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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

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TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

AIR TRAFFIC CONTROL SPECIALIST (air trans.) 0-61.60

B-533 S-256

TM 001 767

U. S. Employment Service
in Cooperation with
Missouri State Employment Service

May 1963

GATB # 2414

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

AIR TRAFFIC CONTROL SPECIALIST (air trans.) 0-61.60

B-533

Summary

The General Aptitude Test Battery, B-1002A, was administered to a final sample of 152 journeymen Air Traffic Control Specialists 0-61.60 employed at four air traffic control facilities located in Kansas City and St. Louis, Missouri. The criterion consisted of supervisory ratings. On the basis of mean scores, standard deviations, job analysis data, and their combined selective efficiency, Aptitudes G-Intelligence, V-Verbal Aptitude, N-Numerical Aptitude and P-Form Perception were selected for inclusion in the final test norms.

GATB Norms for Air Traffic Control Specialist 0-61.60, B-533.

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
G	CB-1-H CB-1-I CB-1-J	115	G	Part 3 Part 4 Part 6	110
V	CB-1-J	100	V	Part 4	100
N	CB-1-D CB-1-I	115	N	Part 2 Part 6	110
P	CB-1-A CB-1-L	85	P	Part 5 Part 7	85

Effectiveness of Norms

The data in Table IV indicate that only 66 percent of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 80 percent would have been good workers. 34 percent of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 20 percent would have been poor workers.

I. Purpose

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Air Traffic Control Specialist 0-61.60.

II. Sample

The GATB, B-1002A, was administered in February 1962 to 152 Air Traffic Control Specialists 0-61.60 employed by the Federal Aviation Agency at four air traffic control facilities located in Kansas City and St. Louis, Missouri. Only controllers at the journeyman level, GS-10-11-12, were included in the study. Table I shows total number of individuals performing the job and the total number tested at each location. The sixty-three controllers not tested were excluded from the study because of scheduling difficulties, sick leave, annual leave, and inadequate length of service with the facility for collection of criterion data. The final sample is comprised of 152 individuals; 151 men and one woman.

TABLE I

Sample	Location	Total Number Employed	Total Tested
MKC Tower	Kansas City, Missouri	34	31
STL Tower	St. Louis, Missouri	32	32
MKC Center	Kansas City, Missouri	97	50
STL Center	St. Louis, Missouri	52	39
		215	152

Both Kansas City and St. Louis are high density air traffic areas and controllers employed at these locations perform all of the functions normally included in any air traffic control operation. Tower controllers provide separation of traffic in the terminal areas. Center controllers provide separation of air traffic enroute between the terminal areas. Both functions are based on the same manual of operations. Air Traffic Control Specialists are selected for employment at the above control facilities based on flying experience, military air traffic control experience, dispatcher experience with an air carrier service, flight operations experience, or air-ground communications experience. After employment, an on-the-job training period of approximately 18 months to 3 years is required to reach the journeyman level. There are no rigid age or education requirements in selecting applicants for employment.

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

	N	M	S.D.	Range	r
Age (Years)					
MKC Tower	31	34.3	7.8	25-51	-.600**
STL Tower	32	29.9	4.7	24-41	.113
MKC Center	50	35.0	6.3	26-57	-.151
STL Center	39	33.3	6.5	25-48	-.311
Combined Sample	152	33.7	6.6	24-57	-.260
Education (Years)					
MKC Tower	31	12.3	1.3	10-16	-.479**
STL Tower	32	11.9	.9	10-14	.018
MKC Center	50	12.0	1.5	8-15	.156
STL Center	39	12.5	16.0	9-16	.179
Combined Sample	152	12.2	1.4	8-16	.169
Experience (Months)					
MKC Tower	31	79.9	50.5	27-221	-.535**
STL Tower	32	51.6	16.6	31-96	.803**
MKC Center	50	79.7	31.8	41-192	.063
STL Center	39	89.3	50.3	45-240	-.350*
Combined Sample	152	75.9	41.7	27-240	.181

*Significant at the .05 level
**Significant at the .01 level

III. Job Description

Job Title: Air Traffic Control Specialist (air trans.) 0-61.60

Job Summary: Maintains safe and even flow of air traffic in terminal areas and enroute between terminal areas. Contacts control centers, stations, towers and pilots, using interphone, light-guns, radar, radio, teletype, etc.

Work Performed: Separates aircraft by radio communication with pilots, operation of surveillance and precision radar, light-guns, and other aids; traffic within the immediate vicinity of the airport is separated by visual observation of the aircraft; traffic not in visual contact is separated by means of radar, and time, distance, and altitude information. Separates enroute aircraft by means of radio communication with pilots, observation of radar targets, and time, distance, and altitude information.

Controls take-off and landing of aircraft by use of radio, or visual signals, such as lights or flags. Establishes radio contact with aircraft to (1) furnish information to pilots regarding course of flight, approaches to field, weather conditions, etc., and (2) receive aircraft position reports, weather data, etc. Keeps written report of messages received from aircraft. Contacts other control centers, stations and towers by use of interphone or teletype to relay messages or receive information for transmission to aircraft. Controls airport lights (boundary, hazard, runway) by push buttons.

IV. Experimental Battery

All the tests of the GATB, B-1002A , were administered to the sample group.

V. Criterion

Separate sets of rank-order ratings for the individuals in each of the four subsamples were made by three supervisors. Each of the 12 sets of rank-order ratings was converted to linear scores and intercorrelations between the three sets of ratings for each subsample were obtained. The median of the 12 inter-rater intercorrelations for the four subsamples was .72. The linear scores corresponding to the three sets of rank-order ratings for each subsample were averaged; these average scores comprise the final criterion for this study.

VI Qualitative and Quantitative Analyses

A. Qualitative Analysis

On the basis of the job analysis data, the following aptitudes were rated "important" for success in this occupation:

Intelligence (G) - required in all phases of air traffic control to learn, interpret, and apply technical information and procedures.

Verbal Aptitude (V) - required in issuing rapid and concise instructions to pilots.

Numerical Aptitude (N) - required in rapid calculation of speed, time, distance, rate of climb and rate of descent through altitude, and in other navigational and control problems.

Spatial Aptitude (S) - required in visualizing the positions of planes in space.

Clerical Perception (Q) - required in accurate marking of flight progress strips, recognition of identical altitudes, times, etc., and in keeping many other required records.

B. Quantitative Analysis:

TABLE II

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 152

Aptitudes	M	σ	r
G-Intelligence	117.5	11.2	.140
V-Verbal Aptitude	113.7	13.9	.210**
N-Numerical Aptitude	114.6	9.9	.270**
S-Spatial Aptitude	112.9	17.2	-.060
P-Form Perception	109.2	15.0	.190*
Q-Clerical Perception	111.4	10.9	.080
K-Motor Coordination	112.2	15.1	.060
F-Finger Dexterity	100.5	17.1	.110
M-Manual Dexterity	106.1	17.3	.190*

**Significant at the .01 level
*Significant at the .05 level

C. Selection of Test Norms:

TABLE III

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X	X	X	X		X			
Irrelevant									
Relatively High Mean	X	X	X	X					
Relatively Low Sigma	X	X	X			X			
Significant Correlation with Criterion		X	X		X				X
Aptitudes to be Considered for Trial Norms	G	V	N	S	P	Q			M

Trial norms consisting of various combinations of Aptitudes G,V,N,S,P,Q and M with appropriate cutting scores were evaluated against the criterion by means of the Phi Coefficient technique. A comparison of the results showed that B-1002 norms consisting of G-110, V-100, N-110 and P-85 had the best selective efficiency.

VII. Validity of Norms (Concurrent)

The validity of the norms was determined by computing a Phi Coefficient between the test norms and the criterion and applying the Chi Square test. The criterion was dichotomized by placing 34 percent of the sample in the low criterion group because this percent was considered to be the unsatisfactory or marginal workers.

Table IV shows the relationship between test norms consisting of Aptitudes G, V, N and P with critical scores of 110, 100, 110 and 85, respectively, and the dichotomized criterion for Air Traffic Control Specialist 0-61.60. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Validity of Test Norms for Air Traffic Control Specialist 0-61.60
(G-110, V-100, N-110, P-85)

N = 152	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	35	66	101
Poor Workers	34	17	52
Total	69	83	152

Phi Coefficient = .30
χ^2 = 14.045
P/2 < .0005

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of the results of this study, Aptitudes G, V, N and P with minimum scores of 110, 100, 110 and 85, respectively, have been established as B-1002 norms for Air Traffic Control Specialist 0-61.60 The equivalent B-1001 norms consist of G-115, V-100, N-115 and P-85.

IX. Determination of Occupational Aptitude Pattern

The data for this study met the requirements for incorporating the occupation studied into OAP-3 which is shown in Section II of the Guide to the Use of the General Aptitude Test Battery, January 1962.