



ED 239 095

CE 037 968

AUTHOR Skinner, Mary J.; Alley, William E.  
 TITLE Performance of Retrained Airmen in Air Force Technical Schools (Revised). Interim Report for Period January 1981-August 1982.  
 INSTITUTION Air Force Human Resources Lab., Brooks AFB, Tex. Manpower and Personnel Div.  
 REPORT NO AFHRL-TR-83-18  
 PUB DATE Jan 84  
 NOTE 39p.; Supersedes AFHRL-TR-80-7.  
 PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.  
 DESCRIPTORS \*Academic Achievement; Adult Education; Adult Vocational Education; Armed Forces; Attrition (Research Studies); \*Career Change; \*Enlisted Personnel; Military Service; Military Training; Multiple Regression Analysis; \*Retraining; \*Transfer of Training; \*Vocational Aptitude

IDENTIFIERS \*Air Force

## ABSTRACT

Research was conducted to determine the effect of changing occupational specialties on the performance of Air Force retrained enlistees attending basic technical schools. The academic performance and attrition rates of approximately 20,000 retrainees and 230,000 nonprior-service enlistees (nonretrainees) attending 272 schools were compared. Multiple linear regression analyses of data from historical personnel records examined the relationship among school performance criteria, retraining status, and aptitude as well as the amount of military service, career status, and background experience acquired prior to retraining. Results indicated the performance of retrainees was comparable or superior to nonretrainees with equivalent aptitudes. Among retrainees, performance generally increased as more time was spent in military service before changing specialties. Retrainingees who were career airmen with more than three years of service tended to do better than noncareer airmen in training. Experience in a specialty with the same aptitude index (mechanical, administrative, general, or electronics) as the retraining specialty typically facilitated performance. A characteristic increasing relationship between aptitude and success in technical training was found. (Technical specifications and data tables are appended.) (YLB)

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ED239095

## PERFORMANCE OF RETRAINED AIRMEN IN AIR FORCE TECHNICAL SCHOOLS (REVISED)

By

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January 1984

Interim Report for Period January 1981 -- August 1982

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Manpower and Personnel Division

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Commander

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFHRL-TR-83-18	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle)  PERFORMANCE OF RETRAINED AIRMEN IN AIR FORCE TECHNICAL SCHOOLS (REVISED)		5. TYPE OF REPORT & PERIOD COVERED. Interim January 1981 - August 1982
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Mary J. Skinner William E. Alley		8. CONTRACT OR NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Manpower and Personnel Division Air Force Human Resources Laboratory Brooks Air Force Base, Texas 78235		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62703F 77340804 77340309
11. CONTROLLING OFFICE NAME AND ADDRESS HQ Air Force Human Resources Laboratory (AFSC) Brooks Air Force Base, Texas 78235		12. REPORT DATE January 1984
		13. NUMBER OF PAGES 38
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS (of this report) Unclassified
		15.a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report)  Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of this abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES  Supersedes AFHRL-TR-80-7, AD-A090535.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
aptitude	military experience	technical training
attrition	occupational changes	training performance
career changes	occupational tenure	transferability of skills
employment experience	retraining	transfer of training
job reassignment	student performance	vocational retraining
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)		
<p>Research was conducted to determine the effect of changing occupational specialties on the performance of Air Force retrained enlistees attending basic technical schools. The academic performance and attrition rates of approximately 20,000 retrainees and 230,000 non-prior-service enlistees (non-retrainees) attending 272 schools were compared. Schools were categorized by selector aptitude index requirements into 18 subgroups for analysis. Data were compiled from historical personnel records. Multiple linear regression analyses examined the relationship between school performance criteria and retraining status and aptitude as well as the amount of military service, career status, and background experience acquired prior to retraining for each subgroup.</p>		

## Item 20 (Continued)

Results indicated that the performance of retrainees was comparable or superior to non-retrainees with equivalent aptitudes. Further, among retrainees performance generally increased as more time was spent in military service before changing specialties. Retrainees who were career airmen with more than three years of service tended to do better than non-career airmen in training. Results also indicated that experience in a specialty with the same aptitude index (Mechanical, Administrative, General, or Electronics) as the retraining specialty typically facilitated performance. A characteristic increasing relationship between aptitude and success in technical training was found. Potential research applications to retrainee selection and assignment procedures were considered.

Unclassified

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

## PREFACE

This technical report revises AFHRL-TR-80-7, which was published under the same title in September 1980 but which was later found to contain erroneous aptitude scores. Norming problems with the Armed Services Vocational Aptitude Battery (ASVAB) resulted in inaccurate aptitude percentiles for the portion of the study sample which tested on Forms 5, 6, and 7. The current report updates earlier study results with corrected aptitude scores and replaces the previous document.

Work was accomplished in support of RPR 77-12, Retrainee Follow-Up Study, for Air Force managers responsible for retraining policy and program operation (HQ USAF/MPPP; AFMPC/MPCR & MPCM). The study was conducted under Project 7734, Force Management System; Task 773408, Personnel Utilization and Retention System; Work Unit 77340804, Evaluation of the Air Force Airman Retraining Program.

Grateful acknowledgement is made of the contributions to the ASVAB score correction and data re-analysis phases of this project by Mr. Jim Brazel and Mr. Jim Friemann and their staffs in the Technical Services Division, Air Force Human Resources Laboratory.

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## I. INTRODUCTION

The Air Force, unlike employers in the private sector, must maintain balanced manning of career fields among the enlisted force within the constraints imposed by a closed personnel system. While the majority of apprentice-level positions are filled from much the same manpower pool available to private industry, the Air Force must utilize personnel already integrated into the military force to staff technician- and superintendent-level jobs. Career field manpower overages and shortages created by such factors as attrition, mission and organizational changes, fluctuations in the recruiting pool, and technological advances in weapon systems are realigned primarily through extensive retraining of airmen. Guided by the policies and procedures of the Airman Retraining Program (AFR 39-4, 1979), military managers initiate retraining actions which change enlistees from one occupational specialty to another either within the same career field or in a different career field. The retraining capability serves as a valuable management tool for adjusting imbalances in manpower needs in the closed personnel system.

Approximately 10,000 to 15,000 enlistees annually participate in the Airman Retraining Program. The program encompasses a variety of personnel subcategories including By-Pass, Dual Air Force Qualification (CONUS/Oversea imbalance), and lateral specialists whose retraining may be selective or voluntary. Managers follow general guidelines for selecting and assigning retrainees to a second Air Force specialty (AFS) according to their skills, experience, and aptitude. The manager's reassignment decision is, nevertheless, primarily a subjective one. The majority of retrainees acquire the fundamental skills and knowledge for their new AFS through formal school or on-the-job training programs. About 60 percent of Air Force retraining is accomplished through attendance at technical training courses, according to historical files of requests for retraining maintained by the Air Force Manpower and Personnel Center. By-Pass specialists, who constitute approximately 1 percent of the retrainees, qualify for apprentice-level duties on the basis of education, training, and experience usually acquired prior to enlistment. The remaining retrainees enter on-the-job training programs. Table 1 shows the number and percentage of enlistees requesting retraining for 5 fiscal years and the anticipated method of retraining. While the costs of training enlistees to proficiency in their new specialty are high, the volume of retraining witnessed in recent years and associated training expenses are not expected to decrease.

Little research related to the Air Force retraining program has been conducted despite its substantial contribution to the total personnel management system. Hook and Massar (1962) conducted a preliminary investigation of 98 AFSs to assess a methodology for estimating time required for retrainees to achieve proficiency in a second specialty. Research findings indicated that additional specialties would need to be examined and several technical problems resolved before the methodology could be satisfactorily applied in the operational environment. More recently, Titsworth (1979) examined grade/job satisfaction, and assignment characteristics of retrained and non-retrained personnel, controlling for length of service. Overall, few differences attributable to retraining status were detected in the 35 AFSs examined. The perceptions of retrainees and non-retrainees regarding reenlistment intent, job interest, and utilization of talent and training were generally comparable. In a few specialties, retrainees were found to be somewhat disadvantaged with regard to grade/rank, number and difficulty of tasks performed, and supervisory responsibilities. The nature and scope of prior research restrict its utility in terms of developing retraining policy and evaluating the impact of retraining on the individual and military force effectiveness. A comprehensive evaluation which systematically tracks the performance of retrainees and their progress in their new occupations is needed. The current research is an initial effort in a planned series of investigations evaluating the Airman Retraining Program.

The earliest progress indicators available for retrainees are measures of performance in formal technical school courses. The majority of retrainees who attend formal schools enroll in the same basic resident courses as non-prior-service enlistees. Non-prior-service airmen are recruits for whom technical training is the first assignment after completing six weeks of basic military training. To provide an overall assessment of the performance of retrainees in technical training, the current study compares retrainees and non-prior-service enlistees in terms of academic achievement and disposition from training. As a comparison sample, non-prior-service airmen are regarded as non-retrainees, since they lack previous military job experience in their occupational specialties.

**Table 1. Frequency and Percentage of Requests for Retraining by Fiscal Year and Planned Method of Retraining**

Method of Retraining	Fiscal Year											
	74		75		76		77		77		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
By-Pass	118	.71	145	.94	174	1.19	31	1.11	79	.68	547	.90
Formal School	9,667	58.25	8,660	56.43	8,099	55.24	1,706	61.15	7,707	66.56	35,839	58.78
On-the-Job Training	6,812	41.04	6,541	42.62	6,389	43.58	1,053	37.74	3,793	32.76	24,588	40.33
Total	16,597	100	15,346	100	14,662	100	2,790	100	11,579	100	60,974	100

**Note.** Table excludes cases with invalid or missing data (N = 76).

In this study, the characteristics of the retrainees upon entry into the new specialties are examined to assess the impact of various factors on technical school performance and their potential implications for retrainee selection and assignment procedures. One objective is to determine if there are optimal points in a military career for changing specialties. A second factor of interest is the career status of the enlistee at the time of retraining. The reasons underlying retraining decisions may differ for non-career and career airmen who change specialties prior to or after 3 years of military service. Non-career enlistees typically retrain to meet Air Force manpower needs or due to disqualification in their current specialty, while career airmen more frequently retrain in conjunction with reenlistment to enhance promotion opportunities or to satisfy individual career interests and goals. The success in training of these two personnel groups is evaluated to determine the merit of promoting retraining among career enlistees. A further issue is transferability of skills and knowledges from previous military occupations. Of interest is the impact on training performance of transferring from an AFS with similar or dissimilar requisite job skills.

A final study objective is an examination of the influence of aptitude on training outcomes. Selection tests administered to enlistees to determine qualifications for entering occupational specialties are validated against technical school performance measures. Consequently, the performance of both retrainees and non-retrainees would be expected to be positively related to aptitude achievement. Although improved performance with higher aptitudes is anticipated for both groups, it is possible that, for a given aptitude level, retrainees will be superior to the non-prior-service enlistees because the previous military experience of the retrainees may favorably impact performance. Thus, a major purpose of the investigation is to determine under conditions of equal aptitudes whether retrainees would perform better in training.

## II. METHOD

Data on enlistees who attended basic technical training schools between July 1973 and December 1977 were extracted for analysis from Air Force historical personnel files. Demographic, performance, and personnel variables were retrieved from the Uniform Airmen Record (UAR), Position and Classification of Enlistees (PACE), and technical training (T-68) files maintained by the Technical Services Division of the Air Force Human Resources Laboratory, and from Retraining History files developed by the Air Force Manpower and Personnel Center (AFMPC). Excluding cases with missing or invalid data, the final sample contained 251,202 enlistees attending 272 technical schools. As shown in Table 2, both retrained and non-retrained groups included male and female enlistees and were racially mixed, with the majority having completed at least a high school education.

Specific data elements were extracted from historical records to examine the relationships between performance in technical school and retraining status and aptitude. In addition, several factors which may potentially impact retrainee selection and assignment procedures were evaluated. Data on amount of service, military career status, and type of background experience attained before retraining were retrieved for analysis.

### Predictor Variables

Enlistees were identified as potential retrainees if personnel records verified that the request for retraining as documented on AFMPC Retraining History files was subsequently approved. Retrainee status was confirmed if the assignment AFS before retraining was different from the AFS of the technical school course attended or if technical training records identified the student as a retrainee. Non-prior-service enlistees were designated as non-retrainees if they were enrolled in basic technical training in conjunction with their initial military assignment. Aptitude scores were derived from the Armed Services Vocational Aptitude Battery (ASVAB) (AFR 35-8, 1978). The ASVAB yields four aptitude index (AI) composites: Mechanical (M), Administrative (A), General (G), and Electronics (E). Raw scores on the composites are converted to a 20-interval centile scale (01, 05, 10, ..., 95). Entry prerequisites for most Air Force career fields include a qualifying score on one of the four AIs (AFM 39-1, 1982). Aptitude scores used in the analysis corresponded to the selector AI of the technical school course attended by the enlistee.

Among the retrainees, amount of military experience was recorded as the total number of months of active Federal military service (TAFMS). TAFMS values ranged from zero to 240 months. The career status variable was also based

Table 2. Percentage of Retrainees and Non-Retrainees  
by Sex, Race, and Educational Level Categories

Retraining Status	N	Sex		Race			Educational Level	
		Male	Female	White	Black	Other/ Unknown	High School Graduate	High School Non-Graduate
Retrainee	19,885	92.98	7.02	80.38	17.64	1.98	99.16	.84
Non-retrainee	231,317	88.80	11.20	84.54	13.13	2.33	97.91	2.09

on the number of months of military service. Enlistees were designated as non-career if they had served 36 months or less at time of retraining or as career if more than 36 months of military service had been completed. Type of background experience identified the aptitude requirement of the specialty to which the enlistee was assigned prior to retraining. That is, background experience was designated as Mechanical, Administrative, General, or Electronics depending on the specialty of origin. If the pre-retraining AFS identification code was invalid or not available from the Retraining History files, background experience was coded as unknown.

### Performance Criteria

Pass/fail status and final school grade in technical training were used as criteria. The reason for terminating technical training was used as the basis for generating the pass/fail dichotomy. School graduates were identified as passes. Failures were eliminated from training due to substandard academic performance, medical disqualification, death, or other/unknown reasons. For a subset of enlistees who passed technical training, an index of academic achievement in the form of a final school grade was recorded in percentiles ranging from 60 to 99. Since performance rating standards in each school could not be assumed to be equivalent, final school grades were standardized to permit analysis at other than the AFS level. The standard score transformation yielded a mean final school grade equal to 50.0 and a standard deviation equal to 10.0 in each technical school. A summary description of predictors and criteria is shown in Table 3.

Table 3. Summary of Predictor and Criterion Variables

Variable	Description
<b>Predictor</b>	
Retraining Status	Dichotomous variable identifying the attendee as a retrainee or non-retrainee.
Time in Service	Continuous variable specifying for retrainees the number of months of military service experience before enrolling in technical training for a new AFS.
Career Status	Dichotomous variable identifying retrainees as non-career airmen with 36 or fewer months of service experience or career airmen with more than 36 months of service experience.
Background Experience	Categorical variable assigning retrainees according to the aptitude index (AI) of the pre-retraining AFS to one of the following five types of background experience categories: Mechanical, Administrative, General, Electronics, or Unknown.
Aptitude	Percentile score achieved on the ASVAB composite which corresponds to the AI entry prerequisite of the technical school attended.
<b>Criterion</b>	
Pass/Fail Status	Dichotomous variable identifying the attendee as a graduate (pass) or eliminee (fail) from technical training.
Final School Grade	Grade assigned upon completion of technical training course expressed as a standard score.

Attendees of the technical schools were categorized into subgroups for analysis. It was undesirable to conduct analysis for each specialty due to insufficient sample sizes for some AFSs as well as the large number of AFSs overall. Categories of AFSs with common selector aptitude index (SAI) requirements were therefore established in keeping with Air Force personnel selection practices (AFR 35-1, 1981). The SAI level designates the minimum aptitude score on one of the four AI composites (M, A, G, or E) required for entry into an AFS. To illustrate, specialties in the Mechanical (M) aptitude area were categorized by minimum aptitude scores of 40, 50, and 60 to form SAI subgroups designated M 40, M 50, and M 60. Those specialties with entry prerequisites on both or either of two SAIs were categorized by the first requirement listed in regulations effective during the 1973 to 1977 time frame. These procedures resulted in 18 SAI subgroups. The number and percentage of total cases in each SAI subgroup are presented in Table 4. Also shown using a five-digit Air Force identification code are those specialties with the highest technical school enrollment in each subgroup.

Table 4. Selector AI Subgroup Composition

SAI Subgroup	N	% of Total N	Number of AFSs	Representative AFSs <sup>a</sup>
M 40	32,492	12.93	52	42132, 42133, 42330, 42335, 42632, 43230, 53133, 53430
M 50	40,376	16.07	23	43130, 43131C, 43131E, 43131F, 44330C, 54330, 54530, 60531
M 60	13,463	5.36	2	46130, 46230
A 40	10,275	4.09	6	60230, 60231, 70230
A 50	1,064	.42	1	60530
A 60	18,653	7.43	9	20731, 29333, 64530, 73230
A 70	673	.27	1	65130
A 80	3,641	1.45	4	67231, 67232
G 40	36,570	14.56	12	57130, 62230, 63130, 64730, 81130
G 50	4,937	1.97	4	53135, 81230
G 60	33,982	13.53	39	27230, 27430, 27630, 29130, 81230, 90230, 90430, 90630
G 65	566	.23	1	55330
G 70	121	.05	2	24130, 79131
G 80	6,142	2.45	23	2030R U, 20530, 20630, 25130, 25231
E 50	2,444	.97	5	54130G, 54231
E 60	4,314	1.72	8	36231, 36232, 36234, 36330
E 70	454	.18	1	46330
E 80	41,035	16.34	79	30332, 30430, 30434, 30630, 30730, 32531, 32830, 32831, 32833
Total	251,202	100	272	

<sup>a</sup>A complete list of AFSs included in subgroup analyses is available upon request.

## Analyses

Descriptive statistics for the sample were obtained in the form of frequencies, percentages, means, and standard deviations for each of the predictor and criterion variables within SAI subgroups. To evaluate the effects of retraining status and aptitude on training outcomes, a series of multiple regression analyses (Bottenberg & Ward, 1963) was performed within each SAI subgroup using the pass/fail dichotomy and standardized final school grades as criteria. This procedure provides the opportunity for testing specific hypotheses about the influence of various classes of predictor variables while holding constant the effects attributable to the remaining (co-) variables. The tests were conducted by comparing the errors of prediction associated with a given set of variables (starting model) with the errors associated with a reduced set (restricted model) after adjustment for the appropriate degrees of freedom. An F-ratio and corresponding probability level computed on the basis of this comparison was used to evaluate the statistical significance of the results.

The starting model for the analysis contained all of the basic predictor variables together with a number of non-linear and interaction terms (retraining status X aptitude, aptitude squared, retraining status X time in service X career status, etc.) to insure a relatively complete specification of potential relationships. Several restricted models were defined for purposes of investigating specific sources of influence attributable to retraining status and aptitudes. For each type of training outcome within SAI subgroups, the following research questions were addressed:

1. Retraining Status - Do retrained personnel with differing time in service, career status, and background experience have the same expected performance in technical training as non-retrainees at fixed aptitude levels?
  - a. Time in Service - Do retrainees with differing amounts of time in service have the same expected performance, holding the career status, background experience, and aptitudes constant?
  - b. Career Status - Do retrainees with differing career status have the same expected performance, holding the time in service, background experience, and aptitudes constant?
  - c. Background Experience - Do retrainees with differing background experience have the same expected performance, holding the time in service, career status, and aptitudes constant?
2. Aptitude - Do persons entering technical training with differing aptitudes have the same expected performance, holding the time in service, career status, and background experience (for retrainees) constant?

For those sources of effect that were found to be significant, an inspection of the direction and magnitude of the differences was made to provide additional insight into the findings. (See Appendix A for a detailed discussion of the analysis.)

## III. RESULTS

General characteristics of the sample are reflected by summary statistics of criterion and predictor variables within SAI subgroups. In the total sample, approximately 8 percent of the 251,202 technical school attendees were retrainees ( $N = 19,885$ ). The remaining 92 percent were non-retrainees ( $N = 231,317$ ) without prior military service. As reflected in Table 5, retrainees typically comprised less than 20 percent of the cases in each SAI subgroup. The percentage of retrainees was higher than non-retrainees only in the A 70 and G 70 subgroups.

**Table 5. Summary of Technical School Performance on Pass/Fail and Final School Grade Criteria by SAI Subgroup and Retraining Status**

SAI Subgroup	Retrainee						Non-Retrainee					
	Pass/Fail			Final School Grade			Pass/Fail			Final School Grade		
	% Pass	% Fail	N	Mean	SD	N	% Pass	% Fail	N	Mean	SD	N
M40	95.60	4.40	1,521	52.39	10.12	1,351	95.75	4.25	30,971	49.89	9.98	28,807
M50	95.24	4.76	2,102	53.65	10.44	1,974	96.48	3.52	38,274	49.88	9.92	36,705
M60	93.22	6.78	177	50.43	9.52	160	95.86	4.14	13,286	50.07	9.99	12,649
A40	93.10	6.90	377	55.42	9.95	347	96.12	3.88	9,898	49.84	9.94	9,451
A50	100.00	0.00	66	58.09	9.56	66	98.00	2.00	998	49.34	9.77	970
A60	97.33	2.67	1,683	55.41	9.52	1,614	94.87	5.13	16,970	49.47	9.87	15,047
A70	99.43	.57	353	53.29	9.03	350	97.19	2.81	320	46.52	9.61	305
A80	96.23	3.77	239	55.28	9.48	230	95.36	4.64	3,402	49.57	9.93	3,213
G40	96.46	3.54	1,101	54.21	9.39	1,036	97.42	2.58	35,469	49.97	9.99	34,197
G50	99.34	.66	302	50.94	11.18	272	96.74	3.26	4,635	47.56	10.26	4,483
G60	95.12	4.88	6,010	52.46	9.85	4,956	94.35	5.65	27,972	49.95	9.84	22,824
G65	91.19	8.81	159	52.54	10.28	144	94.10	5.90	407	48.91	9.69	375
G70	90.41	9.59	73	55.76	8.93	35	93.75	6.25	48	43.90	7.01	33
G80	91.32	8.68	841	52.22	9.89	671	81.04	18.96	5,301	49.68	9.91	4,217
E50	92.37	7.63	367	54.79	9.34	336	86.81	13.19	2,077	49.12	9.84	1,790
E60	86.34	13.66	593	52.05	10.26	489	84.31	15.69	3,721	49.65	9.94	3,092
E70	96.30	3.70	27	53.10	8.73	26	97.19	2.81	427	48.10	10.10	411
E80	91.88	8.12	3,894	53.92	9.93	3,445	87.81	12.19	37,141	49.56	9.91	31,779



Performance measures on the pass/fail criterion are also summarized in Table 5 for retrainees and non-retrainees within subgroups. Inspection of percentages of school graduates (pass) and eliminees (fail) indicates that the majority of school attendees successfully completed training. Percentages of graduates for SAI subgroups ranged from 86 to 100 for retrainees and from 81 to 98 for non-retrainees. In 10 of 18 subgroups, the percentage of retrainees successfully completing training was higher than that of non-retrainees.

Mean and standard deviation values for the final school grade criterion, as shown in Table 5, were computed for a subset of the enlistees who passed technical training. Thus, the number of cases used in analysis of the final school grade criterion was less than those used for the pass/fail criterion. Mean values of standardized final school grades indicate that the academic performance of retrainees in the 18 SAI subgroups was higher than the average score (50.0) achieved in each technical school. Compared to non-retrainees, the academic performance of retrainees was superior in all subgroups with the average achievement of retrainees ranging from about 1 to 12 grade points higher. Performance measures on both pass/fail and final school grade criteria indicate that, relative to non-retrainees, attrition from technical training is lower and academic achievement is higher among retrained enlistees.

Descriptive statistics for predictor variables used in the analysis of the pass/fail criterion are provided for SAI subgroups in Table 6. Summary data for aptitudes indicate that scores were higher on the average for non-retrainees in nearly two-thirds of the subgroups. Mean aptitude differences in the non-retrainees' favor reached as high as 5 to 8 points. However, in most subgroups the differences were small (3 aptitude percentiles or less).

Summary statistics for three additional predictors, i.e., time in service, career status, and background experience, are also presented for the retrainee group (Table 6). The average number of months served in the military before retraining to a new specialty ranged from about 30 months (2.5 years) to about 92 months (7.5 years). In all SAI subgroups, there appeared to be little consistency in the number of months served before retraining. The career status variable revealed that in 14 of 18 subgroups more changes in occupational specialties occurred after 3 years of military service (career) than before (non-career); the M 40, A 40, A 50, and G 50 subgroups were exceptions. The data on type of background experience did not clearly support a trend for retrainees to primarily transfer to a specialty with the same AI as the pre-retraining specialty. Transfer patterns were indeterminate in several SAI subgroups due to the unavailability of AI source of transfer data for a substantial proportion of the retrainees. Whereas considerable retraining among Mechanical, General, and Administrative AIs was noted, the percentages of retrainees transferring from Electronics specialties were usually small. A pattern regarding the background of transfers to Electronics specialties was not clearly established due to lack of data on retrainees in E 70 and E 80 subgroups. A set of summary statistics of predictor variables paralleling those provided for the pass/fail analysis sample is presented in Table 7 for the reduced sample of school graduates used in the analysis of the final school grade criterion. Findings regarding aptitude achievement, time in service, career status, and background experience of the final school grade sample corresponded closely to those noted for the pass/fail sample.

Table 6. Summary Statistics of Predictor Variables for Retrainees and Non-Retrainees by SAI Subgroup on Pass/Fail Criterion

SAI Subgroup	Retrainee												Non-retrainee		
	Aptitude		Time in Service		Career Status		Background Experience					Un-known	Aptitude		
					Career	Non-Career	Mech	Adm	Gen	Elec	N				Mean
N	Mean	SD	Mean	SD	%	%	%	%	%	%	%	N	Mean	SD	
M 40	1,521	60.29	18.52	42.93	50.18	42.14	57.86	59.11	11.57	18.61	5.39	5.33	30,971	57.99	20.44
M 50	2,102	63.15	16.20	55.62	41.30	71.74	28.26	45.15	13.27	19.08	2.66	19.84	38,274	64.96	17.75
M 60	177	61.58	16.01	46.46	31.16	71.19	28.81	35.59	19.77	29.38	2.82	12.43	13,286	69.49	15.23
A 40	377	60.31	16.64	30.78	30.01	21.22	78.78	35.28	29.71	26.53	5.04	3.45	9,898	59.64	15.83
A 50	66	66.14	15.76	49.08	42.66	43.94	56.06	34.85	34.85	25.76	1.52	3.03	998	65.03	13.65
A 60	1,683	65.86	14.41	70.31	54.28	73.08	26.92	21.98	30.60	33.81	4.58	9.03	16,970	66.93	15.34
A 70	353	75.40	11.04	59.23	34.36	83.00	17.00	20.40	40.23	24.36	6.23	8.78	320	75.95	8.86
A 80	239	82.97	8.60	55.59	44.30	62.34	37.66	18.41	37.66	23.85	11.72	8.37	3,402	84.94	8.38
G 40	1,101	63.16	15.31	70.94	58.90	66.58	33.42	20.71	14.90	26.88	2.82	34.70	35,469	61.49	15.64
G 50	302	65.71	14.68	34.53	40.22	36.42	63.58	28.15	13.91	50.99	3.31	3.64	4,635	68.27	13.64
G 60	6,010	70.03	13.33	68.43	50.33	76.72	23.28	26.14	20.97	37.89	8.69	6.32	27,972	72.79	13.48
G 65	159	76.86	13.07	60.20	42.01	81.13	18.87	35.22	15.72	22.64	12.58	13.84	407	82.05	10.30
G 70	73	74.73	10.35	87.23	47.25	89.04	10.96	24.66	30.14	27.40	17.81	0.00	48	76.98	9.51
G 80	841	81.44	10.84	65.56	53.31	75.51	24.49	21.40	16.65	42.93	10.34	8.68	5,301	86.00	8.26
E 50	367	64.97	14.26	91.97	65.37	77.66	22.34	44.69	10.90	20.98	18.80	4.63	2,077	65.23	13.43
E 60	593	71.57	14.46	71.61	54.05	77.74	22.26	36.09	12.31	22.77	23.95	4.89	3,721	68.73	11.80
E 70	27	80.74	8.57	79.11	32.48	88.89	11.11	25.93	18.52	33.33	7.41	14.81	427	76.30	11.89
E 80	3,894	84.56	7.83	72.51	48.21	85.67	14.33	27.30	10.91	15.46	28.94	17.39	37,141	83.95	8.60

**Table 7. Summary Statistics of Predictor Variables for Retrainees and Non-Retrainees by SAI Subgroup on Final School Grade Criterion**

SAI Subgroup	Retrainee												Non-retrainee		
	Aptitude		Time in Service		Career Status		Background Experience					Un. known	Aptitude		
					Career	Non-Career	Mech	Adm	Gen	Elec					
N	Mean	SD	Mean	SD	%	%	%	%	%	%	%	N	Mean	SD	
M 40	1,351	60.23	18.33	42.29	49.51	42.56	57.44	60.03	10.73	18.65	4.74	5.85	28,807	58.31	20.33
M 50	1,974	63.44	16.13	56.12	41.07	72.49	27.51	44.48	13.37	19.00	2.74	20.42	36,705	65.35	17.59
M 60	160	61.88	15.90	48.90	30.76	74.38	25.63	35.00	21.25	28.75	3.13	11.88	12,649	69.75	15.13
A 40	347	60.98	16.61	31.79	30.22	22.48	77.52	34.01	31.99	25.07	5.19	3.75	9,451	59.81	15.83
A 50	66	66.14	15.76	49.08	42.66	43.94	56.06	34.85	34.85	25.76	1.52	3.03	970	64.98	13.66
A 60	1,614	65.87	14.41	71.54	54.01	74.23	25.77	22.12	30.42	33.71	4.71	9.05	15,047	66.45	15.50
A 70	350	75.43	11.04	59.26	34.50	82.86	17.14	20.29	40.57	24.00	6.29	8.86	305	76.00	8.94
A 80	230	82.89	8.62	56.97	44.36	63.91	36.09	18.70	37.83	22.61	12.17	8.70	3,213	85.00	8.22
G 40	1,036	63.27	15.17	72.50	59.01	67.86	32.14	20.95	14.77	26.16	2.99	35.14	34,197	61.49	15.67
G 50	272	65.97	14.85	32.99	40.39	33.46	66.54	23.16	14.71	54.41	3.68	4.04	4,483	68.36	13.62
G 60	4,956	70.46	13.37	68.88	51.26	75.61	24.39	26.31	20.90	38.68	9.00	5.10	22,824	73.08	13.76
G 65	144	78.02	12.76	60.73	40.93	83.33	16.67	34.03	16.67	22.22	13.19	13.89	375	82.59	10.12
G 70	35	73.57	10.25	122.91	39.94	100.00	00.00	37.14	20.00	22.86	20.00	0.00	33	74.85	8.02
G 80	671	81.59	13.87	62.35	49.40	75.71	24.29	22.06	14.75	42.62	10.73	9.84	4,217	86.18	8.16
E 50	336	65.34	14.12	94.08	65.71	77.98	22.02	43.75	10.71	21.43	19.35	4.76	1,790	66.00	13.48
E 60	489	71.61	14.62	71.51	53.19	77.91	22.09	37.63	12.47	20.45	23.93	5.52	3,092	69.52	11.76
E 70	26	80.96	8.66	79.08	33.10	88.46	11.54	26.92	15.38	34.62	7.69	15.38	411	76.62	11.74
E 80	3,445	84.88	7.71	74.49	47.83	87.55	12.45	26.88	10.36	14.60	30.77	17.39	31,779	84.52	8.47

**Pass/Fail Performance**

The results of the pass/fail analysis within SAI subgroups are provided in source table format (see Table B-1 in Appendix B) and are further summarized in Table 8. The overall retrainee versus non-retrainee comparisons in the first row of the table indicate that retraining status contributed significantly to the prediction of course completion over and above the selector AI in 13 of the 18 subgroups. That is, retrainees categorized by time in service, career versus non-career status, and background experience were found to have different attrition rates than non-retrainees at fixed aptitude levels. The effects of entry level aptitudes, shown in the last row of the pass/fail analysis summary in Table 8, were found to be significant with respect to course completion in 15 of the 18 subgroups. Both retrainees and non-retrainees as a group exhibited systematic differences in their probability of completion as a function of aptitude scores available upon entry into training. Major effects due to retraining status and aptitude were found to be non-significant in 3 of the 18 subgroups. In two subgroups (G 50 and E 70), aptitude effects were statistically significant but retraining status effects were not.

**Table 8. Summary of Statistical Findings**

Source of Effect	SAI Subgroup																	
	Mechanical			Administrative				General				Electronics						
	40	50	60	40	50	60	70	80	40	50	60	65	70	80	50	60	70	80
<b>Pass/Fail</b>																		
Retraining Status	*	*	*	*	ns	*	ns	*	*	ns	*	*	ns	*	*	*	ns	*
Time in Service	*	*	*	*	ns	*	ns	*	*	ns	*	*	ns	*	*	*	ns	*
Career Status	*	*	*	*	ns	*	ns	*	ns	ns	*	*	ns	*	*	*	ns	*
Background Experience	*	*	ns	*	ns	ns	ns	*	ns	ns	*	ns	ns	*	ns	*	ns	*
Aptitude	*	*	*	*	ns	*	ns	*	*	*	*	*	ns	*	*	*	*	*
<b>Final School Grade</b>																		
Retraining Status	*	*	ns	*	*	*	*	*	*	*	*	*	*	*	*	*	ns	*
Time in Service	*	*	ns	*	ns	*	ns	ns	*	*	*	ns	ns	ns	ns	ns	ns	*
Career Status	*	*	ns	ns	ns	ns	ns	*	*	ns	*	ns	ns	*	ns	*	ns	*
Background Experience	*	*	ns	*	ns	*	ns	ns	ns	ns	*	*	ns	*	ns	*	ns	*
Aptitude	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Note. An asterisk (\*) in the table indicates statistical significance ( $p < .05$ ) for a predictor. The designation ns specifies a non-significant predictor. Comparisons where insufficient data were available are coded na.

Among retrainees, pass/fail rates varied as a function of time in military service in 13 of the 18 subgroups, as a function of career status in 12 of the 18 subgroups, and according to type of background experience in 8 of the 18 subgroups.

An inspection of the regression coefficients associated with the subgroup equations revealed some general trends in the data. Graduation rates for the retrainee groups at fixed aptitude levels were typically higher than for non-retrainees, although instances where non-retrainee performance equalled or exceeded selected categories of retrainees were not uncommon. The rates for non-retrainees were frequently higher than for non-career retrainees. Overall, there was substantial variation in graduation rates for retrainee categories within subgroups. Ranges of differences as large as 10 to 20 percent were not uncommon. Within subgroups, the probabilities of completing training for non-retrainees were typically within the upper and lower boundaries of any retrainee category.

Characteristic findings for the aptitude variables were that the probabilities of completing training increased with higher aptitude scores for both retrainees and non-retrainees in all but 4 of the 15 significant comparisons. The increases in expected completion rates from the selector AI minimum to the 95th percentile ranged from 1 to 12 percent for retrainees and from 1 to 18 percent for non-retrainees. For the majority of comparisons, the improvement in completion rates as aptitude scores increased was greater for non-retrainees than retrainees in the same SAI subgroup. This trend



was particularly evident in the three Electronics clusters. Exceptions to the generally positive findings for aptitudes were noted in three specialty groups (A 50, A 70, and G 70) where selector AIs were non-significant and in five specialty groups (M 60, A 60, G 40, G 50, and E 50) where they were significant and positively related to the criterion in the lower aptitude ranges but turned slightly negative in the upper ranges.

For the retrainee group, there were no apparent consistencies across all specialties detected for the influence of time in service on completion rates. Positive and negative effects on course completion rates were noted about equally often across the different time-in-service levels depending somewhat on career status and source of background experience. Further, the direction of the time-in-service effects appeared to vary according to SAI entry requirement. Within specific AI categories, the effects of service length were sometimes appreciable—5 to 10 percent differences in expected completion rates between the shortest and longest tenure groups. Training completion probabilities are shown for a representative subgroup in Appendix A (Table A-3) to illustrate the time-in-service findings.

In the 12 of 18 SAI subgroups where career status was found to be significant, there was a marked trend for career airmen to have higher graduation rates than non-career airmen at the 36-month point. It was not uncommon for the careerists to have a 10 percent higher chance for completion when other factors, such as background experience and aptitude, were held constant. The consistency of the results was particularly noticeable among retrainees with Mechanical, General, and Administrative backgrounds.

Although background experience was found to be significant in only 8 of the 18 subgroups, there were some noteworthy trends in the data. The expected level of performance for transfers from the Electronics specialties was generally higher regardless of the occupational category into which they were being transferred. When the same AI subgroup was the source of transfers, moderate success probabilities relative to retrainees with different backgrounds were noted. The extent to which the various backgrounds contributed to successful course completion appeared highly dependent on career status, time in service, and SAI subgroup. Within a given specialty, the differences between groups ranged from trivial to consequential (10 percent or greater). Group differences in background were more pronounced among non-career airmen than among careerists at fixed time-in-service levels.

### **Final School Grade Performance**

Detailed analysis results for the final school grade criterion are presented by SAI subgroup in Appendix B (Table B-2). As shown in the first line of the summary of the final school grade analysis in Table 8, significant retraining status effects were found in 16 of 18 subgroups. With the exception of M 60 and E 70 schools, the final school grades achieved by retrainees with varying time in service, career status, and background experience characteristics were significantly different from those of non-retrainees with equivalent aptitudes. Aptitude scores current at time of entry into technical training made a significant contribution to the prediction of academic achievement for the combined group of retrainees and non-retrainees in all subgroups, as shown in the last line in Table 8.

Analyses pertaining solely to retrained airmen revealed differences in final school grades attributable to time in service and career versus non-career status in each of eight SAI subgroups. Further, in nine subgroups, academic achievement among retrainees varied as a function of type of background experience.

Regression coefficients indicated that retrainees in all time in service, career status, and background experience categories achieved higher grades than did non-retrainees at fixed aptitude levels in eight subgroups. The trend persisted with few exceptions in eight additional subgroups. Among the various categories of retrainees, performance differences of 4 to 12 standardized grade points were typical. Relative to retrainees, the non-retrainees never equalled or exceeded the highest and were commonly inferior to the lowest performance level achieved by any retrainee category in 16 subgroups.

The findings regarding the influence of aptitudes on scholastic achievement were very consistent. Final school grades increased with higher aptitudes for both retrainees and non-retrainees in each of the 18 subgroups. Performance improved from 3 to 16 standardized grade points among retrainees and from 2 to 14 grade points among non-retrainees across the aptitude range of interest (minimum selector AI to 95th percentile). The amount of increase in performance was greater for non-retrainees in nine subgroups and for retrainees in five subgroups. However, these differences were

not appreciable (less than 5 grade points) for any comparison. In the remaining four subgroups, performance increased by the same amount for retrainees and non-retrainees.

Time-in-service effects, while significant in less than half of the subgroups (8 of 18), were generally positive. Academic achievement levels usually increased as more months of military experience were acquired before retraining to a new occupational specialty. Additional military service, beyond a certain point, however, did not consistently have a favorable impact on school grades. In fact, for some groups, increased experience beyond the second or third term had a negative impact on training outcomes. Performance as a function of time in service was apparently dependent on career status, background experience, and SAI entry requirement. Within these retrainee categories, improvements in performance between the shortest and longest tenure groups were usually in the range of 1 to 10 standardized grade points, while performance declines rarely exceeded 5 grade points. An example of these time-in-service effects is shown in Appendix A (Table A-4) for a representative subgroup.

Comparisons at the 36 months of service point in eight subgroups revealed a slight trend for career airmen to perform better than non-career airmen. Whether non-career or career retrainees achieved superior grades seemingly depended on type of background experience. Appreciable differences in performance (greater than 5 standardized grade points) as a function of career status were found in approximately one-third of the comparisons.

Several patterns regarding source of transfers were detected in nine subgroups where type of background experience made a significant contribution. There was a marked trend for Electronics transfers to have higher grades whether retraining into a specialty with the same or different aptitude index. Generally, retrainees transferring within the same occupational category attained intermediate performance levels. Grade achievement levels as a function of type of background experience were apparently dependent on time in service, career status, and SAI subgroup. The ranges of grades scored by retrainees within subgroups with different background experience were generally appreciable (greater than 5 standardized grade points).

#### IV. DISCUSSION

Overall, the results may be viewed as demonstrating that retrained airmen enjoy considerable success in basic technical training for Air Force occupational specialties. Retrainees perform as well as, and in many schools appreciably better than, non-retrainees when both have equivalent aptitudes. A comparison of performance levels as a function of aptitude scores shows a characteristic increasing relationship for both retrainees and non-retrainees. This finding is consistent with prior research demonstrating the validity of ASVAB scores as a predictor of training performance (Vitola, Mullins, & Croll, 1973) and hence as the fundamental prerequisite in personnel selection and assignment. Of particular salience in the investigation is the finding that although retrainees in most SAI subgroups have lower aptitude scores on the average than do non-retrainees, retrainees achieve higher performance levels. This finding is consistent with results of a Navy study evaluating the performance of "strikers" for paramedical training (Booth, McNally, & Berry, 1975). Recruits initially assigned to general duty Navy jobs may later "strike" for assignments to technical duties, and, after satisfactory performance during a brief on-the-job training period, enter formal training for the specialty. Strikers, like Air Force retrainees in that they have prior experience in a military occupation, had lower attrition rates and better school grades than did a comparison group of new recruits, even though aptitudes for the two groups were not statistically different.

Current research findings provide support for the interpretation that familiarity with military life may favorably impact the technical school achievement of retrainees. As retrainees acquire more time in service before changing specialties, evidence was found that their performance in technical school generally improves. The retrainees would appear to capitalize on their prior experience as they become more knowledgeable about and acclimated to military life. The positive influence of the time-in-service variable, as well as the finding that career airmen typically perform better than non-career airmen, may also reflect motivational factors. As tenure increases, enlistees have typically been found to strengthen their commitment to a military career, as shown by their increased propensity to reenlist and increased job satisfaction (Gould, 1976). Airmen retraining after 3 years of military service would be more likely to be changing specialties in conjunction with decisions to reenlist for another tour of duty, to improve promotion opportunities, or to satisfy individual career goals. Inferior performance by non-career airmen may reflect the less desirable reasons and motives which apparently accompany specialty changes within the first 3 years after enlistment in the Air Force.

Seemingly, these retrainees more often retrain due to substandard performance or disqualification in their first specialty assignment or selectively to meet Air Force manning requirements. It has also been suggested that some retraining during the early years of service is an attempt to acquire skills more marketable in the private sector after discharge. A factor which likely underlies the performance findings for both time in service and career status variables is the normal attrition process in the enlisted force. Across time, attrition creates a residual group of more motivated and capable enlistees of which retrainees are a part.

Support for generalization of skills and knowledges from specialties with the same AI was found in that these transfers generally attained moderate performance levels relative to those transferring between different AIs. The transfer of training literature, however, would suggest that the influence of background experience before retraining on training performance outcomes would have been more substantial than was observed. Transfers from Electronics specialties, though small in numbers, typically excelled in training regardless of their retraining SAI subgroup affiliation. These retrainees may also be a residual group of high caliber personnel. As graduates of Electronics training, they would have completed a reputedly rigorous program before retraining. Other factors which may have contributed to the trend noted for Electronics transfers are not readily apparent. Overall, the relatively substantial numbers of retrainee cases without prior experience data may have mitigated anticipated transfer-of-training effects. Alternatively, more specific information on similarity of skills and knowledges than AI area alone may be necessary to determine transferability among specialties.

Analysis of the two performance criteria—pass/fail and final school grade—did not yield equivalent results in all of the SAI subgroups. In general, retraining effects were detected with greater regularity and interpretations were more consistent in the final school grade comparisons than in those using the pass/fail dichotomy. The same was true for aptitude effects which were significant in all grade comparisons but in only 15 of 18 groups on the training completion criterion. A possible explanation of these findings may be found in the nature of the two criteria. Final school grade pertains almost exclusively to academic achievement in technical school whereas pass/fail is more complex in definition. Failures can and do occur for reasons that have nothing to do with academics, for example, medical disqualification, disciplinary problems, or personal hardship. For purposes of evaluating policies on entry requirements from these data, the primary emphasis should focus on the more stable academic criterion, with secondary consideration given to possible impact on attrition rates.

Since the present study applies only to performance of retrainees attending basic technical schools, some caution should be exercised in generalizing the findings to By-Pass specialists, lateral retrainees, and airmen preparing for apprentice-level duties through on-the-job training. Research involving these types of personnel has yet to be conducted.

## V. CONCLUSIONS/IMPLICATIONS

The following major conclusions were supported by study of the performance of retrained airmen attending basic technical training schools for Air Force occupational specialties.

1. The performance of retrained airmen as evidenced by academic achievement and training completion rates is comparable, and in most schools superior, to non-prior-service enlistees with equivalent aptitudes.
2. Scholastic performance in terms of final school grade for retrainees tends to improve as more time is spent in military service before changing occupational specialties. This trend was not noted, however, in analysis of school completion and failure rates. There was also evidence to suggest a diminishing return on the benefits of prior experience beyond the second and third enlistments.
3. Retrainees who are career airmen typically achieve higher final school grades than do non-career airmen. That career airmen are more successful in technical training was corroborated by the analysis of pass/fail rates. These effects were most evident for personnel with less than 12 years of service. It may not be true for all experience levels.
4. Background experience in an occupational specialty in the same aptitude requirement area as the retraining specialty facilitates final school grade achievement levels. The likelihood of completing training is also enhanced by transferring between specialties with common aptitude requirements.

5. Academic achievement level increases as a function of aptitudes for both retrained and non-retrained airmen. The positive relationship between success in training and aptitude was substantiated by analysis of school completion rates.

The results of this study suggest several implications for managers of the retraining program at the Air Force Manpower and Personnel Center and of technical training at Air Training Command. The data have potential utility in selection and assignment of retrainees to improve the likelihood of success in technical schools. Apt candidates for retraining to specialties in an SAI subgroup where retraining status variables contributed significantly to prediction of school performance can be identified. In these specialties, prospective retrainees with high aptitudes and career airman status and/or military tenure up to the 12-year, but probably not beyond the 16-year point, would likely do well in training.

Additional research is needed to address other issues pertinent to a comprehensive evaluation of the Airman Retraining Program. The current study, while providing empirical support for the viability of retraining enlisted personnel to staff positions resulting from shortages in Air Force career fields, is nevertheless limited in scope. The impact of changing specialties on the career progression of retrainees beyond technical training has not yet been fully explored. Of interest is the accommodation of retrainees to their new specialties as reflected by promotion and skill upgrading rates, reenlistments, and productivity. Questions concerning the influence of different reasons for and types of retraining on training outcomes have not been addressed. A particular concern is selective versus voluntary retraining. While retraining to meet manpower requirements in imbalanced specialties without the enlistee's concurrence is limited, information concerning its impact on performance, satisfaction, and morale is needed. The current policy that waives for retrainees 10 points of the aptitude requirement established for entry into a specialty is also of interest. The optimal trade-off in performance achievement for enlistees with aptitudes below required minimums needs to be determined for technical school attendees. The waiver of additional points if justified could potentially stimulate participation in the retraining program in selected specialties. Imposing more stringent aptitude prerequisites could, however, be necessary in other career areas to insure that acceptable performance standards are maintained by retrainees. Resolution of these research questions would be of value to managers in the development of retraining policies in the best interest of the individual airman and overall force effectiveness.

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## Statistical Analysis

The statistical analysis was conducted using the generalized linear regression model outlined by Bottenberg and Ward (1963). In this procedure, the accuracy of prediction ( $R^2$ ) associated with a given set of predictor variables (full model) is compared with the accuracy associated with a number of reduced sets (restricted models). The full model used initially is designed to reflect the various potential relationships among the expected values in the population. The restricted models are formed by hypothesizing specific relationships among these values and imposing the resulting restrictions on the starting model. Comparisons of the degree to which each of these models fit the obtained data in terms of predictive accuracy then serve as a basis for determining statistical significance. Each comparison between full and restricted models is evaluated using the F statistic and associated probability value:

$$F = \frac{(R_f^2 - R_r^2)/df_1}{(R_f^2 - R_r^2)/df_2}$$

where

$R_f^2$  = Squared multiple correlation - full model

$R_r^2$  = Squared multiple correlation - restricted model

$df_1$  = Number of independent predictor variables in full model minus the number of independent predictor variables in the restricted model

$df_2$  = Total number of observations minus the number of independent predictor variables in the full model

The starting model for the analysis contained variables as specified in Table A1. Categorical group membership variables (coded 1 if the corresponding observation was a member of the group; 0 otherwise) were used to define retraining status, career status, and background experience. Since it was assumed that the effects of aptitude and time in service for retrainees would be no more complex than a second-degree polynomial (curvilinear), these variables were represented by both linear and squared terms in the analysis. First-order and second-order interaction terms were included for aptitude by retraining status, time in service by career status, time in service by background experience, career status by background experience, and time in service by career status by background experience. In the majority of SAI subgroups, there were 35 independent predictor variables in the model. This number was reduced in certain cases due to the presence of null vectors (zero cell frequencies).

The starting model is shown again in Table A2 together with the various restricted models that were defined. Statistical comparisons between the models were performed in the sequence described in Figure A1. An initial overall test for retraining effects was followed, depending on outcome, by either (a) a test for time-in-service effects assuming retraining effects were found to be significant (left branch) or (b) a test for aptitude effects assuming retraining effects were found to be non-significant (right branch). Testing procedures continued sequentially through the network until the most appropriate model was determined.

## Computing Estimates of Expected Values (Predicted Scores)

As a follow-up to the statistical analysis, an effort was made to evaluate the magnitude and direction of the significant effects on training performance. For each separate analysis, the most appropriate regression model served as a basis for computing estimates of expected values (predicted criterion scores) for a number of student types differing systematically in terms of background and aptitude. In these computations for example, predicted scores for non-retrainees at low, moderate, and high aptitude levels could be compared to retrainees with the same fixed aptitudes. Where appropriate, distinctions between background experience, time in service, and career status were also made. Selected scores from these analyses are illustrated in Tables A-3 and A-4. Table A-4 shows predicted final school grades for the G 60 selector AI group. At the lowest aptitude level displayed (G 60), the expected values for retrainees, for most background experience and time-in-service categories (42 to 56), equal or exceed the expected value for non-retrainees (47). The same is true for comparisons at the moderate aptitude level. At the highest level of aptitude, the expected performance of non-retrainees (56), is exceeded by the majority of career retrainees but is generally comparable to those computed for retrainees in the lower tenure groups. For interpretive purposes, a difference of 5 points or greater in expected performance was considered appreciable.

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Table A-1. Definition of Predictor Variables

Variables	Description	Source
1	Retraining Status (Retrainee)	1 if retrainee; 0 otherwise
2	Retraining Status (Non-retrainee)	1 if non-retrainee; 0 otherwise
3	Aptitude Score for Selector AI	ASVAB percentile (M, A, G, or E where applicable)
4	Aptitude Squared	ASVAB percentile squared (M, A, G, or E where applicable)
5	Time in Service	Total months active military service for retrainees; 0 otherwise
6	Time in Service Squared	V5 squared
7	Career Status (Non-career retrainee)	1 if V5 $\leq$ 36 months; 0 otherwise
8	Career Status (Career retrainee)	1 if V5 $>$ 36 months; 0 otherwise
9	Background Experience (Mech)	1 if retrained from Mech area; 0 otherwise
10	Background Experience (Admin)	1 if retrained from Admin area; 0 otherwise
11	Background Experience (Gen)	1 if retrained from Gen area; 0 otherwise
12	Background Experience (Elect)	1 if retrained from Elect area; 0 otherwise
13	Background Experience (Unk)	1 if background unknown; 0 otherwise
14-15	Aptitude x Retraining Status	V3 x V1-2
16-17	Aptitude Squared x Retraining Status	V4 x V1-2
18-19	Time in Service x Career Status	V5 x V7-8
20-21	Time in Service Squared x Career Status	V6 x V7-8
22-26	Time in Service x Background Experience	V5 x V9-13
27-31	Time in Service Squared x Background Experience	V6 x V9-13
32-41	Career Status x Background Experience	V7-8 x V9-13
42-51	Time in Service x Career Status x Background Experience	V5 x V7-8 x V9-13
52-61	Time in Service Squared x Career Status x Background Experience	V6 x V7-8 x V9-13

Table A-2. Model Specifications

Model No.	Variables	Description
1 (Starting model)	1-61	Retraining Status, Aptitude, Time-in-Service, Career Status, Background Experience, Aptitude x Retraining Status, Time in Service x Career Status, Time in Service x Background Experience, Career Status x Background Experience, and Time in Service x Career Status x Background Experience
2	1-14,7-17,32-41	Retraining Status, Aptitude, Career Status, Background Experience, Aptitude x Retraining Status, and Career Status x Background Experience
3	1-4,9-17	Retraining Status, Aptitude, Background Experience, and Aptitude x Retraining Status
4	1-4,14-17	Retraining Status, Aptitude, and Aptitude x Retraining Status
5	1-2	Retraining Status
6		Unit Vector
7	3-4	Aptitude
8	1-2,9-13	Retraining Status and Background Experience
9	1-4,7-8,14-17	Retraining Status, Aptitude, Career Status, and Aptitude x Retraining Status
10	1-2,7-8	Retraining Status and Career Status
11	1-2,7-13,32-41	Retraining Status, Career Status, Background Experience, and Career Status x Background Experience
12	1-6,9-13,22-31	Retraining Status, Aptitude, Time in Service, Background Experience, Aptitude x Retraining Status, and Time in-Service x Background Experience
13	1-6,14-17	Retraining Status, Aptitude, Time in Service, and Aptitude x Retraining Status
14	1-2,5-6	Retraining Status and Time in Service

Table A-2 (Continued)

Model No.	Variables	Description
15	1-2,5-6,9-13,22-31	Retraining Status, Time in Service, Background Experience, and Time in Service x Background Experience
16	1-8,14-21	Retraining Status, Aptitude, Time in Service, Career Status, Aptitude x Retraining Status, and Time in Service x Career Status
17	1-2,5-8,18-21	Retraining Status, Time in Service, Career Status, and Time in Service x Career Status
18	1-2,5-13,18-61	Retraining Status, Time in Service, Career Status, Background Experience, Time in Service x Career Status, Time in Service x Background Experience, Career Status x Background Experience, and Time in Service x Career Status x Background Experience

Table A-3. Predicted Training Completion Probabilities for Personnel Attending G 80 Technical Training Courses

Background Experience	Aptitude = 80								Aptitude = 90								Aptitude = 95							
	Retrainees								Retrainees								Retrainees							
	Non-Career				Career				Non-Career				Career				Non-Career				Career			
	Time in Service								Time in Service								Time in Service							
	12	36	36	48	96	144	192	12	36	36	48	96	144	192	12	36	36	48	96	144	192			
	.80								.82								.83							
Mech	.70	.86	.97	.95	.90	.88	.87	.70	.88	.93	.96	.91	.89	.88	.70	.88	.98	.97	.92	.90	.89			
Admin	.69	.79	.95	.96	.96	.87	.75	.70	.80	.96	.97	.97	.90	.76	.70	.80	.96	.97	.97	.90	.76			
Gen	.96	.91	.88	.89	.94	.97	.97	.97	.92	.89	.90	.95	.98	.98	.98	.92	.89	.91	.96	.98	.98			
Elec	1.00	.99	.99	1.00	1.01	1.00	.95	1.01	1.00	1.00	1.01	1.03	1.01	.97	1.01	1.01	1.00	1.01	1.03	1.02	.97			
Unknown	.81	.92	1.04	.98	.82	.84	1.04	.82	.93	1.05	.99	.83	.85	1.05	.83	.93	1.06	.99	.84	.86	1.05			

Table A-4. Predicted Final School Grades for Personnel Attending G 60 Technical Training Courses

Background	Non- Experience	Aptitude = 60								Aptitude = 80								Aptitude = 95							
		Retrainees								Retrainees								Retrainees							
		Non				Career				Non				Career				Non				Career			
		Time in Service								Time in Service								Time in Service							
		47								51								56							
Mech		12	36	36	48	96	144	192	12	36	36	48	96	144	192	12	36	36	48	96	144	192			
Admin		49	49	49	49	51	52	54	53	53	53	53	55	56	58	56	57	57	57	58	60	61			
Gen		49	48	50	50	51	52	52	53	52	54	54	55	56	56	57	55	57	58	59	59	60			
Elec		48	50	50	50	51	53	54	52	55	54	54	56	57	58	55	58	57	57	59	60	62			
Unknown		48	55	52	52	54	55	56	52	59	56	56	58	59	60	56	62	59	60	61	63	63			
		46	50	46	47	51	49	42	50	54	50	51	55	54	47	54	57	53	55	59	60	50			



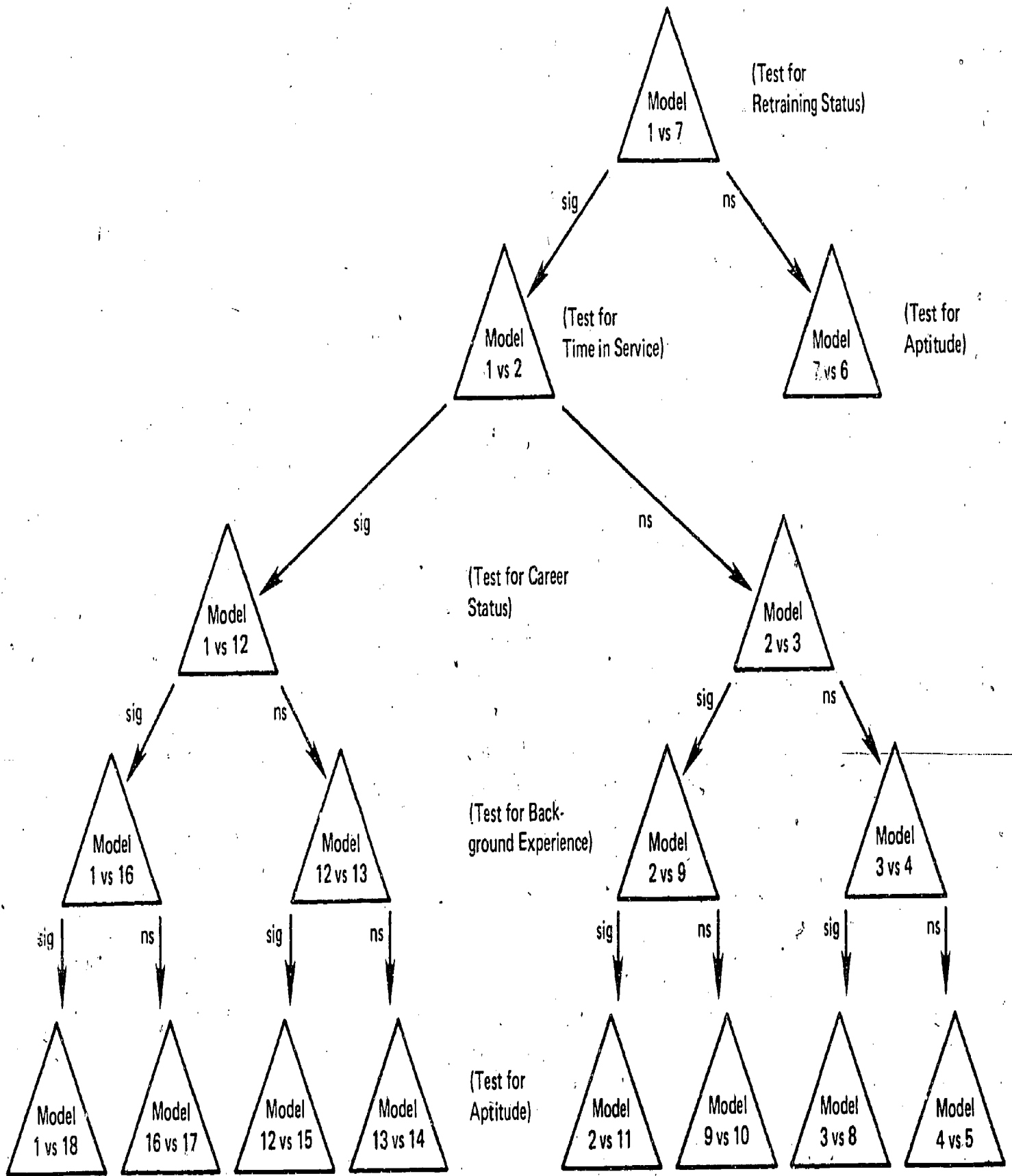


Figure A1. Sequential F-test comparisons.

APPENDIX B: SOURCE TABLES FOR TECHNICAL TRAINING  
PERFORMANCE CRITERIA

*Table B-1. Pass/Fail Criterion Source Table with  
F-tests of Significance for 18 SAI Subgroups*

Source	Comparison		R <sup>2</sup>		df <sub>1</sub>	df <sub>2</sub>	F*
	Full	Restricted	Full	Restricted			
<b>Mechanical 40</b>							
Retraining Status	1	7	.0248	.0213	32	32,457	3.66**
Time in Service	1	2	.0248	.0219	20	32,457	4.87**
Career Status	1	12	.0248	.0228	15	32,457	4.58**
Background Experience	1	16	.0248	.0221	24	32,457	3.78**
Aptitude	1	18	.0248	.0083	4	32,457	174.74**
<b>Mechanical 50</b>							
Retraining Status	1	7	.0218	.0163	32	40,341	6.36**
Time in Service	1	2	.0218	.0181	20	40,341	7.49**
Career Status	1	12	.0218	.0188	15	40,341	8.07**
Background Experience	1	16	.0218	.0197	24	40,341	3.48**
Aptitude	1	18	.0218	.0052	4	40,341	171.16**
<b>Mechanical 60</b>							
Retraining Status	1	7	.0170	.0076	32	13,428	4.01**
Time in Service	1	2	.0170	.0121	20	13,428	3.36**
Career Status	1	12	.0170	.0152	15	13,428	1.68*
Background Experience	1	16	.0170	.0164	24	13,428	.39
Aptitude	16	17	.0164	.0085	4	13,452	26.80**
<b>Administrative 40</b>							
Retraining Status	1	7	.0244	.0041	32	10,240	6.63**
Time in Service	1	2	.0244	.0081	20	10,240	8.52**
Career Status	1	12	.0244	.0120	15	10,240	2.68**
Background Experience	1	16	.0244	.0098	24	10,240	6.51**
Aptitude	1	18	.0244	.0200	4	10,240	11.38**
<b>Administrative 50</b>							
Retraining Status	1	7	.0020	.0006	24	1,037	.06
Time in Service							—
Career Status							—
Background Experience							—
Aptitude	7	6	.0006	.0000	2	1,061	.33
<b>Administrative 60</b>							
Retraining Status	1	7	.0127	.0006	32	18,618	7.11**
Time in Service	1	2	.0127	.0031	20	18,618	9.06**
Career Status	1	12	.0127	.0045	15	18,618	10.22**
Background Experience	1	16	.0127	.0108	24	18,618	1.49
Aptitude	16	17	.0108	.0098	4	18,642	4.27**
<b>Administrative 70</b>							
Retraining Status	1	7	.0125	.0019	32	638	.21
Time in Service							—
Career Status							—
Background Experience							—
Aptitude	7	6	.0019	.0000	2	670	.63

Table B-1 (Continued)

Source	Comparison		R <sup>2</sup>		df <sub>1</sub>	df <sub>2</sub>	F*
	Full	Restricted	Full	Restricted			
<b>Administrative 80</b>							
Retraining Status	1	7	.0275	.0028	32	3,606	2.87**
Time in Service	1	2	.0275	.0083	20	3,606	3.57**
Career Status	1	12	.0275	.0109	15	3,606	4.11**
Background Experience	1	16	.0275	.0069	24	3,606	3.19**
Aptitude	1	18	.0275	.0242	4	3,606	3.07*
<b>General 40</b>							
Retraining Status	1	7	.0029	.0006	32	36,535	2.65**
Time in Service	1	2	.0029	.0019	20	36,535	1.72*
Career Status	1	12	.0029	.0024	15	36,535	1.20
Background Experience	12	13	.0024	.0020	12	36,550	1.04
Aptitude	13	14	.0020	.0014	4	36,562	6.04**
<b>General 50</b>							
Retraining Status	1	7	.0054	.0017	31	4,903	.60
Time in Service							—
Career Status							—
Background Experience							—
Aptitude	7	6	.0017	.0000	2	4,934	4.11**
<b>General 60</b>							
Retraining Status	1	7	.0156	.0092	32	33,947	6.90**
Time in Service	1	2	.0156	.0113	20	33,947	7.38**
Career Status	1	12	.0156	.0117	15	33,947	8.89**
Background Experience	1	16	.0156	.0117	24	33,947	5.57**
Aptitude	1	18	.0156	.0054	4	33,947	87.19**
<b>General 65</b>							
Retraining Status	1	7	.1687	.0602	32	531	2.17**
Time in Service	1	2	.1687	.0771	20	531	2.93**
Career Status	1	12	.1687	.1110	15	531	2.46**
Background Experience	1	16	.1687	.1120	24	531	1.51
Aptitude	16	17	.1120	.0501	4	555	9.68**
<b>General 70</b>							
Retraining Status	1	7	.1960	.0155	21	97	1.04
Time in Service							—
Career Status							—
Background Experience							—
Aptitude	7	6	.0155	.0000	2	118	.93
<b>General 80</b>							
Retraining Status	1	7	.0246	.0008	32	6,107	4.65**
Time in Service	1	2	.0246	.0143	20	6,107	3.23**
Career Status	1	12	.0246	.0161	15	6,107	3.55**
Background Experience	1	16	.0246	.0137	24	6,107	2.85**
Aptitude	1	18	.0246	.0221	4	6,107	3.94**

Table B-1 (Continued)

Source	Comparison		R <sup>2</sup>		df <sub>1</sub>	df <sub>2</sub>	F <sup>a</sup>
	Full	Restricted	Full	Restricted			
<b>Electronic 50</b>							
Retraining Status	1	7	.0450	.0183	32	2,409	2.11**
Time in Service	1	2	.0450	.0243	20	2,409	2.61**
Career Status	1	12	.0450	.0289	15	2,409	2.71**
Background Experience	1	16	.0450	.0313	24	2,409	1.45
Aptitude	16	17	.0313	.0122	4	2,433	11.97**
<b>Electronic 60</b>							
Retraining Status	1	7	.0441	.0259	32	4,279	2.54**
Time in Service	1	2	.0441	.0330	20	4,279	2.48**
Career Status	1	12	.0441	.0345	15	4,279	2.87**
Background Experience	1	16	.0441	.0336	24	4,279	1.95**
Aptitude	1	18	.0441	.0160	4	4,279	31.42**
<b>Electronic 70</b>							
Retraining Status	1	7	.0791	.0400	20	431	.91
Time in Service							—
Career Status							—
Background Experience							—
Aptitude	7	6	.0400	.0000	2	451	9.41**
<b>Electronic 80</b>							
Retraining Status	1	7	.0467	.0304	32	41,000	21.95**
Time in Service	1	2	.0467	.0374	20	41,000	20.01**
Career Status	1	12	.0467	.0389	15	41,000	22.31**
Background Experience	1	16	.0467	.0382	25	41,000	14.69**
Aptitude	1	18	.0467	.0168	4	41,000	322.07**

<sup>a</sup>A dash (—) indicates F-test was inappropriate and assumed to be non-significant.

\*p < .05.

\*\*p < .01.

Table B-2. Final School Grade Criterion Source Table  
with F-tests of Significance for 18 SAI Subgroups

Source	Comparison		R <sup>2</sup>		df <sub>1</sub>	df <sub>2</sub>	F*
	Full	Restricted	Full	Restricted			
<b>Mechanical 40</b>							
Retraining Status	1	7	.1329	.1269	32	30,123	6.55**
Time in Service	1	2	.1329	.1313	20	30,123	2.81**
Career Status	1	12	.1329	.1320	15	30,123	2.29**
Background Experience	1	16	.1329	.1316	24	30,123	1.96**
Aptitude	1	18	.1329	.0084	4	30,123	1081.80**
<b>Mechanical 50</b>							
Retraining Status	1	7	.1601	.1475	32	38,644	18.07**
Time in Service	1	2	.1601	.1589	20	38,644	2.82**
Career Status	1	12	.1601	.1595	15	38,644	1.69*
Background Experience	1	16	.1601	.1584	24	38,644	3.16**
Aptitude	1	18	.1601	.0120	4	38,644	1703.67**
<b>Mechanical 60</b>							
Retraining Status	1	7	.1038	.1016	32	12,774	.97
Time in Service							—
Career Status							—
Background Experience							—
Aptitude	7	6	.1016	.0000	2	12,806	724.51**
<b>Administrative 40</b>							
Retraining Status	1	7	.0886	.0717	32	9,763	5.67**
Time in Service	1	2	.0886	.0845	20	9,763	2.23**
Career Status	1	12	.0886	.0863	15	9,763	1.67
Background Experience	12	13	.0863	.0832	12	9,778	2.78**
Aptitude	12	15	.0863	.0153	4	9,778	189.92**
<b>Administrative 50</b>							
Retraining Status	1	7	.1280	.0637	24	1,000	3.81**
Time in Service	1	2	.1280	.1195	14	1,000	1.71
Career Status	2	3	.1195	.1150	3	1,023	1.12
Background Experience	3	4	.1150	.1125	4	1,026	.73
Aptitude	4	5	.1125	.0458	4	1,030	19.36**
<b>Administrative 60</b>							
Retraining Status	1	7	.0638	.0256	32	16,626	21.15**
Time in Service	1	2	.0638	.0610	20	16,626	2.41**
Career Status	1	12	.0638	.0631	15	16,626	.76
Background Experience	12	13	.0631	.0608	12	16,641	3.47**
Aptitude	12	15	.0631	.0372	4	16,641	114.98**
<b>Administrative 70</b>							
Retraining Status	1	7	.1969	.0310	32	620	4.00**
Time in Service	1	2	.1969	.1697	20	620	1.05
Career Status	2	3	.1697	.1577	5	640	1.85
Background Experience	3	4	.1577	.1494	4	645	1.58
Aptitude	4	5	.1494	.1166	4	649	6.27**

Table B-2 (Continued)

Source	Comparison		R <sup>2</sup>		df <sub>1</sub>	df <sub>2</sub>	F*
	Full	Restricted	Full	Restricted			
<b>Administrative 80</b>							
Retraining Status	1	7	.0422	.0095	32	3,408	3.63**
Time in Service	1	2	.0422	.0372	20	3,408	.88
Career Status	2	3	.0372	.0340	5	3,428	2.32*
Background Experience	2	9	.0372	.0363	8	3,428	.43
Aptitude	9	10	.0363	.0231	4	3,436	11.73**
<b>General 40</b>							
Retraining Status	1	7	.0820	.0745	32	35,198	8.97**
Time in Service	1	2	.0820	.0809	20	35,198	2.03**
Career Status	1	12	.0820	.0813	15	35,198	1.73*
Background Experience	1	16	.0820	.0812	24	35,198	1.28
Aptitude	16	17	.0812	.0075	4	35,222	705.80**
<b>General 50</b>							
Retraining Status	1	7	.1733	.1462	31	4,721	5.01**
Time in Service	1	2	.1733	.1672	19	4,721	1.84*
Career Status	1	12	.1733	.1695	14	4,721	1.57
Background Experience	12	13	.1695	.1667	12	4,735	1.31
Aptitude	13	14	.1667	.0154	4	4,747	215.47**
<b>General 60</b>							
Retraining Status	1	7	.1259	.1006	32	27,745	25.09**
Time in Service	1	2	.1259	.1210	20	27,745	7.79**
Career Status	1	12	.1259	.1244	15	27,745	3.10**
Background Experience	1	16	.1259	.1238	24	27,745	2.73**
Aptitude	1	18	.1259	.0202	4	27,745	838.33**
<b>General 65</b>							
Retraining Status	1	7	.2319	.1447	31	485	1.77**
Time in Service	1	2	.2319	.2151	19	485	.56
Career Status	2	3	.2151	.2016	5	504	1.73
Background Experience	3	4	.2016	.1851	4	509	2.63*
Aptitude	3	8	.2016	.0582	4	509	22.85**
<b>General 70</b>							
Retraining Status	1	7	.6095	.1291	14	51	4.48**
Time in Service	1	2	.6095	.5407	8	51	1.22
Career Status <sup>b</sup>							
Background Experience <sup>c</sup>	3	4	.5407	.5049	3	59	1.53
Aptitude	4	5	.5049	.3514	4	62	4.81**
<b>General 80</b>							
Retraining Status	1	7	.0988	.0692	32	4,853	4.99**
Time in Service	1	2	.0988	.0947	20	4,853	1.11
Career Status	2	3	.0947	.0909	5	4,873	4.05**
Background Experience	2	9	.0947	.0907	8	4,873	2.71**
Aptitude	2	11	.0947	.0131	4	4,873	109.76**

Table B-2 (Continued)

Source	Comparison		R <sup>2</sup>		df <sub>1</sub>	df <sub>2</sub>	F <sup>a</sup>
	Full	Restricted	Full	Restricted			
<b>Electronic 50</b>							
Retraining Status	1	7	.1858	.1250	32	2,091	4.88**
Time in Service	1	2	.1858	.1755	20	2,091	1.32
Career Status	2	3	.1755	.1729	5	2,111	1.37
Background Experience	3	4	.1729	.1706	4	2,116	1.44
Aptitude	4	5	.1706	.0429	4	2,120	81.59**
<b>Electronic 60</b>							
Retraining Status	1	7	.1558	.1389	32	3,546	2.22**
Time in Service	1	2	.1558	.1489	20	3,546	1.45
Career Status	2	3	.1489	.1450	5	3,566	3.26**
Background Experience	2	9	.1489	.1437	8	3,566	2.71**
Aptitude	2	11	.1489	.0222	4	3,566	132.77**
<b>Electronic 70</b>							
Retraining Status	1	7	.2607	.2386	18	416	.69
Time in Service							-
Career Status							-
Background Experience							-
Aptitude	7	6	.2386	.0000	2	434	67.99**
<b>Electronic 80</b>							
Retraining Status	1	7	.1432	.1193	32	35,189	30.62**
Time in Service	1	2	.1432	.1412	20	35,189	4.07**
Career Status	1	12	.1432	.1419	15	35,189	3.56**
Background Experience	1	16	.1432	.1377	25	35,189	8.97**
Aptitude	1	18	.1432	.0259	4	35,189	1203.92**

<sup>a</sup>A dash (-) indicates F-test was inappropriate and assumed to be non-significant.

<sup>b</sup>Comparison deleted due to absence of non-career airmen in sample.

\*p < .05.

\*\*p < .01.