DETERMINATION OF OPTIMAL WEIGHTS OF TESTS OF THE AIRMAN CLASSIFICATION TEST BATTERY FOR MAXIMUM PREDICTION OF SUCCESS IN MECHANICS AND ELECTRONICS TECHNICAL SCHOOLS

THESIS

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CODE USED IN TABLES

The following code is used in Tables I through VII and IX:

1. AI..........Aviation Information
2. AR..........Arithmetic Reasoning
3. BCA.........Background for Current Affairs
4. DTR.........Dial and Table Reading
5. EI..........Electrical Information
6. GM..........General Mechanics
7. ML..........Memory for Landmarks
8. MP..........Mechanical Principles
9. NOI.........Numerical Operations I
10. NOII........Numerical Operations II
11. RC..........Reading Comprehension
12. SI..........Speed of Identification
13. TF..........Tool Functions
14. WK..........Word Knowledge

CHAPTER I

INTRODUCTION

The Problem

Many psychological tests are known to have high validity for predicting success in technical schools. The Airman Classification Test Battery[1], a battery administered to all airmen during basic training, has proven to be an efficient predictor. The real test of a prediction formula is that it predict adequately on subsequent samples. One of the most troublesome problems in the field of prediction is that of assigning the best weights to the tests of a particular battery and combining them in the best manner. The assignment of such weights is the purpose of this study as pertains to the tests of the Airman Classification Test Battery. The specific problem is to determine which tests to use and the weights to apply to them to produce maximum prediction of school success. It is also the purpose to determine the amount to be gained in accuracy of multiple prediction by having different weights for different indices for electronics and mechanics clusters as opposed to a single index for

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[1] John T. Dailey, *Development of the Airman Classification Battery*.

both these groups of MOS's[2] combined. Previously, all

[2] MOS (Military Occupational Specialty) is a military designation, by number, of a job classification.

mechanics specialties were included in the mechanics Aptitude Index (See Appendix).

Rationale

Various combinations of the tests of this battery can be used, and when properly weighted, will predict technical school success to such an extent as to be significant from the economic and operational standpoint. This economic saving is accomplished by relief from training personnel with little or no chance of success, thus reducing wastage of time and impairment of personality in training unresponsive trainees. A notable economy to the government is also realized in the saving on the teaching and training force.

CHAPTER II

RELATED STUDIES

General Background

In the past few years, trends toward aptitude testing have been steadily on the increase. This can be accounted for by the growing realization of the need for aptitude testing as a means of determining the technical and vocational specialties in which an individual is likely to be more successful. Developments in the field of aptitude testing have demonstrated the fact that specific aptitudes are requisite to the learning of each task. Fortunately, these specific aptitudes are not excessive in number. As reported in Research Bulletin Number 48-4:

> It has been found that the number of separate measurable aptitudes involved in common vocational and technical specialties probably does not exceed 20 or 30[1].

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[1] John T. Dailey, Development of the Airman Classification Battery, p. 1.

Civilian Placement

Much has been done in the field of aptitude testing, battery development, and multiple prediction of success, by various individuals and institutions outside as well as within the armed forces. Among these is the Civil Service Commission, which has been working for years on the placement of individuals in jobs by use of results of aptitude tests. Because of the varied types of civil service jobs, and the necessity for taking every precaution against "leakage," civil service tests are prepared for specific jobs. Attempts are made to weight tests and parts of tests optimally for maximum prediction of job success. When reliable measures of job performance are available for prevalidation, the weights at which the parts should be combined in order to yield the maximum correlation with the measures of job performance can be obtained by multiple correlational methods.

When reliable measures of job performance are lacking, as is often the case in civil service situations, weights are established to reflect what is thought to be the importance of the several parts, or tests. The following procedure is used for this. Since the spread or variability of a part, and its correlation with other parts, determines the effective weight of the part, in some instances, the scores on some of the parts are adjusted to equate variability and to take into account the intercorrelations of the parts before assigning the "arbitrary" weights that are supposed to reflect their importance. This is justified, in the opinion of civil service test authorities,[2] on the basis that, although

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[2] Dorothy C. Adkins, Construction and Analysis of Achievement Tests, p. 17.

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there is no good substitute for data, a test technician, with expert experience, can often make approximations that are better than chance on the basis of previous findings with other test variables.

Prediction of Educational Success

Many schools are now using tests and combinations of tests as predictors of school success. Purdue University has been conducting an investigation to determine the relationship of predictive value of its orientation tests, and the relative importance of each of the scores as a predictor of school success. The sample consisted of those members of the freshman class of September, 1947, who had taken all of the orientation tests and were still in school at the completion of the first semester. It was conducted in terms of the total group of freshman students and also in terms of the freshmen in the various schools of the University: Engineering, Science, Home Economics, Agriculture, Forestry, Physical Education for Men, and Pharmacy. Optimal weights for the various orientation scores were determined for the best possible prediction of first semester grade point averages.

The Wherry-Doolittle Test Selection Method was used in selecting the batteries of tests and in estimating the multiple correlation. The study presented weights to be assigned the various tests for optimal prediction of grades in each of the different schools, and suggested that prediction formulas could be developed for individual courses. The chief function of the program at Purdue is for guidance and counseling. A follow up of the study cited was begun by applying a multiple regression equation, based upon orientation scores of the September, 1947, freshman class to the 1948 freshman class. The equivalence of the two groups was verified, in so far as was possible, by comparing the two classes directly on the basis of scores made on two equivalent tests. Thus, they have gone a step further than is done in most cases, by attempting to develop a prediction formula which will predict adequately on subsequent samples, not just on the original sample. Plans were underway for testing, empirically, the prediction formulas by randomly selecting 126 engineering freshmen and predicting their first semester grade point averages on the basis of the formula for engineers. Plans were to correlate the predicted grades with the obtained grades at the end of the semester, and to compare this correlation with the estimated shrunken coefficient of multiple correlation, thus determining the value of the prediction formulas for predicting success in subsequent samples.[3]

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[3] Remmers, Elliott, and Gage, "Predictiveness of the Orientation Tests at Purdue University and Their Use in Counseling."

Other Military Studies

The Army Air Force used a multiple correlation method similar to the one described in this study in its selection program. The same tests were used to predict success as pilot, bombardier, and navigator, using a different combining formula for each job. A study of the combining and weighting of tests for pilot pass-fail prediction has been reported by Doctor John T. Cowles.[4]

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[4] John T. Cowles, "Predictive Efficiency of Various Combinations of Aircrew Classification Tests."

The British Army based its selection program on a multiple cut-off plan. The British plan used separate cutting scores for each test in each division of the service. For men who qualified for several classifications, assignment was made on the basis of preference and the current needs of the various branches. Some of the advantages of this system, as given by Cronbach, are:

(1.) It does not assume that strength in one ability compensates for inadequacy in another important ability.

(2.) It is easier to compute and easier for the layman to understand than a composite formula. It is usually easier to administer.

(3.) Retaining the scores of separate tests in the record permits more effective guidance or placement than an undifferentiated composite or average.[5]

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[5] Cronbach, Lee J., Essentials of Psychological Testing, p. 254.

CHAPTER III

METHOD OF COLLECTING AND TREATING DATA

Sources of the Data

The tests of the Airman Classification Test Battery which have been administered to approximately 175,000 airmen since January 1947 have been scored and the scores entered on the record cards of the airmen. The technical schools have cooperated to the fullest by sending in record sheets showing the success of the trainee in technical school courses. These records are maintained by the Records and Analysis Division, Personnel Research Directorate, Human Resources Research Center at Lackland Air Force Base, San Antonio, Texas. This has been the chief source of data for this study. Other sources include the Psychological Research Bulletins and Quarterly Research Reports of the 3309th Research and Development Squadron (now Personnel Research Directorate, Human Resources Research Center), San Antonio, Texas, from which intercorrelation data were procured.

Procedure

Existing validation data were surveyed in order to determine which tests of the Airman Classification Test

Battery correlated significantly with the criterion (final grade in radar mechanic, radio mechanic, and airplane and engine mechanic schools). These tests, when significantly valid, were used as a basis for multiple correlation studies. The specific technique used was the statistical procedure of obtaining the maximum multiple correlation of various combinations of tests. First, all variables were used to compute the multiple correlation coefficient; then, variables were dropped one at a time until only the two most valid tests of the Airman Classification Battery remained. The computational method used was the Cowles-Crout technique.[1]

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[1] John T. Cowles, "A Labor-Saving Method of Computing Multiple Correlation Coefficients, Regression Weights, and Standard Errors of Regression Weights."

The intercorrelations listed in Table I, page 14, and validities shown in Table II, page 15, were used as the basic matrix from which to compute multiple correlations for all technical schools. In addition, a multiple correlation was computed on radar mechanics final grade using Table III, page 16, as basic data.

Analysis of the regression weights and multiple correlation coefficients were used as a basis for selection of tests to be used in a weighted composite score for prediction of success in mechanics and electronics courses in technical schools. Tests with significant Beta weights were weighted in such a manner that the total weight would be 100 and the weights assigned were in proportion to the Beta weights. The Thorndike iteration method[2] was then

[2] Robert L. Thorndike, Research Problems and Techniques, pp. 154-159.

used to determine the multiple correlation when various weights were assigned to each of the tests.

CHAPTER IV

RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

Results

Table I gives the intercorrelations of all the tests of the Airman Classification Test Battery based on the records of 2,049 basic airmen tested between May 1947 and November 1948, who have scores on all the tests.

Table II shows validities of variables, with technical school grades as criteria. The N is of necessity a variable N as the airmen in the various technical schools did not all have all of the same tests (as a result of different testing dates, changes in the battery, changes in testing program, etc.). The intercorrelations and validities of Table III are based on a sample of 362 students in radar mechanics school. The validation criterion is the school grade at the end of the eighth week. The validities are corrected for restriction of range, as this group had been selected by a cut-off point on the mechanical aptitude scale. Thorndike's formulas (1) and (3) for restriction of range were used in the correction.[1]

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[1] Robert L. Thorndike, Research Problems and Techniques, pp. 65-66.

Tables IV, V, VI, and VII give the partial standard regression weights and multiple correlation coefficients for each of a number of combinations of airmen tests, using intercorrelations from Table I and validity coefficients from Table II.

TABLE I

INTERCORRELATIONS OF TESTS OF AIRMAN CLASSIFICATION TEST BATTERY

(Decimals are omitted in Correlation Coefficients)

N = 2049 Testing Dates: May 47 - Nov 48

	MP	RC	EI	DTR	GM	BCA	AR	NOII	ML	TF	AI	NOI	SI
1. MP		537	586	493	634	428	539	250	374	557	534	166	360
2. RC	537		604	523	557	645	604	387	392	359	637	317	321
3. EI	586	604		478	684	602	502	280	325	526	670	232	358
4. DTR	493	523	478		400	512	641	593	466	313	450	548	486
5. GM	634	557	684	400		458	466	190	252	684	591	142	289
6. BCA	428	645	602	512	458		566	399	363	287	698	352	376
7. AR	539	604	502	641	466	566		606	389	317	484	503	315
8. NOII	250	387	280	593	190	399	606		311	068	258	763	277
9. ML	374	392	325	466	252	363	389	311		187	300	276	316
10. TF*	557	359	526	313	684	287	317	068	187		441	030	293
11. AI	534	637	670	450	591	698	484	258	300	441		218	405
12. NOI	166	317	232	548	142	352	503	763	276	030	218		290
13. SI	360	321	358	486	289	376	315	277	316	293	405	290	

*Intercorrelations for Tool Functions are from J. T. Dailey, The Development of the Airman Classification Test Battery, Table 5, p. 17. N = 881, testing dates: 10-24 March 1948.

TABLE II

VALIDITIES FOR ACTB TESTS AGAINST FINAL SCHOOL GRADES IN SELECTED MECHANICS COURSES

(Decimal Points are Omitted) Testing Dates: May 47 - Nov 48

	Radar Mechanics		Radio Mechanics		A&E Jet Mechanics		A&E Conventional Mechanics	
	N	r_{xy}	N	r_{xy}	N	r_{xy}	N	r_{xy}
1. MP	214	412*	75	284**	1229	430*	1142	498*
2. RC	275	545*	195	588*	1636	522*	1994	659*
3. EI	108	656*	77	496*	840	471*	1063	601*
4. DTR	123	539*	195	500*	1032	469*	1647	609*
5. GM	107	374*	77	290**	839	485*	1064	590*
6. BCA	275	409*	195	536*	1639	492*	1995	554*
7. AR	275	500*	195	506*	1640	476*	1995	588*
8. NOII	58	206	74	187	538	378*	722	453*
9. ML	111	348*	195	387*	948	316*	1648	397*
10. TF	160	311			739	353*	329	481*
11. AI	115	542*	195	453*	970	462*	1648	583*
12. NOI	59	150	74	235**	533	300*	722	395*
13. SI	52	145	75	228**	554	200*	796	392*

*Significant at 1% level (two-tailed test)
**Significant at 5% level (two-tailed test)

TABLE III

RADAR MECHANIC STUDY

Validities are Significant at 1% or 5% level

(Decimal Points Omitted) Testing Dates: Dec 48 - Feb 49

N = 362

Variables	Validities	Validities*	WK	AR	DTR	NOII	AI	BCA	EI	MP	GM	TF	SI	ML
1. WK	513	616		500	472	433	652	614	482	292	346	205	322	289
2. AR	661	733	500		585	634	429	508	417	374	308	169	195	358
3. DTR	636	714	472	585		616	450	502	415	323	225	192	409	325
4. NOII	546	623	433	634	616		304	404	340	194	156	103	262	278
5. AI	425	555	652	429	450	304		638	592	378	463	337	368	268
6. BCA	491	588	614	508	502	404	638		441	280	248	123	324	274
7. EI	492	614	482	417	415	340	592	441		494	582	461	256	261
8. MP	421	536	292	374	323	194	378	280	494		515	404	239	274
9. GM	305	448	346	308	225	156	463	248	582	515		632	204	188
10. TF	180	281	205	169	192	103	337	123	461	404	632		209	127
11. SI	219	318	322	195	409	262	368	324	256	239	204	209		262
12. ML	375	447	289	358	325	278	268	274	261	274	188	127	262	

* Validities corrected for restriction of range

TABLE IV

MULTIPLE CORRELATIONS AND BETA WEIGHTS FOR AIRMAN CLASSIFICATION TEST BATTERY AGAINST RADAR MECHANIC SCHOOL FINAL GRADE

Validities are Significant at 1% or 5% level

Sample: 52-275 Students, Keesler AFB
(Decimal Points are Omitted)

Testing Dates: May 47 - Nov 48

		BETA WEIGHTS							
Variables	Validities	9	8	7	6	5	4	3	2
1. EI	656	582	583	481	443	411	416	468	514
2. RC	545	192	199	167	110	098	115	196	234
3. AI	542	250	247	204	093	078	080	103	-
4. DTR	539	235	250	262	234	221	244	-	-
5. AR	500	135	137	125-	077	055	-	-	-
6. MP	412	-080	-071	-149	-113	-	-	-	-
7. BCA	409	-302	-297	-272	-	-	-	-	-
8. GM	374	-260	-265-	-	-	-	-	-	-
9. ML	348	051	-	-	-	-	-	-	-
Multiple - R		762	761	741	720	716	715	686	682

TABLE V

MULTIPLE CORRELATIONS AND BETA WEIGHTS FOR AIRMAN CLASSIFICATION TEST BATTERY AGAINST RADIO MECHANIC SCHOOL FINAL GRADE

Only Validity not Significant at 1% or 5% level*

Sample: 74-195 Students, Scott AFB
(Decimal Points are Omitted)

Testing Dates: May 47 - Nov 48

		BETA WEIGHTS										
Variables	Validities	12	11	10	9	8	7	6	5	4	3	2
1. RC	588	345	332	337	335	322	283	297	284	318	342	415-
2. BCA	536	143	129	124	108	134	168	176	153	187	215-	268
3. AR	506	294	189	199	141	107	080	086	087	095-	178	-
4. DTR	500	316	253	228	155	135	135-	165	165-	178	-	-
5. EI	496	266	268	265	265	239	126	130	110	-	-	-
6. AI	453	004	024	009	020	-005	-058	-062	-	-	-	-
7. ML	387	125-	123	116	113	091	097	-	-	-	-	-
8. GM	290	-211	-188	-186	-173	-238	-	-	-	-	-	-
9. MP	284	-226	-218	-227	-193	-	-	-	-	-	-	-
10. NOI	235	063	-166	-172	-	-	-	-	-	-	-	-
11. SI	228	-081	-072	-	-	-	-	-	-	-	-	-
12. NOII*	187	-412	-	-	-	-	-	-	-	-	-	-
Multiple - R		750	711	708	695	682	662	657	656	651	637	623

TABLE VI

MULTIPLE CORRELATIONS AND BETA WEIGHTS FOR AIRMAN CLASSIFICATION TEST BATTERY AGAINST A & E MECHANIC (JET) SCHOOL FINAL GRADE

Validities are Significant at 1% or 5% level

Sample: 538-1641 Students, Chanute AFB
(Decimal Points are Omitted)

Testing Dates: May 47 - Nov 48

Variables	Validities	13	12	11	10	9	8	7	6	5	4	3	2
		BETA WEIGHTS											
1. RC	522	144	152	153	158	153	159	161	162	179	185	239	350
2. BCA	492	148	138	138	142	137	148	146	150	169	180	224	266
3. GM	485	176	188	188	184	212	200	206	208	207	226	250	-
4. AR	476	007	023	022	023	023	078	082	082	155-	157	-	-
5. EI	471	013	011	011	012	018	017	020	022	042	-	-	-
6. DTR	469	141	098	094	105	110	158	161	161	-	-	-	-
7. AI	462	044	018	018	016	020	008	011	-	-	-	-	-
8. MP	430	028	016	018	025	036	020	-	-	-	-	-	-
9. NOII	378	140	144	131	131	126	-	-	-	-	-	-	-
10. TF	353	069	053	054	053	-	-	-	-	-	-	-	-
11. ML	316	051	040	040	-	-	-	-	-	-	-	-	-
12. NOI	300	-006	-021	-	-	-	-	-	-	-	-	-	-
13. SI	200	-129	-	-	-	-	-	-	-	-	-	-	-
Multiple - R		638	629	629	628	627	620	620	620	609	608	596	560

TABLE VII

MULTIPLE CORRELATIONS AND BETA WEIGHTS FOR AIRMAN CLASSIFICATION TEST BATTERY AGAINST A & E MECHANIC (CONVENTIONAL) SCHOOL FINAL GRADE

Validities are Significant at 1% or 5% level

Sample: 722-1994 Students, Keesler AFB (Decimal Points are Omitted)

Testing Dates: May 47 - Nov 48

		BETA WEIGHTS											
Variables	Validities	13	12	11	10	9	8	7	6	5	4	3	2
1. RC	659	258	256	255	264	268	254	248	250	277	306	352	469
2. DTR	609	178	188	197	214	262	268	258	259	263	304	310	364
3. EI	601	078	079	079	081	082	098	088	089	120	126	240	-
4. GM	590	147	144	145-	140	135-	214	190	189	203	212	-	-
5. AR	588	061	057	059	060	114	106	093	095-	097	-	-	-
6. AI	583	093	099	099	096	085	096	086	090	-	-	-	-
7. BCA	554	-006	-003	-002	004	014	000	009	-	-	-	-	-
8. MP	498	-100	-097	-102	-091	-104	-072	-	-	-	-	-	-
9. TF	481	161	164	162	161	148	-	-	-	-	-	-	-
10. NOII	453	094	093	123	124	-	-	-	-	-	-	-	-
11. ML	397	058	060	061	-	-	-	-	-	-	-	-	-
12. NOI	395	043	046	-	-	-	-	-	-	-	-	-	-
13. SI	392	029	-	-	-	-	-	-	-	-	-	-	-
Multiple - R		788	788	787	785	780	773	772	772	769	766	752	728

Table VIII presents similar statistics using intercorrelations and validity coefficients from Table III.

Table IX presents weights of selected tests and the Multiple Correlation Coefficients produced by these weights. Bases of these weights are as follows: (1) all variables were used and the regression weights and Multiple-R's were computed by means of the Cowles-Crout Technique; (2) the same technique was used to determine regression weights and Multiple-R's for the tests at present operationally weighted in the mechanics aptitude index; (3) weights for electronics cluster were obtained by averaging regular regression weights for radio and radar, of operationally weighted tests, and adjusting to basis of 100. The same was done for mechanics weights by averaging regression weights for Airplane and Engine Mechanics, Jet and Conventional; (4) weights of operationally weighted tests were adjusted on the basis of a total weight of 100; (5) the new weights were based on an average of the significant, positive regression weights, which were assigned on a proportional basis to total 100.

Table X presents a summary of the Multiple Correlation Coefficients of Table IX.

TABLE VIII

MULTIPLE CORRELATIONS AND BETA WEIGHTS FOR ACTB VARIABLES AGAINST RADAR MECHANIC COURSE GRADES

Validities corrected for restriction of range*

Sample: 362 Students, Keesler AFB Testing Dates: Dec 48 - Feb 49
(Decimal Points are Omitted)

Variables	Validities	Beta Weights
1. Arithmetic Reasoning	733	220
2. Dial and Table Reading	714	260
3. Numerical Operation II	623	100
4. Word Knowledge	616	111
5. Electrical Information	614	152
6. Background for Current Affairs	588	061
7. Aviation Information	555	-042
8. Mechanical Principles	536	168
9. Memory for Landmarks	447	082
10. General Mechanics	448	091
11. Speed of Identification	318	-039
12. Tool Functions	281	-023
13. BI Clerical Key	547	129
Multiple - R		896

*Robert L. Thorndike, Research Problems and Techniques, pp. 65-66.

TABLE IX

VARIOUS WEIGHTS OF TESTS AND RESULTANT MULTIPLE-R'S

	(1)*				(2)*				(3)*		(4)*	(5)*	
Variables	Radio	Radar	Jet	Conv	Radio	Radar	Jet	Conv	Elect	Mech	-	Elect	Mech
1. AR	294	135	007	061	263	121	155	184	25	20	15	10	-
2. DTR	316	235	141	178	236	233	191	290	30	30	15	20	20
3. NOII	-412	-	140	094	-	-	-	-	-	-	-	-	15
4. AI	004	250	044	093	173	162	126	170	25	15	20	05	10
5. EI	266	582	013	078	339	548	068	123	60	10	30	30	05
6. MP	-226	080	028	-100	-167	-038	013	-085	-15	-	10	-	-
7. GM	-211	260	176	147	-156	-239	203	176	-25	20	10	-	15
8. TF	-	-	069	161	-	024	007	119	-	05	-	-	10
9. SI	-081	-	129	029	-	-	-	-	-	-	-	-	-
10. ML	125	051	051	058	-	-	-	-	-	-	-	10	-
11. NOI	063	-	-006	043	-	-	-	-	-	-	-	-	-
12. BCA	143	302	148	-006	-	-	-	-	-	-	-	-	-
13. RC	345	192	144	258	-	-	-	-	-	-	-	25	25
R-Radio	750	-	-	-	637	-	-	-	629	-	566	645	-
R-Radar	-	762	-	-	-	732	-	-	726	-	682	702	-
R-Jet	-	-	638	-	-	-	600	-	-	598	596	-	619
R-Conv	-	-	-	788	-	-	-	759	-	756	739	-	782

*Refer to page 21, paragraph 2, for explanation.

TABLE X

MULTIPLE CORRELATION COEFFICIENTS BASED ON DIFFERENT WEIGHTS OF TESTS OF THE AIRMAN CLASSIFICATION TEST BATTERY

	Regular Regression Weights - all variables	Regular Regression Wts. operationally weighted tests	Average Regression Wts. (operational) basis 100	Operational Weights adjusted to 100	New Weights based on average Regression Wts.
Radio	750	637	629	566	645
Radar	762	732	726	682	702
Jet	638	600	598	596	619
Conventional	788	759	756	739	782

Conclusions and Recommendations

On the basis of the results printed in Tables IV and V, it can be seen that optimal weighting of all the tests in the battery for which there are available data to permit battery validation, gives a Multiple-R for radar mechanics of .762, a Multiple-R for radio mechanics of .750, a Multiple-R of .638 for airplane and engine mechanics, jet, and a Multiple-R of .788 for airplane and engine mechanics, conventional.

When the Multiple-R's are determined by regular regression weights, for the six operationally weighted tests, there is found to be very little loss in accuracy of prediction if the thirteen original tests are cut to six, with the exception of radio, in which case the R drops from .750 to .637 (Table IX). This can be accounted for by the large negative Beta weight of Numerical Operations II, (Table V), which cannot be weighted operationally in the mechanics cluster. There is a loss incurred by not having a separate index for radio but, as stated before, this is due to the high negative regression weight of Numerical Operations II, which is most likely due to the extremely small sample and which would not likely recur in any following samples. Because of this, the Beta weights should be ignored as exceedingly unstable.

If the regular regression weights for radar and radio are averaged to obtain weights for the electronics cluster, and the weights for airplane and engine mechanics, jet and conventional, are averaged to obtain weights for the mechanics group, only a slight difference in the R's is obtained (Table X). This is what should be expected by observing the closeness of the two sets of regression weights which were averaged (Table IX). Again, from Table X, it may be seen that there is very little loss in the present weighting of the six tests operationally weighted over the optimal weights (those based on the regression weights) of the same six tests.

On the basis of evidence presented in Table X, use of two different weights for the electronics and mechanics clusters appears justified. The increase of the Multiple-R of the new weights over the operational weights is .02 for radar and jet mechanics, .04 for conventional, and .08 for radio. Though this is but slight, the increase gained in accuracy of multiple prediction is great enough to merit the use of different weights for different indices. Use of different weights for different indices can also be justified on the basis of the large proportion of the flow going into the electronics and mechanics areas. Two separate indices, by minimizing competition for the same jobs, would make it easier to fill quotas. To illustrate this, a man might have the highest possible score in one area, yet not have the highest in another. Thus, being thrown with all the others he would be compelled to compete with the highest score group in both areas.

Considering the evidence as presented, it is recommended that two separate aptitude indices be used, with tests weighted[2] as shown in the last column of Table IX.

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[2] It should be emphasized that these recommended weights are not the official operational weights which must necessarily be withheld from publication to maintain the security of the battery.

For example:

> The electronics aptitude index would equal 10AR + 20DTR + 05AI + 30EI + 10ML + 25RC and the mechanics aptitude index would equal 20DTR + 15NOII + 10AI + 05EI + 15GM + 10TF + 25RC.

APPENDIX

LIST OF JOB SPECIALTIES IN MECHANICAL APTITUDE CLUSTER[1]

[1] AF Letter 35-390, Revised Attachment, 9 November 49, "Airman Aptitude Classification and Assignment Program."

(Radio and Radar Maintenance)

647 Radio Repairman, Aircraft Equipment
648 Radio Repairman
792 Radio Repairman, Single Channel Telegraph
951 Radio Repairman, VHF
953 Radar Repairman, Reporting Equipment (DS)
955 Radar Repairman, Airborne Equipment (DS)

(Missile Guidance Systems)

1574 Controlled Bomb Systems Repairman

(Armament Systems)

574 Bombsight and Automatic Pilot Repairman
575 Remote Control Turret Repairman
580 Remote Control Turret Mechanic-Gunner
612 Airplane Armorer-Gunner
683 Bombsight Mechanic
511 Armorer
960 Remote Control Turret Mechanic

(Training Devices Maintenance)

969 Synthetic Trainer Mechanic (Designated Type)

(Wire Maintenance)

039 Cable Splicer, Telephone and Telegraph
097 Installer-Repairman, Telephone and Telegraph
115 Automatic Telephone System Maintenance Man
187 Repeaterman, Telephone
238 Lineman, Telephone and Telegraph
2239 Teletype Mechanic
261 Wire Technician, Telephone and Telegraph
637 Information Center Equipment Technician
646 Telephone and Telegraph Equipment Repairman
801 Cryptographic Repairman (DE)
868 Radio-Teletype Mechanic
894 Facsimile Technician

LIST OF JOB SPECIALTIES IN

MECHANICAL APTITUDE CLUSTER (CONT'D)

(Intricate Equipment Maintenance)

098 Instrument Repairman, Non-Electrical
229 Medical Equipment Maintenance Technician
282 Office Machine Serviceman
338 Instrument Repairman, Electrical Optician
365 Optician
366 Orthepedic Mechanic
381 Watchmaker
425 Tabulating Machine Repairman
574 Bombsight and Automatic Pilot Repairman
683 Bombsight Mechanic
686 Airplane Instrument Mechanic
957 Airplane Electrical Instrument Mechanic
941 Camera Technician
959 Airplane Mechanical Instrument Mechanic
961 Airplane Gyro Instrument Repairman
962 Optical Instrument Repairman
1229 Medical Equipment Technician

(Aircraft Accessories Maintenance)

528 Airplane Hydraulic Mechanic
687 Airplane Propellor Mechanic
956 Airplane Carburetor Repairman
958 Airplane and Engine Electrical Accessories Repairman

(Aircraft and Engine Maintenance)

559 Glider Mechanic
684 Airplane Power Plant Mechanic
685 Airplane Electrical Mechanic
737 Flight Engineer
747 Airplane and Engine Mechanic
748 Flight Maintenance Gunner
750 Airplane Maintenance Technician
925 Aircraft Engineering Technician
994 Servo Mechanic, PQ Target Airplane
995 Rotary Wing Mechanic (Helicopter)
1685 Airplane Electrical Mechanic-Gunner
2750 Aerial Engineer

(Rocket Propulsion)

523 Guided Missile Liquid Rocket Propellent Technician
1523 Guided Missile Solid Rocket Propellent Technician
2523 Guided Missile Pulse Jet Mechanic

LIST OF JOB SPECIALTIES IN

MECHANICAL APTITUDE CLUSTER (CONT'D)

(Munitions and Weapons Maintenance)

505 Ammunition Supply Technician
511 Armorer
582 Aerial Mine Technician
786 Toxic Gas Handler
901 Munitions Worker
903 Weapons Repairman, Small Arms
911 Armament Mechanic
949 Ammunition Renovator

(Vehicle Maintenance)

013 Diesel Mechanic
014 Automotive Equipment Mechanic (2nd Echelon)
081 Engineman, Operating
319 Construction Equipment Mechanic
912 Automotive Electrician (4th Echelon)
926 Fuel Induction Repairman
965 Automotive Repairman

(Marine)

080 Marine Engineer
477 Marine Engine Mechanic

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