appropriate responses by putting an X in the corresponding square or provide the best possible answers in the space provided.

A.1. When did you first become interested in aviation?

(a) less than 1 year ago

(b) 1 or more, but less than 2 years ago

(c) 2 or more, but less than 4 years ago

(d) 4 or more years ago

A.2. Where did your first interest in flying come from?

(a) Not sure, I just became interested in flying

(b) from family, friends, or acquaintance

(c) from visiting flying events, airports, or airbases

(d) from flying on the airlines

(e) from flying in small airplanes or gliders

(f) from military recruiters or advertisements

(g) other

A.3. What was your initial activity in aviation?

(a) Reading about history of aviation

(b) Reading books on modern aviation

(c) Reading Aviation Magazines

(d) Studying aerospace technology

(e) Building plastic models

(f) Building flying models

(g) Other/Don't know

A.4. Indicate below which flying magazines you read. Write the names(s) of the magazine(s) in the blank(s) below and enter the number corresponding to how often you read that magazine in the box provided:

0 - Never
1 - Very Seldom
2 - Sometimes

3 - Often
4 - Every Issue

(a)..[ ]

(b)..[ ]

(c)..[ ]

(d)..[ ]

(e)..[ ]

(f)..[ ]

(g)..[ ]

B.1. Which of the following were your major reasons for applying for flight training? Choose up to 5 of the options below:

(a) It's an interesting and diversified job

(b) It was one way to become an Air Force Officer

(c) It's a financially attractive and stable job

(d) It has been a lifelong dream

(e) I was looking for adventure

(f) I was fascinated with the freedom of flight

(g) It has the esteem, prestige and image of pilots

(h) It offered the opportunity to see the world

(i) It has the potential for self-development

(j) I am interested in the technology

(k) I would like to make my hobby my job

(l) It offered a job with considerable responsibility

(m) I wanted a job with tough physical and mental requirements

(n) It's a risky and sometimes dangerous job

(o) The job has constant challenge

(p) I'm attracted to beautiful, sleek, fast aircraft

(q) It has the fellowship of pilots

(r) It offered opportunities for career advancement

(s) I'm attracted to being in control of a very complex technical system

(t) Because I want to get a job in civilian aviation after my military career

B.2. Who was the main influence in your decision to apply for flying training?

(a) It was my own decision

(b) Pilots I had talked to

(c) Family, friends, or an acquaintance

(d) Recruiter

(e) Other

B.3. When did you definitely decide to apply for flying training?

(a) Less than 1 year ago

(b) 1 or more, but less than 2 years ago

(c) 2 or more, but less than 4 years ago

(d) 4 or more years ago

B.4. What was your parent's attitude about your decision to apply for flying training?

(a) Very much in favor

(b) In favor

(c) Neutral

(d) Against

(e) Very much against

B.5. What was your boy/girl friend's or spouse's attitude about your decision to apply for flying training?

(a) Very much in favor

(b) In favor

(c) Neutral

(d) Against

(e) Very much against

B.6. What will you do if you do not get into flying training?

(a) I will try to get into another military career field

(b) I would pursue a flying job in civilian aviation

(c) I would fly as a hobby in civilian aviation

(d) I don't know, but none of the above

(e) I haven't given it any thought

C.1. Name eight modern, over 80-passenger jet transport aircraft and indicate the number of engines on each.

	Aircraft Name	Number of Engines
(a)	______________________	______________
(b)	______________________	______________
(c)	______________________	______________
(d)	______________________	______________
(e)	______________________	______________
(f)	______________________	______________
(g)	______________________	______________
(h)	______________________	______________

C.2. Name 8 modern Air Force fighter aircraft, identify the number of engines on each and the number of crew members in each.

	Aircraft Name	Number Engines	Number crew members
(a)	______________	____________	______
(b)	______________	____________	______

(c) ____________________ ________________ ________

(d) ____________________ ________________ ________

(e) ____________________ ________________ ________

(f) ____________________ ________________ ________

(g) ____________________ ________________ ________

(h) ____________________ ________________ ________

C.3. Name 4 modern military helicopters.

(a) ____

(b) ____

(c) ____

(d) ____

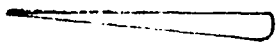
C.4. Name 3 modern military propeller driven transport or training aircraft.

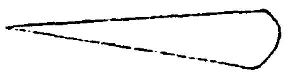
(a) ____

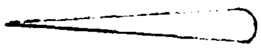
(b) ____

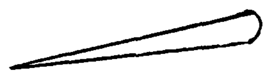
(c) ____

C.5. Based on aerodynamic laws, which of the four wing profiles below would generate the most lift?

(a)  ....

(b)  ....

(c)  ....

(d)  ....

C.6. The primary use of the rudder is to stabilize the aircraft in the :

(a) Vertical axis (top to bottom)

(b) Lateral axis (nose to tail)

C.7. What happens when a helicopter engine fails in flight?

(a) The helicopter crashes

(b) The helicopter rotor is stopped and the helicopter glides to a safe landing

(c) The helicopter keeps flying due to the principle of autorotation

(d) The helicopter can be safely landed using autorotation

C.8. What is the main function of a tail rotor on a helicopter? Choose as many answers as you think are correct.

(a) To generate forward motion

(b) To stabilize the vertical axis

(c) To stablize the lateral axis

(d) To steer the helicopter

C.9. What do the initials AWACS mean?

D.1. How often have you flown as a passenger in the following types of aircraft?

(a) Large transport aircraft

(1) Never

(2) 1-2 times

(3) 3-5 times

(4) 6-10 times

(5) More than 10 times

(b) Gliders or motor gliders

(1) Never

(2) 1-2 times

(3) 3-5 times

(4) 6-10 times

(5) More than 10 times

(c) Small civilian aircraft or helicopters

(1) Never

(2) 1-2 times

(3) 3-5 times

(4) 6-10 times

(5) More than 10 times

D.2. How many total passenger hours do you have flying?

(a) None

(b) Less than five hours

(c) 5 or more but less than 15 hours

(d) 15 or more but less than 50 hours

(e) 50 or more hours

(f) Don't know

D.3. What kind of airplane models have you built (Choose as many answers as necessary)?

(a) I have not built any

(b) Plastic models

(c) Hand launched or hand controlled flying models

(d) Radio controlled flying models

(e) Scratch built flying models

D.4. Have you entered any competitions with model aircraft?

(a) Yes

(b) No

D.5. Have you made any parachute jumps?

(a) No

(b) Yes, up to 10 jumps

(c) Yes, 11-30 jumps

(d) Yes, 31-50 jumps

(e) More than 50 jumps

D.6. Have you ever flown a hang-glider or ultra-light?

(a) No

(b) Yes, but less than 10 hours

(c) Yes, 10 hours or more

D.7. How much pilot training experience do you have? Choose as many answers as apply.

(a) None

(b) Some training for a glider pilot's license

(c) Some training for a regular pilot's license

(d) I have a glider license

(e) I have a regular license

(f) I have both a glider and regular pilot's license

D.8. How many piloting hours do you have?

(a) None

(b) Less than 10 hours

(c) 10 or more but less than 30 hours

(d) 30 or more but less than 50 hours

(e) 50 or more but less than 100 hours

(f) 100 or more but less than 200 hours

(g) 200 or more hours

APPENDIX B

Item composition (for item B1 of ABI) for mini-scales:

MILMIND=B1B+B1G+B1L+B1M+B1N+B1P+B1Q
RSKTAK=B1E+B1N+B1O
SECCAR=B1C+B1K+B1Q+B1R+B1T+B1I
ADVNTUR=B1A+B1D+B1E+B1F+B1H
TECNOLG=B1J+B1O+B1P+B1S

VARIABLE LIST LABELS, CODES & WEIGHTS

FSP: FLIGHT SCREENING PROGRAM OUTCOME

1 ALL OTHERS
2 GRAD

WHNINTAV: WHEN DID YOU FIRST BECOME INTERESTED IN AVIATION?

1 LESS THAN 4 YEARS AGO
2 EQUAL TO OR MORE THAN 4 YEARS AGO

FIRSTINT: WHERE DID FIRST INTEREST IN FLYING COME FROM?

0 OTHER/NOT SURE
1 FAMILY/AQUAINTANCES
2 FLYING ON AIRLINES
3 MILITARY RECRUITERS
4 ATTENDING FLYING EVENTS & VISITING MILITARY BASES
5 FLYING IN SMALL AIRCRAFT

INACTAVI: WHAT WAS YOUR INITIAL ACTIVITY IN AVIATION?

0 OTHER/DO NOT KNOW
1 READING ABOUT AVIATION
2 BUILDING MODELS
3 STUDYING AEROSPACE TECHNOLOGY

READMAG: INDICATE FLYING MAGAZINES YOU READ.

0 DOES NOT READ
1 READS

WHICH OF THE FOLLOWING WERE YOUR MAJOR REASONS FOR APPLYING FOR FLIGHT TRAINING?:

MILMIND: MILITARY MIND FOCUS

0 NONE SELECTED
1 ONE SELECTED RESPONSE
2 2 SELECTED RESPONSES
3 3 OR MORE RESPONSES

RSKTAK: RISK TAKER FOCUS

0 NONE SELECTED
1 ONE SELECTED RESPONSE
2 2 OR MORE RESPONSES

SECCAR: SECURITY/CAREER FOCUS

0 NONE SELECTED
1 1 SELECTED RESPONSE
2 2 OR MORE RESPONSES

ADVNTUR: ADVENTURE FOCUS

0 NONE SELECTED
1 ONE SELECTED RESPONSE
2 2 SELECTED RESPONSES
3 3 OR MORE RESPONSES

TECNOLG: TECHNOLOGY FOCUS

0 NONE SELECTED
1 ONE SELECTED RESPONSE
2 2 OR MORE RESPONSES

MAINNFLU: WHO WAS THE MAIN INFLUENCE IN YOUR

DECISION TO APPLY FOR FLIGHT TRAINING?

0 OTHER INFLUENCE
1 OWN DECISION

DEFDECAP: WHEN DID YOU DEF DECIDE TO APPLY FOR FLYING TRAINING?

0 NO ANSWER
1 LESS THAN 1 YEAR AGO
2 MORE THAN 1 BUT LESS THAN 2 YEARS AGO
3 MORE THAN 2 BUT LESS THAN 4 YEARS AGO
4 MORE THAN 4 YEARS AGO

AWACS: WHAT DO THE INITIALS "AWACS" MEAN?

0 INCORRECT
1 CORRECT

PRNTATT: WHAT WAS YOUR PARENT'S ATTITUDE ABOUT YOUR DECISION TO APPLY FOR FLYING TRAINING?

0 VERY MUCH AGAINST
1 AGAINST
2 NEUTRAL
3 IN FAVOR
4 VERY MUCH IN FAVOR

SIGOTHR: WHAT WAS YOUR BOY/GIRL FRIEND'S OR SPOUSES'S ATTITUDE ABOUT YOUR DECISION TO APPLY FOR FLIGHT TRAINING?

0 VERY MUCH AGAINST
1 AGAINST
2 NEUTRAL
3 IN FAVOR
4 VERY MUCH IN FAVOR

ALTFLY: WHAT WILL YOU DO IF YOU DO NOT GET INTO FLYING TRAINING?

0 NO THOUGHT

1 DO NOT KNOW/NONE OF THE ABOVE
2 HOBBY-CIV AVIATION
3 CIVILIAN AVIATION
4 OTHER MILITARY CAREER

MODTRANS: NAME 8 MODERN, OVER 80-PASSENGER JET TRANSPORT AIRCRAFT AND INDICATE THE NUMBER OF ENGINES ON EACH.

0 INCORRECT
1 ONE CORRECT RESPONSE
2 TWO CORRECT RESPONSES
3 THREE CORRECT RESPONSES
4 FOUR CORRECT RESPONSES
5 FIVE CORRECT RESPONSES
6 SIX CORRECT RESPONSES
7 SEVEN CORRECT RESPONSES
8 EIGHT CORRECT RESPONSES

MODFITR: NAME 8 MODERN AIR FORCE FIGHTER AIRCRAFT, IDENTIFY THE NUMBER OF ENGINES ON EACH AND THE NUMBER OF CREW MEMBERS IN EACH.

0 LESS THAN OR EQUAL TO 8 CORRECT RESPONSES
1 MORE THAN 8 CORRECT

MODHELO: NAME 4 MODERN MILITARY HELICOPTERS.

0 INCORRECT RESPONSES
1 ONE CORRECT RESPONSE
2 TWO CORRECT RESPONSES
3 THREE CORRECT RESPONSES
4 FOUR CORRECT RESPONSES (MAXIMUM)

MILTRANS: NAME 3 MODERN MILITARY PROPELLER DRIVEN TRANSPORT OR TRAINING AIRCRAFT

0 NONE CORRECT
1 ONE CORRECT RESPONSE
2 TWO CORRECT RESPONSES
3 THREE CORRECT RESPONSES (MAXIMUM)

WINGLAW: BASED ON AERODYNAMIC LAWS, WHICH OF THE FOUR WING PROFILES BELOW WOULD GENERATE THE MOST LIFT?

0 INCORRECT
1 CORRECT

RUDDER: THE PRIMARY USE OF THE RUDDER IS TO STABILIZE THE AIRCRAFT IN WHICH AXIS?

0 INCORRECT
1 CORRECT

HELOFAIL: WHAT HAPPENS WHEN A HELICOPTER ENGINE FAILS IN FLIGHT?

0 INCORRECT
1 CORRECT

TALROTR: WHAT IS MAIN FUNCTION OF A HELICOPTER TAIL ROTOR?

0 INCORRECT
1 CORRECT

EXPTRANS: HOW OFTEN HAVE YOU FLOWN AS A PASSENGER IN LARGE TRANSPORT AIRCRAFT?

0 EQUAL TO OR LESS THAN 10 TIMES
1 MORE THAN 10 TIMES

EXPGLIDP: HOW OFTEN HAVE YOU FLOWN AS A PASSENGER IN GLIDERS OR MOTOR GLIDERS?

0 NEVER
1 MORE THAN 1 TIME

EXPSMLAC: HOW OFTEN HAVE YOU FLOWN AS A PASSENGER IN SMALL CIVILIAN AIRCRAFT OR HELICOPTERS?

0 EQUAL TO OR LESS THAN 10 TIMES
1 MORE THAN 10 TIMES

TOTPASHR: HOW MANY TOTAL PASSENGER HOURS DO YOU HAVE FLYING?

0 LESS THAN 50 HOURS
1 EQUAL TO OR MORE THAN 50 HOURS

KINDMODL: WHAT KIND OF AIRPLANE MODELS HAVE YOU BUILT?

0 NONE OF ANY KIND
1 HAVE BUILT VARIOUS KINDS

MODLCOMP: HAVE YOU ENTERED ANY COMPETITIONS WITH MODEL AIRCRAFT?

0 NOT ENTERED
1 ENTERED

CHUTE: HAVE YOU MADE ANY PARACHUTE JUMPS?

0 NONE
1 LESS THAN OR EQUAL TO 1 JUMP
2 11-30 JUMPS
3 31-50 JUMPS
4 MORE THAN 50 JUMPS

EXPGLIDF: HAVE YOU EVER FLOWN A HANG-GLIDER OR ULTRA-LIGHT?

0 NONE
1 LESS THAN 10 HOURS
2 10 OR MORE HOURS

EXPPILOT: HOW MUCH PILOT TRAINING EXPERIENCE DO YOU HAVE?

0 NONE
1 SOME FOR GLIDER/PILOT
2 RATED LICENSE PILOT/GLIDER OR BOTH

EXPILHRS: HOW MANY PILOTING HOURS DO YOU HAVE?

0 LESS THAN 10 HOURS
1 EQUAL OR MORE THAN 10 BUT LESS THAN 30
2 EQUAL TO OR MORE THAN 30 HOURS

THIS COMPLETES THE SURVEY. THANK YOU VERY MUCH.

APPENDIX C

1. TG1 Classification Results -

Actual Group	# of Cases	Predicted Group Membership 1	2
Group 1 ALL OTHERS	31	8 25.8%	23 74.2%
Group 2 GRAD	110	5 4.5%	105 95.5%

Cases correctly classified: 80.14%

2. CV1 Classification Results -

Actual Group	# of Cases	Predicted Group Membership 1	2
Group 1 ALL OTHERS	31	4 12.9%	27 87.1%
Group 2 GRAD	108	4 3.7%	104 96.3%

Cases correctly classified: 77.70%

3. TG2 Classification Results -

Actual Group	# of Cases	Predicted Group Membership 1	2
Group 1 ALL OTHERS	31	13 41.9%	18 58.1%
Group 2 GRAD	108	6 5.6%	102 94.4%

Cases correctly classified: 82.73%

4. CV2 Classification Results -

Actual Group	# of Cases	Predicted Group Membership 1	2
Group 1 ALL OTHERS	31	5 16.1%	26 83.9%
Group 2 GRAD	110	4 3.6%	106 96.4%

Cases correctly classified: 78.72%

5. Total (N=280) Classification Results -

Actual Group	# of Cases	Predicted Group Membership 1	2
Group 1 ALL OTHERS	62	10 16.1%	52 83.9%
Group 2 GRAD	218	9 4.1%	209 95.9%

Cases correctly classified: 78.21%

APPENDIX D

ANALYSES RESULTS

	TG1	CV1	TG2	CV2	TOTAL
N	141	139	139	141	280
Population SR	.40	.40	.40	.40	.40
Sample HR	1.00	1.00	1.00	1.00	1.00
Sample BR	.78	.78	.78	.78	.78
Sample △ HR	.90	.94	.86	.93	.93
Sample △ BR	.82	.79	.85	.80	.80
phi	.40	.31	.50	.36	.35
DSF:All Others	.80495	-.61154	-1.07310	.71187	.68972
DSF:Grad	-.22685	.17553	.31090	.20062	-.19706
Valid Accepts % (VA)	105/141 .74	104/139 .75	102/139 .73	106/141 .75	209/280 .75
Valid Rejects % (VR)	8/141 .06	4/139 .03	13/139 .09	5/141 .04	10/280 .04
False Accepts % (FA)	23/141 .16	27/139 .19	18/139 .13	26/141 .18	52/280 .18
False Rejects % (FR)	5/141 .04	4/139 .03	6/139 .04	4/141 .03	9/280 .03
Overall Class	80.14%	77.70%	82.73%	78.72%	78.21%
Wilks' Lambda	.8437	.9018	.7471	.8735	.8796
Chi-Square Sig Level	22.941 .0034	13.75 .0885	37.759 .0003	17.926 .1604	34.77 .0005
ANOVA F Sig Level	25.75 .00005	14.94 .0002	46.86 .00005	20.14 .00005	38.30 .00005

Where:

Population SR = Selection Rate (selectees/qualified applicants)
HR = Hiring Rate (FA + VA/HR)
BR = Base Rate (VA + FR/HR)
△ HR = Delta Hiring Rate (FA + VA/HR)
△ BR = Delta Base Rate (VA + RA/△ HR)
DSF = Discriminant Function Score

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