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An Analysis of Certain Methods for Increasing the Validity of the Airman Qualifying Examination for the Classification of Basic Airmen

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FOREWORD

This report is based on analyses carried out under Contract AF 41(609)-2273 by the Service Bureau Corporation, in accordance with a research design developed by the three co-authors. Dr. Jane McReynolds was the contract monitor, Dr. Robert A. Bottenberg specified the statistical analyses, and Dr. Ernest C. Tupes prepared the report.

The research was accomplished under Project 7717, Selection, Classification, and Evaluation Procedures for Air Force Personnel; task 771705, Selection and Classification Instruments for Airman Personnel Programs.

This report has been reviewed and is approved.

James H. Ritter, Colonel USAF
Commander

J.W. Bowles
Technical Director

ABSTRACT

Screening and initial assignment of non-prior-service enlistees in the United States Air Force is based primarily on relative standing on any one of four aptitude composites, each derived by a simple summation of scores on certain subtests of the Airman Qualifying Examination (AQE). The present report describes a study designed to determine the increase in validity for prediction of performance in technical training courses which might be obtained by the use of (*a*) aptitude composites derived from optimally weighted subtests along with additional information, or (*b*) separate aptitude composites derived for each technical course, or (*c*) separate aptitude composites derived for enlistees from different geographical areas, or (*d*) various combinations of these variables. Data from 46,000 enlistees and 88 technical courses were analyzed. It was concluded that both the addition of information to the aptitude composites and the utilization of separate composites for each technical course would significantly increase the validity of the selection and classification system.

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AN ANALYSIS OF CERTAIN METHODS FOR INCREASING THE VALIDITY OF THE AIRMAN QUALIFYING EXAMINATION FOR THE CLASSIFICATION OF BASIC AIRMEN

I. INTRODUCTION

Since 1959, the Airman Qualifying Examination (AQE) has been the primary aptitude measure used for the screening and selective enlistment of non-prior-service applicants for Air Force enlistment and for the classification (for technical or on-the-job training) of basic trainees. The AQE consists of about 200 aptitude items which are scored on a rights-only basis and summed to yield four aptitude composites (General, Administrative, Mechanical, and Electronics). In recent forms of the AQE, credit in the form of bonus points has been given in the computation of the aptitude composites for the completion of one or more of five high school courses (Algebra, Geometry, Trigonometry, Physics, and Chemistry). The aptitude composites are then converted into standardized percentile-type scores (01, 05, 10, ... 85, 90, 95) with with each score interval representing approximately 5 per cent of the draft-eligible male population. The USAF Recruiting Service administers the AQE to prospective enlistees, as well as to seniors in large numbers of high schools for guidance purposes.

At the time these data were collected, to be eligible for enlistment, an applicant must have achieved a qualifying score on at least one of the aptitude composites. (The qualifying score is 40 on the General, Administrative, and Mechanical composites, and 60 on the Electronics composite.) Upon such qualification, the applicant is enlisted with the guarantee of initial assignment in any one of four broad career areas (corresponding to the four aptitude composites) for which he is qualified and has an interest and for which a quota vacancy exists. During basic training, the airman receives a specific assignment for technical or on-the-job training within his broad career area. Although a number of factors enter into his assignment, the most important is his achievement on the aptitude composite appropriate to his broad career area.

A number of followup validation studies have been carried out to determine the validity of the AQE for predicting performance in technical training (Lecznar, 1963; Lecznar, 1964; Madden & Lecznar, 1965; McReynolds, 1963). These studies indicate that the AQE aptitude indexes (composites) typically yield correlations with final grades in technical training between .6 and .7 when corrected for restriction of range due to selection and screening. These validities, which are as high as or higher than those of the typical aptitude test battery, indicate that the AQE is quite effective as a selection and classification instrument. However, the AQE is neither a very sophisticated nor technically complex test battery, especially with respect to the way it is scored and used. It appears quite likely, therefore, that the predictive validity of the AQE could be made even higher if more complex scoring techniques were applied and/or a more complex system of aptitude indexes were developed. The purposes of the analyses described in this report were to determine what changes in AQE validity would occur with the use of somewhat more complex scoring systems and aptitude indexes.

In designing the analyses, it was recognized that certain constraints must be imposed so that any changes suggested by the results of the analyses would be operationally feasible. Thus the following assumptions were made with regard to possible revisions of the system.

1. The testing time required for administration of the AQE would remain at approximately two hours.

2. Since selective recruiting is expected to continue relatively unchanged, four aptitude indexes each relevant for a broad career area would be obtained as the first step.

3. Because of the widespread use of the AQE by high school guidance counselors and the comprehensive normative data presently available, the aptitude indexes would necessarily measure about the same factors as at present; further, the standardized percentile-type scores would be obtained.

4. Because of the availability of electronic data processing equipment to the Personnel Processing Squadron at Lackland AFB, a fairly large and complex system of aptitude indexes could be developed for use in the final assignment procedure.

II. ANALYSES

The basic sample for the analyses was the total of approximately 73,000 non-prior-service airmen assigned to technical training courses during 1961. After exclusion of airmen for whom complete data were not available and certain technical courses where the total enrollment was too small for analysis, the final sample approximated 46,000 cases. The list of variables available for each subject is shown in Table 1 in the technical appendix, and the technical course numbers and sample sizes are shown in Table 2.

The various analyses are described and discussed verbally in the following text, with the supporting data reported in Tables 3 through 8 in the technical appendix.

The first set of analyses was designed to determine the increase in validity which might be expected if four aptitude composites were used in selective enlistment and in classification as at present, but with each aptitude composite based upon optimally weighted data rather than the simple sum of number of items right. Since the Recruiting Service will be scoring all AQE answer sheets centrally by means of an optical scanner, the operational computation and use of this type of weighted aptitude composite is feasible within the present framework. The results of the analyses are given in Table 3. It is obvious from these results that substantial increases in validity, both statistically and practically significant, would result if each of the four present aptitude composites were based upon additional data, optimally weighted.[1]

The second set of analyses was designed to provide an estimate of the validity which might be expected if a separate aptitude composite were developed and used for selection for each technical training course. Within the system, each enlistee would be selected into one of four broad careers as at present but would be assigned technical training on the basis of his standing on some twenty or thirty aptitude composites relevant to specific assignments within that broad area. Such a classification system is feasible under the anticipated automated assignment procedures, since the computer can easily compute the aptitude composites for each

[1] It should be noted that all validity coefficients presented in tables throughout this report are the obtained coefficients; that is, they have not been corrected for restriction of range due to screening and selection. Thus, they are much lower than those typically reported. In addition, it should be noted that the AQE now in use gives credit for completion of certain high school courses so that validities of current aptitude indexes, even for restricted samples, are somewhat higher than those reported herein.

basic airman and then make the assignments in such a way that the airmen will be optimally assigned. The results of the analyses are shown in Table 4. These results leave little doubt that the effectiveness of the airman selection and classification system would be greatly increased (with respect to prediction of performance in technical training) under a system in which separate aptitude composites are computed for each technical course. Not only are the validity estimates in Table 4 substantially higher than those obtained under the present system, but they are also substantially higher than those obtained in the first set of analyses.

The third set of analyses was designed to determine whether validity increases would result if separate aptitude composites were developed for certain subgroups of applicants for enlistment, specifically applicants from different geographical areas of the country, as well as for each technical training school. Several studies (Lecznar, 1962; Lecznar, 1965; Tupes, 1965) have shown that Air Force enlistees from different areas differ considerably on aptitudes and other characteristics such as amount and kind of education and motivation to enlist. This set of analyses was carried out to determine whether such differences would be reflected in differential predictor-criterion relationships; that is, whether increased validity would result if separate aptitude composites were developed for applicants in the different enlistment areas. The results of these analyses are shown in Tables 6 and 7. By and large, it appears that statistically significant increases in validity were obtained, but the increases were generally not large enough to be of much practical value. Additional research studies are needed to determine whether such a system of aptitude composites would add sufficiently to the validity of the selection and classification system to warrant their operational use.

III. CONCLUSIONS

The results of this study lead to two main conclusions:

1. Within the frame work of the present four aptitude indexes, each relevant to one of four broad career areas (General, Administrative, Mechanical, and Electronics), the development of revised aptitude indexes would be both operationally feasible and effective from the standpoint of increased validity. The scoring procedures of the present AQE could be revised to yield the revised aptitude indexes; however, it would be more feasible to incorporate the revised indexes in the next form of AQE or in the Armed Services Vocational Aptitude Battery if this test replaces the AQE.

2. The various technical training courses within each broad career area require somewhat different patterns of aptitudes and background of high school courses. Thus, the use of a separate aptitude composite for each training course would result in increased validity and effectiveness of the airman initial assignment system. The use of these separate composites (from twenty to thirty in each broad career area) would be operationally feasible within the context of the newly developed automated assignment procedures.

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APPENDIX: TECHNICAL CONSIDERATIONS

Method of Analysis

The principal method of analysis used in this study is multiple linear regression (Bottenberg & Ward, 1963). In broad terms, the accuracy of prediction of a criterion variable by a set of predictors is compared with the accuracy of prediction of the same criterion by a subset of the same predictor variables. To make this comparison, an *F* ratio is computed between the variance of the errors in prediction of the criterion variable when the regression equation uses the whole set of predictors and the variance of the errors in prediction of the criterion variable when the regression equation uses only the subset of predictors. If the *F* ratio is statistically significant, it is concluded that one or more of the predictors which are included in the whole set but not in the subset contribute significantly to the prediction of the criterion; that is, at least one of the predictors included in the whole set but not in the subset has a non-zero beta weight for prediction of the criterion. The variance of the errors in prediction (when the criterion scores are in standard or *z* score units) is exactly equal to $(1 - R^2)$. Thus, the *F* ratio may be thought of as testing the significance of the difference between two squared multiple correlations (R^2), and the ratio is usually discussed in these terms.

Inasmuch as the method of multiple linear regression requires no assumptions about the type of predictor variables, attributes and categorical variables may be used in the analyses. By means of a system of generated variables, each subject is given a score of *1* if he possesses a particular attribute (or is a member of a certain category group) and *0* if he does not possess that particular attribute (or is not a member of that particular category group). As a matter of interest, it might be noted that the classical analysis of variance is simply a special case of the multiple linear regression model wherein all predictors are of the categorical variety.

List of Variables

Table 1 presents the variables used in the analyses. The first sixteen of these are continuous and consist of the final grade in the technical training course (the criterion variable), scores on the four AQE aptitude indexes (AI), scores on the eleven AQE subtests, and years of education. The others are generated variables (*1* or *0*) based on geographical enlistment area, high school graduation status, and completion of certain high school courses.

Analysis Sample

Of approximately 73,000 non-prior-service airmen assigned to technical training courses during 1961, AQE answer sheets (which provided the AQE subtest scores) and other complete data were available for about 46,000. This latter group constitutes the analysis sample. Table 2 shows the division of this analysis sample among the total of 88 technical training courses in terms of high school graduates (HS Grad) and non-graduates (HS non-grad).

Analyses

The first type of analysis was designed to determine what validity could be expected if the present four aptitude indexes were revised to incorporate into each index various types of data not presently used. To carry out these analyses, all available cases selected and assigned to technical training within each of the four broad aptitude areas were thrown together as one sample, regardless of the specific technical training course the subjects had attended.

Within each sample, multiple correlations were obtained between various subsets of predictor variables and the criterion variable of final course grades. These analyses were carried out separately on the high school graduates within each sample, on the high school non-graduates, and on the two subgroups combined. The results of these analyses are shown in Table 3.

Table 1. **Predictor Variables Used in Regression Analyses**

1. Final grade in technical course

AQE Aptitude Indexes

2. Mechanical AI
3. Administrative AI
4. General AI
5. Electronics AI

AQE Subtests

6. Arithmetic Reasoning
7. Word Knowledge
8. General Mechanics
9. Mechanical Principles
10. Tool Functions
11. Hidden Figures
12. Technical Information
13. Electrical Information
14. Pattern Comprehension
15. Numerical Operations
16. Clerical Matching

17. Years of Education

Enlistment Areas (scored *1* if in area; *0* if not)

18. Enlistment Area 1
19. Enlistment Area 2
20. Enlistment Area 3
21. Enlistment Area 4
22. Enlistment Area 5
23. Enlistment Area 6
24. Enlistment Area 7 (not used)

25. High School Graduation (scored *1* if graduate; *0* if not)

High School Course Completion (scored *1* if completed course in high school; *0* if did not)

26. Algebra
27. Geometry
28. Trigonometry
29. Chemistry
30. Physics

Table 2. **Air Force Technical Training Course Samples**

General AI Area

Course No.	HS Grad	HS Non-Grad
27230A	167	9
27230B	156	19
27330A	448	93
27330B	582	103
23230	102	15
25231	361	27
29230	366	12
77130	2,132	567
90010BR	1,166	196
90010QR	863	115
90230	86	25
92230A	198	41
90630-31	73	16
901 – 905 xx	134	24

Mechanical AI Area

Course No.	HS Grad	HS Non-Grad
36130	101	27
36231	165	24
42132	591	182
42231	162	49
42430	81	19
43131A	808	304
43131C	1,458	539
43131E	2,581	974
43230	1,361	449
43231	557	194
43330	277	53
44331	82	7
46130	106	22
46230	596	55
47131	285	101
47132	73	28
53230	55	20
53430	220	69
54230	238	53
54330	653	237
544-56230	177	36
54530	356	94
54630	117	38
56430	82	26
57130	462	250
58130	75	25
601-60531	65	19
64330A	336	116
44321 AQR	78	9
54630 AQR	57	0

Administrative AI Area

Course No.	HS Grad	HS Non-Grad
29130	733	151
29231	1,535	53
29330	324	124
601-60530	78	18
64530	900	222
64630	982	365
64730	286	148
67130	457	44
70130	136	9
70230	1,320	197
73230	635	76
68530A	519	50

Electronics AI Area

Course No.	HS Grad	HS Non-Grad
30130	783	80
30131	797	67
30133	166	12
30230	106	9
30331	161	13
30332	922	93
30431	84	6
30432	926	85
30433	304	20
30430A	255	23
30430B	267	25
30531D	102	10
30630A	94	9
30630C-D	412	34
31130	169	13
31132	86	8
31330	67	8
31433	54	0
32130	338	20
32230K	310	25
32231	277	24
32330C	105	8
33130A-B	423	21
34131-34430	153	10
36330	348	37
42133	956	163
42230	298	54
42330	699	128
42333	215	62
54130	118	18
99125	107	0
44020 AQR	56	0

Table 3. **Multiple Correlations Obtained When All Technical Training Course Samples Within Each Aptitude Area Are Combined**

Education and Aptitude Group	N	Multiple Correlation A	B	C	D	E	F
High School Graduates							
General	6,854	.17	.32	.35	.36	.37	.39
Administrative	7,905	.14	.28	.28	.30	.30	.30
Mechanical	12,225	.26	.39	.41	.41	.41	.42
Electronics	10,158	.26	.33	.39	.39	.40	.42
High School Non-Graduates							
General	1,262	.20	.28	.35	.35	.36	.37
Administrative	1,457	.20	.32	.33	.33	.33	.35
Mechanical	4,024	.33	.41	.44	.44	.45	.46
Electronics	1,098	.20	.33	.35	.36	.37	.40
HS Grad and Non-Grad Combined							
General	8,116	.20	.36	.37	.40	.41	.42
Administrative	9,362	.20	.32	.32	.33	.35	.35
Mechanical	16,279	.32	.44	.44	.45	.46	.47
Electronics	11,256	.26	.35	.39	.40	.40	.42

The first column in Table 3 identifies the subgroup (by broad aptitude area and by high school graduation status). The second column indicates the number of cases in each subgroup. As can be noted, the sample sizes are quite large, ranging from nearly 1,100 cases to more than 16,000. The columns labeled A through F list the obtained multiple correlations based on the selected sets of predictor variables which are described below:[2]

Column A presents the multiple correlations obtained when only a single predictor is used; i.e., the appropriate aptitude index used in original selection to and assignment within each broad aptitude area. These correlations represent the relationship between each aptitude index and course grades in a group whose range has been severely restricted by screening; they greatly underestimate the relationships which would have been obtained had random samples of the draft-eligible population been entered in the technical training courses. The correlations are also somewhat lower than would be expected between current aptitude indexes and training course grades, since the inclusion of data concerning the completion of certain high school courses has increased the validities of the current aptitude indexes somewhat over the validities found in the present study.

Column B presents the multiple correlations based on the four aptitude indexes (variables 2 through 5), years of education (variable 17) and whether or not the subject came from each of the six geographical enlistment areas (variables 18 through 23). These correlations estimate the validities which would have been obtained if enlistees had first been selected for a broad area on the basis of their aptitude indexes (as is presently done) and then assigned on the

[2] The descriptions of the composition of columns A through F apply to column designations in Tables 3 through 8.

basis of four more complex aptitude indexes, each based on an optimally weighted combination of four aptitude indexes, years of education, and enlistment area. The obtained correlations are also attenuated for the reasons previously given.

Column C lists the multiple correlations obtained when the eleven AQE subtests (variables 6 through 16) are used as predictors.

Column D lists the multiple correlations based on the eleven AQE subtests (variables 6 through 16) and years of education (variable 17).

Column E presents the multiple correlations obtained when the eleven AQE subtests (variables 6 through 16), years of education (variable 17), and the six enlistment areas (variables 18 through 23) are included in the prediction system.

Column F lists the multiple correlations based on the AQE subtests (variables 6 through 16), years of education (variable 17), the six enlistment areas (variables 18 through 23), and whether or not each subject has completed each of five high school courses (variables 26 through 30).

As can be seen, each column of multiple correlations is based on the inclusion of more data than those preceding. The significance of any increase in the size of a multiple correlation as more predictor variables are included can be evaluated by means of an *F* test. Therefore, the following pairs of columns were tested for the significance of their differences.

Column B was compared with Column A to determine whether the use of all four aptitude indexes, years of education, and enlistment area would yield more valid composites than would the present single aptitude index.

Column C was compared with Column A to determine whether the use of all eleven subtests would yield more valid composites than would the present single aptitude index.

Column D was compared with Column C to determine whether years of education would add to the validity obtained from the eleven subtests.

Column E was compared with Column D to determine whether enlistment area would add to the validity obtained from the eleven subtests and years of education.

Column F was compared with Column E to determine whether data concerning completion of certain high school courses would add to the validity obtained from the subtests, years of education, and enlistment area.

Column F was compared with Column A to determine whether the use of all available data would significantly increase validity obtained from the aptitude index alone.

The results of the *F* tests are not detailed since because of the large sample sizes any difference between two multiple correlations other than zero (e.g., any difference of .01 or greater) is statistically significant at the .01 level or beyond. As can be noted, however, the greatest increases in validity would result from the use of additional aptitude test data (either the four present aptitude indexes optimally combined or the subtest scores) and the use of high school course completion information. Relatively small increases in validity would accrue from the use of either years of education or enlistment area.

The second set of analyses was designed to determine the validity for each broad aptitude area which would be obtained if specific regression equations were developed for each technical course within that area. To carry out these analyses, the cases available for each technical course were considered a separate sample, and regression equations were computed for high school graduates, high school non-graduates, and the two subgroups combined. Within each sample, multiple correlations were obtained between various predictor subsets and the criterion.

The multiple correlations and regression equations were then combined for all technical courses within each broad area to yield the validity estimates for the whole area. The results of these analyses are shown in Table 4.

The multiple correlations in Columns B through F in Table 4 are based on the same subsets of predictors as those similarly labeled columns in Table 3. Two sets of *F* tests were carried out. The first of these compared the multiple correlations in Table 4 with the corresponding multiple correlations in Table 3 to determine whether, for each subset of predictors, validity coefficients were significantly increased for each broad area when separate aptitude composites were obtained for each technical course instead of a single aptitude composite for the entire area. Of the total of 60 *F* tests, only 2 were not significant at or beyond the .01 level; it may be concluded, therefore, that higher validities would be obtained through the use of separate composites for each technical course, regardless of the particular subsets of predictors used to compute the aptitude composites. Since the magnitude of the differences ranged from .06 to .47, with a median difference of .15, it may be concluded that the differences would be of practical as well as statistical significance.

Table 4. **Multiple Correlations Obtained With Separate Aptitude Composites for Each Technical Training Course**

Education and Aptitude Group	*N*	*n*[a]	Multiple Correlation				
			B	C	D	E	F
High School Graduates							
General	6,854	14	.59	.61	.62	.63	.65
Administrative	7,905	12	.46	.46	.47	.48	.50
Mechanical	12,225	30	.49	.53	.53	.54	.56
Electronics	10,158	32	.45	.50	.51	.52	.56
High School Non-Graduates							
General	1,262	14	.62	.66	.66	.68	.71
Administrative	1,457	12	.51	.54	.55	.57	.61
Mechanical	4,024	29	.52	.56	.57	.59	.61
Electronics	1,098	30	.61	.70	.71	.75	.79
HS Grad and Non-Grad Combined							
General	8,116	28	.60	.62	.63	.64	.66
Administrative	9,362	24	.47	.48	.49	.50	.52
Mechanical	16,279	59	.50	.54	.54	.56	.57
Electronics	11,256	62	.47	.52	.53	.55	.58

[a] Number of technical training course—educational samples within each aptitude group.

The other set of *F* tests was carried out to determine whether, within the context of separate aptitude composites for each technical training course, the inclusion of more predictors in each composite would result in significant increases in validity. The results of these tests are presented in Table 5. It appears that neither years of education nor enlistment area would add much to the validity. It also appears that composites based on the eleven AQE subtests would be more valid than those based on the present aptitude indexes and that inclusion of information on completion of certain high school courses would increase the validity still more. Although the actual analyses were not carried out, it is also probable that composites based on the four aptitude indexes would be more valid than the single index now used for classification.

Table 5. **Significance of Differences Between Selected Pairs of the Multiple Correlations in Table 4**[a]

Education and Aptitude Group	Pairs of Multiple Correlations[b]			
	E – B	D – C	E – D	F – E
High School Graduates				
General	x	x	ns	x
Administrative	x	x	x	x
Mechanical	x	ns	ns	x
Electronics	x	x	ns	x
High School Non-Graduates				
General	x	ns	ns	ns
Administrative	x	ns	ns	x
Mechanical	x	x	ns	ns
Electronics	ns	ns	ns	ns
HS Grad and Non-Grad Combined				
General	x	x	ns	x
Administrative	x	x	ns	x
Mechanical	x	ns	x	x
Electronics	x	x	ns	x

[a] x indicates that the significance of the difference is .01.
ns indicates that the difference is not significant at the .01 level.

[b] Column headings refer to multiple correlations in Table 4.

A final set of analyses was designed to determine whether, in the context of specific composites for each technical course, further increases in validity would result if separate composites were computed for enlistees from the six enlistment areas; that is, would the development of six composites for each technical course (one for each enlistment area) yield higher validity than that accrued from a single composite for each technical course. In order to insure that the samples were sufficiently large in size, only those courses were used in which the number of high school graduate (or non-graduate) cases was at least 800. The fifteen samples which met this criterion are listed in Table 6. The columns of multiple correlations are based on the same subsets of predictors as those in Table 3, and each correlation is the validity within a technical course obtained when a single aptitude composite is developed for that course. Table 7 lists the corresponding validities for each course when aptitude composites are developed for each enlistment area. The *F* test results are shown in Table 8. It is apparent that the results are somewhat inconclusive, although it does seem that some increase in validity would result by the use of aptitude composites developed for each enlistment area. The increase would be rather small, however, and on the basis of the present study, it does not seem worthwhile to attempt to use a selection and classification system of such complexity. Additional research is planned to provide a more definite answer to the question.

Table 6. **Multiple Correlations Obtained Within Selected Technical Training Course Samples**[a]

Aptitude Group and Course No.	*N*	Multiple Correlation					
		A	B	C	D	E	F
General							
90010BR	1,166	.33	.45	.50	.51	.52	.54
90010QR	883	.24	.44	.46	.48	.50	.53
77130	2,132	.17	.30	.37	.39	.39	.40
Administrative							
29231	1,535	.14	.22	.22	.22	.24	.26
64530	900	.26	.35	.36	.37	.37	.44
64630	983	.42	.53	.54	.54	.55	.57
70230	1,320	.28	.41	.40	.42	.44	.44
Mechanical							
43131A	808	.46	.59	.61	.62	.63	.65
43131C	1,458	.33	.42	.45	.46	.46	.47
43131EN	974	.36	.46	.50	.50	.50	.51
43131E	2,581	.40	.48	.50	.50	.51	.52
43230	1,361	.35	.49	.51	.51	.52	.54
Electronics							
30332	922	.26	.36	.40	.41	.42	.46
30432	926	.35	.40	.45	.47	.47	.50
42133	956	.46	.54	.57	.57	.58	.60

[a] Only courses where the number of high school graduates or the number of high school non-graduates was greater than 800. All of above consist of high school graduates only except 43131EN which consists of high school non-graduates.

Table 7. **Multiple Correlations Obtained With Separate Aptitude Composites for Each Technical Training Course and for Each Enlistment Area**

Aptitude Group and Course No.	N	Multiple Correlation A	B	C	F
General					
90010BR	1,166	.35	.46	.58	.62
90010QR	883	.26	.44	.60	.65
77130	2,132	.24	.30	.45	.48
Administrative					
29231	1,535	.17	.24	.32	.35
64530	900	.26	.40	.50	.56
64630	983	.44	.53	.57	.62
70230	1,320	.35	.41	.47	.50
Mechanical					
43131A	808	.46	.59	.68	.71
43131C	1,458	.33	.47	.53	.55
43131EN	974	.36	.47	.54	.56
43131E	2,531	.41	.50	.54	.56
43230	1,361	.35	.49	.54	.57
Electronics					
30332	922	.32	.36	.48	.52
30432	926	.36	.44	.56	.60
42133	956	.46	.56	.66	.69

Table 8. **Significance of Differences between Selected Pairs of the Multiple Correlations in Tables 6 and 7**[a]

Aptitude Group and Course No.	Pairs of Multiple Correlations[b] A–A	B–B	C–C	F–F
General				
90010BR	ns	ns	x	x
90010QR	ns	ns	x	x
77130	x	ns	x	x
Administrative				
29231	ns	ns	x	ns
64530	ns	x	x	x
64630	ns	ns	ns	ns
70230	x	ns	x	ns
Mechanical				
43131A	ns	ns	x	x
43131C	ns	x	x	x
43131EN	ns	ns	ns	ns
43131E	x	x	x	x
43230	ns	ns	ns	ns
Electronics				
30332	x	ns	x	ns
30432	ns	x	x	x
42133	ns	x	x	x

[a] x indicates that the significance of the difference is .01.
ns indicates that the difference is not significant at the .01 level.
[b] Column headings refer to multiple correlations in Tables 6 and 7.

REFERENCES

Bottenberg, R.A. & Ward, J.H., Jr. *Applied multiple linear regression.* PRL-TDR-63-6, AD-413 128. Lackland AFB, Tex.: Personnel Research Laboratory, Aerospace Medical Division, March 1963.

Lecznar, W.B. *Some aptitude data on Air Force enlisted accessions.* PRL-TDR-62-10, AD-289 874. Lackland AFB, Tex.: Personnel Research Laboratory, Aerospace Medical Division, June 1962.

Lecznar, W.B. *Survey of tests used in airman classification.* PRL-TDR-63-5, AD-403 831. Lackland AFB, Tex.: Personnel Research Laboratory, Aerospace Medical Division, February 1963.

Lecznar, W.B. *Years of education as a predictor of technical training success.* PRL-TDR-64-2, AD-437 940. Lackland AFB, Tex.: Personnel Research Laboratory, Aerospace Medical Division, February 1964.

Lecznar, W.B. *Performance on Airman Qualifying Examination by regional areas and by sex.* PRL-TR-65-8, AD-617 335. Lackland AFB, Tex.: Personnel Research Laboratory, Aerospace Medical Division, April 1965.

Madden, H.L. & Lecznar, W.B. *Development and standardization of Airman Qualifying Examination-64.* PRL-TR-65-14, AD-622 807. Lackland AFB, Tex.: Personnel Research Laboratory, Aerospace Medical Division, August 1965.

McReynolds, Jane. *Validity of Airman Qualifying Examination, Form F, for technical training grades—1961.* PRL-TDR-63-20, AD-426 756. Lackland AFB, Tex.: Personnel Research Laboratory, Aerospace Medical Division, August 1963.

Tupes, E.C. *AQE norms for high school seniors and Air Force training groups.* PRL-TR-65-10, AD-619 346. Lackland AFB, Tex.: Personnel Research Laboratory, Aerospace Medical Division, May 1965.