Clearance number 98-101

# A Comparison of Two U. S. Air Force Pilot Aptitude Tests[1][2]

Thomas R. Carretta, M.S., Ph.D.; Paul D. Retzlaff, M.S., Ph.D.
Joseph D. Callister, M.A., Ph.D.; Raymond E. King, M. A., Psy.D.

***Background:*** The Air Force Officer Qualifying Test (AFOQT) and Multidimensional Aptitude Battery (MAB) were administered to 2,233 US Air Force pilot candidates to investigate the common sources of variance in those batteries. The AFOQT was operationally administered as part of the officer commissioning and aircrew selection testing requirement. The MAB is a clinical test battery and was administered to provide an intellectual baseline to assist clinicians when it becomes necessary to evaluate pilots with cognitive referral questions. ***Results:*** A joint factor analysis of the AFOQT and MAB revealed that each battery had a hierarchical structure. The higher-order factor in the AFOQT previously had been identified as general cognitive ability (*g*). The intercorrelation between the higher-order factors from the batteries was .981, indicating that both measured *g*. Although both batteries measured *g* and included verbal, spatial, and perceptual speed tests, the AFOQT also included tests of aviation knowledge not found in the MAB. Conclusion: Additional studies are required to evaluate the utility of the AFOQT for clinical assessment and the MAB for officer and aircrew selection.

The Air Force Officer Qualifying Test (AFOQT) is used to qualify civilians and prior-enlisted US Air Force (USAF) personnel for officer commissioning through the Officer Training School and Reserve Officer Training Corps programs. It is also used to qualify applicants who pass other educational and physical requirements for aircrew training. The AFOQT has been validated for pilot and navigator training (3, 7, 8, 15, 18, 19, 21) and for several other officer jobs (1, 2, 11).

In 1994, the Air Force Medical Operations Agency began a program to establish a psychological testing baseline for Air Force pilots. This baseline was intended to assist clinicians when evaluating pilots with cognitive referral questions (6, 22). One of the tests used to establish this baseline is the Multidimensional Aptitude Battery

[1] Previously published as Carretta, T. R., Retzlaff, P. D, Callister, J. D., & King, R. E. (1998). A comparison of two U. S. Air Force pilot aptitude tests. *Aviation, Space, and Environmental Medicine, 69*, 931-935.

[2] The first author is a Research Psychologist in the Crew System Development Branch of the Air Force Research Laboratory Human Effectiveness Directorate. Send correspondence and requests for reprints to the first author at AFRL/HECI, 221 8th Street, Area B, Bldg. 146, Room 122, Wright-Patterson Air Force Base, TX 45433-7511. Send electronic mail to thomas.carretta@wpafb.af.mil.

(MAB; 12). The MAB is normally administered in paper-and-pencil form. The USAF developed a computerized version which was administered to pilot candidates during a flight screening program (14).

The purpose of this study was to determine the extent to which the AFOQT and MAB measure the same constructs. If there is considerable overlap between the two batteries, further research may be directed toward using the AFOQT for clinical assessment and the MAB for officer and aircrew selection.

## METHODS

### *Participants*

Participants were 2,233 US Air Force pilot candidates who completed the AFOQT and a computerized version of the MAB. The sample had a mean age of 20.6 years and was predominantly male (92%) and White (87%). The protocol for this study had been reviewed and approved by the Air Force Human Use Committee of the Air Force Medical Operations Agency. Informed consent was obtained from participants prior to their participation.

### *Measures*

*Air Force Officer Qualifying Test.* The AFOQT is a paper-and-pencil multiple aptitude battery used for officer commissioning and aircrew training selection (24). It is developed and maintained by the USAF. Administration time is about 4 hours. The 16 AFOQT tests are combined to create five operational composites: Verbal, Quantitative, Academic Aptitude, Pilot, and Navigator-Technical. It has a hierarchical factor structure and measures general cognitive ability (*g*) and the lower-order factors of verbal, math, spatial, aircrew interest/ aptitude, and perceptual speed (9).

*Multidimensional Aptitude Battery.* The MAB is a broad-based test of intellectual ability. It was patterned after the Wechsler Adult Intelligence Scale (WAIS-R; full-scale $\underline{r}$ = .91). Although the MAB requires about the same amount of time to administer as the WAIS-R (about 1.5 hours), it can be group-administered and machine scored, while the WAIS-R cannot.

The paper-and-pencil version of the MAB was developed by Jackson (12) and the computerized version by the USAF Armstrong Laboratory (23). The computerized version was developed and used with the consent of the test author with explicit copyright permission. The two versions have the same 10 tests with identical items. The tests are Information, Comprehension, Arithmetic, Similarities, Vocabulary, Digit Symbol, Picture Completion, Spatial, Picture Arrangement, and Object Assembly. These tests are combined to form three composites: Full Scale (all 10 tests), Verbal (first five tests), and Performance (last five tests).

The MAB was administered on a 386-based computer with a 14 inch color monitor. Participants entered their responses using a keypad and mouse or light pen.

### *Procedures*

The AFOQT was completed as a requirement of application for officer commissioning and/or aircrew selection. The time frame for AFOQT-testing varied. Some took the AFOQT near the completion of high school or while in college. Others took it after completing college. All participants completed the MAB shortly before beginning the Enhanced Flight Screening Program. MAB-testing was done to establish an ideographic cognitive baseline for the clinical evaluation of pilots for comparative purposes after sustaining a head injury or other neurological insult.

*Analyses*

The participants represented a range restricted sample because they had already been selected for college and for an officer commissioning program based on AFOQT and/or college entrance exams. The Lawley correction procedure (16, 20) was applied to estimate the means, variances, and correlations of the tests as they would be found in USAF officer applicants (24). The confirmatory factor analyses were conducted using the range-restriction-corrected data as it provided a superior estimate of the means, standard deviations, and correlations.

Hierarchical confirmatory factor analyses (HCFAs) were performed using LISREL 8 (13). The first-order confirmatory factor analysis (CFA) allowed all observed variables (16 AFOQT and 10 MAB tests) to load on their first-order factors and those first-order factors to correlate with each other. The first-order factors included the five lower-order AFOQT factors of verbal, math spatial, aircrew interest/aptitude, and perceptual speed and two MAB factors representing the MAB Verbal (first five tests) and Performance (last five tests) composites. A higher-order CFA was then conducted using the first-order factor intercorrelation matrix. This higher-order CFA allowed the five AFOQT factors to load on a higher-order general factor ($g_{AFOQT}$) and the two MAB factors to load on a second higher-order general factor ($g_{MAB}$). These two general factors were allowed to correlate and the between-battery relationships among the lower-order factors were examined. Generalized least squares estimation procedures were used.

Although it may appear that the higher-order $g_{MAB}$ factor is underdefined with only two indicators, Costner (10) discusses the circumstances under which two indicators are sufficient. Generally, it is not required that all correlations between different pairs of indicators be identical. Rather, it is required that several estimates of a single abstract coefficient (e.g., factor loading) be consistent.

Several fit indices were computed. These included the Comparative Fit Index (CFI; 4), Non-Normed Fit Index (NNFI; 17), and Root Mean Square Error of Approximation (RMSEA; 5).

## RESULTS AND DISCUSSION

Table 1 shows the means and standard deviations of the tests in observed and corrected-for-range-restriction form. AFOQT means are raw scores while those for the MAB are scaled scores. The observed AFOQT means were on average about .90

standard deviations above the normative values and the variances were about 77 percent of the normative values for USAF officer applicants (24). The observed means for the MAB tests were about 1 standard deviation above the normative value of 50 and the variances were about 54 percent of the normative

**TABLE 1. MEANS AND STANDARD DEVIATIONS FOR AFOQT AND MAB SCORES**

| Score | Abbr. | Observed Mean | SD | Corrected Mean | SD |
|---|---|---|---|---|---|
| *AFOQT* | | | | | |
| Verbal Analogies | VA | 18.29 | 3.31 | 13.36 | 4.23 |
| Arithmetic Reasoning | AR | 18.43 | 4.57 | 11.00 | 4.40 |
| Reading Comprehension | RC | 17.93 | 4.34 | 15.83 | 5.93 |
| Data Interpretation | DI | 18.81 | 3.83 | 11.15 | 3.93 |
| Word Knowledge | WK | 16.86 | 4.84 | 13.28 | 5.83 |
| Math Knowledge | MK | 19.87 | 4.39 | 14.48 | 6.04 |
| Mechanical Comp. | MC | 11.60 | 3.72 | 9.78 | 3.65 |
| Electrical Maze | EM | 8.89 | 3.31 | 7.68 | 4.22 |
| Scale Reading | SR | 27.93 | 5.88 | 20.07 | 6.73 |
| Instrument Comp. | IC | 15.08 | 4.13 | 8.82 | 4.76 |
| Block Counting | BC | 14.22 | 3.44 | 10.62 | 4.39 |
| Table Reading | TR | 30.69 | 5.96 | 26.46 | 7.35 |
| Aviation Information | AI | 13.31 | 4.24 | 8.65 | 4.08 |
| Rotated Blocks | RB | 9.94 | 2.76 | 7.59 | 3.36 |
| General Science | GS | 11.43 | 3.52 | 8.54 | 3.66 |
| Hidden Figures | HF | 10.89 | 2.75 | 9.60 | 2.76 |
| *MAB* | | | | | |
| Information | INF | 66.80 | 6.89 | 64.36 | 7.18 |
| Comprehension | COM | 59.74 | 4.36 | 58.17 | 4.60 |
| Arithmetic | ARI | 60.89 | 6.23 | 54.72 | 6.60 |
| Similarities | SIM | 59.82 | 8.66 | 56.14 | 9.15 |
| Vocabulary | VOC | 60.29 | 9.33 | 58.15 | 10.02 |
| Digit Symbol | DIG | 63.10 | 6.98 | 58.15 | 7.81 |
| Picture Completion | PC | 59.47 | 6.43 | 56.44 | 6.79 |
| Spatial | SPA | 59.10 | 8.94 | 54.04 | 9.68 |
| Picture Arrangement | PA | 51.95 | 7.01 | 48.33 | 7.45 |
| Object Assembly | OBJ | 58.94 | 7.58 | 53.68 | 8.31 |
| Full IQ | IQ-F | 120.06 | 6.72 | 113.72 | 8.19 |
| Performance IQ | IQ-P | 118.22 | 8.52 | 111.56 | 9.92 |

| | | | | | |
|---|---|---|---|---|---|
| Verbal IQ | IQ-V | 119.17 | 6.71 | 113.79 | 7.77 |

Note. Means and standard deviations were corrected for range restriction using the multivariate Lawley (16) procedure. An AFOQT officer applicant sample was used (24).

value for adults (12). The means for the MAB full-scale IQ, Performance IQ, and Verbal IQ were nearly 2 standard deviations above the normative value of 100. Like the MAB tests, the variances for the MAB IQ scores were about 54 percent of the normative value. The MAB IQ scores were not used in any further analyses and are provided for informative reasons only.

After correction for range restriction (to USAF officer applicant norms), the means for the MAB tests were still about .62 standard deviations above their normative value and the variances were about 69 percent of the adult normative value. The means of the corrected MAB IQ scores were about 1 standard deviation above adult norms and the variances were about 75 percent of the adult normative value. This suggests that USAF officer applicants are above adult norms on the construct measured by the MAB (i.e., intellectual ability).

The correlations among the tests are shown in Table 2. The observed correlations (above the diagonal) were positive with two exceptions involving the AFOQT Aviation Information test and two MAB tests (AI and DIG = -.010; AI and SPA = -.007). The largest observed correlation was between two AFOQT math tests, AR and DI (.636).

All correlations were positive after correction for range restriction (below the diagonal). See Ree et al. (20) for an explanation of change in correlation sign after correction for range restriction. The largest correlation after correction for range restriction was between two AFOQT verbal tests, RC and WK (.770) and the smallest correlation (.071) was between a spatial test from the AFOQT (EM) and a verbal test from the MAB (VOC).

The correlations among the 26 tests were used to estimate a seven factor first-order CFA (5 lower-order AFOQT factors and 2 lower-order MAB factors). The CFI was .975, the NNFI was .970, and the RMSEA was .053. This is evidence of a very good fit. The resulting correlation matrix for the lower-order factors (Table 3) was used to estimate the hierarchical model.

Table 3 shows the correlations among the first-order factors. They ranged from .450 (aviation and MAB verbal) to .895 (AFOQT verbal and math) with a mean value of .727. An examination of the between-battery correlations showed the AFOQT verbal and math factors to have higher correlations with the MAB verbal factor, while the AFOQT spatial, aviation, and perceptual speed factors had higher correlations with the MAB performance factor. The MAB verbal factor showed its highest between-battery correlation with the AFOQT verbal factor (.893) and its lowest correlation with aviation (.450). The MAB performance factor had its highest between-battery correlation with spatial (.854) and its

lowest correlation with aviation (.587). The correlation between the two MAB factors was .787.

The hierarchical model is shown in Figure 1. The loadings of the lower-order factors on their respective higher-order factors were high, ranging from .775 to .976. This indicated that the lower-order factors were essentially measures of their respective higher-order factors. The strong correlation between the two higher-order factors (.981) indicated that they measured the same higher-order factor. Because of the strength of this correlation and because the higher-order AFOQT factor is known

**TABLE 2. CORRELATION MATRIX FOR AFOQT AND MAB SCORES**

| Score | VA | AR | RC | DI | WK | MK | MC | EM | SR | IC | BC | TR | AI | RB | GS | HF | INF | COM | ARI | SIM | VOC | DIG | PC | SPA | PA | OBJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VA | 1000 | 479 | 573 | 472 | 587 | 407 | 389 | 153 | 297 | 191 | 156 | 143 | 243 | 236 | 480 | 205 | 290 | 293 | 299 | 315 | 351 | 230 | 308 | 193 | 215 | 286 |
| AR | 580 | 1000 | 445 | 636 | 438 | 620 | 379 | 220 | 558 | 156 | 273 | 270 | 228 | 287 | 456 | 240 | 222 | 255 | 558 | 233 | 210 | 284 | 177 | 187 | 200 | 285 |
| RC | 730 | 580 | 1000 | 483 | 641 | 369 | 362 | 131 | 296 | 149 | 120 | 177 | 276 | 201 | 494 | 157 | 325 | 393 | 322 | 335 | 397 | 214 | 264 | 113 | 229 | 207 |
| DI | 530 | 670 | 550 | 1000 | 445 | 471 | 333 | 200 | 512 | 184 | 251 | 296 | 294 | 276 | 404 | 234 | 227 | 249 | 452 | 247 | 217 | 290 | 195 | 162 | 220 | 258 |
| WK | 680 | 460 | 770 | 460 | 1000 | 375 | 349 | 074 | 280 | 126 | 110 | 131 | 343 | 193 | 533 | 150 | 324 | 322 | 277 | 316 | 494 | 153 | 247 | 087 | 188 | 209 |
| MK | | 550 | 710 | 510 | 600 | 400 | 1000 | 283 | 131 | 414 | 072 | 190 | 201 | 113 | 233 | 456 | 222 | 234 | 217 | 427 | 227 | 211 | 301 | 162 | 167 | 170 274 |
| MC | 480 | 510 | 460 | 460 | 400 | 480 | 1000 | 333 | 252 | 352 | 227 | 111 | 360 | 430 | 538 | 254 | 191 | 253 | 234 | 166 | 207 | 079 | 348 | 245 | 187 | 303 |
| EM | 270 | 370 | 230 | 380 | 170 | 400 | 440 | 1000 | 259 | 302 | 344 | 243 | 119 | 311 | 199 | 264 | 082 | 027 | 173 | 073 | 022 | 169 | 209 | 253 | 150 | 244 |
| SR | 480 | 660 | 450 | 620 | 370 | 600 | 480 | 450 | 1000 | 207 | 375 | 428 | 251 | 253 | 295 | 225 | 118 | 135 | 431 | 140 | 061 | 301 | 119 | 172 | 187 | 227 |
| IC | 340 | 410 | 330 | 430 | 280 | 390 | 490 | 440 | 490 | 1000 | 346 | 266 | 299 | 330 | 214 | 277 | 065 | 084 | 089 | 074 | 032 | 100 | 248 | 235 | 189 | 217 |
| BC | 450 | 530 | 400 | 510 | 320 | 490 | 500 | 470 | 610 | 490 | 1000 | 410 | 105 | 325 | 118 | 318 | 028 | 051 | 229 | 049 | 011 | 261 | 169 | 289 | 199 | 292 |
| TR | 340 | 440 | 350 | 470 | 270 | 440 | 300 | 310 | 560 | 340 | 510 | 1000 | 134 | 175 | 075 | 199 | 015 | 030 | 209 | 072 | 010 | 318 | 077 | 123 | 165 | 154 |
| AI | 300 | 310 | 340 | 340 | 320 | 250 | 500 | 290 | 330 | 560 | 310 | 210 | 1000 | 130 | 385 | 032 | 075 | 114 | 076 | 037 | 085 | -010 | 095 | -007 | 011 | 032 |
| RB | 430 | 470 | 350 | 420 | 290 | 490 | 540 | 420 | 490 | 460 | 550 | 340 | 340 | 1000 | 298 | 352 | 120 | 111 | 209 | 111 | 084 | 197 | 321 | 404 | 210 | 368 |
| GS | 510 | 490 | 550 | 440 | 510 | 520 | 570 | 340 | 410 | 410 | 370 | 250 | 460 | 400 | 1000 | 196 | 319 | 276 | 268 | 244 | 298 | 112 | 327 | 144 | 153 | 270 |
| HF | 400 | 400 | 360 | 390 | 310 | 400 | 390 | 340 | 470 | 360 | 450 | 360 | 270 | 420 | 340 | 1000 | 124 | 087 | 173 | 118 | 083 | 156 | 256 | 263 | 171 | 298 |
| INF | | 382 | 295 | 425 | 287 | 406 | 307 | 250 | 159 | 223 | 172 | 182 | 129 | 140 | 195 | 363 | 211 | 1000 | 253 | 174 | 191 | 293 | 123 | 235 | 113 | 159 152 |
| COM | 401 | 335 | 495 | 309 | 424 | 296 | 304 | 088 | 238 | 186 | 211 | 145 | 171 | 191 | 320 | 190 | 316 | 1000 | 233 | 369 | 302 | 134 | 225 | 069 | 177 | 148 |
| ARI | 418 | 608 | 436 | 518 | 340 | 534 | 363 | 303 | 528 | 283 | 424 | 350 | 162 | 358 | 331 | 305 | 242 | 300 | 1000 | 198 | 187 | 287 | 124 | 163 | 157 | 215 |
| SIM | 427 | 324 | 455 | 322 | 425 | 320 | 242 | 148 | 258 | 177 | 209 | 191 | 110 | 200 | 304 | 217 | 263 | 432 | 277 | 1000 | 301 | 232 | 254 | 106 | 197 | 267 |
| VOC | 450 | 270 | 516 | 264 | 587 | 254 | 242 | 071 | 160 | 114 | 156 | 120 | 117 | 144 | 321 | 174 | 355 | 375 | 246 | 377 | 1000 | 159 | 187 | 077 | 158 | 123 |
| DIG | 415 | 449 | 385 | 445 | 292 | 493 | 274 | 304 | 469 | 265 | 442 | 459 | 117 | 373 | 259 | 302 | 219 | 233 | 412 | 325 | 243 | 1000 | 214 | 255 | 286 | 314 |
| PC | 434 | 323 | 399 | 321 | 360 | 331 | 420 | 295 | 312 | 340 | 349 | 212 | 242 | 408 | 414 | 337 | 303 | 297 | 246 | 328 | 257 | 337 | 1000 | 269 | 293 | 389 |
| SPA | 355 | 360 | 269 | 325 | 210 | 378 | 376 | 361 | 382 | 345 | 452 | 254 | 176 | 519 | 272 | 338 | 188 | 151 | 298 | 189 | 141 | 381 | 354 | 1000 | 254 | 407 |
| PA | 364 | 343 | 371 | 350 | 318 | 334 | 301 | 240 | 348 | 289 | 351 | 283 | 140 | 319 | 261 | 267 | 236 | 259 | 272 | 280 | 238 | 391 | 372 | 339 | 1000 | 376 |
| OBJ | 440 | 437 | 366 | 404 | 319 | 461 | 426 | 362 | 430 | 349 | 477 | 307 | 199 | 491 | 377 | 387 | 231 | 231 | 344 | 341 | 195 | 445 | 468 | 500 | 457 | 1000 |

**TABLE 3.FIRST-ORDER FACTOR INTERCORRELATIONS**

| Factor[a] | Verbal | Math | Spatial | Percep. Aviation | MAB Speed | MAB Verbal | MAB Performance |
|---|---|---|---|---|---|---|---|
| Verbal | 1.000 | | | | | | |
| Math | 0.895 | 1.000 | | | | | |
| Spatial | 0.781 | 0.825 | 1.000 | | | | |
| Aviation | 0.560 | 0.652 | 0.808 | 1.000 | | | |
| Perceptual Speed | 0.651 | 0.719 | 0.834 | 0.677 | 1.000 | | |
| MAB Verbal | 0.893 | 0.858 | 0.719 | 0.450 | 0.530 | 1.000 | |
| MAB Performance | 0.768 | 0.754 | 0.854 | 0.587 | 0.683 | 0.787 | 1.000 |

[a]The first five factors were from the AFOQT and the last two factors were from the MAB.

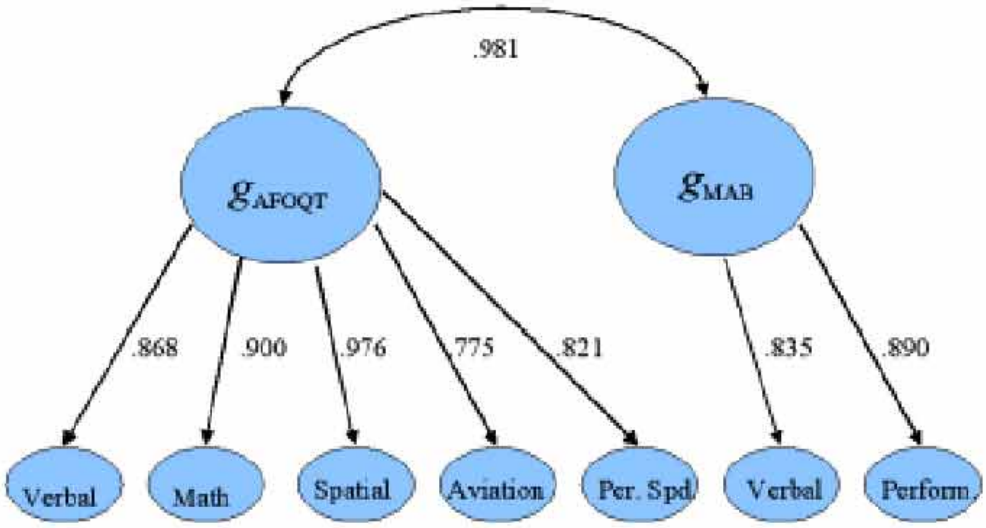


**FIG. 1. HIERARCHICAL MODEL**

Note. The higher-order factors were $g_{AFOQT}$ and $g_{MAB}$, respectively. The lower-order AFOQT factors were Verbal, Math, Spatial, Aviation Interest/Aptitude, and Perceptual Speed. The lower-order MAB factors were MAB Verbal and MAB Performance.

to be psychometric *g*, it is apparent that the higher-order factor in the MAB also is *g*. General cognitive ability accounted for more variance than the sum of the lower-order factors for both batteries. The proportion of common variance accounted for by *g* was similar for the two batteries: 67.2% for the AFOQT (9) and 67.7% for the MAB.

Similar results were reported by Sperl, Ree, and Steuck (25) and by Stauffer, Ree, and Carretta (26). Sperl et al. examined the relationship between the verbal and math tests from the AFOQT and Armed Services Vocational Aptitude Battery (ASVAB). They found a first canonical correlation between the two batteries of .93 indicating a

high level of common variance. Stauffer et al. examined the common sources of variance between all 10 ASVAB tests and a set of computer-based cognitive components tests. As in the current study, Stauffer et al. found a strong correlation (.994) between the higher-order factors from the two batteries indicating both higher-order factors measured the same construct.

These results suggest that both the AFOQT and MAB may be acceptable for establishing a clinical cognitive baseline for USAF pilot trainees. Both batteries measure psychometric *g* as well as verbal, spatial, and perceptual speed (the later two factors are subsumed in the MAB performance factor). However, it is not clear that the two batteries identically measure the lower-order factors.

The chief advantage of the MAB over the AFOQT for use as a clinical assessment tool is its similarity to standard clinical intelligence tests such as the WAIS-R. Air Force clinical psychologists routinely use the WAIS-R to evaluate pilots referred for cognitive assessment. Because of its similarity to the WAIS-R, clinicians find it relatively easy to make pre- and post-incident comparisons using baseline MAB data. If the AFOQT were to be used instead of the MAB for making pre- and post-incident comparisons, clinicians would need training to become more familiar with the AFOQT and its relation to the WAIS-R or MAB.

Although the AFOQT takes longer to administer than the MAB (4 hours vs. 1.5 hours), it is already in operational use for officer commissioning and aircrew selection so would not require any special administration as does the MAB. Further, the AFOQT includes tests of aviation interest/aptitude not covered by the MAB (i.e., Instrument Comprehension and Aviation Information). These tests have been shown to be useful for predicting pilot performance beyond measures of *g* and specific cognitive abilities such as verbal, math, spatial, and perceptual speed (18, 19, 21). Therefore, if the MAB were to be used in place of the AFOQT, it would be desirable to retain at least the aviation interest/aptitude portions of the AFOQT to ensure no loss of validity for predicting pilot training performance.

Additional studies are planned to evaluate the utility of the AFOQT for clinical assessment and the utility of the MAB for officer and aircrew selection. If the two batteries are interchangeable, the Air Force may be able to save administration time by using one test for both purposes.

## ACLKNOWEDGEMENTS AND DISCLAIMERS

The views expressed are those of the authors and are not necessarily those of the United States Government, the United States Department of Defense, or the United States Air Force. The authors thank Charles E. Lance and Malcolm James Ree for their helpful comments.

## REFERENCES

1. Arth TO. Validation of the AFOQT for non-rated officers. Brooks AFB, TX: Air Force Human Resources Laboratory, Manpower and Personnel Division, AFHRL- TP-85-50, 1986.

2. Arth TO, Skinner MJ. Aptitude selection for Air Force officer non-aircrew jobs. Paper presented at the 28th annual

meeting of the Military Testing Association, Mystic, CT, 1986.

3. Arth TO, Steuck KW, Sorrentino CT, Burke EF. Air Force Officer Qualifying Test (AFOQT): Predictors of undergraduate pilot training and undergraduate navigator training. Brooks AFB, TX: Air Force Human Resources Laboratory, Manpower and Personnel Division, AFHRL-TP-89-52, 1990.

4. Bentler PM. Comparative fit indexes in structural models. Psych Bull 1990; 107:238- 40.

5. Browne MW, Cudeck R. Alternative ways of assessing model fit. In KA Bollen, JS Lang (Eds.). Testing statistical equation models. Newbury Park, CA: Sage. 1993: 136-62.

6. Callister JD, King RE, Retzlaff PD. Cognitive assessment of USAF pilot training candidates. Aviat Space Environ Med 1996; 67:1124-29.

7. Carretta TR. Recent developments in U. S. Air Force pilot candidate selection and classification. Aviat Space Environ Med 1992; 63:1112-4.

8. Carretta TR, Ree, MJ. Air Force Officer Qualifying Test Validity for predicting pilot training performance. J Bus Psych 1995; 9:379-88.

9. Carretta TR, Ree, MJ. Factor structure of the Air Force Officer Qualifying Test: Analysis and comparison. Mil Psych 1996; 8:29-42.

10. Costner HL. Theory, deduction, and rules of correspondence. Amer J Sociol 1969; 75:245-63.

11. Finegold L, Rogers D. Relationship between Air Force Officer Qualifying Test scores and success in air weapons controller training. Brooks AFB, TX: Air Force Human Resources Laboratory, Manpower and Personnel Division, AFHRL-TR- 85-13, 1985.

12. Jackson DN. Multidimensional aptitude battery. Port Huron, MI: Research Psychologists Press, 1985.

13. Jöreskog K, Sörbom D. LISREL 8: User's reference guide. Chicago, IL: Scientific Software International, 1996.

14. King RE, Flynn CF. Defining and measuring the "right stuff": Neuropsychiatrically enhanced flight screening (N-EFS). Aviat Space Environ Med 1995; 66:951-6.

15. Koonce JM. Validation of a proposed pilot trainee selection system. Aviat Space Environ Med 1982; 53, 1166-9.

16. Lawley DN. A note on Karl Pearson's selection formulae. Proceedings of the Royal Society of Edinburgh, 1943; Section A, 62, Part 1:28-30.

17. Marsh HW, Balla JR, McDonald RP. Goodness-of-fit indexes in confirmatory factor analysis: The effect of sample size. Psych Bull 1988; 103:391-410.

18. Olea MM, Ree MJ. Predicting pilot and navigator criteria: Not much more than *g*. J Appl Psych 1994; 79:845-9.

19. Ree MJ, Carretta TR. Central role of *g* in military pilot selection. Int J Aviat Psych 1996; 6:111-23.

20. Ree MJ, Carretta TR, Earles JA, Albert W. Sign changes when correcting for range restriction: A note on Pearson's and Lawley's selection formulas. J Appl Psych 1994; 79:298-301.

21. Ree MJ, Carretta TR, Teachout MS. Role of ability and prior job knowledge in complex training performance. J Appl Psych 1995; 80:721-30.

22. Retzlaff PD, Callister JD, King RE. The computerized neuropsychological evaluation of US Air Force pilots: Clinical procedures and data-based decision. Brooks