



AFRL-RH-WP-TR-2022-0038

**Air Force Officer Qualifying Test (AFOQT) Form T Evaluation:
Job Analysis Linkages, Validity, and Subgroup Differences for
Current and Alternative Composites**

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**June 2022
FINAL REPORT**

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REPORT DOCUMENTATION PAGE				<i>Form Approved</i> <i>OMB No. 0704-0188</i>	
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1. REPORT DATE (DD-MM-YY) 13-06-2022		2. REPORT TYPE Final		3. DATES COVERED (From - To) 2/15/20 – 06/10/22	
2. TITLE AND SUBTITLE Air Force Officer Qualifying Test (AFOQT) Form T Evaluation: Job Analysis Linkages, Validity, and Subgroup Differences for Current and Alternative Composites				5a. CONTRACT NUMBER FA8650-20-F-4094	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER 62202F / 081713F	
6. AUTHOR(S) *Tracy Kantrowitz, Donna Kingry, Julia Engelsted, Gary Travinin, Eleanor Lovering, and Mark Gould				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER H12E	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) *PDRI 1911 N. Fort Myer Drive Suite 410 Arlington, VA 22209				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Air Force Materiel Command Air Force Research Laboratory 711 th Human Performance Wing Airman Systems Directorate Airman Biosciences Division Performance Optimization Branch Wright-Patterson AFB, OH 45433				10. SPONSORING/MONITORING AGENCY ACRONYM(S) 711 HPW/RHBC	
				11. SPONSORING/MONITORING AGENCY REPORT NUMBER(S) AFRL-RH-WP-TR-2022-0038	
12. DISTRIBUTION/AVAILABILITY STATEMENT Distribution Statement A: Approved for public release.					
13. SUPPLEMENTARY NOTES Report contains color. AFRL-2022-3233, cleared 8 July 2022					
14. ABSTRACT This technical report describes a comprehensive evaluation of the Air Force Officer Qualifying Test (AFOQT) Form T. The purpose was to evaluate the psychometric and validity characteristics of the AFOQT Form T and to evaluate the value of potential changes and revisions to the scoring of the test. This report is divided into the following sections: evaluation of (1) the AFOQT operational composites, (2) the linkages between critical officer competencies and attributes with AFOQT subtests, (3) the validity, and subgroup differences, and potential for adverse impact for the current operational composites, and (4) alternative composites designed to maintain or increase validity while reducing levels of subgroup differences. Each section provides detailed results and descriptions of processes used to evaluate the AFOQT. Across the objectives, the results indicate the potential for AFOQT composites to result in similar levels of historical validity, measure a broader range of attributes and competencies for officer jobs, and reduce the potential for adverse impact through the inclusion of previously unscored, non-cognitive assessments.					
15. SUBJECT TERMS AFOQT, officer assessment, classification					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT: SAR	18. NUMBER OF PAGES 245	19a. NAME OF RESPONSIBLE PERSON (Monitor) Thomas R. Carretta 19b. TELEPHONE NUMBER (Include Area Code) N/A
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			

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ACKNOWLEDGEMENT

We would like to sincerely thank the following individuals for their valuable contributions to this effort.

Thomas R. Carretta, Ph.D. (Air Force Research Laboratory - Contributor)

Katie Gunther, Ph.D. (Air Force Research Laboratory - Contributor)

John Trent, Ph.D. (Air Force Research Laboratory - Contributor)

Julia Walsh, Ph.D. (Infoscitex - Contributor)

Montana Woolley, M.S. (Infoscitex - Contributor)

Annette Rizer (Infoscitex - Prime Contractor)

1.0 EXECUTIVE SUMMARY

This technical report describes a comprehensive evaluation of the Air Force Officer Qualifying Test (AFOQT) Form T. The purpose of this project was to evaluate the psychometric and validity characteristics of the AFOQT Form T and to evaluate the value of potential changes and revisions to the scoring of the test.

This report is divided into the following evaluations of: (1) AFOQT operational composites, (2) linkages between critical officer competencies and attributes with AFOQT subtests, (3) validity, and subgroup differences, and potential for adverse impact for the current operational composites, and (4) alternative composites designed to maintain or increase validity while reducing levels of subgroup differences. Each section provides detailed results and descriptions of processes used to evaluate the AFOQT. Across the objectives, the results indicate the potential for AFOQT composites to result in similar levels of historical validity, measure a broader range of attributes and competencies for officer jobs, and reduce the potential for adverse impact through the inclusion of previously unscored, non-cognitive assessments.

The recruitment, selection, development, and retention of a diverse workforce has been an important objective for the U.S. military since the publication of the Diversity and Inclusion (D&I) strategic plan in 2012. For the United States Air Force (USAF), recruiting and identifying officer candidates is of critical importance to ensuring a qualified workforce. This evaluation focuses on addressing the D&I initiative in commissioning and classification of officers through the use of the AFOQT, a critical component of the Air Force Personnel Testing Program in use for more than 60 years. The AFOQT has been considered as part of the USAF's D&I initiatives as it is recognized that some selection procedures that strongly predict training and/or job performance (which the AFOQT has historically demonstrated) also show systematic differences in scores across demographic groups such as race, ethnicity, or gender (Bobko & Roth, 2013; Ployhart & Holtz, 2008), which hinder the goals of diversity by selecting minority applicants at lower rates than majority applicants.

The AFOQT has served as a robust tool for officer commissioning and for classification of officers into rated career fields. The current version of the AFOQT (Form T) has nine cognitive subtests, including markers of verbal, quantitative, spatial, and perceptual speed abilities, along with aviation information and instrument comprehension. The development and maintenance of the AFOQT has been informed by substantial validation research on the test and by the broader literature (e.g., Schmidt & Hunter, 1998) documenting the predictive validity of cognitive abilities for training and job performance outcomes. The scored subtests are combined in multiple ways to produce composite scores for officer commissioning and rated specialties, including

pilot/remotely-piloted aircraft pilot, air battle manager, and combat systems officer. The current version of AFOQT also includes three unscored subtests, including a Physical Science assessment, a Situational Judgment Test (SJT), and a personality test, the Self-Description Inventory (SDI).

A recent focus of the evaluation of Form T has been examining the extent to which including unscored components may expand the measurement of the AFOQT, maintain or enhance criterion-related validity, and mitigate historical subgroup differences. The evaluation of alternative composite scores was especially salient given the USAF's D&I initiative and the long-standing focus of the AFOQT on cognitive assessment. Cognitive ability assessments have been a focus of the validity-diversity dilemma as these types of assessments have been shown to be among the strongest predictors of job performance (Schmidt & Hunter, 1998), but also demonstrate higher race-related subgroup differences compared to other common selection procedures (Roth et al., 2001).

In support of the evaluation of alternative composites, a linking task was designed and conducted to map attributes/competencies found to be important for officer roles to constructs measured by the AFOQT. Needs analyses were conducted in 2019 for fighter, mobility, and remotely piloted aircraft (RPA) pilot and Combat Systems Officer (CSO) roles. Performance requirements indicated that more than 60 attributes and competencies were necessary for success (e.g., Instrument Comprehension, Achievement, Situational Awareness, Aviation Knowledge, Adjustment, Control Precision, Attention to Detail, Critical Thinking, Responsibility, and Courage). Some attributes/competencies were expected to be well measured by the AFOQT cognitive components. However, many are "soft skill" in nature (e.g., cooperation, integrity, achievement, persistence, self-control, adaptability) and were not expected to be represented by currently scored AFOQT subtests. They were, however, expected to map to one or more currently unscored non-cognitive assessment administered as part of Form T (i.e., SJT and SDI).

The mappings highlighted that the AFOQT can be transformed to measure not only long-standing, well-established abilities with a track record of validity but also skills that represent a broader range of what is required for officer success. Those subtests with moderate to strong linkages were considered for inclusion in updated composites. Two approaches were used to evaluate alternative composites, including pareto-optimization (DeCorte, Sackett, & Lievens, 2011) to model the concurrent influences of predictors and qualification scores with respect to validity and adverse impact and regression-based prediction with cross-validation using a large criterion-related validity dataset. Results were evaluated against a variety of important criteria measures, including Reserve Officers' Training Corps (ROTC) performance and success in Officer Training School (OTS). The pareto-optimized and regression-based approaches were found to yield similar results in terms of predictor identification and variance

explained in multiple criteria measures. When compared to validity, subgroup difference, and adverse impact results for the current Form T composites, it was found that the addition of multiple non-cognitive scales from the SDI along with cognitive tests maintained validity and substantially reduced group differences and improved adverse impact ratios (AIRs) (Uniform Guidelines on Employee Selection Procedures; Equal Employment Opportunity Commission, 1978). For example, the current Form T composites showed standardized mean differences (evaluated with Cohen's d statistics) between Black and White subgroups that exceeded 1.0, indicative of large effect sizes (range of 1.21 to 1.47). The alternative composites that include several cognitive and non-cognitive tests and scales substantially reduced the mean differences (range of d 's was -.93 to +.10 based on the specific composite). The variance explained by the existing composites ranged from .04 (for both the Verbal and Quantitative composites) to .19 (for the Pilot composite). The alternative composites improved subgroup differences while generally maintaining levels of variance explained (ranging from .06 to .17).

2.0 INTRODUCTION

The research and evaluation to support the AFOQT is a model for other testing programs. Maintaining the AFOQT requires substantial effort, analysis, and oversight to ensure its ongoing usefulness to the Air Force. The project described in this report is an evaluation of the current version of AFOQT, which is Form T. Form T was implemented in 2014 and consists of 10 cognitive and 2 non-cognitive assessments, 9 of which are scored and used in operational composites, and 3 of which (Physical Science, SDI, and SJT) are unscored. Form T has two parallel versions, T1 and T2. Both have been administered operationally over the course of the program. Table 1 provides brief descriptions of each of the AFOQT Form T subtests.

Table 1. AFOQT Form T Subtest Descriptions

Subtest	Definition
Verbal Analogies (VA)	This subtest measures the ability to reason and see relationships among words. The examinee must choose the option that best completes the analogy developed at the beginning of each statement.
Arithmetic Reasoning (AR)	This subtest measures the ability to use arithmetic to solve problems. Each problem is followed by five possible answers. The examinee must decide which one of five choices is correct.
Word Knowledge (WK)	This subtest measures knowledge of words and their meanings. For each question, the examinee must choose the word that is closest in meaning to the capitalized word provided.
Math Knowledge (MK)	This subtest measures knowledge of mathematical terms and principles. Each problem is followed by five possible answers. The examinee must decide which of the five choices is correct.
Reading Comprehension (RC)	This subtest measures the ability to read and understand written material. Each passage is followed by a series of multiple-choice questions. The examinee must choose the option that best answers the question based on the passage. No additional information or specific knowledge is needed.
Physical Science (PS) - unscored	This subtest measures knowledge in the area of science. Each of the questions or incomplete statements is followed by five choices. The examinee must decide which of the choices best answers the question or completes the statement.
Table Reading (TR)	This subtest measures the ability to read a table quickly and accurately. For each test question, the examinee is given an X-axis and a Y-axis value. The examinee's task is to find the block where

	the column and row intersect, note the number that appears there, and then find this number among the five provided answer options.
Instrument Comprehension (IC)	This subtest measures the ability to determine the position of an airplane in flight from reading instruments showing its compass direction heading, amount of climb or dive, and degree of bank to right or left. Each problem consists of two dials and four airplanes in flight as answer options. The examinee's task is to determine which of the four airplanes is MOST NEARLY in the position indicated by the two dials.
Block Counting (BC)	This subtest measures the ability to “see into” a 3-dimensional pile of blocks. Given a certain numbered block, the examinee's task is to determine how many other blocks the numbered block touches.
Aviation Information (AI)	This subtest measures knowledge of aviation. Each of the questions or incomplete statements is followed by five choices. The candidate is to decide which of the choices best answers the question or completes the statement.
Situational Judgment Test (SJT) - unscored	This subtest measures judgment in responding to interpersonal situations similar to those a candidate may encounter as an officer. Responses are scored relative to the consensus judgment across experienced U.S. Air Force officers.
Self-Descriptive Inventory (SDI) - unscored	This 240-item subtest measures the Big Five personality traits (Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness) and Machiavellianism and their underlying facets.

The AFOQT Form T evaluation was designed to accomplish several objectives. They were related to the twin goals of evaluating the psychometric properties of the subtests and composites and identifying opportunities to maintain the validity of the assessment while improving the usefulness of AFOQT as a method for enhancing the diversity of the Air Force officer workforce.

We designed our evaluation of AFOQT Form T to accomplish several specific objectives, spanning subtest and composite psychometric evaluation, linkage evaluation between critical officer attributes and competencies with subtests, subgroup differences evaluation, and validity evaluation for current and alternative composites. Some of these objectives were performed by Infoscitex and results are documented separately (see Walsh, Brady, Woolley, & Carretta, in press; Walsh, Woolley, Brady, & Carretta, 2022). The objectives performed by PDRI and documented in this report include the following:

Objective 1. Evaluating the Structure of the Current AFOQT Operational Composites

The first objective focused on evaluating the current composites that are derived from the AFOQT cognitive subtests. The structure of the current operational composites was examined using confirmatory factor analysis (CFA) for the construct-oriented composites (i.e., Verbal and Quantitative) to evaluate the fit of the current Form T composites using the existing composite structure for these scored composites. Factor loadings were evaluated to determine how well the subtests contribute to the composites, and whether alternative models would improve their contribution to composite scores. Measurement equivalence and invariance (MEI) analysis was also used to test whether the existing composites were invariant across race, ethnicity, and gender subgroups. In addition, the reliability of the existing composites was evaluated. Correlational analysis was also conducted among the subtests to evaluate the potential for common or unique variance in the formation of alternative composites, including subtests not currently included in the composites (namely, the SJT, SDI, and PS subtests). This was done to determine whether using multiple correlated subtests in the same composite may not yield additional information, which can inform the reduction of the subtests in the AFOQT and can also have additional benefits (e.g., reducing the magnitude of subgroup differences for cognitively-oriented subtests, increasing the potential for incremental validity using SDI scales). Together, this first set of analyses provided initial results on the appropriateness of the current composites and was used as a basis for exploring alternative composite models.

Objective 2. Critical Officer Job Analysis

The next objective involved the development and administration of a set of subject matter expert (SME) rating tasks to map important officer attributes and competencies identified from the provided job analyses to the AFOQT subtests. The goal was to determine the presence and strength of conceptual mappings between critical competencies and constructs measured in the subtests. The mappings were used to 1) confirm the current composites, 2) inform development of new composites, and 3) provide a roadmap for future versions of the AFOQT should critical attributes and competencies not be sufficiently represented by the existing subtests. Results were used to inform the creation of potential alternative composites.

Objective 3. Evaluating the Validity, Subgroup Differences, and Adverse Impact for the Current Composites

The next objective examined the criterion-related validity of the AFOQT current composites for a range of training and job performance criteria. We also evaluated between-subgroup score differences and the potential for adverse impact (AI) for the subtests and composites. Analyses were conducted on the current operational composites for Form T and alternative composites. The results of these analyses should inform policy makers about the validity and the level of adverse impact for Form T, and also served as a baseline for comparing results of the same analyses for potential alternative composites.

Objective 4. Exploration of Validity, Subgroup Differences, and Adverse Impact for Alternative Composites

The final objective focused on validity and diversity analyses for the subtest-criteria predicted relationships stemming from a mapping of subtests to an array of criteria pertinent to officer training and job performance. The validity of unscored subtests was evaluated for those found to be relevant for officer roles. Combinations of predictors were evaluated to identify alternative configurations in which individual predictors yielded significant predictive relationships and in combination yielded similar levels of validity and lower subgroup differences. Both uncorrected and corrected correlations (corrected for criterion unreliability and range restriction) were documented in this report. We also used the pareto-optimal analytic method for modeling multiple assessment design decisions (DeCorte et al., 2011). In this method, the concurrent influences of predictors and qualification scores were evaluated concurrently with regards to validity and adverse impact. Finally, validation analysis focused on testing for possible non-linear effects to identify the potential for curvilinear relationships between subtests/subtest dimensions and criteria, which was particularly fruitful for examining the contribution of SDI dimensions.

3.0 METHOD, ASSUMPTION AND PROCEDURES

In this section, we describe the data sources used to evaluate the AFOQT as part of the objectives described in the previous section. We also provide an overview of the methods and procedures used to evaluate the properties of the AFOQT.

The assessment data used for executing the objectives came from a variety of sources. The AFOQT subtests and composites represented the predictor data, spanned the years 2014-2021, and included data on 70,867 officer candidate examinees. AFOQT data were cleaned for duplicate values, careless responding, and retest instances. The most recent testing data were retained in cases of multiple tests for one candidate. The AFOQT data was also matched to a range of demographic/background variables provided by the Air Force Personnel Center (AFPC) including sex, race, ethnicity, socioeconomic status, education level, and degree. These data were also matched to the various criterion datasets for further analysis.

Training and job performance data were derived from several sources including OTS, ROTC, and the United States Air Force Academy (USAFA). Criteria variable definitions are included for OTS, USAFA, and ROTC and described in Tables 2-4. Given the large number of training and job performance variables, we sought feedback from the Air Force about the relative priority and importance so that analysis could focus on prediction of the most critical outcomes. AFPC indicated that variables included as part of initial flight training (IFT) and Specialized Undergraduate Pilot Training (SUPT) were to be used as the main criteria. Training completion/attrition was also noted as a critical outcome. Finally, the Merit Assignment Selection System (MASS) score was deemed to be an important non-attrition variable.

Table 2. Definitions of Training Outcomes for OTS

Training Outcome	Definition
Merit Assignment Selection System (MASS) Score	A composite score indicative of the overall assessment of the student's airmanship and capability based on all indicators of performance (e.g., academic grades, check flight scores, daily flight scores, flight commander ratings). Scores may range from 0 to 100. Higher is better. MASS is measured for SUPT and Specialty Training (separately for Pilot, CSO, Air Battle Manager (ABM)).

Training Outcome	Definition
Check flight average (CFA; RawCheck)	During training, trainees must pass a check flight for each course of instruction. As with daily flying grades, check flight grades are a weighted average of ratings of flying procedures/maneuvers, which may range from 0 = poor, 1 = fair, 2 = good to 3 = excellent. CFA reflects the number of points achieved on all check flights as a ratio of the number of points possible and may range from 0 to 100 (i.e., $CFA = [N \text{ points achieved} / N \text{ points possible}] * 100$). Higher scores are better.
Daily flying average (DFA; RawDaily)	These include instructor pilots' evaluations of a trainee's performance on all flights other than check flights. Daily flying grades are a weighted average of all flying training procedures/maneuvers performed during a flight and were rated: 0 = poor, 1 = fair, 2 = good, and 3 = excellent. DFA reflects the number of points achieved on all flights other than check flights, as a ratio of the number of points possible and may range from 0 to 100 (i.e., $DFA = [N \text{ points achieved} / N \text{ points possible}] * 100$). Higher scores are better.
Academic average (AA; Raw Academic Average - RawAcad)	Academic classes include instruction in aerospace physiology, aircraft systems, basic instruments, mission planning, navigation, weather, and other topics. Pilot trainees are evaluated on several written tests regarding flying theory and procedures. AA reflects the number of points achieved on written tests as a proportion of the number of points possible and may range from 0 to 100 (i.e., $AA = [N \text{ points achieved} / N \text{ points possible}] * 100$). Higher scores are better.
Flight Commander's Ranking (FCR; RawFltCC)	The FCR is the commander's assessment of the student's flying skills, leadership, teamwork, officership, attitude, and potential to complete follow-on training. Scores may range from 0 to 100. Higher scores are better.

Table 3. Definitions of Training Outcomes for USAFA

Training Outcome	Definition
O_MERIT	Order of Merit - lower numbers are better
GPA	Grade Point Average
MPA	Military Performance Assessment across all 4 years of the academy
PEA	A measure of physical performance

Table 4. Definitions of Training Outcomes for ROTC

Training Outcome	Definition
AEFComp (Air Expeditionary Composite)	Supervisor ratings comprising a unit-weighted average of all AEF ratings (created by PDRI). Includes the variables of AEF Leadership, AEF Professional Qualities, AEF Communication, AEF Judgement/Decision, AEF Warrior Ethos, AEF Followership
AEF Prep for FT	Preparation for AEF Training: Initial Interview, Mobility Line
AEF Leadership	Leadership: Problem solving, Coordination, Control, Delegating, Directing, Dynamic Leadership, Initiative, Performance of Duties
AEF Professional Qualities	Professional Qualities: Loyalty, Discipline, Dedication, Integrity, Accepts responsibility, Attention to detail/situational awareness, Tact/sensitivity, Attitude, Human relations
AEF Communication	Communication: Verbal/written, clear, concise, articulate, confident
AEF Judgement/Decision Making	Judgement and Decision Making: Time management, Reaction to counseling, Resource use, Learns from mistakes
AEF Warrior Ethos	Warrior Ethos: Adaptability to change/stress, Applies training to austere environments, Expeditionary skills adaptability
AEF Followership	Dynamic Followership: Supportive/motivating to others, Team cohesiveness, Contribution to flight

For Objective 1 (evaluation of current composites), the current composites were evaluated in several ways. First, an approach was designed to determine appropriate statistical methods for evaluating the composites. It was determined that some composites were construct-oriented, while others were job-oriented. The analytic approach differed according to the nature of the composite. The construct-oriented

composites included those that were designed to measure broad ability constructs (Quantitative and Verbal) in a manner that involved assessing multiple indicators of a given construct. The construct-oriented composites and their constituent assessments are shown in Table 5 below. For these composites, it was hypothesized that the marker tests were designed to measure a broad ability construct (namely, verbal and quantitative abilities) and should demonstrate evidence of goodness of fit. These composites were tested via CFA using parcels to evaluate fit of the marker tests to the intended ability construct.

Table 5. AFOQT Construct-Oriented Composites and Underlying Subtests

Verbal Composite
Reading Comprehension
Verbal Analogies
Work Knowledge
Quantitative Composite
Arithmetic Reasoning
Math Knowledge

Other composites were designed to reflect job requirements for several rated specialty areas that examinees are evaluated against for classification purposes, including Pilot, ABM, and CSO. It was hypothesized that the composites were rationally and empirically designed to measure job-specific requirements. Since these composites were not designed to measure constructs but rather broad job requirements, CFA was not deemed to be an appropriate way to evaluate them. Instead, other methods were used to evaluate the properties of the composites, including descriptive statistics, composite reliability, job analysis linkages, and validity analysis.

Table 6. AFOQT Job-Oriented Composites and Underlying Subtests

Pilot
Math Knowledge
Table Reading
Instrument Comprehension
Aviation Information
Combat Systems Officer
Word Knowledge
Math Knowledge
Table Reading
Block Counting
Air Battle Manager
Verbal Analogies
Math Knowledge
Table Reading
Instrument Comprehension
Block Counting
Aviation Information

For Objective 2 (linkages between job analyses and AFOQT subtests), existing job analysis information (see Pena, Shore, Haight, Wolliston, & Gonzalez, 2019a, 2019b, 2019c, 2019d) for Fighter Pilot, Mobility Pilot, RPA Pilot, and Combat Systems Officer jobs was linked to AFOQT subtests through an expert rating process. Experts rated the degree to which the AFOQT subtests (all subtests including the unscored subtests, i.e., PS, SJT, and SDI) were related to attributes and competencies that were identified in previous job analyses as important for performance.

For Objective 3 (validity and between-group score differences and adverse impact for current composites), a range of methods were used, including correlational and regression analysis between the AFOQT subtests, composites, and the criteria data described in this section. Standardized subgroup differences were also evaluated using Cohen's *d* (Cohen, 1988) and Adverse Impact Ratios (AIRs), which describe the difference in passing rates between minority and majority groups and indicate adverse impact when the passing rate for the minority group is less than 4/5 or 80 percent (%) that of the majority group (U. S. Equal Employment Opportunity Commission, 1978).

For Objective 4 (validity and between-group score differences and adverse impact for alternative composites), the same methods used in Objective 3 were applied but a broader approach was used to evaluate potential alternative composites. The method for

identifying alternative composites included mapping the job relevant tests based on the job analysis to AFOQT subtest linkages, examining the predictors that showed the highest predictive power to the outcome variables, excluding individual predictors that did not demonstrate significance alongside other predictors, and endeavoring to meet or exceed current operational composite validities. The alternative composites were designed to maximize variance explained without restricting/pre-determining the direction of the effects. Therefore, some of the results included non-significant predictors if their inclusion minimally increased variance explained and also increased competency coverage based on the job analysis linkage results. Passing rates were calculated on the validation data set and predictor data set ($N = 70,867$) based on standardized scores (z-scores) using the mean and standard deviation values calculated from the validation data set to standardize the predictor scores.

Our methods called for development of composites for use in selection and classification, such that the first composite was designed to predict officership as measured by ratings of officer performance (i.e., AEFComp). The academic aptitude composite was designed to predict academic performance as measured by academic average in OTS (i.e., RawAcademic), and technical training performance in rated specialties (Pilot/RPA Pilot, CSO, ABM) as designed to predict the respective MASS variables. As part of the development of these composites, each composite was deconflicted so that a given predictor was only present once in a composite in the event that composites would be used sequentially or in tandem. Conflicting predictors were removed based on relative contribution to the composite and significance level. For instance, if a predictor was significant ($p < .05$) in one composite and nonsignificant ($p > .05$) in another, the predictor was retained in the $p < .05$ model and dropped from the other. Finally, various predictor weighting schemes were investigated, including unit-weighting, regression weighting, and pareto-optimized weighting (De Corte, et al., 2007) with a final decision to use regression-based weights based on favorable statistical results.

The presence of non-linear relationships between SDI facet scores and criteria variables was also examined using moderated regression where a quadratic term was calculated, the criterion is regressed on the predictor variable (i.e., a single SDI facet score), and the criterion is regressed on the quadratic predictor variable. A t -test is conducted to evaluate the nonlinear effect. Nonlinear effects are plotted to evaluate the level of the criterion variable at different levels of the predictor.

4.0 RESULTS AND DISCUSSION

4.1 Objective 1: Evaluating the Structure of the Current AFOQT Operational Composites

Per the analysis plan described in the method section, we approached the analysis of the structure of the current composites through a range of techniques, including 1) composite reliability analysis, 2) CFA where appropriate, 3) measurement equivalence/invariance where appropriate, 4) and correlational analysis across scored subtests that contribute to the composites. Note that item and subtest statistics were evaluated separately, including item level difficulty, discrimination, differential item functioning, subgroup differences, distractor analysis, item-total correlations, reliability analysis (see Walsh et al., in press, 2022).

In this section, we provide results and discussion of the following analysis:

- Descriptive statistics for each of the scored AFOQT subtests and intercorrelations among subtests
- Descriptive statistics for the current composites
- Composite reliability analysis
- CFAs for the construct-oriented composites
- Measurement equivalence/invariance analyses for the construct-oriented composites
- Descriptive and correlational analyses for the job-oriented composites

4.1.1 Cognitive Subtest Descriptive Statistics

- Descriptive statistics and correlations for scored cognitive subtests based on the full officer candidate examinee dataset ($N = 70,867$) are presented in Tables 7 and 8. Scores are represented in terms of t-scores designed to have a mean of 50 and standard deviation of 10. While it was beyond the scope of this analysis to examine test-level statistics in detail, in-depth analysis of AFOQT item and subtest properties are provided elsewhere (Walsh Brady, Woolley, & Carretta, in press; Walsh, Woolley, Brady, & Carretta, 2022).

Table 7. Cognitive Subtest Descriptive Statistics

Subtests	<i>N</i>	Mean	SD	Min	Max	Skew	Kurtosis
Verbal Analogies	70867	50.38	9.87	14.86	74.14	-0.22	-0.42

Subtests	N	Mean	SD	Min	Max	Skew	Kurtosis
Arithmetic Reasoning	70867	48.91	9.95	21.55	72.50	0.11	-0.65
Word Knowledge	70867	50.84	9.96	23.20	69.70	-0.09	-0.94
Math Knowledge	70867	47.38	10.54	18.02	69.42	0.04	-0.77
Reading Comprehension	70867	50.35	9.72	8.15	69.93	-0.63	0.12
Physical Science	70867	47.44	9.93	19.17	71.65	0.09	-0.69
Table Reading	70867	51.17	10.19	6.28	71.90	-0.25	0.08
Instrument Comprehension	70867	49.23	10.02	26.50	64.94	-0.30	-0.99
Block Counting	70867	50.97	10.34	19.05	77.63	-0.03	-0.41
Aviation Information	70867	50.71	10.31	27.37	78.20	0.52	-0.42

4.1.2 Cognitive Assessment Intercorrelation Analysis

Correlational analysis among the scored cognitive subtests was conducted to evaluate construct validity across the measures and to determine the potential for predictor overlap. Construct validity is indicated when two measures purporting to assess the same construct show a high degree of relationship (convergent validity) or when two measures purporting to assess dissimilar constructs show weak or no relationship (discriminant validity).

Correlations are shown in Table 8. In general, AFOQT scored subtests are positively and significantly correlated. These results follow broader research on cognitive ability assessments which indicates positive manifold among tests measuring different cognitive abilities, indicating a common latent dimension (Spearman, 1904). Furthermore, subtests representing marker tests of broader abilities were found to be most highly correlated. For instance, Verbal Analogies was highly correlated with other verbal cognitive subtests, including Word Knowledge ($r = .68$), and Reading Comprehension ($r = .60$). Similarly, Arithmetic Reasoning and Math Knowledge were highly correlated ($r = .72$). The very strong correlation among marker tests of the same constructs was noted as an area for further investigation in later analysis for Objective 4, to determine the effect on validity and subgroup differences of reducing to a single assessment. While robust correlations provide evidence of convergent validity, they also indicate potential for alternative composite evaluation to determine validity and diversity tradeoffs. Lastly, the job specific subtests, Instrument Comprehension, Block Counting, and Aviation Information correlated between .51 and .58.

Table 8. Correlations between Cognitive Subtests

Subtest	VA	AR	WK	K	RC	PS	TR	IC	BC	AI
VA	1.00									
AR	0.51	1.00								
WK	0.68	0.41	1.00							
MK	0.46	0.72	0.35	1.00						
RC	0.60	0.47	0.63	0.41	1.00					
PS	0.49	0.53	0.46	0.61	0.46	1.00				
TR	0.29	0.40	0.19	0.34	0.26	0.21	1.00			
IC	0.39	0.43	0.32	0.39	0.38	0.46	0.35	1.00		
BC	0.37	0.44	0.28	0.37	0.31	0.32	0.47	0.51	1.00	
AI	0.34	0.32	0.34	0.28	0.38	0.43	0.26	0.58	0.35	1.00
<i>Note.</i> $N = 70867$ (officer candidate sample). All correlations are significant at $p < 0.01$.										

4.1.3 Current Composite Descriptive Statistics

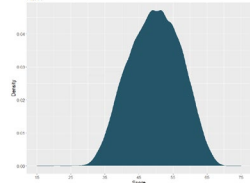
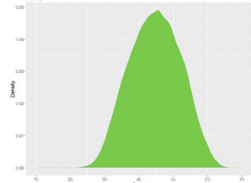
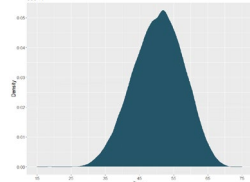
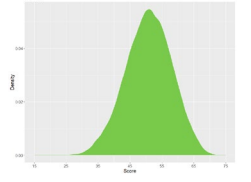
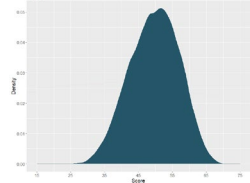
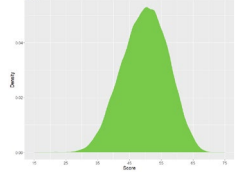
Next, the composites were evaluated through descriptive statistics. The composites consist of weighted subtest t-scores, with subtest weighting determined on the basis of previous research. Results, including mean, standard deviation, skewness, and kurtosis are shown in Table 9.

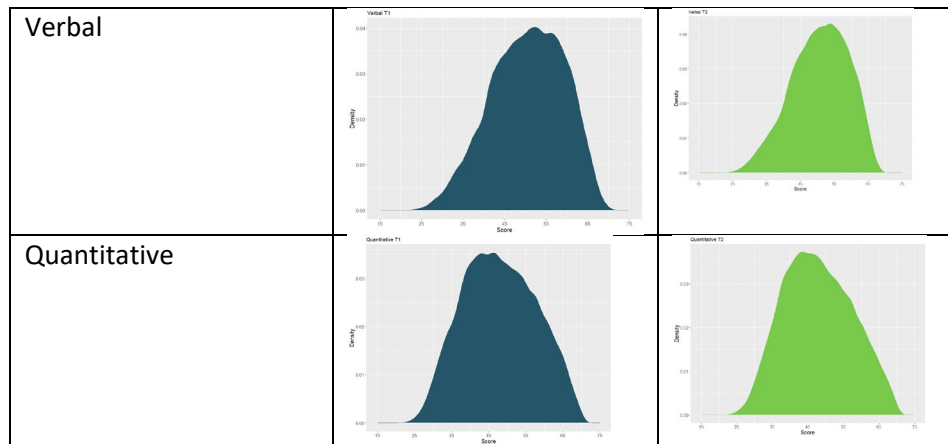
Table 9. Descriptive Statistics for Current Composites

Composite	N	Mean	SD	Skewness	Kurtosis
Pilot	70867	49.69	7.47	-0.05	-0.57
CSO	70867	50.64	7.28	-0.15	-0.26
ABM	70867	49.75	7.20	-0.16	-0.36
Verbal	70867	50.52	8.58	-0.29	-0.49
Quantitative	70867	47.89	9.68	0.10	-0.74

Score distributions for the Form T1 and T2 composites are shown in Table 10 below. The composite scores for Forms T1 and T2 were generally normally distributed.

Table 10. Frequency Distributions for Current Composites

Composite	T1	T2
Pilot		
CSO		
ABM		



4.1.4 Current Composite Reliability

Coefficient alpha, a measure of the internal consistency reliability, is one of the most frequently used coefficients for measuring the reliability of a test. Lord and Novick (1968) showed that all items must be tau-equivalent for coefficient alpha to be an unbiased estimator of the reliability. Items are considered to be tau-equivalent when the difference between the true scores for any pair of items is a constant and the items have equal true score variance. However, a composite score made up of multiple constructs generally does not meet these criteria. Instead, a composite can be assumed to be composed of stratified layers of items, with items in each layer being assumed to be unidimensional. Thus, the reliability of the composite score can be calculated based on the reliabilities of the strata, each of which is treated as a single subtest (He, 2009). Additionally, among other measures of composite reliability, Kamata, Turhan, and Darandari (2003) showed that stratified alpha generally performs the best of the various composite measures. Therefore, stratified alpha was used to estimate the reliability of the AFOQT composites. The reliability estimate for the AFOQT composites were excellent, ranging from .89 to .95. Full results are presented in Tables 11-16 below.

Table 11. Pilot Composite Reliability Results

Scale	Item Count	Alpha	Mean	Variance	Stratified Alpha
Total	110	0.93	65.74	269.28	0.94
Math Knowledge	25	0.82	14.28	26.69	NA
Table Reading	40	0.89	27.35	41.48	NA
Instrument Comprehension	25	0.91	14.82	44.26	NA
Aviation Information	20	0.78	9.30	17.89	NA

Table 12. CSO Composite Reliability Results

Scale	Item Count	Alpha	Mean	Variance	Stratified Alpha
Total	120	0.92	72.31	258.53	0.92
Word Knowledge	25	0.85	14.84	30.16	NA
Math Knowledge	25	0.82	14.28	26.69	NA
Table Reading	40	0.89	27.35	41.48	NA
Block Counting	30	0.83	15.85	31.94	NA

Table 13. ABM Composite Reliability Results

Scale	Item Count	Alpha	Mean	Variance	Stratified Alpha
Total	165	0.94	96.42	520.09	0.95
Verbal Analogies	25	0.74	14.83	19.18	NA
Math Knowledge	25	0.82	14.28	26.69	NA
Table Reading	40	0.89	27.35	41.48	NA
Instrument Comprehension	25	0.91	14.82	44.26	NA
Block Counting	30	0.83	15.85	31.94	NA
Aviation Information	20	0.78	9.30	17.89	NA

Table 14. Verbal Composite Reliability Results

Scale	Item Count	Alpha	Mean	Variance	Stratified Alpha
Total	75	0.90	46.99	148.53	0.90
Verbal Analogies	25	0.74	14.83	19.18	NA
Word Knowledge	25	0.85	14.84	30.16	NA
Reading Comprehension	25	0.73	17.33	16.71	NA

Table 15. Quantitative Composite Reliability Results

Scale	Item Count	Alpha	Mean	Variance	Stratified Alpha
Total	50	0.89	27.63	89.28	0.89
Arithmetic Reasoning	25	0.81	13.35	25.40	NA
Math Knowledge	25	0.82	14.28	26.69	NA

Table 16. Academic Aptitude Composite Reliability Results

Scale	Item Count	Alpha	Mean	Variance	Stratified Alpha
Total	125	0.93	74.62	360.73	0.93
Verbal Analogies	25	0.74	14.83	19.18	NA
Arithmetic Reasoning	25	0.81	13.35	25.40	NA
Word Knowledge	25	0.85	14.84	30.16	NA
Math Knowledge	25	0.82	14.28	26.69	NA
Reading Comprehension	25	0.73	17.33	16.71	NA

Next, we evaluated the current composites through the use of CFA for the construct-oriented composites (Verbal and Quantitative). As noted previously, upon review of the five operational AFOQT composites (note that Academic Aptitude is a combination of Verbal and Quantitative), it was determined that only the Verbal and Quantitative composites met the criteria to be analyzed using CFA. CFA is a technique used to identify a latent construct structure underpinning a set of observed variables (i.e., items). The Verbal and Quantitative composites were determined to be the only composites that fit the theoretical tenets underpinning CFA. The determination was made based on the content of the subtests in each of the composites to evaluate whether the subtests measure theoretically similar constructs that should relate to the higher-order Verbal and Quantitative ability constructs, respectively. The remaining composites (i.e., Pilot, CSO, and ABM) had structures that were more representative of composites containing multiple constructs rather than a single construct, as they were designed to measure relevant job requirements rather than singular constructs.

To determine the model-data fit and the appropriateness of treating the Verbal and Quantitative composites as constructs, these composites and their underlying structures were included in an *a priori* CFA following procedures described by Drasgow, Nye, Carretta, and Ree (2010) on similar data. Drasgow et al. found model identification issues when testing factor structure. To help mitigate this issue they created item parcels, which are groups of five items within each subtest. For example, the VAsubtest has 25 items; thus five parcels were created to measure Verbal Analogies. Drasgow et al., found that parcels consisting of items towards the end of the subtests were poorest performing. To address this, items were assigned to parcels in a sequence so that each parcel included items from the beginning, middle and end of the subtest.

A CFA was conducted on each version of the assessment (Forms T1 and T2) as well as a combined total for both the Verbal and Quantitative composites. The results of the CFAs suggested good to excellent model-data fit (Hu & Bentler, 1998) for all the Verbal and Quantitative models (see Table 17). The results of the CFA models provided strong supporting evidence that the items within the subtests support the current structure of the Verbal and Quantitative composites.

Table 17. Confirmatory Factor Analysis Results for Verbal and Quantitative

Model	DF	χ^2	CFI	TLI	RMSEA (95% CI)	SRMSR
Verbal Total	78	259759.20***	0.92	0.91	0.066 (0.065, 0.066)	0.039
Verbal T1	78	137207.12***	0.94	0.93	0.057 (0.056, 0.058)	0.034
Verbal T2	78	134918.88***	0.95	0.94	0.056 (0.055, 0.057)	0.033
Quantitative Total	45	271701.36***	0.97	0.96	0.060 (0.059, 0.061)	0.030
Quantitative T1	45	142238.39***	0.96	0.94	0.070 (0.068, 0.071)	0.035
Quantitative T2	45	134314.61***	0.98	0.97	0.053 (0.052, 0.055)	0.025

*** $p = .00$

4.1.5 Measurement Equivalence/Invariance Analysis

The evidence of strong model-data fit for the Verbal and Quantitative composites suggested that the models are accurate representations of the Verbal and Quantitative constructs. To further understand the constructs, a test of measurement equivalence/invariance (ME/I, Byrne, Shavelson, & Muthen, 1989; Drasgow & Kanger, 1985; Horn & McArdle, 1992) was performed. ME/I investigates the degree to which the same construct is being measured across specified groups. This series of tests investigates how classes (i.e., race, gender, and ethnicity) performed on the Verbal and Quantitative constructs in comparison to the referent groups (i.e., White, Male). Evidence of construct invariance suggests that the constructs are being interpreted and measured equally among different race, ethnic, and gender groups and a lack of construct invariance may indicate that groups are interpreting and performing differently on the constructs.

Vandenberg and Lance (2000) recommended a four-step process for investigating measurement equivalence:

1. Configural Invariance – Baseline model, determine fit of overall model
2. Metric Invariance – Determine if factor loadings are equivalent across groups
3. Scalar Invariance – Determine if intercepts are equivalent across groups
4. Strict Invariance – Determine if factor and error variance is equivalent across groups

These four steps are conducted sequentially, such that if the criterion for invariance is met for one step, the analysis proceeds onto the next. If all four steps suggest evidence of invariance, the construct is said to have demonstrated ‘full invariance’ across groups. The results of the full CFA model fulfill the configural invariance step for all models. The results shown in Table 18 provide the starting point for the metric invariance step. Models were tested until they failed one of the invariance steps, as identified by a significant χ^2 difference value. Note that χ^2 is sensitive to sample size. There is some debate regarding whether the strict invariance step is required (Van

Table 18. Measurement Equivalence/Invariance Results of Verbal and Quantitative Composites

Model	Comparison	Step2			Step 3			Step 4		
		χ^2	df	<i>p</i>	χ^2	df	<i>p</i>	χ^2	df	<i>p</i>
Verbal Total	M-F	270.96	12	0.00						
Verbal Total	W-B	647.18	12	0.00						
Verbal Total	W-A	211.22	12	0.00						
Verbal Total	W-NH/PI	46.31	12	0.00						
Verbal Total	W-AI/AN	24.46	12	0.04						
Verbal Total	W-Two	403.91	12	0.00						
Verbal T1	M-F	188.41	12	0.00						
Verbal T1	W-B	411.87	12	0.00						
Verbal T1	W-A	73.46	12	0.00						
Verbal T1	W-NH/PI	32.48	12	0.00						
Verbal T1	W-AI/AN	7.65	12	0.81	9.90	12	0.62	15.01	13	0.31
Verbal T1	W-Two	247.81	12	0.00						
Verbal T2	M-F	185.14	12	0.00						
Verbal T2	W-B	452.11	12	0.00						
Verbal T2	W-A	215.61	12	0.00						
Verbal T2	W-NH/PI	40.92	12	0.00						
Verbal T2	W-AI/AN	25.12	12	0.01						
Verbal T2	W-Two	266.23	12	0.00						
Quantitative Total	M-F	111.93	9	0.00						
Quantitative Total	W-B	89.25	9	0.00						
Quantitative Total	W-A	51.25	9	0.00						
Quantitative Total	W-NH/PI	7.60	9	0.58	46.84	9	0.00	19.22	10	0.04
Quantitative Total	W-AI/AN	16.63	9	0.08	19.06	9	0.02	16.45	10	0.09
Quantitative Total	W-Two	29.44	9	0.00						
Quantitative T1	M-F	65.13	9	0.00						
Quantitative T1	W-B	53.38	9	0.00						
Quantitative T1	W-A	86.45	9	0.00						
Quantitative T1	W-NH/PI	5.503	9	0.79	50.23	9	0.00	12.35	10	0.26
Quantitative T1	W-AI/AN	11.74	9	0.23	15.64	9	0.07	14.46	10	0.15
Quantitative T1	W-Two	25.35	9	0.00						
Quantitative T2	M-F	66.83	9	0.00						
Quantitative T2	W-B	59.71	9	0.00						
Quantitative T2	W-A	26.42	9	0.00						
Quantitative T2	W-NH/PI	10.37	9	0.32	15.12	9	0.09	14.66	10	0.15
Quantitative T2	W-AI/AN	10.85	9	0.29	12.31	9	0.20	19.82	10	0.03
Quantitative T2	W-Two	15.13	9	0.09	111.16	9	0.00	34.83	10	0.00

Note: Two is Two or More Races

De Schoot, Schmidt, De Beuckelaer, Lek & Zondervan-Zwinjenburg, 2015). Given this, if scalar invariance was not satisfied, we proceeded to test for strict invariance. For a majority of the models and comparisons tested, a lack of invariance was found. Notably, the White-American Indian/Alaskan Native comparison was found to have full invariance on the Verbal T1 and Quantitative T1 forms. The White-Native Hawaiian/Pacific Islander comparison demonstrated full invariance on the Quantitative T1 and T2 forms. The remaining models suggested that groups are interpreting the construct differently from the focal groups. This lack of invariance identifies differences in subgroup performance on the Verbal and Quantitative composites. Practically, this suggests that most of the minority groups are interpreting and performing on the Verbal and Quantitative items significantly differently than the majority groups.

4.1.6 Discussion

The current AFOQT composites were evaluated using a variety of techniques, including correlational analysis, reliability analysis, factor analysis, and measurement equivalence/invariance analysis. Across these analyses, results showed that the currently scored AFOQT subtests (which measure a range of cognitive abilities, including verbal, quantitative, spatial, and perceptual speed abilities, along with aviation information and instrument comprehension) demonstrate evidence of convergent validity that would be expected for multiple measures of cognitive abilities designed to measure general intelligence (Spearman, 1904). Results indicated that composite reliability is high, indicating that operational decisions made on the basis of the composites are based on reliable measurement.

The confirmatory factor analyses conducted for the construct-oriented composites (Verbal and Quantitative) indicated good fit of the models to the data, as judged by benchmarks of fit (Hu & Bentler, 1998). As such, the latent structure of these composites was supported.

The evaluation of the job-oriented composites consisted of descriptive statistics and frequency analysis. The composites were found to generally be normally distributed and descriptive statistics were found to be similar to those found in previous versions of the AFOQT.

Lack of measurement invariance was found for the Verbal and Quantitative composites, indicating differences in subgroup performance for them. Practically, this suggests that most of the minority groups interpreted and performed on the Verbal and Quantitative items significantly differently than the majority groups. The implications for this set of findings will be further explored in subsequent analyses to investigate mean differences and differences in passing rate among groups.

In the next section, we describe a task to link the AFOQT scored and unscored subtests to job-specific attributes and competencies. This information is used in subsequent tasks to evaluate alternative composites to those described above.

4.2. Objective 2: Critical Officer Job Analysis

To identify the attributes and competencies of importance for CSO, ABM, and fighter, mobility, and RPA pilots, job analysis reports (see Pena et al., 2019a, 2019b, 2019c, 2019d) provided by the Air Force were reviewed and used as the basis of a linking exercise to relate job-specific

attributes and competencies to AFOQT subtests (including the scored and unscored tests). While several types of pilot roles have been analyzed, the operational AFQOT composite has been implemented for the role of Pilot in the aggregate. As such, commonalities and uniqueness were noted as part of this analysis for the different pilot roles to inform whether a singular alternative Pilot composite was warranted. Note that job analysis materials were not available for ABM as there was an insufficient amount of data to support the job analysis, so linkages between the AFOQT subtests and critical officer attributes and competencies were not made. See Appendix A and Appendix B for details regarding the job analysis linkage ratings tasks for the AFOQT cognitive and non-cognitive measures,

4.2.1 Review of Job Analysis Reports

The job analysis reports (Pena et al., 2019a, 2019b, 2019c, 2019d) described the approach taken to evaluate the importance of a large number of attributes and competencies of potential relevance to each role. In short, job analysis surveys were administered to technical training and field training instructors and first line supervisors who were asked to rate the importance of 71 attributes on a 5-point scale where 1 = Not Important and 5 = Extremely Important. In addition, these SMEs rated the expectation for Airmen to possess 29 competencies upon arriving to their first duty assignment after completing technical training and for initial service commitment.

For the attributes, an average importance rating of 3.0 or higher was established as the threshold for an important attribute for each job. Based on this criterion, 44 attributes were deemed important across all four jobs, while five attributes were important for three jobs, one attribute was important for two of the jobs, and five attributes were important for one job. Similarly, SMEs rated their expectations for Airmen to possess 29 competencies upon their arrival at their first duty assignment after completing technical training or for initial service commitment. A competency receiving an 80% or higher agreement level regarding the expectation for Airmen to possess it at either the First Duty Assignment or Initial Service Commitment was the threshold established for the competency to be deemed critical for the role. Given this, six competencies were critical across all jobs, three competencies were critical for three jobs, one competency were critical for two jobs, and two competencies were critical for one job. Based on the results of the job analyses, 56 attributes were important for at least one of the four jobs, and 12 competencies were critical for at least one of the four jobs.

We reviewed the commonalities and unique requirements across the roles. Tables 19 and 20 show the range of attributes and competencies determined to be important for each of the jobs. As can be seen, most attributes and competencies were in common for all jobs. Definitions for the attributes and competencies are shown in Appendices A and B (for cognitive and non-cognitive test rating tasks, respectively) as part of the rating task exhibit.

**Table 19. Important Attributes for Fighter Pilot, Mobility Pilot, RPA Pilot, and CSO
Jobs as Determined from 2019 Job Analysis Information**

Attribute	Fighter Pilot	Mobility Pilot	RPA Pilot	CSO
Responsibility	X	X	X	X
Attention to Detail	X	X	X	X
Situational Awareness	X	X	X	X
Adjustment	X	X	X	X
Aviation Knowledge	X	X	X	X
Critical Thinking	X	X	X	X
Achievement	X	X	X	X
Reasoning	X	X	X	X
Working Memory	X	X	X	X
Auditory Attention	X	X	X	X
Self-Discipline	X	X	X	X
Vigilance	X	X	X	X
Even-Tempered	X	X	X	X
Intellectual Efficiency	X	X	X	X
Time-Sharing	X	X	X	X
Commitment to Serve	X	X	X	X
Persistence	X	X	X	X
Long-term Memory	X	X	X	X
Perceptual Speed and Accuracy	X	X	X	X
Courage	X	X	X	X
Self-Control	X	X	X	X
Arithmetic Reasoning	X	X	X	X
Cooperation	X	X	X	X
Ingenuity	X	X	X	X
Self-Efficacy	X	X	X	X
Situational Judgment	X	X	X	X
Spatial Orientation	X	X	X	X
Deliberation	X	X	X	X
Instructing	X	X	X	X
Instrument Comprehension	X	X	X	X
Reaction Time	X	X	X	X
Curiosity	X	X	X	X
Mathematics Knowledge	X	X	X	X
Activity	X	X	X	X
Paragraph Comprehension	X	X	X	X
Humility	X	X	X	X
Team Orientation	X	X	X	X
Mental Rotation	X	X	X	X
Control Precision	X	X	X	X

Moral Courage	X	X	X	X
Virtue	X	X	X	X
Depth	X	X	X	X
Order		X	X	X
Optimism	X	X	X	X
Selflessness	X	X		X
Mechanical Comprehension	X	X	X	X
Flexibility of Closure	X		X	X
Electronics Information				X
Unconventional				X
Physical Conditioning	X	X		
Rate Control	X	X	X	
Tolerance		X		
Multi-Limb Coordination	X	X	X	
Consideration		X		
Dominance	X			

X = critical to the role

Table 20. Important Competencies for Fighter Pilot, Mobility Pilot, RPA Pilot, and CSO Jobs as Determined from 2019 Job Analysis Information

Competency	Fighter Pilot	Mobility Pilot	RPA Pilot	CSO
Accepts Feedback	X	X	X	X
Active Listening	X	X		X
Adaptability	X	X	X	X
Decision Making	X	X	X	X
Followership	X	X		
Integrity	X	X	X	X
Learning Orientation	X			
Problem Solving	X	X	X	X
Professionalism	X	X	X	X
Self-Awareness	X	X		X
Timeliness	X	X		X
Warrior Ethos	X			

X = critical to the role

4.2.2 Design of the Linkage Rating Task

After determining the important attributes and competencies for each role, the next step was to evaluate the relevance of these attributes and competencies to the various subtests utilized in the AFOQT Form T. To do this, a rating task was developed in which raters were asked to evaluate the extent to which an attribute or competency is measured by a specific subtest. Based on the

review of important attributes and competencies from the job analyses, the rating task was designed to include attributes and competencies rated as important for at least one job. This resulted in including 56 attributes and 12 competencies in the rating task. Definitions of the AFOQT subtests and important officer attributes and competencies were provided to raters. Raters were asked to evaluate the extent to which an attribute or competency is related to each of the subtests and the six domains and 30 facets of the SDI. The relationship was rated on a 3-point scale, from 0-2, with 0 = not at all related and 2 = related to a great extent.

4.2.3 Administration of Linkage Rating Task

To make best use of resources, a two-phase rating process was used. Furthermore, ratings were administered in two phases (cognitive tests and SJT, SDI) to minimize rater fatigue given the large number of ratings that were required. Four initial raters from PDRI completed the entire rating task and served as phase one raters. Of these initial raters, 50% had a master's degree in Industrial-Organizational (I-O) psychology while the other 50% have a Ph.D. in I-O psychology. The average amount of experience for the group of initial raters was 16.3 years. The results of the initial rating task were used to update the subsequent rating task (which was completed by a larger number of raters) such that only those ratings that the initial raters uniformly indicated were a "0" in terms of describing the lack of relationship between the attribute or competency and the AFOQT subtest (including scored and unscored subtests) were not included in the follow-up rating task.

The second group of raters was composed of 3 raters from the Air Force and 7 raters from PDRI. Again, 50% of the secondary raters possessed a M.A in I-O psychology and the other 50% had a Ph.D. in I-O Psychology. This group's average experience was 12.5 years. After all ratings had been completed, both group's ratings were combined for analysis.

Linkage Data Analysis. Statistics describing rater average, dispersion, frequency distribution, and interrater agreement (within-group rater agreement or r_{wg} , James, Demaree, & Wolf, 1993) were evaluated for each subtest. Instances in which ratings were split roughly evenly between scores of 0 and 2 were identified as requiring discussion given the polarity of ratings. R_{wg} ratings of at least .70 were desired to ensure that the rating data were sufficiently reliable. It was decided that all raters with ratings of 2 in these situations would be given an opportunity to review their ratings. Following the review, group discussions were held to review and discuss the ratings. Inter-rater agreement was re-evaluated and all ratings met a minimum r_{wg} threshold of .70.

4.2.4 Linkage Task Results

The results of the linkage task are shown in the tables below. Tables 21 and 22 display moderate and strong linkages between attributes/competencies and AFOQT cognitive tests and Tables 23 and 24 describe the linkages for non-cognitive subtests. Separate tables are provided for those linkages deemed strong (with an average rating of 1.50-2.00) on the 0-2 scale, and another for linkages deemed moderate (those with an average rating of 1.00-1.49) on the 0-2 scale. Note that results for Pilot are presented in the aggregate as most attributes and competencies were in common across the various pilot roles. Exceptions to these are noted in the tables.

Table 21. Cognitive Subtests with Strong Linkages for CSO and Pilot (Average Linkage Rating of 1.50-2.00)

Attribute/Competency	CSO	Pilot
Achievement	--	--
Courage	--	--
Persistence	--	--
Responsibility	--	--
Curiosity	--	--
Attention to Detail	Table Reading (1.62)	Table Reading (1.62)
	Instrument Comprehension (1.50)	Instrument Comprehension (1.50)
Order	--	-- ¹
Deliberation	--	--
Consideration	NI	-- ^{1,3}
Humility	--	--
Cooperation	--	--
Selflessness	--	-- ³
Virtue	--	--
Moral Courage	--	--
Dominance	NI	-- ^{2,3}
Even-Tempered	--	--
Ingenuity	--	--
Unconventional	--	NI
Tolerance	NI	-- ^{1,3}
Adjustment	--	--
Optimism	--	--
Self-Control	--	--
Self-Discipline	--	--
Depth	--	--
Situational Awareness	--	--
Team Orientation	--	--
Commitment to Serve	--	--
Intellectual Efficiency	Instrument Comprehension (1.71)	Instrument Comprehension (1.71)
	Table Reading (1.57)	Table Reading (1.57)
	Arithmetic Reasoning (1.54)	Arithmetic Reasoning (1.54)
Self-Efficacy	--	--
Activity	--	--

Physical Conditioning	NI	-- ³
Mental Rotation	Block Counting (1.69)	Block Counting (1.69)
	Instrument Comprehension (1.64)	Instrument Comprehension (1.64)
Spatial Orientation	--	--
Instrument Comprehension	Instrument Comprehension (2.00)	Instrument Comprehension (2.00)
Rate Control	NI	--
Auditory Attention	--	--
Control Precision	--	--
Reaction Time	--	--
Multi-Limb Coordination	NI	--
Perceptual Speed and Accuracy	Table Reading (1.86)	Table Reading (1.86)
	Instrument Comprehension (1.85)	Instrument Comprehension (1.85)
	Block Counting (1.79)	Block Counting (1.79)
	Math Knowledge (1.69)	Math Knowledge (1.69)
	Arithmetic Reasoning (1.62)	Arithmetic Reasoning (1.62)
Flexibility of Closure	Table Reading (1.62)	Table Reading (1.62) ²
Critical Thinking	--	--
Reasoning	Verbal Analogies (1.64)	Verbal Analogies (1.64)
	Arithmetic Reasoning (1.64)	Arithmetic Reasoning (1.64)
Arithmetic Reasoning	Arithmetic Reasoning (2.00)	Arithmetic Reasoning (2.00)
	Math Knowledge (1.79)	Math Knowledge (1.79)
Paragraph Comprehension	Reading Comprehension (2.00)	Reading Comprehension (2.00)
Long-term Memory	Physical Science (1.62)	Physical Science (1.62)
	Aviation Information (1.57)	Aviation Information (1.57)
Working Memory	Block Counting (1.62)	Block Counting (1.62)
	Instrument Comprehension (1.58)	Instrument Comprehension (1.58)
	Reading Comprehension (1.54)	Reading Comprehension (1.54)
Time-Sharing	--	--
Instructing	--	--
Vigilance	--	--
Situational Judgment	--	--
Aviation Knowledge	Aviation Information (1.93)	Aviation Information (1.93)
	Instrument Comprehension (1.69)	Instrument Comprehension (1.69)
Mathematics Knowledge	Math Knowledge (2.00)	Math Knowledge (2.00)
	Arithmetic Reasoning (1.93)	Arithmetic Reasoning (1.93)
Mechanical Comprehension	Physical Science (1.85)	Physical Science (1.85)

Electronics Information	--	NI
Active Listening	--	-- ³
Followership	NI	-- ³
Adaptability	--	--
Learning Orientation	NI	-- ^{2,3}
Problem Solving	--	--
Decision Making	--	--
Integrity	--	--
Professionalism	--	--
Warrior Ethos	NI	-- ^{2,3}
Accepts Feedback	--	--
Self-Awareness	--	-- ³
Timeliness	--	-- ³

¹ indicates Attribute/Competency is not important for Fighter Pilots; ² indicates Attribute/Competency is not important for Mobility Pilots; ³ indicates Attribute/Competency is not important for RPA Pilots; -- indicates Attribute/Competency is important for the Role but it did not strongly link with any subtests; NI indicates Attribute/Competency is not important for the Role(s).

Table 22. Cognitive Subtests with Moderate Linkages for CSO and Pilot (Average Linkage Rating of 1.00-1.49)

Attribute/Competency	CSO	Pilot
Achievement	--	--
Courage	--	--
Persistence	--	--
Responsibility	--	--
Curiosity	--	--
Attention to Detail	Arithmetic Reasoning (1.31)	Arithmetic Reasoning (1.31)
	Block Counting (1.21)	Block Counting (1.21)
	Reading Comprehension (1.00)	Reading Comprehension (1.00)
Order	--	-- ¹
Deliberation	--	--
Consideration	NI	-- ^{1,3}
Humility	--	--
Cooperation	--	--
Selflessness	--	-- ³
Virtue	--	--
Moral Courage	--	--
Dominance	NI	-- ^{2,3}

Even-Tempered	--	--
Ingenuity	--	--
Unconventional	--	NI
Tolerance	NI	-- ^{1,3}
Adjustment	--	--
Optimism	--	--
Self-Control	--	--
Self-Discipline	--	--
Depth	--	--
Situational Awareness	--	--
Team Orientation	--	--
Commitment to Serve	--	--
Intellectual Efficiency	Math Knowledge (1.46)	Math Knowledge (1.46)
	Verbal Analogies (1.38)	Verbal Analogies (1.38)
	Block Counting (1.38)	Block Counting (1.38)
	Word Knowledge (1.31)	Word Knowledge (1.31)
Self-Efficacy	--	--
Activity	--	--
Physical Conditioning	NI	-- ³
Mental Rotation	--	--
Spatial Orientation	Instrument Comprehension (1.46)	Instrument Comprehension (1.46)
	Block Counting (1.15)	Block Counting (1.15)
Instrument Comprehension	Aviation Information (1.00)	Aviation Information (1.00)
Rate Control	NI	--
Auditory Attention	--	--
Control Precision	--	--
Reaction Time	--	--
Multi-Limb Coordination	NI	--
Perceptual Speed and Accuracy	Verbal Analogies (1.46)	Verbal Analogies (1.46)
	Word Knowledge (1.15)	Word Knowledge (1.15)
Flexibility of Closure	Block Counting (1.38)	Block Counting (1.38) ²
Critical Thinking	Reading Comprehension (1.38)	Reading Comprehension (1.38)
	Arithmetic Reasoning (1.29)	Arithmetic Reasoning (1.29)
Reasoning	Reading Comprehension (1.43)	Reading Comprehension (1.43)
	Math Knowledge (1.15)	Math Knowledge (1.15)
Arithmetic Reasoning	--	--
Paragraph Comprehension	--	--
Long-term Memory	Word Knowledge (1.38)	Word Knowledge (1.38)

	Math Knowledge (1.23)	Math Knowledge (1.23)
Working Memory	Table Reading (1.00)	Table Reading (1.00)
Time-Sharing	Table Reading (1.43)	Table Reading (1.43)
	Instrument Comprehension (1.43)	Instrument Comprehension (1.43)
Instructing	--	--
Vigilance	--	--
Situational Judgment	--	--
Aviation Knowledge	--	--
Mathematics Knowledge	--	--
Mechanical Comprehension	Aviation Information (1.15)	Aviation Information (1.15)
	Instrument Comprehension (1.00)	Instrument Comprehension (1.00)
Electronics Information	Physical Science (1.29)	NI
	Aviation Information (1.00)	
Active Listening	--	-- ³
Followership	NI	-- ³
Adaptability	--	--
Learning Orientation	NI	-- ^{2,3}
Problem Solving	Arithmetic Reasoning (1.36)	Arithmetic Reasoning (1.36)
Decision Making	--	--
Integrity	--	--
Professionalism	--	--
Warrior Ethos	NI	-- ^{2,3}
Accepts Feedback	--	--
Self-Awareness	--	-- ³
Timeliness	--	-- ³

¹ indicates Attribute/Competency is not important for Fighter Pilots; ² indicates Attribute/Competency is not important for Mobility Pilots; ³ indicates Attribute/Competency is not important for RPA Pilots; -- indicates Attribute/Competency is important for the Role but it did not strongly link with any subtests; NI indicates Attribute/Competency is not important for the Role(s).

Table 23. Non-Cognitive Tests with Strong Linkages (Average Linkage Rating of 1.50-2.00)

Attribute/Competency	CSO	Pilot
Achievement	SDI - Conscientiousness [Achievement Striving] (1.93)	SDI - Conscientiousness [Achievement Striving] (1.93)
	SDI - Conscientiousness [Self-Discipline] (1.62)	SDI - Conscientiousness [Self-Discipline] (1.62)
Courage	--	--
Persistence	SDI – Conscientiousness [Self-Discipline] (1.86)	SDI – Conscientiousness [Self-Discipline] (1.86)
	SDI - Conscientiousness (1.79)	SDI - Conscientiousness (1.79)
	SDI – Conscientiousness [Achievement-Striving] (1.64)	SDI – Conscientiousness [Achievement-Striving] (1.64)
Responsibility	SDI - Conscientiousness (1.64)	SDI - Conscientiousness (1.64)
	SDI - Conscientiousness [Self-Discipline] (1.62)	SDI - Conscientiousness [Self-Discipline] (1.62)
Curiosity	SDI - Openness (1.79)	SDI - Openness (1.79)
	SDI - Openness [Scientific Interest] (1.54)	SDI - Openness [Scientific Interest] (1.54)
Attention to Detail	SDI - Conscientiousness (1.62)	SDI - Conscientiousness (1.62)
	SDI - Conscientiousness [Order] (1.62)	SDI - Conscientiousness [Order] (1.62)
Order	SDI - Conscientiousness [Order] (2.00)	SDI - Conscientiousness [Order] (2.00) ¹
	SDI - Conscientiousness (1.79)	SDI - Conscientiousness (1.79) ¹
Deliberation	SDI - Conscientiousness [Deliberation] (1.93)	SDI - Conscientiousness [Deliberation] (1.93)
	SDI - Extraversion [Spontaneous-Variety] (1.64)	SDI - Extraversion [Spontaneous-Variety] (1.64)
	SDI - Conscientiousness (1.62)	SDI - Conscientiousness (1.62)
Consideration	NI	SDI - Agreeableness (2.00) ^{1,3}
		SDI - Agreeableness [Helpful Altruistic] (1.77) ^{1,3}
		SDI - Agreeableness [Pleasant] (1.71) ^{1,3}
		SDI - Neuroticism [Angry Hostility] (1.69) ^{1,3}
		SDI - Machiavellianism [Interpersonal Tactics] (1.69) ^{1,3}
Humility	SDI - Agreeableness [Team Player] (1.92)	SDI - Agreeableness [Team Player] (1.92)
	SDI - Machiavellianism (1.77)	SDI - Machiavellianism (1.77)
	SDI - Agreeableness (1.62)	SDI - Agreeableness (1.62)

	SDI - Machiavellianism [Interpersonal Tactics] (1.62)	SDI - Machiavellianism [Interpersonal Tactics] (1.62)
	SDI - Agreeableness [Helpful Altruistic] (1.57)	SDI - Agreeableness [Helpful Altruistic] (1.57)
Cooperation	SDI - Agreeableness (1.93)	SDI - Agreeableness (1.93)
	SDI - Agreeableness [Team Player] (1.79)	SDI - Agreeableness [Team Player] (1.79)
	SDI - Agreeableness [Pleasant] (1.79)	SDI - Agreeableness [Pleasant] (1.79)
	SDI - Machiavellianism [Cynical View] (1.69)	SDI - Machiavellianism [Cynical View] (1.69)
	SDI - Agreeableness [Helpful Altruistic] (1.64)	SDI - Agreeableness [Helpful Altruistic] (1.64)
Selflessness	SDI - Agreeableness [Helpful Altruistic] (2.00)	SDI - Agreeableness [Helpful Altruistic] (2.00) ³
	SDI - Agreeableness (1.54)	SDI - Agreeableness (1.54) ³
Virtue	SDI - Machiavellianism (1.86)	SDI - Machiavellianism (1.86)
	SDI - Machiavellianism [Interpersonal Tactics] (1.86)	SDI - Machiavellianism [Interpersonal Tactics] (1.86)
Moral Courage	SDI - Machiavellianism (1.62)	SDI - Machiavellianism (1.62)
Dominance	NI	SDI – Extraversion [Dominance-Leader] (2.00) ^{2,3}
Even-Tempered	SDI - Neuroticism [Temperamental] (2.00)	SDI - Neuroticism [Temperamental] (2.00)
	SDI - Neuroticism [Angry Hostility] (2.00)	SDI - Neuroticism [Angry Hostility] (2.00)
	SDI - Neuroticism (1.85)	SDI - Neuroticism (1.85)
	SDI - Agreeableness [Pleasant] (1.71)	SDI - Agreeableness [Pleasant] (1.71)
	SDI - Agreeableness [Well-Adjusted] (1.62)	SDI - Agreeableness [Well-Adjusted] (1.62)
	SDI - Neuroticism [Stress Under Pressure] (1.54)	SDI - Neuroticism [Stress Under Pressure] (1.54)
Ingenuity	SDI - Openness [Creative] (2.00)	SDI - Openness [Creative] (2.00)
	SDI - Conscientiousness [Unconventional] (1.62)	SDI - Conscientiousness [Unconventional] (1.62)
	SDI - Openness [Imagination] (1.62)	SDI - Openness [Imagination] (1.62)
Unconventional	SDI - Conscientiousness [Unconventional] (2.00)	NI
	SDI - Openness [Creative] (1.64)	
Tolerance	NI	SDI - Openness (1.62) ^{1,3}
Adjustment	SDI - Neuroticism (1.93)	SDI - Neuroticism (1.93)
	SDI - Neuroticism [Stress Under Pressure] (1.93)	SDI - Neuroticism [Stress Under Pressure] (1.93)

	SDI - Neuroticism [Worry] (1.93)	SDI - Neuroticism [Worry] (1.93)
	SDI - Agreeableness [Well-Adjusted] (1.85)	SDI - Agreeableness [Well-Adjusted] (1.85)
	SDI - Neuroticism [Temperamental] (1.50)	SDI - Neuroticism [Temperamental] (1.50)
Optimism	SDI - Agreeableness [Optimist] (2.00)	SDI - Agreeableness [Optimist] (2.00)
	SDI - Machiavellianism [Cynical View] (1.86)	SDI - Machiavellianism [Cynical View] (1.86)
	SDI - Neuroticism [Worry] (1.71)	SDI - Neuroticism [Worry] (1.71)
	SDI - Agreeableness [Pleasant] (1.64)	SDI - Agreeableness [Pleasant] (1.64)
Self-Control	SDI - Neuroticism [Angry Hostility] (1.69)	SDI - Neuroticism [Angry Hostility] (1.69)
	SDI - Neuroticism [Temperamental] (1.64)	SDI - Neuroticism [Temperamental] (1.64)
	SDI - Neuroticism [Stress Under Pressure] (1.54)	SDI - Neuroticism [Stress Under Pressure] (1.54)
Self-Discipline	SDI - Conscientiousness [Self-Discipline] (2.00)	SDI - Conscientiousness [Self-Discipline] (2.00)
	SDI - Conscientiousness (1.77)	SDI - Conscientiousness (1.77)
	SDI - Conscientiousness [Achievement Striving] (1.71)	SDI - Conscientiousness [Achievement Striving] (1.71)
Depth	SDI - Openness [Reflective] (1.93)	SDI - Openness [Reflective] (1.93)
Situational Awareness	--	--
Team Orientation	SDI - Agreeableness [Team Player] (2.00)	SDI - Agreeableness [Team Player] (2.00)
	SDI - Machiavellianism [Independent] (1.92)	SDI - Machiavellianism [Independent] (1.92)
	SDI - Agreeableness [Helpful Altruistic] (1.54)	SDI - Agreeableness [Helpful Altruistic] (1.54)
Commitment to Serve	--	--
Intellectual Efficiency	--	--
Self-Efficacy	--	--
Activity	SDI - Extraversion [Activity] (2.00)	SDI - Extraversion [Activity] (2.00)
	SDI - Extraversion (1.71)	SDI - Extraversion (1.71)
	SDI - Extraversion [Excitement Seeking] (1.50)	SDI - Extraversion [Excitement Seeking] (1.50)
Physical Conditioning	NI	-- ³
Mental Rotation	--	--
Spatial Orientation	--	--
Instrument Comprehension	--	--
Rate Control	NI	--

Auditory Attention	--	--
Control Precision	--	--
Reaction Time	--	--
Multi-Limb Coordination	NI	--
Perceptual Speed and Accuracy	--	--
Flexibility of Closure	--	-- ²
Critical Thinking	Situational Judgment Test (1.62)	Situational Judgment Test (1.62)
Reasoning	Situational Judgment Test (1.69)	Situational Judgment Test (1.69)
Arithmetic Reasoning	--	--
Paragraph Comprehension	--	--
Long-term Memory	--	--
Working Memory	--	--
Time-Sharing	--	--
Instructing	--	--
Vigilance	--	--
Situational Judgment	Situational Judgment Test (2.00)	Situational Judgment Test (2.00)
Aviation Knowledge	--	--
Mathematics Knowledge	--	--
Mechanical Comprehension	--	--
Electronics Information	--	NI
Active Listening	--	-- ³
Followership	NI	SDI - Agreeableness [Team Player] (1.92) ³
		SDI - Extraversion [Dominance-Leader] (1.79) ³
		Machiavellianism (1.69) ³
Adaptability	SDI - Neuroticism [Stress Under Pressure] (1.64)	SDI - Neuroticism [Stress Under Pressure] (1.64)
Learning Orientation	NI	SDI - Openness (1.57) ^{2,3}
Problem Solving	SDI - Conscientiousness [Deliberation] (1.77)	SDI - Conscientiousness [Deliberation] (1.77)
	Situational Judgment Test (1.64)	Situational Judgment Test (1.64)
Decision Making	Situational Judgment Test (1.79)	Situational Judgment Test (1.79)
	SDI - Conscientiousness [Deliberation] (1.69)	SDI - Conscientiousness [Deliberation] (1.69)
Integrity	SDI - Machiavellianism (1.79)	SDI - Machiavellianism (1.79)
	SDI - Machiavellianism [Interpersonal Tactics] (1.57)	SDI - Machiavellianism [Interpersonal Tactics] (1.57)

	Situational Judgment Test (1.57)	Situational Judgment Test (1.57)
Professionalism	Situational Judgment Test (1.71)	Situational Judgment Test (1.71)
	SDI - Conscientiousness [Self-Discipline] (1.69)	SDI - Conscientiousness [Self-Discipline] (1.69)
	SDI - Machiavellianism (1.62)	SDI - Machiavellianism (1.62)
	SDI - Neuroticism [Angry Hostility] (1.62)	SDI - Neuroticism [Angry Hostility] (1.62)
	SDI - Neuroticism [Temperamental] (1.54)	SDI - Neuroticism [Temperamental] (1.54)
Warrior Ethos	NI	SDI - Conscientiousness [Self-Discipline] (1.64) ^{2,3}
		SDI - Machiavellianism (1.54) ^{2,3}
		SDI - Neuroticism [Stress Under Pressure] (1.54) ^{2,3}
Accepts Feedback	SDI - Neuroticism [Temperamental] (1.54)	SDI - Neuroticism [Temperamental] (1.54)
Self-Awareness	SDI - Openness [Reflective] (1.86)	SDI - Openness[Reflective] (1.86) ³
Timeliness	SDI - Conscientiousness (1.77)	SDI - Conscientiousness (1.77) ³
	SDI - Conscientiousness [Self-Discipline] (1.77)	SDI - Conscientiousness[Self-Discipline] (1.77) ³

¹ indicates Attribute/Competency is not important for Fighter Pilots; ² indicates Attribute/Competency is not important for Mobility Pilots; ³ indicates Attribute/Competency is not important for RPA Pilots; -- indicates Attribute/Competency is important for the Role but it did not strongly link with any subtests; NI indicates Attribute/Competency is not important for the Role(s).

Table 24. Non-Cognitive Subtests with Moderate Linkages for CSO and Pilot (Average Linkage Rating of 1.00-1.49)

Attribute/Competency	CSO	Pilot
Achievement	SDI - Conscientiousness (1.38)	SDI - Conscientiousness (1.38)
	SDI - Extraversion [Dominance Leader] (1.31)	SDI - Extraversion [Dominance Leader] (1.31)
	SDI - Machiavellianism [Interpersonal Tactics] (1.14)	SDI - Machiavellianism [Interpersonal Tactics] (1.14)
	Situational Judgment Test (1.00)	Situational Judgment Test (1.00)
Courage	SDI - Extraversion [Dominance Leader] (1.38)	SDI - Extraversion [Dominance Leader] (1.38)
	SDI - Neuroticism [Stress Under Pressure] (1.21)	SDI - Neuroticism [Stress Under Pressure] (1.21)
Persistence	SDI - Neuroticism [Stress Under Pressure] (1.23)	SDI - Neuroticism [Stress Under Pressure] (1.23)
Responsibility	SDI - Agreeableness [Team Player] (1.43)	SDI - Agreeableness [Team Player] (1.43)

	SDI - Agreeableness [Well-Adjusted] (1.38)	SDI - Agreeableness [Well-Adjusted] (1.38)
	SDI - Conscientiousness [Achievement Striving] (1.31)	SDI - Conscientiousness [Achievement Striving] (1.31)
	Situational Judgment Test (1.14)	Situational Judgment Test (1.14)
Curiosity	SDI - Extraversion [Excitement Seeking] (1.46)	SDI - Extraversion [Excitement Seeking] (1.46)
	SDI - Openness [Creative] (1.15)	SDI - Openness [Creative] (1.15)
	SDI - Extraversion [Spontaneous Variety] (1.00)	SDI - Extraversion [Spontaneous Variety] (1.00)
Attention to Detail	SDI - Conscientiousness [Deliberation] (1.46)	SDI - Conscientiousness [Deliberation] (1.46)
Order	--	-- ¹
Deliberation	SDI - Conscientiousness [Self-Discipline] (1.38)	SDI - Conscientiousness [Self-Discipline] (1.38)
	SDI - Conscientiousness [Order] (1.38)	SDI - Conscientiousness [Order] (1.38)
	Situational Judgment Test (1.36)	Situational Judgment Test (1.36)
Consideration	NI	SDI - Machiavellianism [Envious] (1.38) ^{1,3}
		SDI - Machiavellianism [Cynical View] (1.23) ^{1,3}
		SDI - Machiavellianism (1.14) ^{1,3}
		Situational Judgment Test (1.14) ^{1,3}
		SDI - Agreeableness [Well-Adjusted] (1.00) ^{1,3}
Humility	Situational Judgment Test (1.14)	Situational Judgment Test (1.14)
Cooperation	SDI - Neuroticism [Angry Hostility] (1.38)	SDI - Neuroticism [Angry Hostility] (1.38)
	SDI - Agreeableness [Well-Adjusted] (1.31)	SDI - Agreeableness [Well-Adjusted] (1.31)
	Situational Judgment Test (1.29)	Situational Judgment Test (1.29)
	SDI - Neuroticism [Temperamental] (1.00)	SDI - Neuroticism [Temperamental] (1.00)
	SDI - Machiavellianism (1.00)	SDI - Machiavellianism (1.00)
Selflessness	SDI - Agreeableness [Team Player] (1.46)	SDI - Agreeableness [Team Player] (1.46) ³
Virtue	SDI - Agreeableness [Helpful Altruistic] (1.36)	SDI - Agreeableness [Helpful Altruistic] (1.36)
	Situational Judgment Test (1.21)	Situational Judgment Test (1.21)
	SDI - Agreeableness [Well-Adjusted] (1.00)	SDI - Agreeableness [Well-Adjusted] (1.00)
Moral Courage	Situational Judgment Test (1.14)	Situational Judgment Test (1.14)

Dominance	NI	SDI - Extraversion [Reserved] (1.46) ^{2,3}
		Situational Judgment Test (1.36) ^{2,3}
		SDI - Machiavellianism [Influence Tactics] (1.00) ^{2,3}
Even-Tempered	SDI - Agreeableness (1.46)	SDI - Agreeableness (1.46)
	Situational Judgment Test (1.21)	Situational Judgment Test (1.21)
Ingenuity	--	--
Unconventional	--	NI
Tolerance	NI	SDI - Agreeableness [Pleasant] (1.46) ^{1,3}
		SDI - Openness [Cultured] (1.38) ^{1,3}
		Situational Judgment Test (1.15) ^{1,3}
Adjustment	SDI - Neuroticism [Angry Hostility] (1.21)	SDI - Neuroticism [Angry Hostility] (1.21)
Optimism	SDI - Agreeableness [Well-Adjusted] (1.38)	SDI - Agreeableness [Well-Adjusted] (1.38)
	SDI - Neuroticism [Angry Hostility] (1.23)	SDI - Neuroticism [Angry Hostility] (1.23)
	SDI - Neuroticism (1.00)	SDI - Neuroticism (1.00)
Self-Control	SDI - Conscientiousness (1.23)	SDI - Conscientiousness (1.23)
	SDI - Conscientiousness [Deliberation] (1.00)	SDI - Conscientiousness [Deliberation] (1.00)
	Situational Judgment Test (1.00)	Situational Judgment Test (1.00)
Self-Discipline	SDI - Conscientiousness [Deliberation] (1.31)	SDI - Conscientiousness [Deliberation] (1.31)
	SDI - Agreeableness [Team Player] (1.07)	SDI - Agreeableness [Team Player] (1.07)
Depth	--	--
Situational Awareness	--	--
Team Orientation	SDI - Extraversion (1.38)	SDI - Extraversion (1.38)
	Situational Judgment Test (1.29)	Situational Judgment Test (1.29)
	SDI - Agreeableness (1.00)	SDI - Agreeableness (1.00)
Commitment to Serve	--	--
Intellectual Efficiency	--	--
Self-Efficacy	SDI - Extraversion [Dominance Leader] (1.31)	SDI - Extraversion [Dominance Leader] (1.31)
	SDI - Neuroticism [Worry] (1.15)	SDI - Neuroticism [Worry] (1.15)
Activity	SDI - Extraversion [Spontaneous Variety] (1.31)	SDI - Extraversion [Spontaneous Variety] (1.31)
Physical Conditioning	NI	SDI - Extraversion [Activity] (1.31) ³

Mental Rotation	--	--
Spatial Orientation	--	--
Instrument Comprehension	--	--
Rate Control	NI	--
Auditory Attention	--	--
Control Precision	--	--
Reaction Time	--	--
Multi-Limb Coordination	NI	--
Perceptual Speed and Accuracy	--	--
Flexibility of Closure	--	-- ²
Critical Thinking	SDI - Conscientiousness [Deliberation] (1.00)	SDI - Conscientiousness [Deliberation] (1.00)
Reasoning	SDI - Conscientiousness [Deliberation] (1.15)	SDI - Conscientiousness [Deliberation] (1.15)
Arithmetic Reasoning	--	--
Paragraph Comprehension	--	--
Long-term Memory	--	--
Working Memory	--	--
Time-Sharing	SDI - Extraversion [Activity] (1.43)	SDI - Extraversion [Activity] (1.43)
Instructing	SDI - Agreeableness [Helpful Altruistic] (1.31)	SDI - Agreeableness [Helpful Altruistic] (1.31)
Vigilance	SDI - Conscientiousness (1.23)	SDI - Conscientiousness (1.23)
Situational Judgment	--	--
Aviation Knowledge	--	--
Mathematics Knowledge	--	--
Mechanical Comprehension	--	--
Electronics Information	--	NI
Active Listening	--	-- ³
Followership	NI	SDI - Conscientiousness [Unconventional] (1.14) ³
		SDI - Machiavellianism [Independent] (1.00) ³
Adaptability	SDI - Neuroticism [Angry Hostility] (1.23)	SDI - Neuroticism [Angry Hostility] (1.23)
	Situational Judgment Test (1.14)	Situational Judgment Test (1.14)
	SDI - Openness (1.07)	SDI - Openness (1.07)
	SDI - Neuroticism (1.00)	SDI - Neuroticism (1.00)
Learning Orientation	NI	SDI - Conscientiousness [Achievement Striving] (1.46) ^{2,3}

		SDI - Openness [Scientific Interest] (1.38) ^{2,3}
Problem Solving	SDI - Openness [Creative] (1.43)	SDI - Openness [Creative] (1.43)
Decision Making	--	--
Integrity	--	--
Professionalism	SDI - Conscientiousness [Order] (1.46)	SDI - Conscientiousness [Order] (1.46)
	SDI - Machiavellianism [Interpersonal Tactics] (1.46)	SDI - Machiavellianism [Interpersonal Tactics] (1.46)
Warrior Ethos	NI	SDI - Neuroticism [Temperamental] (1.46) ^{2,3}
		SDI - Neuroticism [Angry Hostility] (1.43) ^{2,3}
		SDI - Machiavellianism [Interpersonal Tactics] (1.38) ^{2,3}
		SDI - Machiavellianism [Cynical View] (1.00) ^{2,3}
Accepts Feedback	SDI - Openness [Reflective] (1.38)	SDI - Openness [Reflective] (1.38)
	SDI - Agreeableness [Team Player] (1.00)	SDI - Agreeableness [Team Player] (1.00)
Self-Awareness	--	-- ³
Timeliness	Situational Judgment Test (1.00)	Situational Judgment Test (1.00) ³

¹ indicates Attribute/Competency is not important for Fighter Pilots; ² indicates Attribute/Competency is not important for Mobility Pilots; ³ indicates Attribute/Competency is not important for RPA Pilots; -- indicates Attribute/Competency is important for the Role but it did not strongly link with any subtests; NI indicates Attribute/Competency is not important for the Role(s).

For another view of the results, Table 25 presents the results in terms of attributes/competencies linked to each AFOQT cognitive and non-cognitive subtest.

Table 25. AFOQT Cognitive and Noncognitive Subtests Moderately or Strongly Linked to CSO and Pilot Jobs

AFOQT Subtest	CSO	Pilot
Verbal Analogies	Reasoning (1.64)	Reasoning (1.64)
	Perceptual Speed and Accuracy (1.46)	Perceptual Speed and Accuracy (1.46)
	Intellectual Efficiency (1.38)	Intellectual Efficiency (1.38)
Arithmetic Reasoning	Arithmetic Reasoning (2.00)	Arithmetic Reasoning (2.00)
	Mathematics Knowledge (1.93)	Mathematics Knowledge (1.93)
	Reasoning (1.64)	Reasoning (1.64)
	Perceptual Speed and Accuracy (1.62)	Perceptual Speed and Accuracy (1.62)
	Intellectual Efficiency (1.54)	Intellectual Efficiency (1.54)
	Problem Solving (1.36)	Problem Solving (1.36)
	Attention to Detail (1.31)	Attention to Detail (1.31)
	Critical Thinking (1.29)	Critical Thinking (1.29)
Word Knowledge	Long-term Memory (1.38)	Long-term Memory (1.38)
	Intellectual Efficiency (1.31)	Intellectual Efficiency (1.31)
	Perceptual Speed and Accuracy (1.15)	Perceptual Speed and Accuracy (1.15)
Math Knowledge	Mathematics Knowledge (2.00)	Mathematics Knowledge (2.00)
	Arithmetic Reasoning (1.79)	Arithmetic Reasoning (1.79)
	Perceptual Speed and Accuracy (1.69)	Perceptual Speed and Accuracy (1.69)
	Intellectual Efficiency (1.46)	Intellectual Efficiency (1.46)
	Long-term Memory (1.23)	Long-term Memory (1.23)
	Reasoning (1.15)	Reasoning (1.15)
Reading Comprehension	Paragraph Comprehension (2.00)	Paragraph Comprehension (2.00)
	Working Memory (1.54)	Working Memory (1.54)
	Reasoning (1.43)	Reasoning (1.43)
	Critical Thinking (1.38)	Critical Thinking (1.38)
	Attention to Detail (1.00)	Attention to Detail (1.00)
Physical Science	Mechanical Comprehension (1.85)	Mechanical Comprehension (1.85)
	Long-term Memory (1.62)	Long-term Memory (1.62)
	Electronics Information (1.29)	--
Table Reading	Perceptual Speed and Accuracy (1.86)	Perceptual Speed and Accuracy (1.86)
	Attention to Detail (1.62)	Attention to Detail (1.62)
	Flexibility of Closure (1.62)	Flexibility of Closure (1.62) ²
	Intellectual Efficiency (1.57)	Intellectual Efficiency (1.57)
	Time-Sharing (1.43)	Time-Sharing (1.43)
	Working Memory (1.00)	Working Memory (1.00)
	Instrument Comprehension (2.00)	Instrument Comprehension (2.00)

Instrument Comprehension	Perceptual Speed and Accuracy (1.85)	Perceptual Speed and Accuracy (1.85)
	Intellectual Efficiency (1.71)	Intellectual Efficiency (1.71)
	Aviation Knowledge (1.69)	Aviation Knowledge (1.69)
	Mental Rotation (1.64)	Mental Rotation (1.64)
	Working Memory (1.58)	Working Memory (1.58)
	Attention to Detail (1.50)	Attention to Detail (1.50)
	Spatial Orientation (1.46)	Spatial Orientation (1.46)
	Time-Sharing (1.43)	Time-Sharing (1.43)
	Mechanical Comprehension (1.00)	Mechanical Comprehension (1.00)
Block Counting	Perceptual Speed and Accuracy (1.79)	Perceptual Speed and Accuracy (1.79)
	Mental Rotation (1.69)	Mental Rotation (1.69)
	Working Memory (1.62)	Working Memory (1.62)
	Flexibility of Closure (1.38)	Flexibility of Closure (1.38) ²
	Intellectual Efficiency (1.38)	Intellectual Efficiency (1.38)
	Attention to Detail (1.21)	Attention to Detail (1.21)
	Spatial Orientation (1.15)	Spatial Orientation (1.15)
Aviation information	Aviation Knowledge (1.93)	Aviation Knowledge (1.93)
	Long-term Memory (1.57)	Long-term Memory (1.57)
	Mechanical Comprehension (1.15)	Mechanical Comprehension (1.15)
	Electronics Information (1.00)	--
	Instrument Comprehension (1.00)	Instrument Comprehension (1.00)
SJT	Situational Judgment (2.00)	Situational Judgment (2.00)
	Decision Making (1.79)	Decision Making (1.79)
	Professionalism (1.71)	Professionalism (1.71)
	Reasoning (1.69)	Reasoning (1.69)
	Problem Solving (1.64)	Problem Solving (1.64)
	Critical Thinking (1.62)	Critical Thinking (1.62)
	Integrity (1.57)	Integrity (1.57)
	Deliberation (1.36)	Deliberation (1.36)
	--	Dominance (1.36) ^{2,3}
	Cooperation (1.29)	Cooperation (1.29)
	Team Orientation (1.29)	Team Orientation (1.29)
	Even-Tempered (1.21)	Even-Tempered (1.21)
	Virtue (1.21)	Virtue (1.21)
	--	Tolerance (1.15) ^{1,3}
	Adaptability (1.14)	Adaptability (1.14)
	--	Consideration (1.14) ^{1,3}
	Humility (1.14)	Humility (1.14)
	Moral Courage (1.14)	Moral Courage (1.14)
	Responsibility (1.14)	Responsibility (1.14)
	Achievement (1.00)	Achievement (1.00)

	Self-Control (1.00)	Self-Control (1.00)
	Timeliness (1.00)	Timeliness (1.00) ³
Agreeableness	--	Consideration (2.00) ^{1,3}
	Cooperation (1.93)	Cooperation (1.93)
	Humility (1.62)	Humility (1.62)
	Selflessness (1.54)	Selflessness (1.54) ³
	Even-Tempered (1.46)	Even-Tempered (1.46)
	Team Orientation (1.00)	Team Orientation (1.00)
	Team Orientation (2.00)	Team Orientation (2.00)
Team Player	--	Followership (1.92) ³
	Humility (1.92)	Humility (1.92)
	Cooperation (1.79)	Cooperation (1.79)
	Selflessness (1.46)	Selflessness (1.46) ³
	Responsibility (1.43)	Responsibility (1.43)
	Self-Discipline (1.07)	Self-Discipline (1.07)
	Accepts Feedback (1.00)	Accepts Feedback (1.00)
	Cooperation (1.79)	Cooperation (1.79)
Pleasant	--	Consideration (1.71) ^{1,3}
	Even-Tempered (1.71)	Even-Tempered (1.71)
	Optimism (1.64)	Optimism (1.64)
	--	Tolerance (1.46) ^{1,3}
	Selflessness (2.00)	Selflessness (2.00) ³
Helpful-Altruistic	--	Consideration (1.77) ^{1,3}
	Cooperation (1.64)	Cooperation (1.64)
	Humility (1.57)	Humility (1.57)
	Team Orientation (1.54)	Team Orientation (1.54)
	Virtue (1.36)	Virtue (1.36)
	Instructing (1.31)	Instructing (1.31)
	Optimism (2.00)	Optimism (2.00)
Optimist	Optimism (2.00)	Optimism (2.00)
Well-Adjusted	Adjustment (1.85)	Adjustment (1.85)
	Even-Tempered (1.62)	Even-Tempered (1.62)
	Optimism (1.38)	Optimism (1.38)
	Responsibility (1.38)	Responsibility (1.38)
	Cooperation (1.31)	Cooperation (1.31)
	--	Consideration (1.00) ^{1,3}
	Virtue (1.00)	Virtue (1.00)
Neuroticism	Adjustment (1.93)	Adjustment (1.93)
	Even-Tempered (1.85)	Even-Tempered (1.85)
	Adaptability (1.00)	Adaptability (1.00)
	Optimism (1.00)	Optimism (1.00)
Stress-Under-Pressure	Adjustment (1.93)	Adjustment (1.93)

	Adaptability (1.64)	Adaptability (1.64)
	Even-Tempered (1.54)	Even-Tempered (1.54)
	Self-Control (1.54)	Self-Control (1.54)
	--	Warrior Ethos (1.54) ^{2,3}
	Persistence (1.23)	Persistence (1.23)
	Courage (1.21)	Courage (1.21)
Temperamental	Even-Tempered (2.00)	Even-Tempered (2.00)
	Self-Control (1.64)	Self-Control (1.64)
	Accepts Feedback (1.54)	Accepts Feedback (1.54)
	Professionalism (1.54)	Professionalism (1.54)
	Adjustment (1.50)	Adjustment (1.50)
	--	Warrior Ethos (1.46) ^{2,3}
	Cooperation (1.00)	Cooperation (1.00)
Worry	Adjustment (1.93)	Adjustment (1.93)
	Optimism (1.71)	Optimism (1.71)
	Self-Efficacy (1.15)	Self-Efficacy (1.15)
Angry-Hostility	Even-Tempered (2.00)	Even-Tempered (2.00)
	--	Consideration (1.69) ^{1,3}
	Self-Control (1.69)	Self-Control (1.69)
	Professionalism (1.62)	Professionalism (1.62)
	--	Warrior Ethos (1.43) ^{2,3}
	Cooperation (1.38)	Cooperation (1.38)
	Adaptability (1.23)	Adaptability (1.23)
	Optimism (1.23)	Optimism (1.23)
	Adjustment (1.21)	Adjustment (1.21)
Extraversion	Activity (1.71)	Activity (1.71)
	Team Orientation (1.38)	Team Orientation (1.38)
Reserved	--	Dominance (1.46) ^{2,3}
Dominance-Leader	--	Dominance (2.00) ^{2,3}
	--	Followership (1.79) ³
	Courage (1.38)	Courage (1.38)
	Achievement (1.31)	Achievement (1.31)
	Self-Efficacy (1.31)	Self-Efficacy (1.31)
Excitement-Seeking	Activity (1.50)	Activity (1.50)
	Curiosity (1.46)	Curiosity (1.46)
High-Intensity Pleasure	--	--
Activity	Activity (2.00)	Activity (2.00)
	Time-Sharing (1.43)	Time-Sharing (1.43)
	--	Physical Conditioning (1.31) ³
Spontaneous-Variety	Deliberation (1.64)	Deliberation (1.64)
	Activity (1.31)	Activity (1.31)

	Curiosity (1.00)	Curiosity (1.00)
Conscientiousness	Order (1.79)	Order (1.79)
	Persistence (1.79)	Persistence (1.79)
	Self-Discipline (1.77)	Self-Discipline (1.77)
	Timeliness (1.77)	Timeliness (1.77) ³
	Responsibility (1.64)	Responsibility (1.64)
	Attention to Detail (1.62)	Attention to Detail (1.62)
	Deliberation (1.62)	Deliberation (1.62)
	Achievement (1.38)	Achievement (1.38)
	Self-Control (1.23)	Self-Control (1.23)
	Vigilance (1.23)	Vigilance (1.23)
Achievement-Striving	Achievement (1.93)	Achievement (1.93)
	Self-Discipline (1.71)	Self-Discipline (1.71)
	Persistence (1.64)	Persistence (1.64)
	--	Learning Orientation (1.46) ^{2,3}
	Responsibility (1.31)	Responsibility (1.31)
Order	Order (2.00)	Order (2.00)
	Attention to Detail (1.62)	Attention to Detail (1.62)
	Professionalism (1.46)	Professionalism (1.46)
	Deliberation (1.38)	Deliberation (1.38)
Self-Discipline	Self-Discipline (2.00)	Self-Discipline (2.00)
	Persistence (1.86)	Persistence (1.86)
	Timeliness (1.77)	Timeliness (1.77) ³
	Professionalism (1.69)	Professionalism (1.69)
	--	Warrior Ethos (1.64) ^{2,3}
	Achievement (1.62)	Achievement (1.62)
	Responsibility (1.62)	Responsibility (1.62)
	Deliberation (1.38)	Deliberation (1.38)
Deliberation	Deliberation (1.93)	Deliberation (1.93)
	Problem Solving (1.77)	Problem Solving (1.77)
	Decision Making (1.69)	Decision Making (1.69)
	Attention to Detail (1.46)	Attention to Detail (1.46)
	Self-Discipline (1.31)	Self-Discipline (1.31)
	Reasoning (1.15)	Reasoning (1.15)
	Critical Thinking (1.00)	Critical Thinking (1.00)
	Self-Control (1.00)	Self-Control (1.00)
Unconventional	Unconventional (2.00)	--
	Ingenuity (1.62)	Ingenuity (1.62)
	--	Followership (1.14) ³
Openness	Curiosity (1.79)	Curiosity (1.79)
	--	Tolerance (1.62) ^{1,3}
	--	Learning Orientation (1.57) ^{2,3}

	Adaptability (1.07)	Adaptability (1.07)
Creative	Ingenuity (2.00)	Ingenuity (2.00)
	Unconventional (1.64)	--
	Problem Solving (1.43)	Problem Solving (1.43)
	Curiosity (1.15)	Curiosity (1.15)
Reflective	Depth (1.93)	Depth (1.93)
	Self-Awareness (1.86)	Self-Awareness (1.86) ³
	Accepts Feedback (1.38)	Accepts Feedback (1.38)
Scientific Interest	Curiosity (1.54)	Curiosity (1.54)
	--	Learning Orientation (1.38) ^{2,3}
Cultured	--	Tolerance (1.38) ^{1,3}
Imagination	Ingenuity (1.62)	Ingenuity (1.62)
Machiavellianism	Virtue (1.86)	Virtue (1.86)
	Integrity (1.79)	Integrity (1.79)
	Humility (1.77)	Humility (1.77)
	--	Followership (1.69) ³
	Moral Courage (1.62)	Moral Courage (1.62)
	Professionalism (1.62)	Professionalism (1.62)
	--	Warrior Ethos (1.54) ^{2,3}
	--	Consideration (1.14) ^{1,3}
	Cooperation (1.00)	Cooperation (1.00)
Interpersonal Tactics	Virtue (1.86)	Virtue (1.86)
	--	Consideration (1.69) ^{1,3}
	Humility (1.62)	Humility (1.62)
	Integrity (1.57)	Integrity (1.57)
	Professionalism (1.46)	Professionalism (1.46)
	--	Warrior Ethos (1.38) ^{2,3}
	Achievement (1.14)	Achievement (1.14)
Cynical View	Optimism (1.86)	Optimism (1.86)
	Cooperation (1.69)	Cooperation (1.69)
	--	Consideration (1.23) ^{1,3}
	--	Warrior Ethos (1.00) ^{2,3}
Envious	--	Consideration (1.38) ^{1,3}
Influence Tactics	--	Dominance (2.00) ^{2,3}
Independent	Team Orientation (1.92)	Team Orientation (1.92)
	--	Followership (1.00) ³

4.2.5 Evaluating Linkage Task Results

The linkage task results were evaluated to understand the extent to which the predictors are conceptually mapped to the array of important attributes and competencies for each job. The linkages were evaluated to determine several scenarios, including:

- AFOQT subtests linked to important attributes and competencies provide confirmatory value for subtests currently included in current composites; likewise, any AFOQT subtests not linked to important attributes and competencies would diminish the meaning of the composites and would require evaluation of the composite that excludes the predictor(s)
- AFOQT subtests linked to important attributes and competencies indicate ways the AFOQT composites could be redefined to measure a larger number of attributes and competencies
- AFOQT subtests not mapped to any attributes or competencies provide a roadmap for future test development to measure a broader range of success factors for officer performance

With these possible scenarios in mind, we first evaluated the extent to which linkages supported the AFOQT subtests currently included in composites. We determined that all subtests were strongly linked to the current composites, with the exception of Word Knowledge which was only moderately linked. The subtests that comprise the Verbal and Quantitative composites were found to link to CSO and Pilot jobs. Results of these linkages are shown in Tables 26 and 27.

The linkages were also reviewed to determine the number of linkages between subtests that are currently part of the Pilot, CSO, and ABM composites. Results of these linkages are shown in Tables 28 and 29. It was noted that the currently scored subtests map to a relatively small number of the overall important attributes and competencies. For example, the Pilot composite linked to 16 out of nearly 55 important competencies and attributes, which is a small portion of the overall factors contributing to success in the role. Similarly, the CSO composite linked to 13 out of the 60 important competencies and attributes, which is also a small portion of the overall set. It was noted that there is opportunity to expand the measurement of the AFOQT through the use of additional assessments that measure non-cognitive traits and potentially other cognitive abilities. For example, all 6 SDI domains mapped to 17 attributes and competencies. Examining the potential for SDI domains and facets in the competencies would greatly expand the range of what can be measured by the AFOQT. The tables below summarize the linkages of the subtests for the AFOQT Verbal, Quantitative, Pilot, and ABM Composites.

Table 26. AFOQT Verbal Composite with Attribute/Competency Linkages

	CSO	Pilot
Reading Comprehension	Paragraph Comprehension (2.00)	Paragraph Comprehension (2.00)
	Working Memory (1.54)	Working Memory (1.54)
	Reasoning (1.43)	Reasoning (1.43)
	Critical Thinking (1.38)	Critical Thinking (1.38)
	Attention to Detail (1.00)	Attention to Detail (1.00)
Verbal Analogies	Reasoning (1.64)	Reasoning (1.64)
	Perceptual Speed and Accuracy (1.46)	Perceptual Speed and Accuracy (1.46)
	Intellectual Efficiency (1.38)	Intellectual Efficiency (1.38)
Word Knowledge	Long-term Memory (1.38)	Long-term Memory (1.38)
	Intellectual Efficiency (1.31)	Intellectual Efficiency (1.31)
	Perceptual Speed and Accuracy (1.15)	Perceptual Speed and Accuracy (1.15)

Table 27. AFOQT Quantitative Composite with Attribute/Competency Linkages

	CSO	Pilot
Arithmetic Reasoning	Arithmetic Reasoning (2.00)	Arithmetic Reasoning (2.00)
	Mathematics Knowledge (1.93)	Mathematics Knowledge (1.93)
	Reasoning (1.64)	Reasoning (1.64)
	Perceptual Speed and Accuracy (1.62)	Perceptual Speed and Accuracy (1.62)
	Intellectual Efficiency (1.54)	Intellectual Efficiency (1.54)
	Problem Solving (1.36)	Problem Solving (1.36)
	Attention to Detail (1.31)	Attention to Detail (1.31)
	Critical Thinking (1.29)	Critical Thinking (1.29)
Math Knowledge	Mathematics Knowledge (2.00)	Mathematics Knowledge (2.00)
	Arithmetic Reasoning (1.79)	Arithmetic Reasoning (1.79)
	Perceptual Speed and Accuracy (1.69)	Perceptual Speed and Accuracy (1.69)
	Intellectual Efficiency (1.46)	Intellectual Efficiency (1.46)
	Long-term Memory (1.23)	Long-term Memory (1.23)
	Reasoning (1.15)	Reasoning (1.15)

Table 28. AFOQT Pilot Composite with Attribute/Competency Linkages

AFOQT Subtest	Pilot
Math Knowledge	Mathematics Knowledge (2.00)
	Arithmetic Reasoning (1.79)
	Perceptual Speed and Accuracy (1.69)
	Intellectual Efficiency (1.46)
	Long-term Memory (1.23)
	Reasoning (1.15)
Table Reading	Perceptual Speed and Accuracy (1.86)
	Attention to Detail (1.62)
	Flexibility of Closure (1.62) ²
	Intellectual Efficiency (1.57)
	Time-Sharing (1.43)
	Working Memory (1.00)
Instrument Comprehension	Instrument Comprehension (2.00)
	Perceptual Speed and Accuracy (1.85)
	Intellectual Efficiency (1.71)
	Aviation Knowledge (1.69)
	Mental Rotation (1.64)
	Working Memory (1.58)
	Attention to Detail (1.50)
	Spatial Orientation (1.46)
	Time-Sharing (1.43)
	Mechanical Comprehension (1.00)

Table 29. AFOQT CSO Composite with Attribute/Competency Linkages

AFOQT Subtest	CSO
Word Knowledge	Long-term Memory (1.38)
	Intellectual Efficiency (1.31)
	Perceptual Speed and Accuracy (1.15)
Math Knowledge	Mathematics Knowledge (2.00)
	Arithmetic Reasoning (1.79)
	Perceptual Speed and Accuracy (1.69)
	Intellectual Efficiency (1.46)
	Long-term Memory (1.23)
	Reasoning (1.15)
Table Reading	Perceptual Speed and Accuracy (1.86)
	Attention to Detail (1.62)
	Flexibility of Closure (1.62)
	Intellectual Efficiency (1.57)
	Time-Sharing (1.43)
	Working Memory (1.00)
Block Counting	Perceptual Speed and Accuracy (1.79)
	Mental Rotation (1.69)
	Working Memory (1.62)
	Flexibility of Closure (1.38)
	Intellectual Efficiency (1.38)
	Attention to Detail (1.21)
	Spatial Orientation (1.15)

As noted previously, job analysis information was not available for the ABM role to evaluate the relatedness of tests currently in the ABM composite to required attributes and competencies for that role. This is an area that should be reviewed when sufficient ABM job analysis data is available.

4.2.6 Mapped but Not Included in AFOQT Scoring

All SDI domains and facets were found to uniquely map to important attributes and competencies, indicating the potential for the SDI to augment the measurement of the AFOQT. For example, the SDI facets of Team Player, Optimistic, and Well Adjusted uniquely mapped to several attributes that are not already accounted for by AFOQT cognitive subtests.

4.2.7 Unmapped Attributes/Competencies

Many attributes that were deemed important for the CSO and/or pilot roles were not strongly or moderately linked to any AFOQT subtests or scales, including those in Table 30. It may be that these attributes and competencies are best assessed using other techniques, such as the Test of Basic Aviation Skills (Carretta, 2005). We have reviewed the unmeasured attributes and

competencies for suitability for measurement. Appendix C indicates other measures that were identified. This list of unmeasured attributes and competencies provides a roadmap for future test development.

Table 30. Important Attributes and Competencies Not Linked to any AFOQT Subtest

Situational Awareness
Commitment to Serve
Rate Control
Auditory Attention
Control Precision
Reaction Time
Active Listening
Multi-Limb Coordination

In sum, the results of the linkage task describe the relatedness of the current AFOQT subtests and scales to a range of officer attributes and competencies that were previously identified as being important and expected for performance in the pilot and CSO roles. These results provided foundational information about how to re-conceptualize AFOQT composites in a way that would identify relevant subtests that were job-related. We believe that the conceptual mapping between predictors and competencies is a necessary criterion to satisfy for evaluating the soundness of the composites.

4.3 Objective 3: Evaluating the Validity, Subgroup Differences, and Adverse Impact for the Current Composites

In this section, we describe analyses and results for how the AFOQT subtests and current composites (those used in operation for selection and classification decisions) relate to the various criteria of interest. In this way, we investigate the criterion-related validity of the AFOQT subtests and composites. First, we describe the properties of the criteria variables followed by correlations describing the relationships between the currently scored AFOQT subtests and composites with the range of prioritized criteria variables. Following the validity analysis, we investigate the subgroup mean differences between minority (non-White, Hispanic, female) and majority groups (White, Hispanic, male) in terms of performance on the AFOQT tests and composites. We also evaluate passing rates for different gender, race, and ethnicity groups and comparisons of passing rates as expressed in terms of adverse impact ratios (AIRs). The results generated from this set of analyses were intended to describe the current state of the AFOQT as well as provide a reference point for evaluating alternative composites described in Objective 4.

As part of evaluating the validity for the current subtests and composites, we started with developing a set of hypotheses for the type of criteria expected to be predicted by the AFOQT. We endeavored to test the relationships between Verbal and Quantitative subtests and training/performance outcomes, and intended to correct for criteria unreliability and range restriction for individual predictor-criterion correlations using unrestricted mean and standard

deviations from the predictor-only data set. We also planned to test relationships between job-specific subtests and Pilot, CSO, and ABM composites using this approach.

Of particular interest was the relationship between the AFOQT and training attrition. Upon examination of the attrition data, we noted limited positive attrition (N = 329) across attrition reasons. To enable analyses, we collapsed across non-medical attrition reasons (N = 281) for analysis purposes.

4.3.1 Criteria Descriptive Statistics

Criteria data were available for a more limited group of officers compared to the available AFOQT data. The sample size ranged from 331 to 5,718. Table 31 provides descriptive statistics for training performance scores for OTS, ROTC, and USAFA. Definitions of these performance outcomes are provided in the Method section.

**Table 31. Descriptive Statistics for Training Performance (OTS, ROTC, USAFA)
Criteria Variables**

Criteria	Data	N	Mean	SD	Min	Max	Skew	Kurtosis
ABM: MASS Total	OTS	321	46.54	4.25	35	93	4.10	44.27
ABM: Raw Acad	OTS	331	95.87	2.45	87	100	-0.65	0.11
CSO: MASS Total	OTS	742	49.75	7.51	30	73	0.05	-0.30
CSO: Raw Acad	OTS	724	94.06	4.59	48	100	-3.81	29.91
CSO: Raw Check	OTS	693	55.36	7.95	34	87	0.63	0.53
CSO: Raw Daily	OTS	742	36.25	3.90	25	50	0.36	0.68
Pilot: MASS Total	OTS	2856	50.04	7.34	25	79	0.19	-0.04
Pilot: Raw Acad	OTS	2851	94.10	4.97	44	100	-3.65	29.31
Pilot: Raw Check	OTS	2402	63.15	7.95	43	88	0.07	-0.58
Pilot: Raw Daily	OTS	2856	43.02	5.03	26	70	0.60	1.51
RPA: MASS Total	OTS	835	49.62	6.83	31	75	0.33	0.34
RPA: Raw Acad	OTS	835	93.22	6.74	47	100	-3.40	14.20
RPA: Raw Check	OTS	735	73.05	3.99	57	98	1.52	6.28
RPA: Raw Daily	OTS	835	50.57	4.22	32	68	-0.27	3.20
SUPT: MASS Total	OTS	1391	61.03	14.06	19	89	0.05	-1.17
SUPT: Raw Acad	OTS	1365	96.40	2.34	85	100	-0.78	0.74
SUPT: Raw Check	OTS	1365	72.27	16.85	15	98	-0.43	-1.05
SUPT: Raw Daily	OTS	1365	66.64	5.01	52	85	0.33	0.23
AEFCComp	ROTC	5964	3.94	0.68	2.57	5	0.07	-1.17
O_MERIT	USAFA	5717	484.26	282.67	1	1019	0.04	-1.16
GPA	USAFA	5718	3.08	0.43	2.03	3.99	0.05	-0.82

3.3.2 Approach to Correlational Analyses for AFOQT Subtests with Training Outcomes

The cognitive subtests were evaluated in relation to performance at Air Force training programs: SUPT, Undergraduate Remotely Piloted Aircraft Training (URT), Combat System Officer Training, and Air Battle Manager Training. Validity analysis is reported in this section in terms of correlations and regression analyses. Pearson product-moment correlations with corrections for restriction of range (using unrestricted mean and standard deviation values for the predictor-only data) as a function of pre-selection on the assessment and criterion unreliability ($r_{yy} = .52$) are included.

4.3.3 Correlations between Cognitive Subtests and Criterion Variables

Correlational analyses were first conducted between the cognitive subtests and the prioritized/hypothesized criteria. Given the large number of correlations produced in this set of analyses and the large sample size that was likely to yield statistically significant results, a threshold of $\pm .10$ was adopted as an indicator of a meaningful correlation.

As summarized in Table 32, the observed cognitive subtest correlations were generally zero to small for most training criteria. Notable exceptions are the Academic outcome for ABM students which was correlated highly with the Verbal Analogies subtest ($r = .26$) and the Reading Comprehension subtest ($r = .22$). The Physical Science subtest correlated with the Pilot and CSO MASS Score ($r = .23$ and $.22$, respectively). Instrument Comprehension and Aviation Information were the subtests most highly correlated to performance outcomes. All the cognitive subtests demonstrated at least one correlation with a rating area at or above the $\pm .10$ threshold. Table 33 presents correlations corrected for reliability attenuation of the criterion and restriction of range. As expected, the correlations increased after the corrections were applied.

Table 32. Uncorrected Correlations for Cognitive Subtests and Criteria Variables

Training Outcome	N	Verbal Analogies	Arithmetic Reasoning	Word Knowledge	Math Knowledge	Reading Comp	Physical Science	Table Reading	Instrument Comp	Block Counting	Aviation Information
SUPT: MASS	1391	-0.03	0.01	-0.04	0.00	0.03	0.06	0.07	0.20	0.09	0.07
SUPT: CFA	1365	0.04	0.05	0.03	0.02	0.04	0.06	0.02	0.08	0.07	0.08
SUPT: DFA	1365	0.04	0.11	0.00	0.06	0.10	0.11	0.12	0.30	0.09	0.25
SUPT: AA	1365	0.12	0.17	0.13	0.15	0.19	0.17	0.08	0.13	0.08	0.16
Pilot: MASS	2856	0.14	0.18	0.12	0.17	0.18	0.23	0.12	0.28	0.13	0.37
Pilot: CFA	2402	0.06	0.15	0.05	0.14	0.11	0.18	0.07	0.21	0.04	0.24
Pilot: DFA	2856	0.09	0.14	0.07	0.12	0.11	0.13	0.11	0.22	0.07	0.32
Pilot: AA	2851	0.17	0.14	0.15	0.11	0.18	0.20	0.07	0.16	0.13	0.21
CSO: MASS	742	0.06	0.18	0.03	0.19	0.13	0.22	0.14	0.25	0.15	0.25
CSO: CFA	693	0.04	0.12	-0.03	0.11	0.07	0.12	0.14	0.18	0.11	0.18
CSO: DFA	742	0.02	0.14	0.00	0.12	0.08	0.14	0.16	0.28	0.19	0.25
CSO: AA	724	0.12	0.11	0.09	0.13	0.15	0.17	0.05	0.12	0.06	0.11
RPA: MASS	835	0.06	0.13	0.10	0.04	0.17	0.11	0.18	0.22	0.11	0.29
RPA: CFA	735	0.04	0.05	0.06	-0.01	0.03	0.06	0.13	0.10	0.05	0.11
RPA: DFA	835	0.04	0.12	0.05	0.07	0.07	0.11	0.12	0.22	0.07	0.29
RPA: AA	835	0.04	0.08	0.08	0.08	0.15	0.06	0.06	0.04	0.03	0.13
ABM: MASS	321	0.17	0.09	0.17	0.18	0.16	0.14	0.16	0.17	0.13	0.18
ABM: AA	331	0.26	0.20	0.14	0.14	0.22	0.16	0.15	0.11	0.16	0.19
Note: Significant correlations are shown in bold font.											

Table 33. Correlations for Cognitive Tests and Criteria Variables Corrected for Criteria Unreliability and Range Restriction

Training Outcome	N	Verbal Analogies	Arithmetic Reasoning	Word Knowledge	Math Knowledge	Reading Comp	Physical Science	Table Reading	Instrument Comp	Block Counting	Aviation Info
SUPT: MASS	1391	-0.05	0.01	-0.07	0.00	0.05	0.09	0.11	0.38	0.13	0.11
SUPT: CFA	1365	0.08	0.09	0.04	0.03	0.08	0.08	0.03	0.16	0.10	0.13
SUPT: DFA	1365	0.07	0.17	0.01	0.10	0.18	0.18	0.19	0.54	0.14	0.38
SUPT: AA	1365	0.20	0.28	0.20	0.25	0.34	0.26	0.13	0.25	0.12	0.24
Pilot: MASS	2856	0.24	0.29	0.19	0.29	0.33	0.35	0.19	0.52	0.19	0.55
Pilot: CFA	2402	0.10	0.24	0.08	0.23	0.20	0.27	0.11	0.40	0.06	0.37
Pilot: DFA	2856	0.16	0.23	0.11	0.21	0.19	0.20	0.18	0.41	0.10	0.48
Pilot: AA	2851	0.28	0.23	0.24	0.18	0.32	0.31	0.12	0.30	0.20	0.32
CSO: MASS	742	0.10	0.29	0.04	0.31	0.24	0.34	0.22	0.46	0.22	0.38
CSO: CFA	693	0.07	0.19	-0.04	0.18	0.13	0.19	0.22	0.34	0.16	0.27
CSO: DFA	742	0.03	0.23	-0.01	0.20	0.15	0.22	0.25	0.51	0.28	0.38
CSO: AA	724	0.20	0.18	0.14	0.22	0.27	0.27	0.07	0.23	0.08	0.18
RPA: MASS	835	0.10	0.21	0.16	0.07	0.30	0.17	0.30	0.41	0.17	0.43
RPA: CFA	735	0.06	0.08	0.10	-0.01	0.06	0.08	0.21	0.19	0.08	0.16
RPA: DFA	835	0.07	0.19	0.07	0.12	0.14	0.18	0.20	0.41	0.10	0.44
RPA: AA	835	0.06	0.13	0.12	0.13	0.27	0.09	0.10	0.08	0.04	0.20
ABM: MASS	321	0.28	0.15	0.26	0.30	0.29	0.21	0.25	0.32	0.20	0.27
ABM: AA	331	0.43	0.32	0.22	0.24	0.39	0.25	0.24	0.22	0.24	0.29

4.3.4 Summary of Correlations for Cognitive Subtests with Training Performance

As noted above, the cognitive subtests demonstrated some robust correlations with multiple performance areas. All subtests demonstrated at least one correlation meeting or exceeding the $\pm.10$ threshold.

Next, multiple regression analyses were conducted to determine the overall level of prediction for the current operational composites with prioritized criteria variables. The Air Force indicated that the MASS variables (SUPT MASS for Verbal and Quantitative composites, and class-specific MASS for the rated specialty composites which are aggregate indicators of training outcomes), were most critical for validity analyses.

4.3.5 Current Composite Validity Analyses

To examine how well the verbal subtests predicted the SUPT MASS criterion, we used a model that included the verbal subtests from the first hurdle of the pilot assessment: Verbal Analogies, Word Knowledge, and Reading Comprehension. Interestingly, this model did not predict any of the variance associated with the SUPT MASS variable. See Table 34.

We also examined the predictiveness of the quantitative tests in relation to the criterion variable of SUPT MASS. Similar to the verbal predictors, the Arithmetic Reasoning and Math Knowledge subtests did not predict any of the variance associated with the SUPT MASS variable. See Table 35.

Table 34. Verbal Subtests Prediction of SUPT MASS

	B	Beta	SE	t-value	Significance
(Intercept)	62.76		3.35	18.75	0.00
Verbal Analogies	-0.02	-0.01	0.06	-0.41	0.68
Word Knowledge	-0.08	-0.05	0.05	-1.55	0.12
Reading Comprehension	0.08	0.04	0.06	1.22	0.22
R	R²	SE	F	df	p-value
0.05	0.00	14.06	1.32	3, 1390	0.27

Table 35. Quantitative Subtests Prediction of SUPT MASS

	B	Beta	SE	t-value	Significance
(Intercept)	60.49		2.82	21.46	0.00
Arithmetic Reasoning	0.02	0.01	0.06	0.39	0.70
Math Knowledge	-0.01	-0.01	0.06	-0.22	0.83
R	R²	SE	F	df	p-value
0.01	0.00	14.07	0.07	2, 1390	0.93

We also examined the predictive value of the verbal subtests to the IFT Pilot MASS criterion (specialized training that follows SUPT). See Table 36. This model predicted 4% of the variance associated with the IFT Pilot MASS variable ($R^2 = .04$). The low predictive value is surprising given the relevance of verbal ability to training performance.

Table 36. Prediction of Verbal Composite for IFT Pilot MASS

	B	Beta	SE	t-value	Significance
(Intercept)	36.95		1.22	30.32	<0
Verbal Analogies	0.07	0.08	0.02	3.32	0.00
Word Knowledge	0.01	0.01	0.02	0.30	0.76
Reading Comprehension	0.16	0.15	0.02	7.24	0.00
<i>R</i>	<i>R²</i>	<i>SE</i>	<i>F</i>	<i>df</i>	<i>p-value</i>
0.20	0.04	7.19	39.79	3, 2401	0.00

We also examined the prediction of the quantitative subtests in relation to the criterion variable of IFT Pilot MASS. Similar to the verbal tests, Arithmetic Reasoning and Mathematic Knowledge tests only predicted 4% of the variance associated with the IFT Pilot MASS variable. See Table 37.

Table 37. Prediction of Quantitative Composite for IFT Pilot MASS

	B	Beta	SE	t-value	Significance
(Intercept)	39.05		1.03	37.80	<0
Arithmetic Reasoning	0.11	0.12	0.02	5.37	0.00
Math Knowledge	0.09	0.10	0.02	4.14	0.00
<i>R</i>	<i>R²</i>	<i>SE</i>	<i>F</i>	<i>df</i>	<i>p-value</i>
0.20	0.04	7.20	58.13	2, 2855	0.00

Next, we examined the predictive validity of the Pilot composite for IFT Pilot MASS using a multiple regression approach. As summarized in Table 38, IFT Pilot MASS was significantly positively predicted by the Math Knowledge, Table Reading, Instrument Comprehension, and Aviation Information cognitive subtests. The overall model predicted 19% of the variance associated with IFT Pilot MASS ($R^2 = .19$), which supports the validity of the current Pilot composite.

Table 38. Prediction of Pilot Composite for IFT Pilot MASS

	B	Beta	SE	t-value	Significance
(Intercept)	13.89		1.53	9.10	<0
Math Knowledge	0.12	0.13	0.02	7.69	0.00
Table Reading	0.06	0.07	0.02	4.03	0.00
Instrument Comprehension	0.17	0.16	0.02	9.01	0.00
Aviation Information	0.28	0.31	0.02	17.37	0.00
<i>R</i>	<i>R</i>²	<i>SE</i>	<i>F</i>	<i>df</i>	p-value
.43	0.19	6.61	167.38	4, 2855	0.00

The predictive validity of the CSO composite for CSO MASS was next examined. CSO MASS was predicted by Word Knowledge, Math Knowledge, Table Reading, and Block Counting. The overall model predicted 5% of the variance associated with CSO MASS ($R^2 = .05$). See Table 39 for a summary.

Table 39. Prediction of CSO Composite for CSO MASS

	B	Beta	SE	t-value	Significance
(Constant)	33.95		2.93	11.59	0.00
Word Knowledge	0.01	0.01	0.03	0.39	0.69
Math Knowledge	0.14	0.16	0.03	4.18	0.00
Table Reading	0.07	0.09	0.03	2.17	0.03
Block Counting	0.07	0.08	0.03	2.09	0.04
<i>R</i>	<i>R</i>²	<i>SE</i>	<i>F</i>	<i>df</i>	p-value
0.23	0.05	7.33	10.34	4, 741	0.00

The predictive validity of the ABM composite for predicting ABM MASS was next examined. ABM MASS was predicted by Verbal Analogies, Math Knowledge, Table Reading, Instrument Comprehension, Block Counting, and Aviation Information. The overall model predicted 9% of the variance associated with ABM MASS ($R^2 = .09$). See Table 40.

Table 40. Prediction of ABM Composite for ABM MASS

	B	Beta	SE	t-value	Significance
(Constant)	32.79		2.55	12.84	0.00
Verbal Analogies	0.03	0.06	0.03	0.96	0.34
Math Knowledge	0.07	0.13	0.03	2.33	0.02
Table Reading	0.06	0.12	0.03	2.08	0.04
Instrument Comprehension	0.03	0.05	0.03	0.84	0.40
Block Counting	0.01	0.02	0.03	0.33	0.75
Aviation Information	0.06	0.14	0.03	2.21	0.03
<i>R</i>	<i>R</i>²	<i>SE</i>	<i>F</i>	<i>df</i>	p-value
0.30	0.09	4.10	5.02	6, 320	0.00

Next, given the importance of predicting attrition to the Air Force due to the high cost, analyses were conducted to compare attrite vs. non-attrite groups. For purposes of examining attrition, attrition data from all courses was examined in order to increase sample size for analysis. Table 41 presents descriptive statistics and score differences between the attrite and non-attrite groups for training criteria. Levene's test results were analyzed first to ensure equal variances between groups. When Levene's test results were significant, Welch's *t*-tests were run. Otherwise, a standard *t*-test was run. Both *t*-tests and Cohen's *d* were utilized to examine group differences. The differences between attrite and non-attrite groups on the MASS, RawAcad, and RawDaily criterion were significant, indicating that individuals who did not attrite performed higher than those who did.

Table 41. Descriptive Statistics and Differences for Attrite vs. Non-Attrite Groups for Training Criteria

Criterion		N	Mean	SD	<i>t</i>	<i>d</i>
MASS						
	Total	4870	53.09	10.97	-	-
	Non-Attrite	4767	53.27	10.95	-	-
	Attrite	103	45.05	8.69	-9.45**	-0.83
RawCheck						
	Total	4870	60.44	22.44	-	-
	Non-Attrite	4767	60.66	22.38	-	-
	Attrite	103	50.39	22.71	-4.61**	-0.46
RawAcad						
	Total	4870	93.72	10.4	-	-
	Non-Attrite	4767	93.76	10.4	-	-
	Attrite	103	91.42	10.02	-2.26*	-0.23
RawDaily						
	Total	4870	49.51	12.78	-	-
	Non-Attrite	4767	49.7	12.81	-	-
	Attrite	103	40.88	6.57	-13.09**	-0.87

Note. * $p < .05$; ** $p < .01$. Negative *t* and *d* values favor the comparison group (i.e., Non-Attrite), whereas positive *t* and *d* values favor the target group (i.e., Attrite).

Tables 42 and 43 present predictor descriptive statistics and score differences between the attrite and non-attrite groups. Levene's test results were analyzed first to ensure equal variances between groups. When Levene's test results were significant, Welch's *t*-tests were run. Otherwise, a standard *t*-test was run. Both *t*-tests and Cohen's *d* were utilized to examine group differences. The differences between attrite and non-attrite groups on the Pilot and ABM composite predictors were significant and showed small effect sizes on each with the non-attrite group outperforming the attrite group. The other composites did not show significant differences between the attrite and non-attrite groups.

Table 42. AFOQT Composite Descriptive Statistics and Cohen's *d* for Attrite vs. Non-Attrite Groups

Composite	Group	N	Mean	SD	Min	Max	Skew	Kurtosis	SE	Cohen's <i>d</i>
Pilot Composite	Attrite	284	54.21	5.23	37.14	66.32	-0.04	-0.36	0.31	-0.39
Pilot Composite	Non-Attrite	5772	56.21	5.11	20.80	69.76	-0.22	-0.07	0.07	
CSO Composite	Attrite	284	54.19	5.71	39.10	68.31	0.11	-0.33	0.34	-0.09
CSO Composite	Non-Attrite	5772	54.73	5.70	18.36	70.87	-0.03	-0.20	0.08	
ABM Composite	Attrite	284	54.00	5.10	40.91	66.39	0.04	-0.55	0.30	-0.28
ABM Composite	Non-Attrite	5772	55.40	4.90	21.48	70.25	-0.06	-0.06	0.06	
Verbal	Attrite	284	53.82	6.79	34.14	67.93	-0.19	-0.57	0.40	-0.08
Verbal	Non-Attrite	5772	54.35	6.58	29.30	70.15	-0.20	-0.70	0.09	
Quantitative	Attrite	284	52.44	7.88	33.91	70.03	-0.03	-0.90	0.47	-0.10
Quantitative	Non-Attrite	5772	53.19	7.83	26.23	70.04	-0.05	-0.80	0.10	
Academic Composite	Attrite	284	53.13	5.93	40.42	66.17	0.03	-0.80	0.35	-0.11
Academic Composite	Non-Attrite	5772	53.77	5.99	27.76	69.18	-0.05	-0.63	0.08	

Table 43. AFOQT Composite Descriptive Statistics and Differences for Attrite vs. Non-Attrite Groups

	Pilot Composite	CSO	ABM	Verbal Composite	Quantitative Composite	Academic Aptitude Composite
t	6.43	1.57	4.69	1.34	1.57	1.76
df	6054	6054	6054	6054	6054	6054
p-value	0.00	0.12	0.00	0.18	0.12	0.08
Attrite Mean	54.21	54.19	54.00	53.82	52.44	53.13
Non-Attrite Mean	56.21	54.73	55.40	54.35	53.19	53.77

As shown in Tables 44 and 45, the differences between attrite and non-attrite groups on the Physical Science, Table Reading, Instrument Comprehension, and Aviation Information subtests were significant and showed small effect sizes on each with the non-attrite group outperforming the attrite group. The other subtests did not show significant differences between the attrite and non-attrite groups.

Table 44. AFOQT Subtest Descriptive Statistics and Cohen's d for Attrite vs. Non-Attrite Groups

Subtest	Group	N	Mean	SD	Min	Max	Skew	Kurtosis	SE	Cohen's d
Verbal Analogies	Attrite	284	53.84	8.28	24.34	74.14	-0.20	-0.05	0.49	-0.08
	Non-attrite	5772	54.49	7.93	26.71	74.14	-0.20	-0.37	0.10	
Arithmetic Reasoning	Attrite	284	53.13	8.94	29.27	72.50	-0.09	-0.53	0.53	-0.10
	Non-attrite	5772	54.01	8.51	29.70	72.50	-0.11	-0.59	0.11	
Word Knowledge	Attrite	284	53.81	8.79	34.16	69.70	-0.19	-0.89	0.52	-0.01
	Non-attrite	5772	53.92	8.89	24.71	69.70	-0.27	-0.84	0.12	
Math Knowledge	Attrite	284	52.10	8.46	32.41	68.80	-0.08	-0.84	0.50	-0.08
	Non-attrite	5772	52.79	8.66	18.02	69.42	-0.16	-0.74	0.11	
Reading Comprehension	Attrite	284	53.80	7.71	30.39	69.93	-0.50	-0.08	0.46	-0.11
	Non-attrite	5772	54.65	7.31	9.95	69.93	-0.60	0.42	0.10	
Physical Science	Attrite	284	51.14	9.34	31.05	70.74	-0.07	-0.83	0.55	-0.14
	Non-attrite	5772	52.41	8.95	19.17	71.65	-0.19	-0.60	0.12	
Table Reading	Attrite	284	55.03	9.66	23.26	71.90	-0.42	0.01	0.57	-0.12
	Non-attrite	5772	56.17	8.66	9.14	71.90	-0.20	-0.17	0.11	
Instrument Comprehension	Attrite	284	53.15	7.95	29.57	64.94	-0.65	-0.29	0.47	-0.41
	Non-attrite	5772	56.26	7.02	26.50	64.94	-1.04	0.60	0.09	
Block Counting	Attrite	284	54.53	9.44	26.86	77.63	-0.10	-0.35	0.56	-0.05
	Non-attrite	5772	55.02	9.51	19.05	77.63	-0.07	-0.41	0.13	
Aviation Information	Attrite	284	56.25	9.35	32.45	78.20	0.17	-0.60	0.55	-0.28
	Non-attrite	5772	58.86	9.30	27.37	78.20	-0.14	-0.68	0.12	

Table 45. AFOQT Subtest Descriptive Statistics and Differences for Attrite vs. Non-Attrite Groups

	t	df	p-value	Attrite Mean	Non-Attrite Mean
Verbal Analogies	1.34	6054	0.18	53.84	54.49
Arithmetic Reasoning	1.69	6054	0.09	53.13	54.01
Word Knowledge	0.21	6054	0.84	53.81	53.92
Math Knowledge	1.3	6054	0.19	52.1	52.79
Reading Comprehension	1.91	6054	0.06	53.8	54.65
Physical Science	2.33	6054	0.02	51.14	52.41
Table Reading	2.16	6054	0.03	55.03	56.17
Instrument Comprehension	6.47	6054	0	53.15	56.26
Block Counting	0.85	6054	0.4	54.53	55.02
Aviation Information	4.6	6054	0	56.25	58.86

4.3.6 Attrition Analysis for Pilot Composite

Because the Pilot training course is of particular interest to the Air Force, results were calculated separately to take a closer look at the relationships between the predictors and the criterion. An analysis was conducted to evaluate the correlational results between the Pilot criterion and the predictors, including the criterion outcome of completion through the SUPT Primary course which requires completing both the Pilot IFT course and the SUPT T-6 Primary course. The AFOQT Pilot composite correlated $r = .41$ with the IFT Pilot MASS, indicating a robust relationship with the criterion. Additionally, the Pilot composite also correlated $r = .12$ with the completion through SUPT Primary criterion, indicating a small but useful relationship with this criterion.

4.3.7 Assessment of Subgroup Differences

Next, subgroup differences comparing test performance for gender, race, and ethnicity groups were analyzed using Cohen's d . The Hispanic/Latino subgroup was compared to Non-Hispanic/Latinos. The racial subgroups of Black/African American, Asian, American Indian/Alaskan Native, Native Hawaiian/Pacific Islander, and Two or More racial groups were compared to the White subgroup. The females were compared to males. We followed the general guidelines established by Cohen (1988), where effects less than 0.2 are considered negligible, effects between 0.2 and 0.5 are considered small, effects between 0.5 and 0.8 are considered medium, and effects greater than 0.8 are larger.

4.3.8 Cognitive Subtests

As shown in the Table 46, most of the subgroup differences observed for the cognitive subtests across both race and gender were medium-sized. Negative values indicate higher scores for the majority group; positive values indicate higher scores for the minority group. Larger, negative effects were present for the Black/African American subgroup. Negligible and small negative effects were found for Hispanics/Latino subgroup compared to the Non-Hispanic/Non-Latino and Two or More races subgroups. Medium and smaller negative effects were found for the Asian subgroup except for the mathematic related tests (Arithmetic Reasoning and Math Knowledge), which yielded smaller positive effects. Medium negative effects were present for the American Indian/Alaskan Native, and Native Hawaiian/ Pacific Islander subgroups.

For gender, small to large negative effects on the cognitive scores were found for females compared to males. The largest effect sizes were observed for the Instrument Comprehension and Aviation Information subtests.

Table 46. Cognitive Subgroup Differences

Cognitive Test	Hispanic / Latino	Black/ African American	Asian	Native Hawaiian / Pacific Islander	American Indian/ Alaskan Native	Two or More Races	Female
Verbal Analogies	-0.38	-0.86	-0.34	-0.71	-0.67	-0.25	-0.19
Arithmetic Reasoning	-0.37	-0.99	0.07	-0.74	-0.59	-0.28	-0.54
Word Knowledge	-0.34	-0.78	-0.40	-0.70	-0.68	-0.23	-0.24
Math Knowledge	-0.32	-0.84	0.31	-0.55	-0.55	-0.21	-0.38
Reading Comp	-0.33	-0.94	-0.49	-0.81	-0.65	-0.29	-0.36
Physical Science	-0.28	-0.94	-0.10	-0.78	-0.62	-0.25	-0.65
Table Reading	-0.28	-0.83	-0.11	-0.37	-0.34	-0.24	-0.14
Instrument Comp	-0.29	-1.19	-0.44	-0.68	-0.55	-0.31	-1.10
Block Counting	-0.24	-1.08	-0.19	-0.45	-0.41	-0.26	-0.49
Aviation Info	-0.36	-0.94	-0.56	-0.68	-0.62	-0.36	-0.86
<i>Note.</i> For cognitive subtests, White $N = 47636$, Black/African American $N = 7171$, Hispanic/Latino $N = 10242$, Non-Hispanic/Non-Latino $N = 59210$, Asian $N = 3906$, Native Hawaiian/ Pacific Islander = 330, American Indian/Alaskan Native $N = 355$, Two or More= 8211, Male $N = 52266$, and Female $N = 18507$.							

4.3.9 Composite Subgroup Differences

For the current composites, two of the 42 subgroup comparisons across ethnicity, race, and gender were considered negligible, 20 of the effects were small, 8 of the effects were considered medium, and 12 were considered large. Most notably, larger subgroup differences were found for the Black/African American and Native Hawaiian/ Pacific Islander subgroups. Complete results of the subgroup analyses for the AFOQT composites are presented in Table 47.

Table 47. AFOQT Composite Subgroup Differences

	Verbal	Quantitative	Academic	Pilot	CSO	ABM
Hispanic/Latino	-0.40	-0.36	-0.43	-0.43	-0.41	-0.44
Black/African American	-1.00	-0.96	-1.14	-1.38	-1.30	-1.37
Asian	-0.47	0.25	-0.10	-0.32	-0.28	-0.19
Native Hawaiian/ Pacific Islander	-0.86	-0.66	-0.88	-0.83	-0.76	-0.81
American Indian/ Alaskan Native	-0.77	-0.61	-0.80	-0.74	-0.72	-0.74
Two or More Races	-0.30	-0.25	-0.31	-0.40	-0.35	-0.38
Female	-0.30	-0.46	-0.44	-0.88	-0.42	-0.63
<i>Note.</i> For cognitive subtests, White $N = 47636$, Black/African American $N = 7171$, Hispanic/Latino $N = 10242$, Non-Hispanic/Non-Latino $N = 59210$, Asian $N = 3906$, Native Hawaiian/ Pacific Islander = 330, American Indian/Alaskan Native $N = 355$, Two or More= 8211, Male $N = 52266$, and Female $N = 18507$.						

4.3.10 Current Composite Subgroup Pass Rate Analyses

The minimum qualifying scores for officer commissioning through the ROTC and OTS programs is 15 or greater on the Verbal composite and 10 or greater on the Quantitative composite. Out of 70,867 examinees, the overall passing rate for the Verbal composite was 87.16% and Quantitative composite was 86.45%. The rate of test takers that passed both the Verbal and Quantitative composites was 79.26% ($N = 56,172$). The pass rates for the rated specialty composites (defined as a percentile score of 25) were 83.03% for Pilots ($N = 46,638$), 88.23% for CSOs ($N = 49,562$), and 85.44% for ABMs ($N = 47,996$). Taken together, the pass rate for the examinees that pass both the Hurdle 1 (officer qualification) composites, and the rated specialty composites are: 65.81% for Pilots ($N = 46,638$), 69.94% for CSOs ($N = 49,562$), and 67.73% for ABMs ($N = 47,996$).

4.3.11 Examination of Subgroup Differences and Adverse Impact

For the Verbal composite, the pass rates by subgroup ranged from 65% to 92%. The lowest pass rate was for the Black/African American subgroup and the highest pass rate among the White subgroup. Adverse impact ratios (AIRs) were computed by dividing the pass rate for the minority group by the pass rate for the majority group. It is desirable for this value to be greater than or equal to .80. All AIRs were acceptable except that for Blacks/African American which was .71, Native Hawaiian-Pacific Islander which was .75, and American Indian-Alaskan Native which was .77. See Table 48 for details.

Table 48. Verbal Composite Pass Rates and Subgroup Results

Subgroup	Pass N	Total N	Pass Rates	AIR
Hispanic/Latino	8092	10242	79.01%	0.89
Non-Hispanic/Non-Latino	52572	59210	88.79%	1.00
Black/African American	4711	7171	65.70%	0.71
Native Hawaiian-Pacific Islander	227	330	68.79%	0.75
American Indian-Alaskan Native	254	355	71.55%	0.77
Asian	3120	3906	79.88%	0.87
Two or More Races	7081	8211	86.24%	0.93
White	43983	47636	92.33%	1.00
Female	15010	18507	81.10%	0.91
Male	46686	52266	89.32%	1.00

For the Quantitative composite, the lowest pass rate was 66% for the Black/African American subgroup and the highest pass rate was 91% for the Asian subgroup. As with the Verbal composite, the AIR was below .80 for Blacks/African Americans. Table 49 summarizes the subgroup pass rates and AIRs for the Quantitative composite.

Table 49. Quantitative Composite Pass Rates and Subgroup Results

Subgroup	Pass N	Total N	Pass Rates	AIR
Hispanic/Latino	8234	10242	80.39%	0.92
Non-Hispanic/Non-Latino	51960	59210	87.76%	1.00
Black/African American	4771	7171	66.53%	0.74
Native Hawaiian-Pacific Islander	243	330	73.64%	0.82
American Indian-Alaskan Native	276	355	77.75%	0.86
Asian	3564	3906	91.24%	1.01
Two or More Races	6891	8211	83.92%	0.93
White	43039	47636	90.35%	1.00
Female	14545	18507	78.59%	0.88
Male	46653	52266	89.26%	1.00

The combined Verbal and Quantitative composite requirements for officer commissioning through ROTC and OTS (Hurdle 1) was 15 or greater for the Verbal composite and 10 or greater for the Quantitative composite. The joint pass rate for these requirements ranged from 51% to 86% across subgroups with the lowest AIR being .60 for Black/African Americans. The AIR was also below the .80 threshold for the Native Hawaiian-Pacific Islander and American Indian-Alaskan Native groups. See Table 50.

Table 50. Hurdle 1 (Officer Qualification) AFOQT Pass Rates and Subgroup Results

Subgroup	Pass N	Total N	Pass Rates	AIR
Hispanic/Latino	7070	10242	69.03%	0.85
Non-Hispanic/Non-Latino	48174	59210	81.36%	1.00
Black/African American	3696	7171	51.54%	0.60
Native Hawaiian-Pacific Islander	190	330	57.58%	0.67
American Indian-Alaskan Native	219	355	61.69%	0.72
Asian	2975	3906	76.16%	0.89
Two or More Races	6289	8211	76.59%	0.89
White	40778	47636	85.60%	1.00
Female	12929	18507	69.86%	0.85
Male	43185	52266	82.63%	1.00

For the Pilot composite which has a minimum qualifying score of 25, the pass rates ranged from 30% (Black/African Americans) to 81% (Whites) among the subgroups. Several subgroups were below the .80 AIR threshold, with the lowest AIR being .38 for Black/African Americans. Results are summarized in Table 51.

Table 51. Pilot Composite Pass Rates and Subgroup Results

Subgroup	Pass N	Total N	Pass Rates	AIR
Hispanic/Latino	6148	10242	60.03%	0.80
Non-Hispanic/Non-Latino	44259	59210	74.75%	1.00
Black/African American	2181	7171	30.41%	0.38
Native Hawaiian-Pacific Islander	169	330	51.21%	0.63
American Indian-Alaskan Native	199	355	56.06%	0.69
Asian	2772	3906	70.97%	0.88
Two or More Races	5542	8211	67.49%	0.83
White	38555	47636	80.94%	1.00
Female	9153	18507	49.46%	0.62
Male	42014	52266	80.38%	1.00

For the CSO composite (minimum qualifying score of 25), the pass rates among the subgroups ranged from 40% to 85%. The highest pass rates occurred for Whites (85%) and males (81%). The AIR was below .80 for several of the racial/ethnic groups with the lowest AIR of .47 for Blacks/African Americans. See Table 52.

Table 52. CSO Composite Pass Rates and Subgroup Results

Subgroup	Pass N	Total N	Pass Rates	AIR
Hispanic/Latino	6787	10242	66.27%	0.83
Non-Hispanic/Non-Latino	47107	59210	79.56%	1.00
Black/African American	2866	7171	39.97%	0.47
Native Hawaiian-Pacific Islander	202	330	61.21%	0.72
American Indian-Alaskan Native	228	355	64.23%	0.76
Asian	2969	3906	76.01%	0.90
Two or More Races	6103	8211	74.33%	0.88
White	40418	47636	84.85%	1.00
Female	12363	18507	66.80%	0.82
Male	42367	52266	81.06%	1.00

The pass rates for the ABM composite (minimum qualifying score of 25) ranged from 32% (Black/African Americans) to 82% (Whites). The lowest AIR of .39 was observed for Black/African Americans. See Table 53.

Table 53. ABM Composite Pass Rates and Subgroup Results

Subgroup	Pass N	Total N	Pass Rates	AIR
Hispanic/Latino	6259	10242	61.11%	0.81
Non-Hispanic/Non-Latino	44896	59210	75.83%	1.00
Black/African American	2302	7171	32.10%	0.39
Native Hawaiian-Pacific Islander	178	330	53.94%	0.66
American Indian-Alaskan Native	202	355	56.90%	0.70
Asian	2929	3906	74.99%	0.92
Two or More Races	5686	8211	69.25%	0.85
White	38838	47636	81.53%	1.00
Female	10557	18507	57.04%	0.72
Male	41359	52266	79.13%	1.00

For the combined Hurdle 1 (officer commissioning) and Pilot composite, the pass rates ranged from 24% to 75% among the subgroups. The lowest AIR occurred for the Blacks/African American group (0.33). See Table 54.

Table 54. Hurdle 1 + Pilot Composite Pass Rates and Subgroup Results

Subgroup	Pass N	Total N	Pass Rates	AIR
Hispanic/Latino	5313	10242	51.87%	0.76
Non-Hispanic/Non-Latino	40625	59210	68.61%	1.00
Black/African Americans	1753	7171	24.45%	0.33
Native Hawaiian-Pacific Islander	140	330	42.42%	0.57
American Indian-Alaskan Native	158	355	44.51%	0.59
Asian	2411	3906	61.73%	0.82
Two or More Races	4973	8211	60.57%	0.81
White	35693	47636	74.93%	1.00
Female	8395	18507	45.36%	0.62
Male	38199	52266	73.09%	1.00

For the combined Hurdle 1 (officer commissioning) and CSO composite, the pass rates ranged from 32% to 78% among the subgroups. The lowest AIR occurred for the Blacks/African American group (0.41). See Table 55.

Table 55. Hurdle 1 + CSO Pass Rates and Subgroup Results

Subgroup	Pass N	Total N	Pass Rates	AIR
Hispanic/Latino	5832	10242	56.94%	0.78
Non-Hispanic/Non-Latino	42975	59210	72.58%	1.00
Black/African American	2302	7171	32.10%	0.41
Native Hawaiian-Pacific Islander	153	330	46.36%	0.59
American Indian-Alaskan Native	183	355	51.55%	0.66
Asian	2607	3906	66.74%	0.85
Two or More Races	5444	8211	66.30%	0.85
White	37228	47636	78.15%	1.00
Female	10727	18507	57.96%	0.78
Male	38790	52266	74.22%	1.00

For the combined Hurdle 1 (officer commissioning) and ABM composite, the pass rates ranged from 27% to 76% among the subgroups. The AIR was lowest for the Blacks/African American group (0.35). See Table 56.

Table 56. Hurdle 1 + ABM Pass Rates and Subgroup Results

Subgroup	Pass N	Total N	Pass Rates	AIR
Hispanic/Latino	5538	10242	54.07%	0.77
Non-Hispanic/Non-Latino	41734	59210	70.48%	1.00
Black/African American	1928	7171	26.89%	0.35
Native Hawaiian-Pacific Islander	149	330	45.15%	0.59
American Indian-Alaskan Native	166	355	46.76%	0.61
Asian	2560	3906	65.54%	0.86
Two or More Races	5198	8211	63.31%	0.83
White	36418	47636	76.45%	1.00
Female	9674	18507	52.27%	0.71
Male	38276	52266	73.23%	1.00

Because the current composites are comprised of cognitive ability assessments, the standardized subgroup mean differences exhibited by the AFOQT subtests are expected and are consistent with mean differences commonly observed in cognitive ability test scores in employment settings. Research has consistently shown that cognitive ability tests produce mean score differences between White test takers and Black/African Americans test takers (Roth et al., 2006). The standardized subgroup mean differences observed in the AFOQT examinee sample are in line or lower than the subgroup mean differences reported in the professional literature for tests of cognitive ability.

The results obtained on the current composites indicated some robust validity findings (with the exception of the Verbal and Quantitative composites predicting SUPT MASS), but large subgroup differences and indication of adverse impact. In the next objective we sought to explore alternative composites that would maintain or potentially increase the level of predictive validity while reducing subgroup differences and the potential for adverse impact through the inclusion of unscored tests.

4.4 Objective 4: Exploration of Validity, Subgroup Differences, and Adverse Impact for Alternative Composites

As noted in the Introduction, a goal of the evaluation of AFOQT Form T was to determine its potential to aid in the commissioning and classification of a diverse officer workforce. While the historical evidence on AFOQT documents its predictive validity for training and job performance outcomes, the exclusive focus on assessing cognitive abilities has implications for the extent to which it can aid in diversity goals, given the large group differences that have been shown to exist on these types of assessments. The evaluation of AFOQT in terms of validity and subgroup differences is consistent with the cognitive ability literature (Roth et al., 2001; Schmidt & Hunter, 1998).

The linking task described in Objective 2 provided the foundation to identify additional AFOQT subtests/scales based on their relevance to Pilot and CSO roles. Performance requirements indicated that more than 60 attributes and competencies were necessary for success (e.g., Instrument Comprehension, Achievement, Situational Awareness, Aviation Knowledge, Adjustment, Control Precision, Attention to Detail, Critical Thinking, Responsibility, and Courage), a minority of which were mapped to currently scored subtests. The mappings highlighted that the AFOQT can be transformed to measure not only long-standing, well-established abilities with a track record of validity, but also skills that represent a broader range of what is required for officer success.

As part of evaluating alternative composites, several approaches were taken. First, the results of the analyses described in Objective 1 were used to determine whether the substantial overlap that exists in the construct-oriented composites (Verbal and Quantitative) could be the basis of reducing the number of subtests within the composites and evaluating potential reduction in group differences. For the job-oriented composites (Pilot, CSO, and ABM), the job analysis linkages were used to determine suitable additional assessments to evaluate for alternative composites. Those subtests with moderate to strong linkages were considered for inclusion in updated composites. Two approaches were used to evaluate alternative composites, including pareto-optimization (De Corte et al., 2011) to model the concurrent influences of predictors and qualification scores with respect to validity and adverse impact and regression-based prediction with cross-validation using a large criterion-related validity dataset.

In this section, we describe specific results for the validity and diversity analyses for AFOQT Form T alternative composites, along with discussion and next steps for continuing to evolve the AFOQT in future versions.

4.4.1 Evaluating Alterations to Existing Verbal and Quantitative Composites

We started our search for alternative composites by taking advantage of the strong within-composite intercorrelations (separately for Verbal and Quantitative) to determine the efficacy of reduced composites on validity and subgroup differences.

As noted in Objective 3, the subgroup differences for the current Verbal and Quantitative composites are summarized in Table 57.

Table 57. Subgroup Differences for Current Verbal and Quantitative Composites

Subgroup	Verbal	Quantitative
Hispanic/Latino	-0.40	-0.36
Black/African American	-1.00	-0.96
Native Hawaiian-Pacific Islander	-0.86	-0.66
American Indian-Alaskan Native	-0.75	-0.61
Asian	-0.46	0.25
Two or More Races	-0.30	-0.24
Female	-0.30	-0.46

The Verbal composite demonstrated a large mean difference for the Black/African American group ($d = -1.00$). By reducing the composite to one or two tests (Reading Comprehension or Verbal Analogies or Word Knowledge), the Black/African American group difference for a Verbal score could potentially be reduced since the Cohen's d values for the constituent subtests range from -0.83 to -0.99. However, the validity of the constituent assessments was near zero or even negative in the prediction of SUPT MASS (r 's range from -0.04 to 0.03). As such, this was not a viable strategy for meaningfully reducing group differences and maintaining or increasing validity.

Similarly, for the Quantitative composite, there was a large mean difference for the Black/African American group ($d = -0.96$). By reducing the composite to a single subtest (Math Knowledge), the Black/African American group difference for a Quantitative score could be reduced to -0.88. The validity of the Math Knowledge subtest, however, in the prediction of SUPTMass was zero ($r = 0.00$). As such, this was not considered a viable strategy for modifications for this composite.

Next, we examined the properties of the unscored assessments (Physical Science, SDI, and SJT). As part of another effort (Walsh et al., 2021), it was determined that the SJT required revisions. As such, analysis of the SJT was de-prioritized as the Air Force requested revisions to it before it would be considered for operational use.

4.4.2 Evaluating SDI and Physical Science

We start by exploring the use of unscored AFOQT subtests (SDI, Physical Science) in alternative composites. Definitions for SDI domains and facets, along with historical internal consistency estimates (Manley & Weissmuller, 2017) are shown in Table 58 below.

The Physical Science test is defined as: measuring knowledge in the area of science. Each of the questions or incomplete statements is followed by five choices. The candidate is to decide which one of the choices best answers the question or completes the statement.

Table 58. SDI Domain and Facet Definitions

Domain/Facet	Coefficient Alpha (Manley & Weissmuller, 2017)	Definition
A - Agreeableness	0.96	<i>The kinds of interactions an individual prefers ranging from compassion to antagonism</i>
Team Player	0.85	Being a dependable and responsible team member
Pleasant	0.90	Tendency to be in a pleasant mood, act friendly and get along well with others
Helpful-Altruistic	0.89	Tendency to be helpful and generous to others with time and effort
Optimist	0.88	Having a happy, hopeful, and encouraging outlook on life and the future
Well-Adjusted	0.86	Enjoy being around upbeat people while engaging in well-adjusted behavior with laughter, honesty, and dependability
N - Neuroticism	0.95	<i>The chronic level of emotional adjustment and instability</i>
Stress-Under-Pressure	0.86	Tendency to experience stress and discouragement when faced with high-pressure situations
Temperamental	0.88	Gets easily upset over events; can be irritable and sensitive to criticism
Worry	0.92	Worry a great deal over many things, including what the future holds and how things might go wrong
Angry-Hostility	0.91	React with anger and hostility to many stimuli, are easily upset and have short tempers
E - Extraversion	0.93	<i>The quantity and intensity of preferred interpersonal interactions, activity level, need for stimulation, and capacity for joy</i>
Reserved (R)	0.91	Are typically shy and reserved in social situations, often quite and withdrawn

Dominance-Leader	0.89	Tend to take charge in group settings, dominate conversations and viewed as a leader
Excitement-Seeking	0.92	Enjoy excitement and tend to seek out stimulating situations
High-Intensity Pleasure	0.90	Have a preference for environments with high intensity stimulation such as loud noises and bright lights
Activity	0.81	Prefer to stay active much of the time, have a wide range of activities and enjoy multitasking
Spontaneous-Variety	0.80	Frequently engage in unplanned and spontaneous activities
C - Conscientiousness	0.96	<i>The degree of organization, persistence, control, and motivation in goal-directed behavior</i>
Achievement-Striving	0.87	Usually engaged in goal-directed behavior and striving to achieve
Order	0.91	Are neat and organized with a strong preference for environments with orderly arrangement
Self-Discipline	0.88	Focused and dedicated to working hard and completing the task at hand in a timely manner
Deliberation	0.90	Carefully think through details of a plan and consequences of behavior before acting
Unconventional (R)	0.85	Not strictly bound to following rules, especially if they do not make sense in a given situation
O - Openness	0.92	<i>The active seeking and appreciation of experiences for one's own sake</i>
Creative	0.87	Having the ability to arrive at many novel and innovative solutions to ill-defined problems
Reflective	0.83	Propensity to engage in deep reflective thought and meditation; in tune with inner feelings
Scientific Interest	0.93	Being highly interested in all topics of science and technology
Cultured	0.91	Valuing artistic expression and performance such as art museums, theater, and dance
Imagination	0.86	Having an active and vivid imagination, often resulting in daydreaming and fantasy
M - Machiavellianism	0.91	<i>The level in which one engages in deceit, craftiness, and duplicity to expedite control</i>
Interpersonal Tactics	0.86	Employing manipulative and exploitive tactics with others as a means for achieving desired ends
Cynical View	0.86	Possessing a cynical and negative view of human nature, emphasized with lack of trust
Envious	0.91	Often experiences envious and resentful emotions concerning what others have
Influence Tactics	0.82	Employing charm and persuasive tactics with others to gain compliance

Independent	0.84	Having a preference to work alone on tasks and problems because others are seen as obstacles to accomplishment
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Note: SDI domains in bold.

4.4.3 Descriptive Statistics for Experimental Subtests (SDI, Physical Science).

Table 59 summarizes the descriptive statistics for Physical Science (reported as t-scores) and the SDI domain scores (scored as average raw item scores on a 5-point scale). We noted that the descriptive statistics for the SDI (domain and facet level) indicated a high degree of skew, with most scores falling within a narrow range of the theoretical score distribution. This indicated limited variability for the SDI which could inhibit the amount of additional variance that could be described by SDI in the prediction of officer criteria.

Table 59. Physical Science and SDI Domain Descriptive Statistics

SDI Domain	N	Mean	SD	Min	Max	Skew	Kurtosis
Physical Science	70867	47.44	9.93	19.17	71.65	0.09	-0.69
Agreeableness	70837	4.30	0.46	1	5	-1.97	9.12
Conscientiousness	70837	4.15	0.52	1	5	-1.13	2.98
Extroversion	70837	3.48	0.52	1	5	-0.25	0.09
Neuroticism	70837	1.91	0.60	1	5	1.02	1.52
Openness	70837	3.55	0.54	1	5	-0.24	0.14
Machiavellianism	70837	2.38	0.49	1	5	0.38	0.44

It was determined during the course of data cleaning that four SDI facets had data anomalies. The anomalies were deemed to be data transcription errors that could not be overcome. As such, results for these four SDI scales (High Intensity Pleasure, Spontaneous-Variety, Deliberation, and Imagination) are not included in the reporting of results for SDI. Table 60 summarizes the SDI facet descriptive statistics.

Table 60. SDI Facet Descriptive Statistics

SDI Facet	N	Mean	SD	Min	Max	Skew	Kurtosis
Team Player	70836	4.62	0.44	1	5	-3.93	25.08
Stress Under Pressure	70837	1.81	0.67	1	5	1.10	1.49
Reserved (R)	70837	2.34	0.86	1	5	0.55	-0.30
Achievement Striving	70837	4.38	0.55	1	5	-1.60	5.21
Creative	70837	4.15	0.62	1	5	-1.02	1.95
Interpersonal Tactics	70837	1.82	0.66	1	5	1.09	1.66
Pleasant	70837	4.35	0.59	1	5	-1.49	4.05
Temperamental	70836	1.75	0.64	1	5	1.22	2.17
Dominance Leader	70837	3.57	0.72	1	5	-0.35	0.01
Order	70837	4.06	0.72	1	5	-0.92	0.78
Reflective	70837	3.50	0.70	1	5	-0.15	-0.25
Cynical View	70837	2.61	0.73	1	5	0.12	-0.14
Helpful-Altruistic	70837	4.21	0.59	1	5	-1.06	2.58
Worry	70836	2.53	0.92	1	5	0.42	-0.49
Excitement Seeking	70836	3.96	0.95	1	5	-1.01	0.42
Self-Discipline	70837	4.17	0.66	1	5	-0.97	1.22
Scientific Interest	70837	3.55	1.01	1	5	-0.54	-0.44
Envious	70837	1.96	0.78	1	5	0.79	0.30
Independent	70837	2.80	0.69	1	5	0.15	0.05
Angry-Hostile	70837	1.55	0.64	1	5	1.84	4.50
Cultured	70836	3.45	0.91	1	5	-0.41	-0.29
Influence Tactics	70836	2.82	0.67	1	5	0.10	-0.16
Optimist	70836	3.95	0.65	1	5	-0.70	0.77
Unconventional (R)	70836	2.09	0.70	1	5	0.54	0.18
Activity	70836	3.68	0.70	1	5	-0.32	-0.02
Well Adjusted	70836	4.62	0.45	1	5	-3.86	24.76

4.4.4 Intercorrelations between cognitive tests and SDI domains and facets

Correlational analyses for the AFOQT cognitive subtests with the SDI domain and facet scores were conducted to evaluate construct validity across the measures and potential for predictor overlap. Construct validity is indicated when two measures purporting to assess the same construct show a high degree of relationship (convergent validity) or when two measures purporting to assess dissimilar constructs show no relationship (discriminant validity). Results are presented in the subsequent tables, including uncorrected correlations and correlations corrected for predictor reliability attenuation.

None of the SDI domain scores correlated highly with the cognitive subtests. See Table 61. These results support the construct validity of both the SDI and cognitive assessments. Because these scores are not correlated, each subtest can be assumed to be measuring a different construct (i.e., discriminant validity) and offer potential for incremental validity due to lack of shared variance.

Table 61. Uncorrected Correlations between Cognitive Subtests and SDI Domains

Cognitive Subtests	Agree	Neur	Extro	Cons	Open	Mach
Verbal Analogies	-0.07	-0.10	-0.03	-0.05	0.11	0.05
Arithmetic Reasoning	-0.10	-0.14	0.00	-0.02	0.02	0.11
Word Knowledge	-0.08	-0.10	-0.10	-0.06	0.14	0.03
Math Knowledge	-0.13	-0.18	-0.01	0.05	0.04	0.13
Reading Comp	-0.04	-0.09	-0.03	-0.09	0.08	0.02
Physical Science	-0.13	-0.20	-0.04	0.03	0.15	0.13
Table Reading	0.01	0.02	0.07	-0.09	-0.06	0.01
Instrument Comp	-0.06	-0.10	0.05	-0.08	0.05	0.08
Block Counting	-0.01	0.00	0.02	-0.12	0.03	0.01
Aviation Info	-0.05	-0.07	0.05	-0.09	0.01	0.04
<i>Note.</i> $N = 70837$. All correlations are significant at $p < 0.05$. Agree = Agreeableness, Neur = Neuroticism, Extro = Extroversion, Cons = Conscientiousness, Open = Openness, Mach = Machiavellianism.						

4.4.5 Intercorrelations between Cognitive Subtests and SDI Facets

Table 62 shows the uncorrected correlations between the AFOQT cognitive subtests and SDI facets. Scientific Interest was the SDI facet most highly correlated with the cognitive subtests, specifically Physical Science ($r = .33$) and Instrument Comprehension ($r = .23$). It was expected that the facet defined as “Being highly interested in all topics of science and technology” correlates with the physical science and technology (i.e., Physical Science and Instrument Comprehension) subtests.

The general lack of shared variance between the AFOQT cognitive subtests and SDI facets offers potential for incremental prediction in validity analysis, although limited variability on many SDI scales may preclude incremental prediction. Complete results are presented in the following tables.

Table 62. Uncorrected Correlations between Cognitive Tests and SDI Facets

	Verbal Analogies	Arithmetic Reasoning	Word Knowledge	Math Knowledge	Reading Comp	Physical Science	Table Reading	Instrument Comp	Block Counting	Aviation Info
Team Player	0.03	-0.02	0.03	-0.05	0.06	-0.05	0.04	-0.01	0.05	-0.01
Stress Under Pressure	-0.05	-0.05	-0.06	0.04	-0.10	0.02	-0.11	-0.12	-0.13	-0.13
Reserved	0.07	0.07	0.11	0.11	0.04	0.14	-0.05	0.03	0.02	0.02
Achievement Striving	-0.01	-0.05	-0.01	-0.09	0.01	-0.10	0.05	-0.04	0.03	-0.01
Creative	0.03	-0.01	0.03	-0.04	0.01	0.01	-0.02	0.03	0.05	0.01
Interpersonal Tactics	-0.07	0.02	-0.10	0.04	-0.10	0.03	-0.03	0.03	-0.03	0.00
Pleasant	-0.10	-0.12	-0.13	-0.13	-0.09	-0.16	0.02	-0.06	-0.01	-0.06
Temperamental	0.01	0.05	0.01	0.09	-0.02	0.08	-0.04	0.00	-0.06	-0.01
Dominance Leader	-0.04	-0.04	-0.07	-0.10	-0.03	-0.11	0.05	-0.01	0.02	0.00
Order	-0.16	-0.15	-0.18	-0.17	-0.16	-0.21	0.03	-0.12	-0.03	-0.09
Reflective	0.04	-0.02	0.08	0.00	0.03	0.04	-0.10	-0.04	-0.07	-0.08
Cynical View	-0.05	0.01	-0.04	0.06	-0.08	0.05	-0.05	0.00	-0.05	-0.03
Helpful-Altruistic	-0.08	-0.11	-0.08	-0.11	-0.07	-0.13	-0.03	-0.10	-0.06	-0.09
Worry	-0.10	-0.07	-0.12	0.00	-0.12	-0.03	-0.09	-0.10	-0.12	-0.12
Excitement Seeking	0.05	0.13	-0.01	0.15	0.07	0.15	0.09	0.22	0.12	0.19
Self-Discipline	-0.10	-0.12	-0.10	-0.18	-0.08	-0.19	0.04	-0.08	0.02	-0.04
Scientific Interest	0.15	0.16	0.15	0.18	0.13	0.33	0.06	0.23	0.19	0.20
Envious	0.10	0.16	0.07	0.21	0.08	0.20	0.06	0.16	0.06	0.12
Independent	0.08	0.10	0.08	0.10	0.04	0.09	0.02	0.01	0.03	0.01
Angry-Hostile	0.00	0.02	0.00	0.06	-0.03	0.06	-0.04	-0.01	-0.07	-0.01
Cultured	0.02	-0.13	0.06	-0.13	-0.04	-0.10	-0.10	-0.15	-0.09	-0.17
Influence Tactics	0.11	0.09	0.10	0.05	0.11	0.05	0.03	0.05	0.03	0.03
Optimist	-0.08	-0.08	-0.10	-0.12	-0.08	-0.14	0.01	-0.05	0.00	-0.05
Unconventional	0.09	0.15	0.08	0.18	0.08	0.19	0.01	0.10	0.01	0.09
Activity	-0.03	-0.03	-0.07	-0.05	-0.04	-0.08	0.06	-0.02	0.03	0.02
Well-Adjusted	0.03	0.01	0.00	0.00	0.05	-0.02	0.06	0.02	0.03	0.01
Note. N = 70863. All correlations $\geq \pm 0.09$ are significant at $p < 0.05$.										

4.4.6 Correlations between SDI Domains and Criteria Variables

The observed and corrected correlations between the SDI domain scores and aircrew training performance are summarized in Tables 63 (observed) and 64 (corrected). SDI domain scores demonstrated some robust correlations with multiple aircrew training performance areas. All scales demonstrated at least one correlation meeting or exceeding the $\pm .10$ threshold. In general, however, the pattern and magnitude of correlations were higher for the AFOQT cognitive tests, as described in Objective 3.

As shown in Table 62, the SDI domains that demonstrated the most robust uncorrected correlations are Agreeableness with the SUPT MASS score ($r = .14$) and Openness with RPA MASS and RPA Daily flying grades ($r = -.14$). Machiavellianism did not demonstrate a significant relationship with any of the

Table 63. Uncorrected Correlations between SDI Domains and Criteria Variables

Training Outcome	N	Agree	Neur	Extro	Cons	Open	Mach
SUPT: MASS	1391	0.14	0.02	-0.09	-0.03	0.06	0.04
SUPT: CFA	1365	-0.02	-0.04	-0.01	0.00	0.03	0.03
SUPT: DFA	1365	-0.01	-0.02	0.00	-0.02	-0.04	0.02
SUPT: AA	1365	0.02	0.03	-0.08	-0.04	0.03	0.00
Pilot: MASS	2855	-0.05	-0.01	-0.01	-0.04	-0.03	0.01
Pilot: CFA	2401	-0.04	-0.02	-0.01	-0.02	-0.02	0.02
Pilot: DFA	2855	-0.08	-0.02	0.02	-0.03	-0.06	0.01
Pilot: AA	2850	-0.02	0.05	-0.03	-0.04	0.00	-0.02
CSO: MASS	741	-0.04	-0.06	-0.03	-0.01	-0.09	0.04
CSO: CFA	692	0.00	-0.03	-0.01	-0.01	-0.03	0.04
CSO: DFA	741	-0.04	-0.04	-0.05	-0.02	-0.08	0.07
CSO: AA	723	-0.01	0.00	0.00	-0.02	-0.03	0.01
RPA: MASS	835	-0.04	-0.04	-0.06	-0.02	-0.14	-0.04
RPA: CFA	735	0.02	-0.04	0.02	-0.03	-0.05	-0.01
RPA: DFA	835	-0.08	-0.07	-0.02	0.01	-0.14	-0.03
RPA: AA	835	-0.05	0.00	-0.08	0.03	-0.10	-0.05
ABM: MASS	321	0.00	0.03	0.01	-0.01	-0.01	-0.05
ABM: AA	331	0.04	0.09	-0.06	-0.08	0.02	-0.06

Note. Bold cells indicate significance at $p < .01$.

training outcome variables. Overall, the SDI domains demonstrated relatively low correlations with the criterion variables, with the majority being well below the ± 0.10 threshold. As shown in Table 64, a similar pattern of results was observed after correcting the correlations for range restriction and criterion unreliability.

Table 64. Correlations between SDI Domains and Criteria Variables Corrected for Reliability Attenuation and Range Restriction

Training Outcome	N	Agree	Neur	Extro	Cons	Open	Mach
SUPT: MASS	1391	0.19	0.02	-0.13	-0.04	0.08	0.06
SUPT: CFA	1365	-0.02	-0.06	-0.01	0	0.04	0.05
SUPT: DFA	1365	-0.01	-0.03	0.01	-0.03	-0.06	0.03
SUPT: AA	1365	0.03	0.04	-0.11	-0.06	0.05	0
Pilot: MASS	2855	-0.07	-0.01	-0.02	-0.05	-0.04	0.01
Pilot: CFA	2401	-0.05	-0.02	-0.01	-0.03	-0.03	0.03
Pilot: DFA	2855	-0.11	-0.03	0.02	-0.04	-0.09	0.01
Pilot: AA	2850	-0.03	0.07	-0.04	-0.06	0	-0.03
CSO: MASS	741	-0.06	-0.08	-0.05	-0.01	-0.12	0.06
CSO: CFA	692	-0.01	-0.04	-0.01	-0.02	-0.05	0.06
CSO: DFA	741	-0.06	-0.06	-0.07	-0.03	-0.11	0.1
CSO: AA	723	-0.02	0.01	-0.01	-0.03	-0.05	0.01
RPA: MASS	835	-0.05	-0.06	-0.09	-0.02	-0.2	-0.05
RPA: CFA	735	0.03	-0.05	0.02	-0.04	-0.06	-0.02
RPA: DFA	835	-0.11	-0.11	-0.03	0.01	-0.19	-0.05
RPA: AA	835	-0.07	0	-0.12	0.04	-0.13	-0.07
ABM: MASS	321	-0.01	0.04	0.02	-0.02	-0.02	-0.07
ABM: AA	331	0.05	0.13	-0.09	-0.11	0.03	-0.08
Note. Correlations corrected using a criterion reliability value of $r_{yy} = .52$. Bold cells indicate significance at $p < .05$.							

4.4.7 Correlations between SDI Facets and Criteria Variables

A few of the SDI facets, such as Scientific Interest and Cultured, correlated with a rating area at or above the ± 0.10 threshold. Note that many of the significant correlations are negative, indicating that higher levels of SDI scores are related to lower levels of the criteria measures. Uncorrected (observed) correlations are presented in Table 65. Table 66 shows correlations corrected for reliability attenuation and range restriction.

Table 65. Uncorrected Correlations between SDI Facets and Criteria Variables

	SUPT				Pilot				CSO				RPA				ABM	
	MASS	CFA	DFA	AA	MASS	CFA	DFA	AA	MASS	CFA	DFA	AA	MASS	CFA	DFA	AA	MASS	AA
N	1391	1365	1365	1365	2855	2401	2855	2850	741	692	741	723	835	735	835	835	321	331
Team Player	0.03	-0.04	-0.02	0.00	-0.01	-0.03	-0.04	0.05	-0.01	-0.02	-0.01	0.01	-0.05	0.00	-0.07	-0.06	0.04	0.09
Stress Under Pressure	-0.04	-0.01	-0.06	-0.05	-0.05	-0.03	-0.05	-0.05	-0.03	-0.01	-0.05	-0.05	-0.03	-0.04	0.02	0.01	0.00	-0.09
Reserved	0.01	0.00	0.00	0.04	0.04	0.02	0.03	0.03	0.04	-0.01	0.06	0.03	0.03	-0.03	0.05	0.06	-0.03	0.03
Achievement Striving	0.04	-0.03	0.00	0.05	0.02	-0.01	-0.01	0.08	-0.03	-0.01	-0.04	0.03	0.01	-0.01	-0.04	0.01	0.03	0.09
Creative	0.05	0.00	-0.05	0.01	-0.01	-0.03	-0.03	0.01	-0.06	-0.03	-0.08	0.01	-0.08	-0.01	-0.10	-0.05	0.03	0.04
Interpersonal Tactics	0.03	0.07	0.02	-0.03	-0.02	0.00	-0.01	-0.03	0.04	0.04	0.07	0.00	-0.03	0.00	-0.02	-0.06	-0.08	-0.05
Pleasant	-0.01	-0.03	-0.02	-0.07	-0.06	-0.05	-0.05	-0.03	-0.05	-0.03	-0.04	-0.03	-0.06	0.01	-0.07	-0.05	-0.04	0.03
Temperamental	-0.05	-0.01	0.01	-0.02	-0.01	0.00	0.00	-0.03	0.04	0.02	0.02	0.00	0.01	0.00	0.02	0.02	0.01	-0.05
Dominance Leader	0.02	-0.03	0.02	0.01	0.02	0.00	0.02	0.01	-0.05	0.02	-0.05	-0.03	-0.08	0.00	-0.10	-0.07	0.06	-0.01
Order	0.04	0.01	0.01	0.01	-0.02	0.00	-0.01	0.00	-0.05	0.00	-0.03	-0.02	-0.06	-0.04	-0.10	-0.02	0.00	0.07
Reflective	-0.03	0.02	-0.04	-0.01	-0.04	-0.04	-0.05	0.00	-0.12	-0.09	-0.11	-0.03	-0.18	-0.07	-0.14	-0.05	-0.01	0.02
Cynical View	0.06	0.01	0.02	0.00	-0.02	0.01	-0.01	-0.04	0.01	0.01	0.03	-0.02	-0.07	-0.05	-0.02	-0.05	-0.03	-0.08
Helpful-Altruistic	-0.01	-0.01	-0.01	-0.01	-0.04	-0.05	-0.04	-0.02	-0.03	-0.02	-0.07	0.02	-0.07	-0.02	-0.09	0.01	0.06	0.03
Worry	0.03	0.00	-0.01	-0.04	-0.04	-0.04	-0.03	-0.03	-0.05	-0.07	-0.03	-0.04	-0.06	-0.07	-0.04	0.02	-0.01	-0.07
Excitement Seeking	0.01	0.00	0.06	-0.03	0.05	0.04	0.05	0.01	0.04	0.00	0.03	0.05	0.04	0.03	0.06	-0.05	-0.05	-0.04
Self-Discipline	0.06	-0.04	0.02	0.06	0.01	-0.01	-0.01	0.06	-0.02	0.00	-0.01	0.03	0.00	-0.05	-0.02	0.02	0.02	0.11
Scientific Interest	0.05	0.04	0.06	0.09	0.11	0.08	0.03	0.11	0.01	0.04	0.00	0.01	-0.03	-0.03	-0.03	-0.02	0.00	-0.01
Envious	-0.01	0.02	0.04	0.00	0.05	0.05	0.04	-0.01	0.06	0.00	0.07	0.02	0.05	0.02	0.02	0.02	-0.01	-0.06
Independent	-0.04	-0.01	-0.02	-0.01	0.05	0.02	0.04	0.04	0.03	0.02	0.04	0.04	0.01	-0.03	-0.02	0.03	0.00	0.04
Angry-Hostile	-0.04	0.01	0.00	-0.02	-0.01	0.01	-0.01	-0.03	0.04	0.04	0.01	0.03	0.04	0.02	0.03	0.05	-0.04	-0.05
Cultured	-0.11	0.00	-0.10	-0.06	-0.11	-0.08	-0.09	-0.06	-0.15	-0.09	-0.15	-0.08	-0.16	-0.07	-0.15	-0.10	0.00	-0.02
Influence Tactics	-0.05	0.03	-0.01	-0.03	-0.01	-0.01	0.01	-0.01	0.00	0.05	0.02	0.00	-0.09	0.01	-0.08	-0.09	-0.02	-0.02
Optimist	0.00	0.01	0.01	-0.04	-0.04	-0.04	-0.01	-0.03	-0.07	0.00	-0.04	-0.04	-0.03	-0.01	-0.05	-0.02	0.01	0.00
Unconventional	-0.02	0.07	0.03	-0.02	0.01	0.01	0.04	-0.04	0.06	0.04	0.04	0.03	0.02	0.01	0.05	-0.03	-0.04	-0.05
Activity	0.03	0.05	0.04	0.03	0.02	0.00	0.01	0.03	-0.01	0.01	0.02	-0.01	-0.04	0.00	-0.05	-0.06	0.03	0.03
Well-Adjusted	-0.01	-0.02	-0.03	-0.04	-0.02	-0.01	-0.03	0.00	-0.03	-0.04	-0.05	0.02	-0.07	0.00	-0.07	-0.05	0.00	0.05

	SUPT				Pilot				CSO				RPA				ABM	
	MASS	CFA	DFA	AA	MASS	CFA	DFA	AA	MASS	CFA	DFA	AA	MASS	CFA	DFA	AA	MASS	AA
Note. Bold cells indicate significance at $p < .01$.																		

Table 66. Correlations between SDI Facets with Criteria Variables Corrected for Criterion Unreliability and Range Restriction

	SUPT				Pilot				CSO				RPA				ABM	
	MASS	CFA	DFA	AA	MASS	CFA	DFA	AA	MASS	CFA	DFA	AA	MASS	CFA	DFA	AA	MASS	AA
N	1391	1365	1365	1365	2855	2401	2855	2850	741	692	741	723	835	735	835	835	321	331
Team Player	0.04	-0.05	-0.03	0	-0.02	-0.05	-0.06	0.08	-0.02	-0.03	-0.02	0.02	-0.07	-0.01	-0.1	-0.08	0.05	0.13
Stress Under Pressure	-0.07	-0.01	-0.10	-0.08	-0.07	-0.04	-0.08	-0.07	-0.04	-0.01	-0.04	-0.07	-0.04	-0.05	0.04	0.01	0	-0.13
Reserved	0.02	0.01	0	0.05	0.06	0.03	0.04	0.05	0.06	-0.01	0.06	0.04	0.05	-0.04	0.07	0.08	-0.04	0.05
Achievement Striving	0.06	-0.04	-0.01	0.07	0.03	-0.01	-0.02	0.11	-0.04	-0.01	-0.04	0.04	0.02	-0.01	-0.05	0.02	0.04	0.13
Creative	0.06	-0.01	-0.07	0.02	-0.02	-0.04	-0.04	0.01	-0.08	-0.03	-0.08	0.01	-0.11	-0.01	-0.13	-0.07	0.04	0.05
Interpersonal Tactics	0.04	0.10	0.02	-0.04	-0.02	0	-0.02	-0.05	0.05	0.05	0.05	0	-0.04	0	-0.03	-0.09	-0.11	-0.07
Pleasant	-0.01	-0.05	-0.03	-0.10	-0.09	-0.07	-0.07	-0.04	-0.07	-0.05	-0.07	-0.04	-0.08	0.02	-0.11	-0.08	-0.06	0.05
Temperamental	-0.07	-0.01	0.01	-0.03	-0.01	0	-0.01	-0.04	0.05	0.03	0.05	0	0.01	0	0.03	0.02	0.01	-0.07
Dominance Leader	0.02	-0.05	0.02	0.01	0.03	0.01	0.04	0.02	-0.07	0.03	-0.07	-0.05	-0.12	0.01	-0.14	-0.11	0.09	-0.02
Order	0.06	0.01	0.01	0.01	-0.03	0	-0.02	0	-0.08	0	-0.08	-0.03	-0.09	-0.05	-0.14	-0.03	0	0.09
Reflective	-0.04	0.03	-0.06	-0.02	-0.06	-0.06	-0.07	-0.01	-0.17	-0.12	-0.17	-0.05	-0.25	-0.1	-0.20	-0.07	-0.02	0.02
Cynical View	0.09	0.01	0.02	0	-0.03	0.01	-0.02	-0.06	0.02	0.01	0.02	-0.02	-0.09	-0.06	-0.02	-0.07	-0.05	-0.11
Helpful-Altruistic	-0.01	-0.01	-0.02	-0.01	-0.06	-0.06	-0.06	-0.03	-0.05	-0.02	-0.05	0.03	-0.10	-0.03	-0.13	0.01	0.09	0.04
Worry	0.04	0	-0.01	-0.05	-0.06	-0.05	-0.04	-0.05	-0.07	-0.1	-0.07	-0.06	-0.09	-0.11	-0.06	0.02	-0.01	-0.1
Excitement Seeking	0.02	0	0.10	-0.05	0.09	0.07	0.09	0.02	0.07	0	0.07	0.09	0.08	0.06	0.11	-0.08	-0.09	-0.07
Self-Discipline	0.08	-0.05	0.03	0.09	0.01	-0.01	-0.01	0.09	-0.03	0	-0.03	0.04	0	-0.07	-0.02	0.02	0.03	0.16
Scientific Interest	0.07	0.05	0.09	0.13	0.16	0.12	0.04	0.16	0.01	0.06	0.01	0.01	-0.04	-0.04	-0.05	-0.04	0	-0.02
Envious	-0.02	0.02	0.05	0	0.06	0.07	0.06	-0.01	0.08	0	0.08	0.02	0.06	0.02	0.03	0.03	-0.02	-0.09
Independent	-0.05	-0.01	-0.03	-0.02	0.07	0.04	0.06	0.05	0.05	0.03	0.05	0.05	0.02	-0.05	-0.02	0.05	0	0.05
Angry-Hostile	-0.05	0.01	0	-0.03	-0.02	0.01	-0.02	-0.05	0.05	0.06	0.05	0.04	0.05	0.03	0.04	0.07	-0.06	-0.07
Cultured	-0.15	0	-0.14	-0.08	-0.15	-0.10	-0.12	-0.09	-0.21	-0.12	-0.21	-0.10	-0.22	-0.09	-0.20	-0.14	0	-0.03
Influence Tactics	-0.07	0.05	-0.02	-0.04	-0.01	-0.01	0.01	-0.01	0	0.08	0	0	-0.13	0.01	-0.12	-0.14	-0.03	-0.03

	SUPT				Pilot				CSO				RPA				ABM	
	MASS	CFA	DFA	AA	MASS	CFA	DFA	AA	MASS	CFA	DFA	AA	MASS	CFA	DFA	AA	MASS	AA
Optimist	-0.01	0.02	0.01	-0.05	-0.06	-0.05	-0.02	-0.05	-0.1	0	-0.1	-0.06	-0.05	-0.01	-0.07	-0.03	0.02	0
Unconventional	-0.02	0.09	0.05	-0.02	0.02	0.02	0.05	-0.06	0.09	0.06	0.09	0.04	0.03	0.01	0.07	-0.04	-0.05	-0.07
Activity	0.04	0.07	0.06	0.05	0.03	0	0.02	0.05	-0.01	0.02	-0.01	-0.01	-0.06	-0.01	-0.08	-0.08	0.04	0.04
Well-Adjusted	-0.01	-0.03	-0.05	-0.05	-0.03	-0.01	-0.04	0	-0.04	-0.06	-0.04	0.03	-0.1	0	-0.10	-0.08	0	0.07
Note: The criterion reliability value used to correct the correlations was .52. Range restriction was corrected based on values from the OTS data. Bold cells indicate significance at $p < .05$.																		

Next, analyses were conducted to evaluate differences between attrite and non-attrite groups across all aircrew training courses combined (i.e., Pilot, CSO, ABM, RPA, and SUPT), using SDI domain scores calculated as the average rating for items in a given domain. As shown in Table 67 below, all of the mean score subgroup differences (d values) were small. The standardized differences in means for attrite and non-attrite groups were small, ranging from $-.17$ to $.15$. As shown in Table 68 a few differences were statistically significant due to the large sample size. The non-attrite group scored slightly lower on Conscientiousness and Neuroticism and slightly higher on Extroversion.

Table 67. SDI Domain Descriptive Statistics and Cohen's d for Attrite vs. Non-Attrite Groups

Domain	Group	N	Mean	SD	Min	Max	Skew	Kurtosis	SE	Cohen's d
Agreeableness	Attrite	284	4.20	0.53	1.13	4.97	-2.43	10.71	0.03	-0.06
	Non-attrite	5770	4.23	0.45	1.13	5.00	-1.45	5.97	0.01	
Conscientiousness	Attrite	284	4.15	0.53	1.44	4.97	-1.52	4.85	0.03	0.10
	Non-attrite	5770	4.10	0.49	1.25	5.00	-0.92	2.30	0.01	
Extraversion	Attrite	284	3.56	0.56	1.42	4.92	-0.56	0.79	0.03	-0.17
	Non-attrite	5770	3.65	0.48	1.25	4.98	-0.37	0.39	0.01	
Neuroticism	Attrite	284	1.94	0.62	1.00	4.31	1.01	1.25	0.04	0.15
	Non-attrite	5770	1.85	0.58	1.00	4.91	1.09	1.81	0.01	
Openness	Attrite	284	3.47	0.59	1.30	4.88	-0.46	0.87	0.03	0.09
	Non-attrite	5770	3.42	0.53	1.23	5.00	-0.11	0.00	0.01	
Machiavellianism	Attrite	284	2.42	0.50	1.22	4.19	0.44	0.30	0.03	0.00
	Non-attrite	5770	2.42	0.49	1.10	4.78	0.39	0.40	0.01	

Table 68. SDI Domain Descriptive Statistics and Differences for Attrite vs. Non-Attrite Groups

	Agreeableness	Conscientiousness	Extraversion	Neuroticism	Openness	Mach
t	0.83	-1.93*	2.46*	-2.40*	-1.36	0.04
df	6052	6052	6052	6052	6052	6052
p-value	0.41	0.05	0.01	0.02	0.18	0.97
Attrite Mean	4.21	4.15	3.56	1.94	3.47	2.42
Non-Attrite Mean	4.23	4.10	3.65	1.85	3.42	2.42

As with the SDI domain scores, all mean score differences between the attrite and non-attrite groups on the facets were small or negligible (d ranged from $-.40$ to $.22$). See Table 69.

However, as shown in Table 70, due to large sample size, some mean score differences were statistically significant. The differences between attrite and non-attrite groups on the Stress Under Pressure, Reflection, Worry, Excitement seeking, Scientific Interest, Cultured, Unconventional, and Adjustment SDI facet predictors were significant with the non-attrite group scoring slightly lower on the Stress under pressure, Reflection, Worry, and Cultured facets and slightly higher on the Excitement Seeking, Scientific Interest, Unconventional, and Adjustment facets.

Table 69. SDI Facet Descriptive Statistics and Cohen's *d* for Attrite vs. Non-Attrite Groups

Facet	Group	N	Mean	SD	Min	Max	Skew	Kurtosis	SE	Cohen's <i>d</i>
Team Player - A	Attrite	284	4.60	0.56	1.00	5.00	-4.21	22.91	0.03	-0.02
	Non-attrite	5770	4.61	0.42	1.00	5.00	-3.57	22.94	0.01	
Pleasant - A	Attrite	284	4.33	0.65	1.00	5.00	-2.15	7.86	0.04	-0.03
	Non-attrite	5770	4.35	0.57	1.00	5.00	-1.33	3.44	0.01	
Helpful-Altruistic- A	Attrite	284	4.16	0.67	1.00	5.00	-1.61	4.95	0.04	0.03
	Non-attrite	5770	4.14	0.58	1.00	5.00	-0.83	1.74	0.01	
Optimist - A	Attrite	284	3.96	0.70	1.13	5.00	-0.82	1.19	0.04	0.02
	Non-attrite	5770	3.95	0.63	1.13	5.00	-0.64	0.64	0.01	
Well-Adjusted – A	Attrite	284	4.58	0.57	1.00	5.00	-4.08	21.93	0.03	-0.16
	Non-attrite	5770	4.66	0.42	1.00	5.00	-4.16	28.82	0.01	
Stress Under Pressure - N	Attrite	284	1.77	0.68	1.00	4.50	1.12	1.53	0.04	0.11
	Non-attrite	5770	1.70	0.62	1.00	5.00	1.32	2.51	0.01	
Temperamental - N	Attrite	284	1.81	0.65	1.00	4.63	1.11	1.70	0.04	0.08
	Non-attrite	5770	1.76	0.62	1.00	5.00	1.14	1.81	0.01	
Worry - N	Attrite	284	2.56	0.95	1.00	5.00	0.41	-0.58	0.06	0.15
	Non-attrite	5770	2.42	0.89	1.00	5.00	0.53	-0.32	0.01	
Angry Hostile - N	Attrite	284	1.62	0.73	1.00	5.00	2.01	5.10	0.04	0.09
	Non-attrite	5770	1.56	0.64	1.00	5.00	1.75	3.96	0.01	
Reserved - E	Attrite	284	1.77	0.68	1.00	4.50	1.12	1.53	0.04	0.11
	Non-attrite	5770	1.70	0.62	1.00	5.00	1.32	2.51	0.01	
Dominance Leader - E	Attrite	284	3.67	0.74	1.13	5.00	-0.51	0.15	0.04	0.03
	Non-attrite	5770	3.65	0.67	1.00	5.00	-0.32	0.01	0.01	
Excitement Seeking - E	Attrite	284	4.00	0.96	1.00	5.00	-1.29	1.31	0.06	-0.40
	Non-attrite	5770	4.34	0.72	1.00	5.00	-1.56	2.69	0.01	
Activity- E	Attrite	284	3.71	0.70	1.13	5.00	-0.48	0.33	0.04	-0.06
	Non-attrite	5770	3.75	0.67	1.00	5.00	-0.34	-0.06	0.01	
Achievement Striving - C	Attrite	284	4.37	0.62	1.00	5.00	-2.07	7.10	0.04	0.05

Facet	Group	N	Mean	SD	Min	Max	Skew	Kurtosis	SE	Cohen's d
Order - C	Non-attribite	5770	4.34	0.54	1.00	5.00	-1.29	3.66	0.01	0.09
	Attribite	284	4.06	0.77	1.00	5.00	-1.01	0.80	0.05	
	Non-attribite	5770	3.99	0.71	1.00	5.00	-0.75	0.39	0.01	
Self-Discipline- C	Attribite	284	4.17	0.66	1.63	5.00	-0.81	0.55	0.04	0.09
	Non-attribite	5770	4.11	0.65	1.00	5.00	-0.82	0.77	0.01	
Unconventional - C	Attribite	284	2.11	0.67	1.00	4.25	0.34	-0.28	0.04	-0.14
	Non-attribite	5770	2.21	0.71	1.00	5.00	0.38	-0.11	0.01	
Creative – O	Attribite	284	4.12	0.68	1.00	5.00	-1.34	3.25	0.04	0.05
	Non-attribite	5770	4.09	0.62	1.00	5.00	-0.81	1.17	0.01	
Reflective - O	Attribite	284	3.52	0.74	1.25	5.00	-0.34	-0.03	0.04	0.19
	Non-attribite	5770	3.38	0.70	1.00	5.00	-0.04	-0.30	0.01	
Scientific Interest - O	Attribite	284	3.47	1.06	1.00	5.00	-0.49	-0.66	0.06	-0.13
	Non-attribite	5770	3.60	0.96	1.00	5.00	-0.54	-0.37	0.01	
Cultured - O	Attribite	284	3.41	0.96	1.00	5.00	-0.51	-0.26	0.06	0.22
	Non-attribite	5770	3.20	0.92	1.00	5.00	-0.24	-0.45	0.01	
Interpersonal Tactics - M	Attribite	284	1.88	0.70	1.00	5.00	1.18	1.83	0.04	0.04
	Non-attribite	5770	1.85	0.64	1.00	5.00	1.02	1.62	0.01	
Cynical View - M	Attribite	284	2.61	0.72	1.00	4.75	0.14	-0.22	0.04	0.04
	Non-attribite	5770	2.58	0.70	1.00	5.00	0.23	0.06	0.01	
Envious - M	Attribite	284	2.06	0.81	1.00	4.50	0.65	-0.15	0.05	-0.10
	Non-attribite	5770	2.14	0.79	1.00	5.00	0.56	-0.09	0.01	
Independent - M	Attribite	284	2.79	0.64	1.25	4.75	0.21	-0.08	0.04	0.02
	Non-attribite	5770	2.78	0.68	1.00	5.00	0.20	0.10	0.01	
Influence Tactics- M	Attribite	284	2.95	0.67	1.25	4.75	0.01	-0.54	0.04	0.06
	Non-attribite	5770	2.91	0.63	1.00	5.00	0.05	-0.08	0.01	

Table 70. SDI Facet Descriptive Statistics and Differences for Attrite vs. Non-Attrite Groups

	t	df	p-value	Attrite Mean	Non-Attrite Mean
Team Player – A	0.26	6052	0.79	4.60	4.61
Pleasant – A	0.62	6052	0.54	4.33	4.35
Helpful-Altruistic - A	-0.53	6052	0.60	4.16	4.14
Optimist – A	-0.12	6052	0.90	3.96	3.95
Well-Adjusted – A	2.36*	6052	0.02	4.58	4.66
Stress under Pressure- N	-1.86	6052	0.06	1.77	1.70
Temperamental - N	-1.41	6052	0.16	1.81	1.76
Worry – N	-2.60*	6052	0.01	2.56	2.42
Angry-Hostile - N	-1.74	6052	0.08	1.62	1.56
Reserved – E	-1.20	6052	0.23	2.30	2.24
Dominance Leader - E	-0.43	6052	0.66	3.67	3.65
Excitement Seeking - E	5.91*	6052	0.00	4.00	4.34
Activity – E	1.00	6052	0.32	3.71	3.75
Achievement Striving - C	-0.88	6052	0.38	4.37	4.34
Order – C	-1.47	6052	0.14	4.06	3.99
Self-Confidence - C	-1.40	6052	0.16	4.17	4.11
Unconventional - C	2.34*	6052	0.02	2.11	2.21
Creative – O	-0.86	6052	0.39	4.12	4.09
Reflective – O	-3.28*	6052	0.00	3.52	3.38
Scientific Interest- O	2.02*	6052	0.04	3.47	3.60
Cultured – O	-3.70*	6052	0.00	3.41	3.20
Interpersonal Tactics - M	-0.79	6052	0.43	1.88	1.85
Cynical View – M	-0.62	6052	0.53	2.61	2.58
Envious – M	1.61	6052	0.11	2.06	2.14
Independent- M	-0.21	6052	0.84	2.79	2.78
Influence Tactics - M	-0.92	6052	0.36	2.95	2.91

4.4.8 Subgroup Differences: SDI Domains

The potential for the SDI to mitigate the large mean score differences in the current AFOQT composites was next explored, by conducting subgroup differences analyses for SDI domains and facets. For the SDI domains, 40 of the 42 comparisons showed negligible mean score differences across race, ethnicity, and gender and 2 effects were considered small (e.g., effect size in the .20s). Negligible effects were seen for Hispanic/Latino, American Indian/Alaskan Native, and two or more ethnicities. A small positive effect was seen where the Blacks/African American group scored higher on Openness and Conscientiousness, the Asian group scored higher on Neuroticism and Openness but lower on Extroversion, and females scored higher than males on Conscientiousness and Neuroticism but lower on Machiavellianism. Complete results of the subgroup analyses for SDI domains are presented in Table 71.

Table 71. SDI Domains Subgroup Differences (*d* scores)

SDI Domain	Hispanic/ Latino	Black/ African American	Asian	Native Hawaiian/ Pacific Islander	American Indian/ Alaskan Native	Two or More	Female
Agreeableness	0.11	0.15	-0.10	0.14	0.13	0.01	0.14
Conscientiousness	0.14	0.27	-0.07	0.15	0.13	0.00	0.21
Extroversion	0.09	-0.16	-0.26	-0.09	0.05	-0.03	-0.01
Neuroticism	-0.03	0.00	0.36	0.15	0.00	0.08	0.22
Openness	0.12	0.20	0.23	0.14	0.19	0.15	-0.10
Machiavellianism	-0.14	-0.14	0.20	-0.06	-0.15	0.04	-0.25
<i>Note.</i> White <i>N</i> = 47636, Black/African American <i>N</i> = 7171, Hispanic/Latino <i>N</i> = 10242, Non-Hispanic/Non-Latino <i>N</i> = 59210, Asian <i>N</i> = 3906, Native Hawaiian/ Pacific Islander = 330, American Indian/Alaskan Native <i>N</i> = 355, Two or More = 8211, Male <i>N</i> = 52266, and Female <i>N</i> = 18507.							

As noted, medium and large subgroup differences which can potentially lead to adverse impact ratios that do not meet the four fifths rule were found across the cognitive tests for the minority subgroups (i.e., Black/African American, Hispanic/Latino, Native Hawaiian/ Pacific Islander, American Indian/Alaskan Native, and Female) with exception of the Asian subgroup. Therefore, the pattern of results for the SDI indicating negligible to small and many positive effects indicate promise to reduce the potential for adverse impact when added to the composite AFOQT scoring method.

4.4.9 Subgroup Differences: SDI Facets

For the SDI facets, the vast majority of comparisons across race, ethnicity, and gender groups were considered negligible; a small portion were considered small and medium with many favoring the minority subgroup (e.g., Achievement Striving: *d* = .43 favoring the Asian subgroup). Complete results of the subgroup analyses for SDI facets are presented in Table 72.

Table 72. SDI Facets Subgroup Differences

SDI Facet	Hispanic/ Latino	Black/ African American	Asian	Native Hawaiian/ Pacific Islander	American Indian/ Alaskan Native	Two or More	Female
Team Player - A	0.05	0.04	-0.16	0.00	0.00	-0.02	0.09
Pleasant – A	-0.03	0.05	0.33	0.12	-0.02	0.09	0.46
Helpful Altruistic – A	-0.08	0.09	0.26	0.04	-0.05	0.05	-0.09
Optimist – A	0.06	0.11	-0.09	0.04	0.07	-0.04	0.14
Well Adjusted – A	0.08	0.15	0.01	-0.03	0.03	0.04	-0.14
Stress Under Pressure - N	-0.06	0.02	0.24	0.07	0.01	0.05	-0.32
Temperamental – N	0.10	0.17	-0.06	0.20	0.11	0.01	0.12
Worry – N	-0.09	-0.15	0.22	0.06	-0.05	0.03	0.03
Angry Hostile – N	0.04	0.02	-0.29	-0.06	-0.06	-0.05	-0.01
Reserved – E	0.14	0.27	0.07	0.27	0.13	0.03	0.23
Dominance Leader - E	0.08	0.39	0.21	0.15	0.14	0.18	-0.04
Excitement Seeking - E	0.01	0.11	0.25	0.19	0.03	0.11	-0.12
Activity – E	0.15	0.25	0.09	0.24	0.18	0.07	0.21
Achievement Striving - C	0.06	0.15	0.43	0.21	0.07	0.11	0.22
Order – C	-0.02	-0.49	-0.25	-0.28	-0.04	-0.12	-0.30
Self-Discipline – C	0.12	0.16	-0.12	0.12	0.12	-0.04	0.12
Unconventional – C	0.04	-0.27	0.13	-0.12	0.05	-0.04	-0.49
Creative – O	-0.27	-0.57	0.10	-0.28	-0.32	-0.09	-0.23
Reflective – O	-0.07	0.06	0.11	0.01	-0.05	0.04	0.03
Scientific Interest – O	-0.08	-0.10	0.18	0.07	-0.03	0.02	0.00
Cultured – O	0.17	0.03	-0.12	0.01	0.23	0.07	0.02
Interpersonal Tactics - M	0.15	0.33	0.02	0.17	0.19	0.05	0.09
Cynical View – M	0.25	0.53	0.32	0.51	0.37	0.27	0.47
Envious – M	-0.10	-0.04	-0.03	-0.18	-0.20	0.05	-0.19
Independent – M	0.11	0.17	-0.10	0.14	0.18	0.01	0.08
Influence Tactics – M	-0.13	-0.26	0.16	0.00	-0.10	0.02	-0.29

Note. White $N = 47636$, Black/African American $N = 7171$, Hispanic/Latino $N = 10242$, Non-Hispanic/Non-Latino $N = 59210$, Asian $N = 3906$, Native Hawaiian/ Pacific Islander = 330, American Indian/Alaskan Native $N = 355$, Two or More = 8211, Male $N = 52266$, and Female $N = 18507$.

4.4.10 Exploring Composites Using Cognitive Subtests and SDI

Once correlational tests and subgroup differences were evaluated, we started to examine various predictor combinations that leveraged several sources of information, including job analysis linkages, descriptive statistics, and predictor-criterion relationships. The process of evaluating alternative composites was highly iterative, as there were many combinations of predictors to test. Some guidelines were established to prioritize predictor combinations for testing, including 1) prioritizing individual predictors that were statistically significant, 2) incorporating SDI

domains or facets (not both) into a single prediction model, and 3) using a given predictor only once across the various composites.

In addition to the composites currently used in Form T (Verbal, Quantitative, Pilot, CSO, and ABM), the Air Force indicated interest in creating a new composite designed to predict general officership outcomes. The current AFOQT Form T composites aim to select and classify officers using technical performance/training criteria (e.g., SUPT MASS). The Air Force noted that a range of non-technical officers need to be identified using the AFOQT, and encouraged a broader treatment of general officership through the examination of a composite designed to predict non-technical outcomes, which was examined using ROTC and USAFA outcomes.

The composites were scoped and defined as follows and could be used standalone or together.

- General Officership composite
- Academic Aptitude (formerly Verbal and Quantitative)
- Pilot/RPA Pilot
- ABM
- CSO

We conducted a series of multiple regression analyses to determine the combined influence of the cognitive subtests and SDI in the prediction of the training outcomes. The alternative composites were created by considering the cognitive subtests and SDI facets and domains that were found to be at least moderately linked in the job analysis linkage results reported in Objective 2. We also reviewed the zero-order correlations between individual subtests and facets and outcomes to determine a subset of predictors that was more likely to result in robust prediction. Multiple regression analyses on the alternative composites permitted exploration of incremental validity to examine whether there was unique prediction captured by the cognitive subtests above and beyond the SDI and vice versa. After the regression analyses, we deconflicted the SDI domains from their facets so that there were no redundancies.

The first regression analysis was run on the full set of cognitive subtests and SDI models for each of the four criterion variables of: MASS, CFA, DFA, and AA. These regressions served as the basis for the final composites reported in the Final Composites for Officership, Academic Aptitude, Pilot (inclusive of RPA Pilot, which mirrors the use of RPA in the current composites), ABM, and CSO in the section below.

4.4.11 Composite Analysis for Officership, Academic Aptitude, Pilot, ABM, and CSO

As described above, the Air Force expressed a goal of developing several composites, including the types historically used to score AFOQT (that is, to assess academic aptitudes like verbal and quantitative ability along with fit for several rated specialties) as well as a new general officership composite. The first composite was evaluated against a general officership criterion measure, Air Expeditionary Force (AEF) performance, a composite of supervisor ratings comprising a unit-weighted average of all AEF ratings. The Academic Aptitude composite was first evaluated against SUPT MASS. We noted that the current composites (Verbal and Quantitative) provided near zero prediction of this criterion. We evaluated alternative criteria that may be better aligned to this type of measure, and expanded the evaluation to include SUPT

RawAcad (a measure of academic performance in pilot training). Finally, the rated specialty composites (Pilot, ABM, and CSO) were evaluated against their respective specialized course performance (IFT Pilot MASS, ABM MASS, and CSO MASS). We ran a series of regression analyses to determine the predictors that maximized prediction for each outcome.

We recognized that some composites may be used standalone (e.g., general officership) while others may be used in a hurdled format (e.g., academic aptitude to assess officership followed by rated specialty classification). Given the potential use of the composites in a hurdled format, efforts were made to deconflict the predictors across composites to ensure that each cognitive ability measure and each SDI facet were used only once throughout the process. Once the predictors for each hurdle were cleaned of any duplicates, the initial regressions were re-run to ensure prediction levels were still high for the criterion of interest. Additionally, 5-fold cross-validation analyses were conducted to analyze whether the regression-weighted composites would remain stable across various samples. Once regression-weighted composites were confirmed as stable across samples, additional criterion variables of interest were analyzed to ensure the results generalized to other areas of interest to the Air Force, including Grade Point Average and Order of Merit (O_MERIT). The sections below describe the validation of each composite in detail.

4.4.12 Development and Validation of the General Officership Composite

The criterion variable of AEFCComp was used to validate the general officership composite. AEFCComp is a unit-weighted composite made up of various competencies (including Leadership, Professional Qualities, Communication, Judgment/Decision Making, Warrior Ethos, and Followership). It was significantly positively predicted by the subtests shown in Table 73 below, which included Reading Comprehension and six SDI facets. The overall prediction model accounted for 8% of the variance associated with AEFCComp ($R^2 = .08$). Combining subtests can sometimes lead to a lower level of validity due to some variance lost, however, the general officership composite was able to maintain the same level of validity even when combined into a composite score (see Table 74). Overall, these results indicated that this composite is a robust predictor of AEFCComp.

Table 73. General Officership Component Criterion Related Validity: AEFCComp

	B	Beta	SE	t-value	Significance
(Intercept)	-0.01		0.01	-0.71	0.47
Stress Under Pressure - N	-0.06	-0.06	0.02	-3.14	0.00
Reserved – E	-0.13	-0.13	0.02	-7.46	0.00
Temperamental – N	0.08	0.08	0.02	4.38	0.00
Dominance Leader – E	0.14	0.14	0.02	7.91	0.00
Excitement Seeking – E	0.07	0.07	0.01	4.68	0.00
Well-Adjusted – A	-0.05	-0.05	0.01	-3.48	0.00
Reading Comprehension	0.12	0.12	0.01	9.22	0.00
R	R²	SE	F	df	p-value
0.28	0.08	0.96	67.44	5,463	0.00

Table 74. General Officership Composite Criterion Related Validity: AEFComp

	B	Beta	SE	t-value	Significance
(Intercept)	-0.01		0.01	-0.71	0.48
Regression Weighted Officership Composite	1.01	0.28	0.05	21.73	0.00
R	R²	SE	F	df	p-value
0.28	0.08	0.96	472.3	5,469	0.00

Cross-validation analyses showed that this regression-based composite maintained predictive validity across five different “cuts” of the data. R-squared values ranged from .05 to .11, indicating a minimum prediction capability of 5% and a maximum prediction capability of 11%. In general, this provided evidence of cross-validity. See Table 75.

Table 75. Regression Weighted General Officership Composite Cross Validation: AEFComp

Sample	RMSE	R-squared	MAE	Sample Size
1	0.95	0.11	0.81	4376
2	0.97	0.05	0.82	4377
3	0.95	0.08	0.81	4376
4	0.95	0.09	0.80	4378
5	0.98	0.05	0.82	4377

After confirming the stability of the officership composite, five additional regressions were run to analyze whether the composite predicted other criteria of interest to the Air Force, including Military Performance Assessment (MPA), O_MERIT, Instructor Ranking, Peer Ranking, and Commander Ranking. As shown in Table 76, the O_MERIT criterion was significantly positively predicted by the general officership composite. Additionally, cross-validation analyses (see Table 77) showed that this relationship between the O_MERIT score and general officership composite held across five different draws of the data. R-squared values ranged from .02 to .04, indicating a minimum prediction capability of 2% and a maximum prediction capability of 4%. However, MPA, Instructor Rankings, Peer Rankings, and Commander Rankings did not result in a predictive relationship ($R^2 < .02$).

Table 76. Regression Weighted General Officership Composite Criterion Related Validity with O_MERIT

	B	Beta	SE	t-value	Significance
(Intercept)	0.00		0.01	-0.31	0.76
H1 Composite	-0.60	-0.60	0.05	-12.84	0.00
<i>R</i>	<i>R</i> ²	<i>SE</i>	<i>F</i>	<i>df</i>	<i>p</i> -value
0.17	.03	0.99	164.9	5,573	0.00

Table 77. Regression Weighted General Officership Composite Cross Validation with O_MERIT

Sample	RMSE	R-squared	MAE	Sample Size
1	0.99	0.02	0.86	4459
2	0.99	0.02	0.85	4461
3	0.98	0.03	0.84	4460
4	0.99	0.03	0.85	4460
5	0.98	0.04	0.84	4460

4.4.13 Development and Validation of the Academic Aptitude Composite

The criterion variable of SUPT Academic Average (SUPTAcad), a variable designed to measure academic performance, was significantly predicted by the set of predictors shown in Table 78 below. This included the Physical Science and Arithmetic Reasoning subtests, along with one SDI facet (Self-Discipline). The overall prediction model accounted for 5% of the variance associated with SUPTAcad ($R^2 = .05$). When the AFOQT subtests and SDI facet were combined into a composite, the composite was able to predict 6% of the variance associated with SUPTAcad ($R^2 = .06$). Overall, these results indicate that this set of scores is a robust predictor of SUPTAcad. See Table 79.

Table 78. Academic Aptitude Component Criterion Related Validity: SUPTAcad

	B	Beta	SE	t-value	Significance	Pareto Weighting
(Intercept)	96.30		0.06	1519.42	0.00	
Physical Science	0.32	0.13	0.07	4.55	0.00	0.409
Arithmetic Reasoning	0.33	0.14	0.07	4.84	0.00	0.195
Self-Discipline - C	0.25	0.10	0.06	3.85	0.00	0.397
<i>R</i>	<i>R</i> ²	<i>SE</i>	<i>F</i>	<i>df</i>	<i>p</i> -value	
0.22	0.05	2.28	25	1,361	0.00	

Table 79. Pareto Weighted Academic Aptitude Composite Criterion Related Validity: SUPTAcad

	B	Beta	SE	t-value	Significance
(Intercept)	96.32		0.06	1535.55	0.00
Pareto Weighted Academic Aptitude Composite	0.88	0.21	0.11	8.22	0.00
R	R²	SE	F	df	p-value
0.24	0.06	0.97	17.65	1,359	0.00

Cross-validation analyses summarized in Table 80 showed that this regression-based composite maintained prediction capability across four of five different draws of the data. R-squared values ranged from .03 to .07, indicating a minimum prediction capability of 3% and a maximum prediction capability of 7%. For Sample 5, RMSE was 1.02, which indicates a large amount of variation or noise in the data. This result suggests that predictability was low in this particular portion of the data, so it was not included as a final result.

Table 80. Academic Aptitude Composite Cross Validation: SUPTAcad

Sample	RMSE	R-squared	MAE	Sample Size
1	0.93	0.07	0.74	1092
2	0.97	0.06	0.79	1093
3	0.97	0.03	0.77	1093
4	1.00	0.06	0.77	1090
5	1.02	0.02	0.80	1092

After confirming the stability of the regression-based composite, three additional regressions were run to determine whether the composite was able to predict other criteria of interest to the Air Force, including O_MERIT, GPA, and Final Score. Both O_MERIT and GPA were significantly positively predicted by the academic aptitude composite. See Tables 81 (O_MERIT) and 83 (GPA). Additionally, cross-validation analyses showed that these relationships held across five different draws of the data. See Tables 82 (O_MERIT) and 84 (GPA). R-squared values for O_MERIT ranged from .16 to .19 and for GPA from .19 to .22, indicating a minimum prediction capability of 19% and a maximum prediction capability of 22% across both criteria. However, Final Score did not result in a predictive relationship ($R^2 < .006$).

Table 81. Pareto Weighted Academic Aptitude Composite Criterion Related Validity: O_MERIT

	B	Beta	SE	t-value	Significance
(Intercept)	0.00		0.01	-0.33	0.74
Pareto Weighted Academic Aptitude Composite	-0.64	-0.42	0.02	-34.47	0.00
<i>R</i>	<i>R</i> ²	<i>SE</i>	<i>F</i>	<i>df</i>	p-value
0.42	0.18	0.91	1188	5,573	0.00

Table 82. Academic Aptitude Composite Cross Validation: O_MERIT

Sample	RMSE	R-squared	MAE	Sample Size
1	0.91	0.18	0.77	4460
2	0.90	0.18	0.76	4460
3	0.92	0.17	0.78	4461
4	0.91	0.16	0.76	4460
5	0.89	0.19	0.75	4459

Table 83. Pareto Weighted Academic Aptitude Composite Criterion Related Validity with GPA

	B	Beta	SE	t-value	Significance
(Intercept)	0.00		0.01	0.36	0.718
Pareto Weighted Academic Aptitude Composite	0.69	0.45	0.02	37.71	0.00
<i>R</i>	<i>R</i> ²	<i>SE</i>	<i>F</i>	<i>df</i>	p-value
0.45	0.20	0.89	1422	5,574	0.00

Table 84. Academic Aptitude Composite Cross Validation: GPA

Sample	RMSE	R-squared	MAE	Sample Size
1	0.91	0.19	0.75	4461
2	0.90	0.19	0.75	4461
3	0.87	0.22	0.72	4461
4	0.89	0.21	0.74	4461
5	0.89	0.21	0.72	4460

4.4.14 Development and Validation of the Rated Specialty Composites

The rated specialty composites (Pilot, CSO, and AMB) involved developing and validating three separate composites dependent upon which specialty area of flight school a candidate would like to pursue. For Pilot, CSO, and ABM, the criterion variable of MASS for each respective training course was used. To begin, IFT Pilot MASS was significantly positively predicted by the set of predictors shown below which included the Instrument Comprehension and Aviation Information subtests, and two SDI facets. The overall prediction model accounted for 17% of the variance associated with IFT Pilot MASS ($R^2 = .17$). See Table 85. As summarized in Table 86, when the subtests were combined to create a composite, the composite predicted 16% of the variance associated with IFT Pilot MASS ($R^2 = .16$). Overall, these results indicate that the Pilot composite is a robust predictor of IFT Pilot MASS.

Table 85. Pilot Composite Criterion Related Validity: MASS

	B	Beta	SE	t-value	Significance	Pareto Weighting
(Intercept)	50.00		0.13	397.13	0.00	
Instrument Comprehension	1.40	0.18	0.14	10.15	0.00	0.205
Aviation Information	2.56	0.30	0.15	16.73	0.00	0.653
Scientific Interest - O	0.20	0.03	0.13	1.56	0.12	0.059
Independent - M	0.25	0.03	0.12	2.04	0.04	0.083
R	R²	SE	F	df	p-value	
0.41	0.17	6.70	144.6	2850	0.00	

Table 86. Pareto Weighted Pilot Composite Criterion Related Validity: MASS

	B	Beta	SE	t-value	Significance
(Intercept)	50.02		0.13	398.28	0.00
Pareto Weighted Pilot Composite	4.37	0.41	0.18	23.69	0.00
R	R²	SE	F	df	p-value
0.40	0.16	6.71	561.1	2853	0.00

Cross-validation analyses showed that this regression based composite maintained prediction capability across five different draws of the data. R-squared values ranged from .13 to .21, indicating a minimum prediction capability of 13% and a maximum prediction capability of 21%. See Table 87.

Table 87. Pilot Composite Cross Validation MASS

Sample	RMSE	R-squared	MAE	Sample Size
1	0.91	0.16	0.72	2286
2	0.91	0.18	0.74	2283
3	0.95	0.13	0.75	2283
4	0.87	0.21	0.69	2285
5	0.93	0.15	0.75	2283

CSO MASS was significantly predicted by a combination of AFOQT subtests and SDI facets. As with the Pilot composite, the CSO composite included Instrument Comprehension and Aviation Information. It also included Math Knowledge and the SDI facet of Helpful-Altruistic. As shown in Table 88, the overall prediction model accounted for 11% of the variance associated with CSO MASS ($R^2 = .11$). When combined into a composite, the composite predicted 10% of the variance associated with CSO MASS ($R^2 = .10$). See Table 89. Overall, these results indicate that the CSO composite is a robust predictor of CSO MASS.

Table 88. CSO Composite Criterion Related Validity: MASS

	B	Beta	SE	t-value	Significance	Pareto Weighting
(Intercept)	51.39		0.32	159.13	0.00	
Instrument Comprehension	1.10	0.15	0.27	4.08	0.00	0.122
Aviation Information	1.50	0.18	0.31	4.81	0.00	0.500
Math knowledge	1.22	0.15	0.28	4.36	0.00	0.277
Helpful-Altruistic - A	-0.06	-0.01	0.26	-0.22	0.83	0.101
<i>R</i>	<i>R</i> ²	<i>SE</i>	<i>F</i>	<i>df</i>	<i>p</i> -value	
0.33	0.11	7.11	23.23	736	0.00	

Table 89. Pareto Weighted CSO Composite Criterion Related Validity: MASS

	B	Beta	SE	t-value	Significance
(Intercept)	51.42		0.32	160.77	0.00
Pareto Weighted CSO Composite	3.98	0.32	0.44	9.10	0.00
<i>R</i>	<i>R</i> ²	<i>SE</i>	<i>F</i>	<i>df</i>	<i>p</i> -value
0.40	0.10	7.14	82.72	739	0.00

Cross-validation analyses showed that this regression-based composite maintained prediction capability across five different draws of the data. R-squared values ranged from .04 to .18, indicating a minimum prediction capability of 4% and a maximum prediction capability of 18%. See Table 90.

Table 90. CSO Composite Cross Validation: MASS

Sample	RMSE	R-squared	MAE	Sample Size
1	0.96	0.08	0.77	592
2	0.96	0.14	0.77	593
3	0.96	0.04	0.77	593
4	0.92	0.18	0.75	593
5	0.96	0.08	0.78	593

Finally, ABM MASS was significantly predicted by the set of predictors shown in Table 91, which included Aviation Information, Math Knowledge, and the SDI facet of Helpful-Altruistic. The overall prediction model accounted for 7% of the variance associated with ABM MASS ($R^2 = .07$). When combined into a composite, the composite was able to predict 8% of the variance associated with ABM MASS ($R^2 = .08$). See Table 92. Overall, these results indicate that the ABM composite is a robust predictor of ABM MASS.

Table 91. ABM Composite Criterion Related Validity: MASS

	B	Beta	SE	t-value	Significance
(Intercept)	47.43		0.30	156.45	0.00
Aviation Information	0.83	0.19	0.24	3.43	0.00
Math Knowledge	0.85	0.19	0.25	3.44	0.00
Helpful-Altruistic - A	0.52	0.11	0.26	2.00	0.05
<i>R</i>	<i>R</i> ²	<i>SE</i>	<i>F</i>	<i>df</i>	<i>p</i> -value
0.26	0.07	4.11	8.353	317	0.00

Table 92. Regression Weighted ABM Composite Criterion Related Validity: MASS

	B	Beta	SE	t-value	Significance
(Intercept)	0.20		0.07	3.09	0.00
Regression Weighted ABM Composite	1.04	0.28	0.20	5.28	0.00
<i>R</i>	<i>R</i> ²	<i>SE</i>	<i>F</i>	<i>df</i>	<i>p</i> -value
0.28	0.08	0.96	27.83	319	0.00

Cross-validation analyses showed that this regression-based composite maintained prediction capability across four of five different draws of the data. See Table 93. R-squared values ranged from .02 to .12, indicating a maximum prediction capability of 12%. For Sample 1, the RMSE was 1.54, which indicates a large amount of variation or noise in the data. This result suggests that predictability was low in this particular portion of the data, so it was not included as a final result. Overall, sample sizes for ABM were low, so it is recommended that prediction be monitored in this sample in the future to ensure the composite is continuing to predict outcomes as expected.

Table 93. ABM Composite Cross Validation: MASS

Sample	RMSE	R-squared	MAE	Sample Size
1	1.54	0.14	0.77	256
2	0.74	0.02	0.59	256
3	0.81	0.12	0.61	258
4	0.83	0.07	0.61	257
5	0.67	0.05	0.55	257

We evaluated the magnitude of the predictive validity findings according to reference values described by Bosco, Aguinis, Singh, Field and Pierce (2015). Bosco et al. (2015) reviewed numerous criterion-related studies that spanned a 30 year period. For knowledge, skills and abilities (including general cognitive ability) predicting job performance they found that correlations ranging from .13 to .31 could be considered “medium” with about 33% of observed validities occurring in this range. For psychological characteristics (personality traits, emotional states) predicting job performance they found that correlations ranging from .10 to .23 could be considered “medium.” Correlations below and above these ranges could be considered “low” and “high” respectively.

The R^2 values for the AFOQT composites are in line with these values. Coarsely, a .25 effect size (which is on the lower end of the range of multiple regression values found in the above composite analyses and would be deemed “medium” according to the Bosco et al. analysis) translates to an R^2 of 6% which is in line with the AFOQT composite validity results. Combinations of predictors in the AFOQT/SDI composites show medium effect sizes in the prediction of various Air Force criteria. Also, note that the regression analyses reported in this section use observed correlations, and are not corrected for range restriction and criterion reliability. As such, the prediction estimates are likely to be underestimated.

Overall, the composites generally showed some robust prediction of the criterion outcomes, with the most robust results observed for the Academic Aptitude composite in the prediction of O_MERIT and GPA and the Pilot and CSO composites in the prediction of IFT Pilot MASS. The general officership and academic aptitude composites also predicted additional criteria of interest such as GPA and O_MERIT. It is recommended that these composites be considered for implementation in operational testing and continue to be monitored after implementation to

ensure validity remains stable over time. In the next section, subgroup differences regarding each composite will be discussed.

4.4.15 Comparison of Regression Weights with Pareto-Optimized Weights

One of the Air Force's objectives for evaluating new composites was to improve the diversity of its officer workforce. A method for ensuring an optimal trade-off between the validity and diversity outcomes was proposed by DeCorte et al. (2007, 2011). In this method, a pareto-optimized solution provides the best possible diversity outcome (as evaluated using the adverse impact ratio, AIR) at a given level of validity. This type of solution tends to be helpful in scenarios where a cognitive predictor is included within the same composite as non-cognitive predictors. Cognitive predictors tend to contribute to adverse impact and non-cognitive predictors tend to mitigate this issue. A pareto-optimized solution is able to optimally weight both the cognitive and non-cognitive predictors in a way that maximizes both validity and diversity (Song et. al., 2017).

Given the benefits of pareto-optimization, a side-by-side comparison was done to ensure the best weighting scheme was chosen for the composite hurdles. In order to investigate the pareto-optimized solutions for the chosen composites, the R program ParetoR was used. This program requires a selection ratio ($\#$ of selected applicants)/(total $\#$ of applicants), a proportion of minority applicants ($\#$ of minority applicants)/(total $\#$ of applicants), Cohen's d s for the predictors, and a correlation matrix of the predictors and criterion. For these analyses, a selection ratio of .80 was chosen, which is identical to the current Verbal+Quant composite selection ratio. Additionally, the Black/African American subgroup was used for calculating both the proportion of minority applicants and the Cohen's d values. When comparing the pareto-optimized weighted composite to the regression-weighted composites, analyses revealed relatively small differences between Cohen's d s and AIRs for the General Officership and ABM composites. For these cases, because the prediction capability of the regression composite was slightly better, the regression composites were chosen for use. For Academic Aptitude, Pilot, and CSO, the pareto-optimized weighted composites were chosen for their advantageous Cohen's d s and AIRs. The following tables provide a summary of comparisons of the pareto-optimized and regression-based models for the General Officership (Table 94), Academic Aptitude (Table 95), Pilot (Table 96), CSO (Table 97), and ABM (Table 98) criteria.

Table 94. General Officership Composite Comparison of Pareto-Optimized Composite with Regression-Based (using AEF Comp as criterion)

	Pareto Optimized	Regression
R^2	0.07	0.08
Cohen's d		
Hispanic/Latino	-0.23	-0.13
Black/ African American	-0.68	-0.67
Native Hawaiian-Pacific Islander	-0.39	-0.54
American Indian-Alaskan Native	-0.35	-0.33
Asian	-0.11	-0.52
Two or More	-0.13	-0.22
Female	-0.21	-0.32
AIRs		
Hispanic/Latino	0.89	0.85
Non-Hispanic	1.00	1.00
Black/ African American	0.67	0.75
Native Hawaiian-Pacific Islander	0.83	0.82
American Indian-Alaskan Native	0.83	0.89
Asian	0.91	0.79
Two or More	0.93	0.93
White	1.00	1.00
Female	0.88	0.88
Male	1.00	1.00
<i>Note.</i> Subgroup differences were analyzed using the AFOQT dataset and validity estimates were analyzed using the ROTC dataset.		

Table 95. Academic Aptitude Composite Comparison of Pareto-Optimized Composite with Regression-Based (SUPT RawAcad as criterion)

	Pareto Optimized	Regression
R^2	0.05	0.06
Cohen's d		
Hispanic/Latino	-0.23	-0.35
Black/ African American	-0.81	-1.11
Native Hawaiian-Pacific Islander	-0.69	-0.85
American Indian- Alaskan Native	-0.51	-0.65
Asian	-0.12	-0.07
Two or More	-0.29	-0.34
Female	-0.53	-0.58
AIRs		
Hispanic/Latino	0.93	0.88
Non-Hispanic	1.00	1.00
Black/ African American	0.72	0.59
Native Hawaiian-Pacific Islander	0.76	0.70
American Indian- Alaskan Native	0.84	0.82
Asian	0.94	0.94
Two or More	0.90	0.88
White	1.00	1.00
Female	0.83	0.80
Male	1.00	1.00
<i>Note.</i> Subgroup differences were analyzed using the AFOQT dataset. Validity estimates were analyzed using the OTS dataset.		

Table 96. Pilot Composite Comparison of Pareto-Optimized Composite with Regression-Based (PilotMASSTotal as criterion)

	Pareto Optimized	Regression
R ²	0.17	0.18
Cohen's d		
Hispanic/Latino	-0.37	-0.37
Black/ African American	-1.09	-1.19
Native Hawaiian-Pacific Islander	-0.73	-0.74
American Indian- Alaskan Native	-0.65	-0.66
Asian	-0.55	-0.55
Two or More	-0.37	-0.38
Female	-1.03	-1.02
AIRs		
Hispanic/Latino	0.90	0.91
Non-Hispanic	1.00	1.00
Black/ African American	0.65	0.60
Native Hawaiian-Pacific Islander	0.78	0.79
American Indian- Alaskan Native	0.83	0.85
Asian	0.87	0.87
Two or More	0.92	0.91
White	1.00	1.00
Female	0.73	0.74
Male	1.00	1.00
<i>Note.</i> Subgroup differences were analyzed using the AFOQT dataset. Validity estimates were analyzed using the OTS dataset.		

Table 97. CSO Composite Comparison of Pareto-Optimized Composite with Regression-Based (CSOMASSTotal as criterion)

	Pareto Optimized	Regression
R^2	0.10	0.13
Cohen's d		
Hispanic/Latino	-0.40	-0.43
Black/ African American	-1.17	-1.37
Native Hawaiian-Pacific Islander	-0.79	-0.90
American Indian-Alaskan Native	-0.74	-0.80
Asian	-0.32	-0.35
Two or More	-0.38	-0.44
Female	-0.91	-0.97
AIRs		
Hispanic/Latino	0.91	0.91
Non-Hispanic	1.00	1.00
Black/ African American	0.69	0.62
Native Hawaiian-Pacific Islander	0.84	0.82
American Indian-Alaskan Native	0.85	0.86
Asian	0.95	0.94
Two or More	0.92	0.90
White	1.00	1.00
Female	0.80	0.79
Male	1.00	1.00
<i>Note.</i> Subgroup differences were analyzed using the AFOQT dataset. Validity estimates were analyzed using the OTS dataset.		

Table 98. ABM Composite Comparison of Pareto-Optimized Composite with Regression-Based (ABMMASSTotal as criterion)

	Pareto Optimized	Regression
R ²	0.07	0.07
Cohen's d		
Hispanic/Latino	-0.37	-0.36
Black/ African American	-1.03	-1.00
Native Hawaiian-Pacific Islander	-0.70	-0.67
American Indian- Alaskan Native	-0.68	-0.66
Asian	-0.10	-0.06
Two or More	-0.33	-0.32
Female	-0.68	-0.64
AIRs		
Hispanic/Latino	0.91	0.91
Non-Hispanic	1.00	1.00
Black/ African American	0.70	0.72
Native Hawaiian-Pacific Islander	0.83	0.84
American Indian- Alaskan Native	0.83	0.85
Asian	0.98	0.99
Two or More	0.91	0.92
White	1.00	1.00
Female	0.82	0.83
Male	1.00	1.00
<i>Note.</i> Subgroup differences were analyzed using the AFOQT dataset. Validity estimates were analyzed using the OTS dataset.		

4.4.16 Alternative Composite Reliability

Stratified alpha was computed for all composites in order to compare reliability between the current and alternative composites. The reliability estimates for the AFOQT composites were excellent, ranging from .83 to .92. Despite the number of items in each composite being lower than they were for the current composites, the alternative composites performed similarly in reliability (.89 to .94). This is an indication that reliability of the measures will not change significantly once the new composites are implemented. Results are presented below for the General Officership (Table 99), Academic Aptitude (Table 100), Pilot (Table 101), CSO (Table 102), and ABM (Table 103) composites.

Table 99. General Officership Composite Reliability Results

Scale	Item #	Alpha	Mean	Variance	Stratified Alpha
total	73	0.74	161.61	186.86	0.86
Reading Comprehension	25	0.73	17.33	16.71	NA
Stress Under Pressure - N	8	0.86	14.43	28.99	NA
Reserved – E	8	0.91	18.66	47.32	NA
Temperamental – N	8	0.87	13.97	26.02	NA
Dominance Leader – E	8	0.89	28.56	33.20	NA
Excitement Seeking – E	8	0.92	31.64	57.95	NA
Well-Adjusted – A	8	0.83	36.97	12.72	NA

Table 100. Academic Aptitude Composite Reliability Results

Scale	Item #	Alpha	Mean	Variance	Stratified Alpha
total	53	0.79	57.42	74.29	0.83
Arithmetic Reasoning	25	0.81	13.35	25.40	NA
Physical Science	20	0.74	10.70	15.17	NA
Self-Discipline - C	8	0.88	33.33	27.58	NA

Table 101. Pilot Composite Reliability Results

Scale	Item #	Alpha	Mean	Variance	Stratified Alpha
total	61	0.88	74.95	226.43	0.92
Instrument Comprehension	25	0.91	14.82	44.26	NA
Aviation Information	20	0.78	9.30	17.89	NA
Scientific Interest - O	8	0.93	28.41	65.63	NA
Independent - M	8	0.83	22.35	30.45	NA

Table 102. CSO Composite Reliability Results

Scale	Item #	Alpha	Mean	Variance	Stratified Alpha
total	78	0.89	72.14	165.99	0.91
Instrument Comprehension	25	0.91	14.82	44.26	NA
Aviation Information	20	0.78	9.30	17.89	NA
Math Knowledge	25	0.82	14.28	26.69	NA
Helpful-Altruistic - A	8	0.88	33.67	21.97	NA

Table 103. ABM Composite Reliability Results

Scale	Item #	Alpha	Mean	Variance	Stratified Alpha
total	53	0.80	57.28	69.29	0.84
Aviation Information	20	0.78	9.30	17.89	NA
Math Knowledge	25	0.82	14.28	26.69	NA
Helpful-Altruistic - A	8	0.88	33.67	21.97	NA

4.4.17 Alternative Composite Subgroup Pass Rates Analyses

To compare the current composite pass rates with the alternate composite pass rates, an additional round of analyses was conducted on the new composites (General Officership, Academic Aptitude, Pilot, CSO, and ABM) to explore the reduction in subgroup differences and adverse impact ratios. While the previous analyses report adverse impact ratios for the validation sample, the analyses below report AIRs for the predictor-only sample, that is, the unrestricted sample that completed the AFOQT and SDI. This sample was evaluated to determine the effect sizes using a sample without any prior selection.

Standardized subgroup mean differences for participants with adequate sample sizes (> 75) were computed for the various composites. With the exception of the General Officership composite (as it is new and cannot be compared to current composites), the alternative composites yielded lower subgroup differences and less incidence of adverse impact compared to the current composites.

Table 104 shows adverse impact ratios for the General Officership composite. The AIRs exceed the .80 threshold with the exception of those for Black/African-American and Asian, which approached the threshold.

Table 104. General Officership Composite: Pass Rates and AIRs

Subgroup	Alternative Composite			
	Pass N	Total N	Pass Rates	AIR
Hispanic/Latino	7926	10242	77.40%	0.96
Non-Hispanic	47737	59210	80.62%	1.00
Black/ African American	4542	7171	63.34%	0.75
Native Hawaiian-Pacific Islander	229	330	69.39%	0.82
American Indian-Alaskan Native	268	355	75.49%	0.89
Asian	2614	3906	66.92%	0.79
Two or More	6415	8211	78.13%	0.93
White	40206	47636	84.40%	1.00
Female	13495	18507	72.92%	0.88
Male	43136	52266	82.53%	1.00

Note. Passing score was designed to mimic current Verbal+Quant pass rate of 80% in the AFOQT dataset.

AIR results for the Academic Aptitude composite are shown in Table 105. The AIRs were higher compared to the current Verbal + Quantitative composite for the Hispanic, Black/African American, Native Hawaiian-Pacific Islander, American Indian-Alaskan Native, Asian, and Two or More Races subgroups. However, despite improvement the AIR remained below the .80 threshold for several of these subgroups. This indicates improvement in adverse impact compared to the current composites. The AIRs were similar for Females.

Table 105. Academic Aptitude Composite: Pass Rates and AIRs

Subgroup	Alternative Composite				Current Composite	
	Pass N	Total N	Pass Rates	AIR	Pass Rates	AIR
Hispanic/Latino	7708	10242	75.26%	0.93	69.03%	0.85
Non-Hispanic	47980	59210	81.03%	1.00	81.36%	1.00
Black/African American	4335	7171	60.45%	0.72	51.54%	0.60
Native Hawaiian-Pacific Islander	213	330	64.55%	0.76	57.58%	0.67
American Indian-Alaskan Native	253	355	71.27%	0.84	61.69%	0.72
Asian	3093	3906	79.19%	0.94	76.16%	0.89
Two or More	6254	8211	76.17%	0.90	76.59%	0.89
White	40194	47636	84.38%	1.00	85.60%	1.00
Female	12846	18507	69.41%	0.83	69.86%	0.85
Male	43784	52266	83.77%	1.00	82.63%	1.00

Note. Passing score was designed to mimic current Verbal+Quant pass rate of 80% in the AFOQT dataset.

The AIRs for the alternative Pilot composite were higher compared to the current composite for all minority subgroups. See Table 106. This indicates improvement in adverse impact compared to the current composites.

Table 106. Pilot Test Battery Pass Rates and Subgroup Results

	Alternative Composite				Current Composite	
	Pass N	Total N	Pass Rates	AIR	Pass Rates	AIR
Hispanic/Latino	6748	10242	65.89%	0.90	51.87%	0.76
Non-Hispanic	43408	59210	73.31%	1.00	68.61%	1.00
Black/African American	3444	7171	48.03%	0.62	24.45%	0.33
Native Hawaiian-Pacific Islander	165	330	50.00%	0.65	42.42%	0.57
American Indian-Alaskan Native	228	355	64.23%	0.83	44.51%	0.59
Asian	2785	3906	71.30%	0.92	61.73%	0.82
Two or More	5524	8211	67.28%	0.87	60.57%	0.81
White	36883	47636	77.43%	1.00	74.93%	1.00
Female	10880	18507	58.79%	0.77	45.36%	0.62
Male	40094	52266	76.71%	1.00	73.09%	1.00

Note. Passing score mimics current Pilot pass rate of 72% in the AFOQT dataset.

For the alternate CSO composite, the AIRs were higher compared to the current composite for all subgroups except Females. See Table 107. This indicates improvement in adverse impact

Table 107. CSO Composite Pass Rates and Subgroup Results

	Alternative Composites				Current Composites	
	Pass N	Total N	Pass Rates	AIR	Pass Rates	AIR
Hispanic/Latino	6837	10242	66.75%	0.84	56.94%	0.78
Non-Hispanic	46826	59210	79.08%	1.00	72.58%	1.00
Black/African American	3015	7171	42.04%	0.50	32.10%	0.41
Native Hawaiian-Pacific Islander	187	330	56.67%	0.67	46.36%	0.59
American Indian-Alaskan Native	212	355	59.72%	0.71	51.55%	0.66
Asian	3019	3906	77.29%	0.92	66.74%	0.85
Two or More	5965	8211	72.65%	0.86	66.30%	0.85
White	40138	47636	84.26%	1.00	78.15%	1.00
Female	10281	18507	55.55%	0.66	57.96%	0.78
Male	44222	52266	84.61%	1.00	74.22%	1.00

Note. Passing score mimics current CSO pass rate of 77% in the AFOQT dataset.

compared to the current composites for race and ethnicity subgroups. The AIR for females for the alternate composite was worse than that for the current composite. This group should be monitored and consideration should be given to this difference in future test development efforts.

The AIRs for the alternate ABM composite were higher than the current composite for all subgroups. See Table 108. This indicates improvement in adverse impact compared to the current composites.

Table 108. ABM Test Battery Pass Rates and Subgroup Results

	Alternative Composites				Current Composites	
	Pass N	Total N	Pass Rates	AIR	Pass Rates	AIR
Hispanic/Latino	6479	10242	63.26%	0.84	54.07%	0.77
Non-Hispanic	44419	59210	75.02%	1.00	70.48%	1.00
Black/African American	3079	7171	42.94%	0.54	26.89%	0.35
Native Hawaiian-Pacific Islander	185	330	56.06%	0.71	45.15%	0.59
American Indian-Alaskan Native	201	355	56.62%	0.72	46.76%	0.61
Asian	3035	3906	77.70%	0.98	65.54%	0.86
Two or More	5596	8211	68.15%	0.86	63.31%	0.83
White	37686	47636	79.11%	1.00	76.45%	1.00
Female	10471	18507	56.58%	0.72	52.27%	0.71
Male	41201	52266	78.83%	1.00	73.23%	1.00

Note. Passing score mimics current ABM pass rate of 73% in the AFOQT dataset.

4.4.18 Examination of Non-Linear Effects for Selected SDI Facets

The inclusion of SDI facets generally maintained validity of the composites compared to the current operational versions and generally reduced group differences and adverse impact. In most cases, the SDI facets were found to have positive beta weights but some were found to be negative. In discussion with the Air Force, it was determined that negative predictors for select constructs have been obtained in previous research. For instance, it was shared that there is a known negative correlation between Creativity and pilot training completion. It is undesirable for pilots to exhibit high levels of creativity in the highly rule-based career field.

To further evaluate the underlying relationship between SDI facets and criteria variables, we conducted a series of regression analyses to evaluate non-linearity on the relationship between SDI scores and performance. This was evaluated through a series of moderated regression analyses in which quadratic terms were created representing the SDI facet scores. Incremental validity of the quadratic terms was evaluated in terms of additional variance explained by the simple regression result. Analyses were conducted separately for SUPT Raw Academic, IFT

Pilot MASS and CSO Mass training criteria. Evidence of significant incremental validity of the quadratic terms was found for 3 SDI facets in the prediction of SUPT Raw Academic. Results for significant nonlinear relationships are shown in Table 109.

Table 109. Moderated Regression Results for SDI Facets Predicting SUPT Raw Academic

Model	Beta	t	Significance
Team Player	.05	1.369	.171
Team Player ²	.08	2.002*	.046
Stress Under Pressure	-.10	-3.044*	.002
Stress Under Pressure ²	.08	2.509*	.012
Self-Discipline	.09	2.959*	.003
Self-Discipline ²	.06	1.999*	.046

The plots depicting the relations between the quadratic terms for these SDI facets (Team Player, Stress Under Pressure, and Self-Discipline) and SUPT Raw Academic are shown in Figures 1-3. The plots were derived by plotting the formula $y = a + bx + bx^2$ intercept, where a is the intercept, bx is the linear term, and bx^2 is the quadratic term.

In general, the magnitude of the non-linear relationships was modest. It was most pronounced for SDI Stress Under Pressure, (see Figure 2) in which lower SDI scores were related to higher academic outcomes but there was also evidence that higher SDI scores were related to higher academic outcomes than moderate SDI scores. Given the modest degree of non-linearity found in these predictor analyses, it is expected that non-linear analysis performed on composites that include these predictors would be monotonic increasing. As such, it is not expected the modest non-linear effects have substantive meaning.

Figure 1. Non-Linear Relationship between SDI Team Player and SUPT Raw Academic

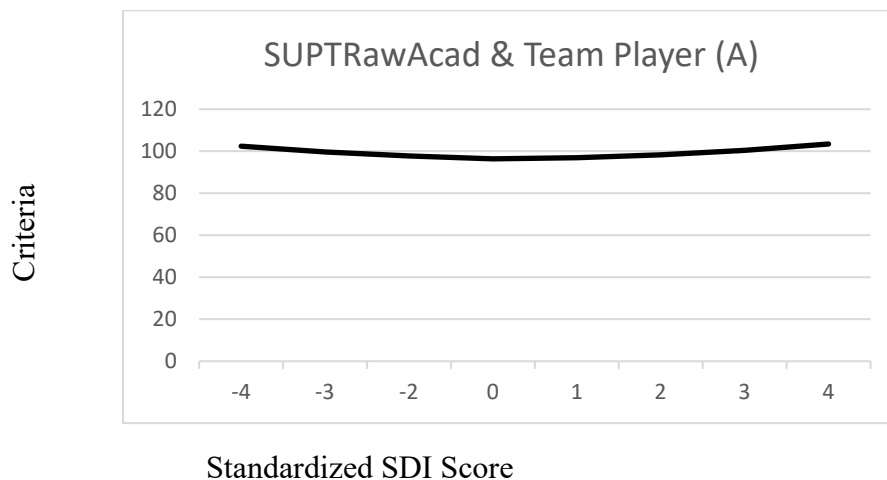


Figure 2. Non-Linear Relationship between SDI Stress Under Pressure and SUPT Raw Academic

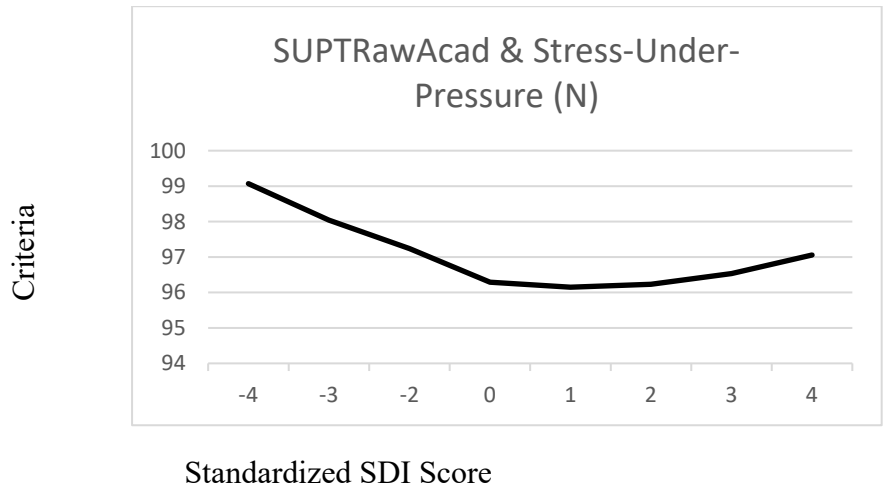
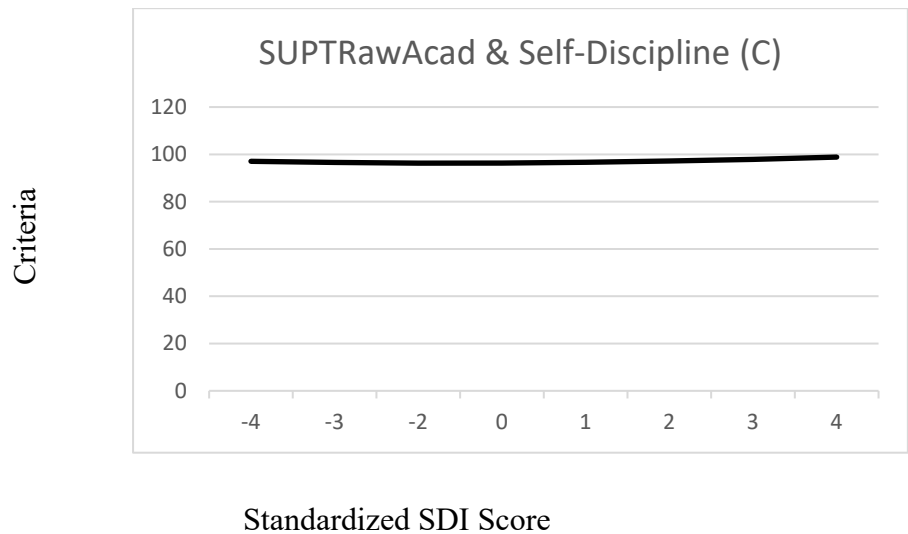


Figure 3. Non-Linear Relationship between SDI Self Discipline and SUPT Raw Academic



As shown in Table 110, significant non-linear relationships were found for 10 SDI facets in the prediction of IFT Pilot MASS.

Table 110. Moderated Regression Results for SDI Facets Predicting IFT Pilot MASS

Model	Beta	t	Significance
Creative	-.04	-1.987	.058
Creative ²	-.05	-2.485*	.013
Interpersonal Tactics	.02	.820	.412
Interpersonal Tactics ²	-.06	-2.778*	.006
Pleasant	-.10	-4.141*	.000
Pleasant ²	-.05	-2.286*	.022
Reflective	-.05	-2.565*	.010
Reflective ²	-.05	2.517*	.012
Cynical	-.01	-.504	.614
Cynical ²	-.04	-2.099*	.036
Helpful-Altruistic	-.08	-3.925*	.000
Helpful-Altruistic ²	-.08	-3.728*	.000
Scientific Interest	.09	4.269*	.000
Scientific Interest ²	-.05	-2.397*	.017
Envious	.09	4.198*	.000
Envious ²	-.09	-4.087*	.000
Influential	-.00	-.077	.938
Influential ²	-.05	-2.520*	.012
Unconventional	.04	1.699	.089
Unconventional ²	-.06	2.648*	.008

Plots describing these relationships between the SDI facets and IFT Pilot MASS are shown in the Figures 4 through 13. In general, the plots showed inverted-U relationships, indicating that low and high SDI scores are associated with higher levels of IFT Pilot MASS. Given the modest degree of non-linearity found in these predictor analyses, it is expected that non-linear analysis performed on composites that include these predictors would be monotonic increasing. As such, it is not expected the modest non-linear effects have substantive meaning.

Figure 4. Non-Linear Relationship between SDI Creative and IFT Pilot MASS

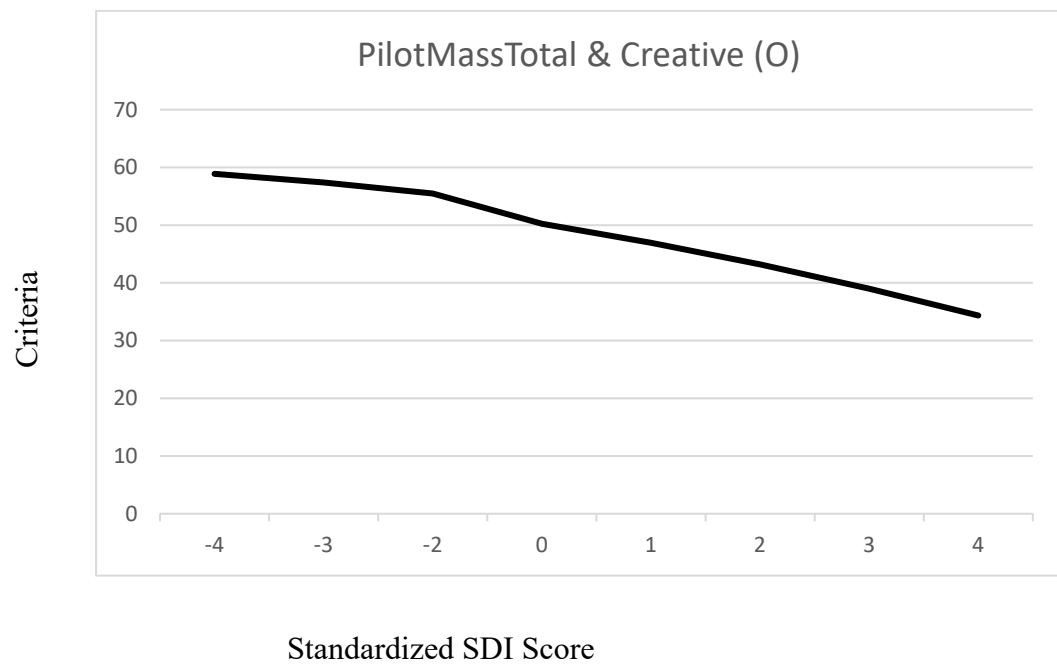


Figure 5. Non-Linear Relationship between SDI Interpersonal Tactics and IFT Pilot MASS

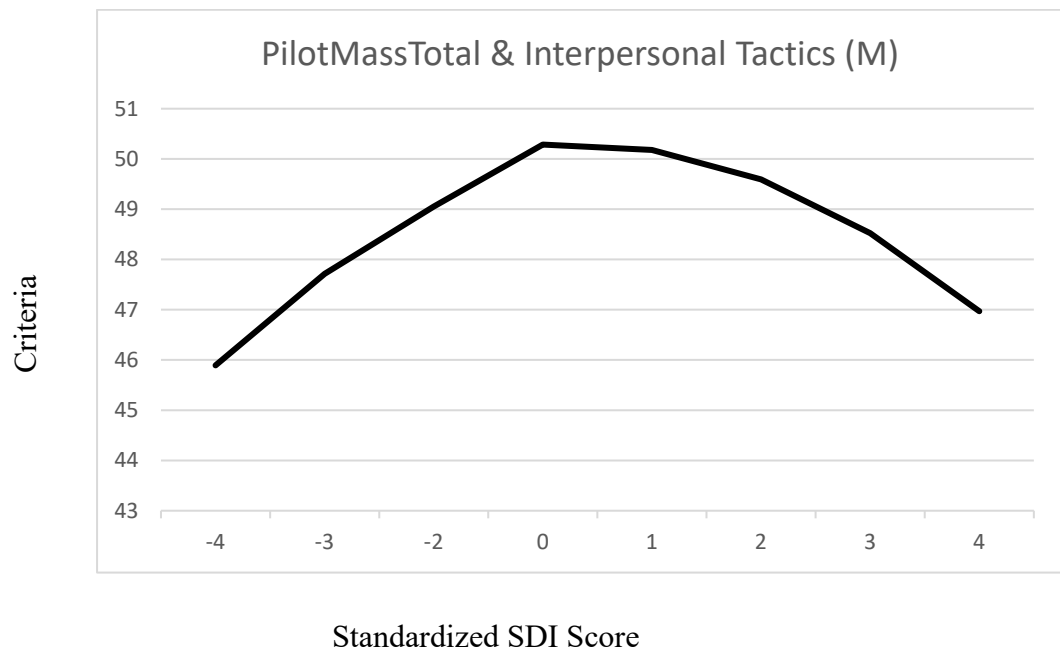


Figure 6. Non-Linear Relationship between SDI Pleasant and IFT Pilot MASS

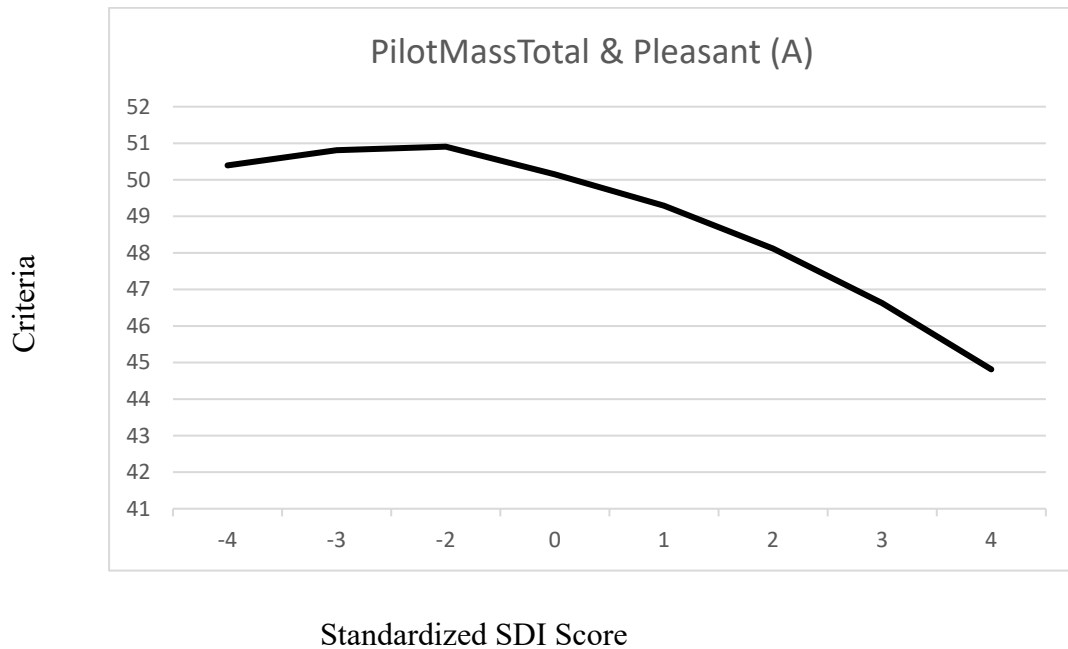


Figure 7. Non-Linear Relationship between SDI Reflective and IFT Pilot MASS

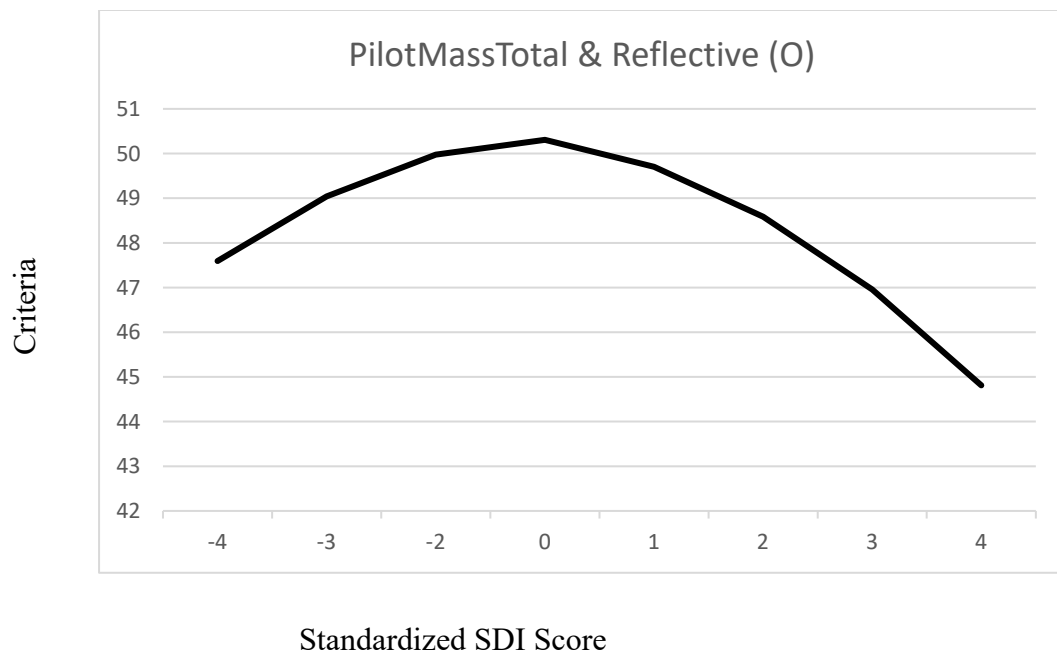


Figure 8. Non-Linear Relationship between SDI Cynical and IFT Pilot MASS

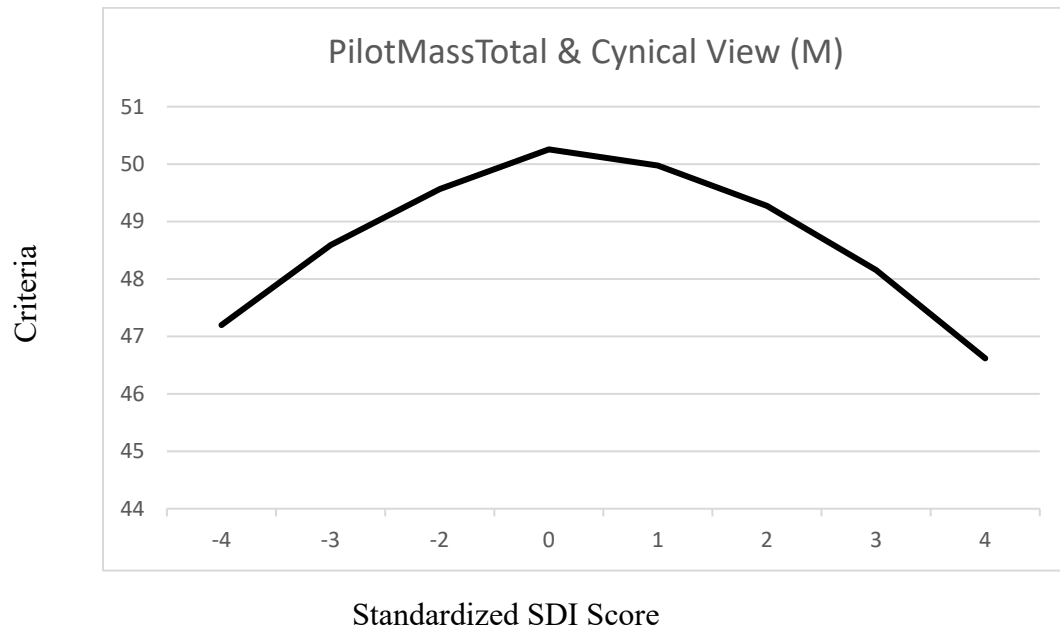


Figure 9. Non-Linear Relationship between SDI Helpful-Altruistic and IFT Pilot MASS

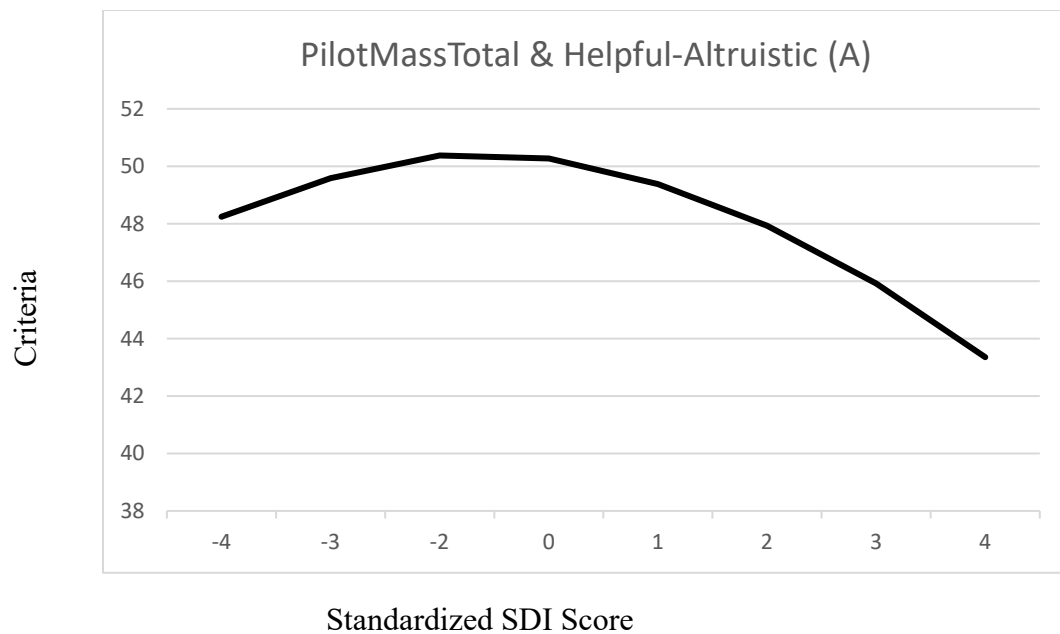


Figure 10. Non-Linear Relationship between SDI Scientific Interest and IFT Pilot MASS

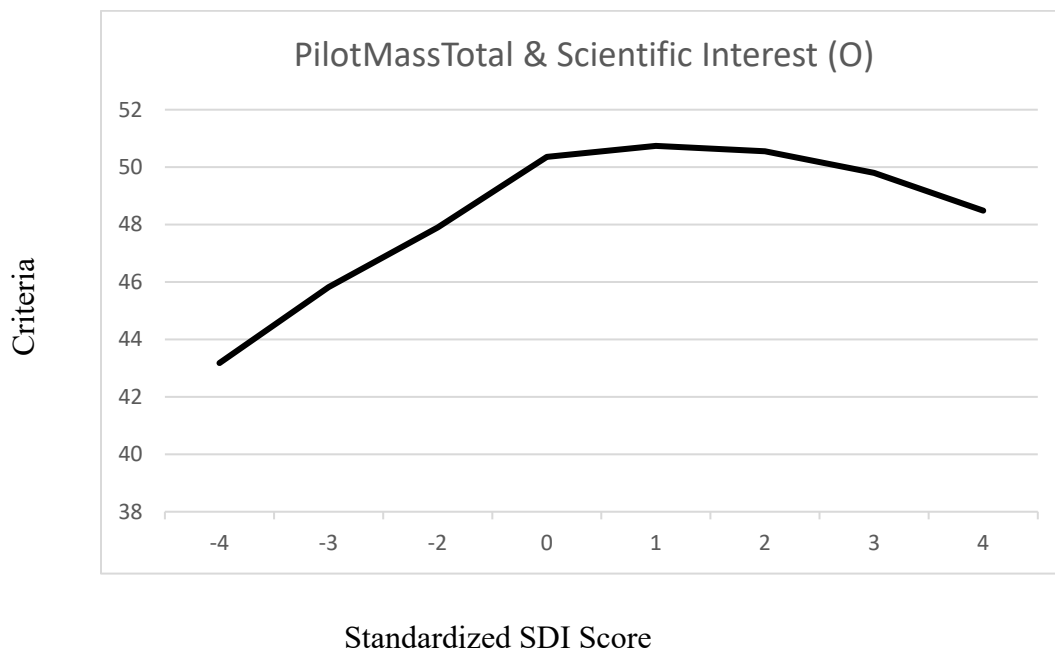


Figure 11. Non-Linear Relationship between SDI Envious and IFT Pilot MASS

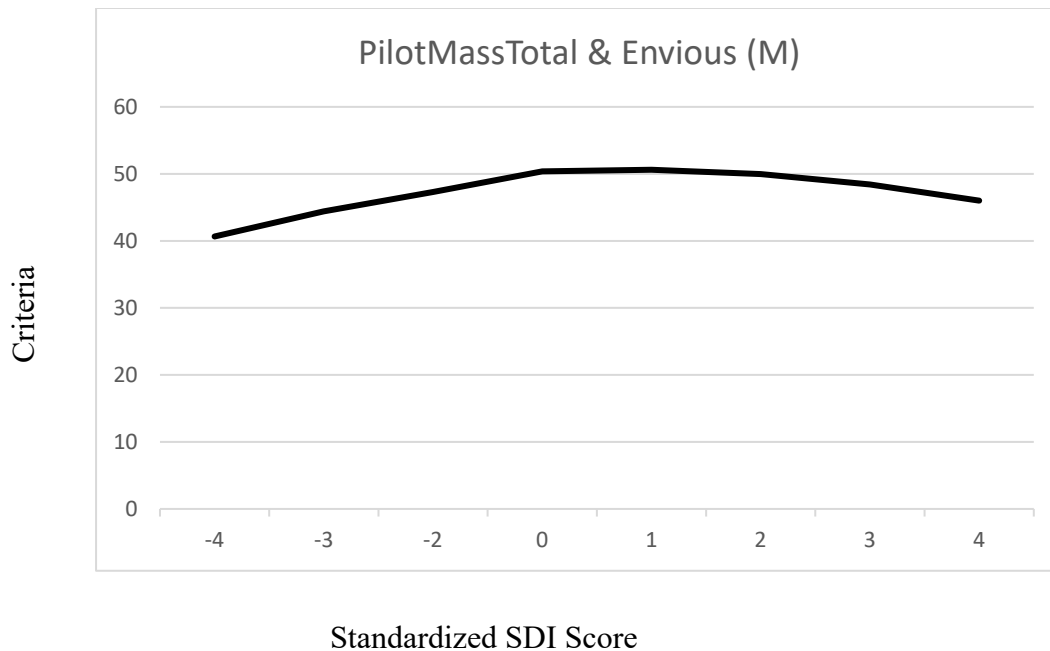


Figure 12. Non-Linear Relationship between SDI Influence Tactics and IFT Pilot MASS

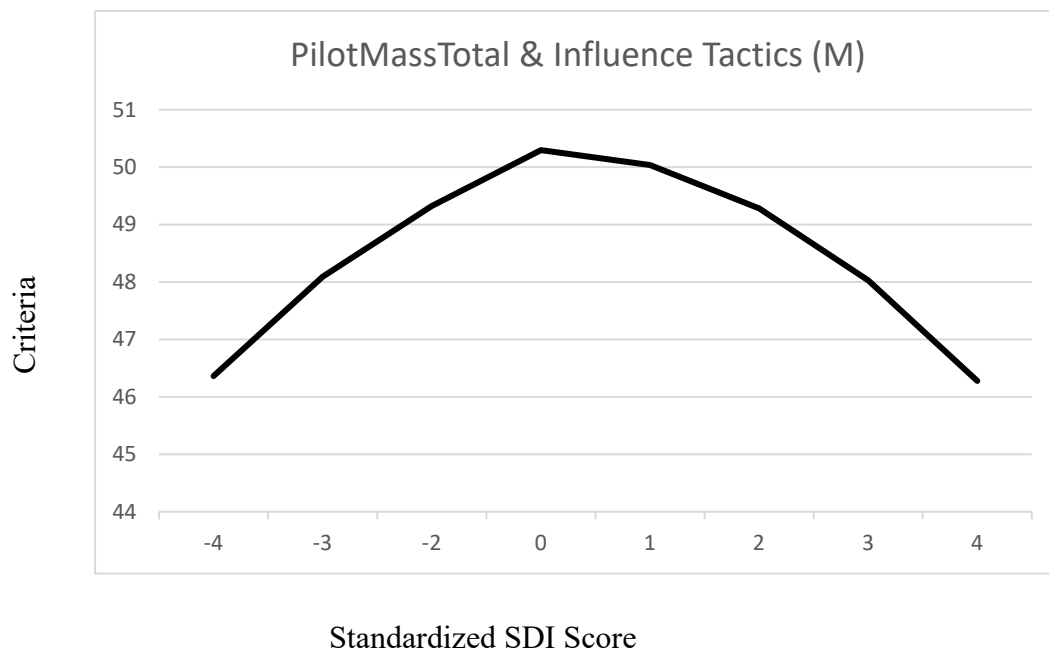
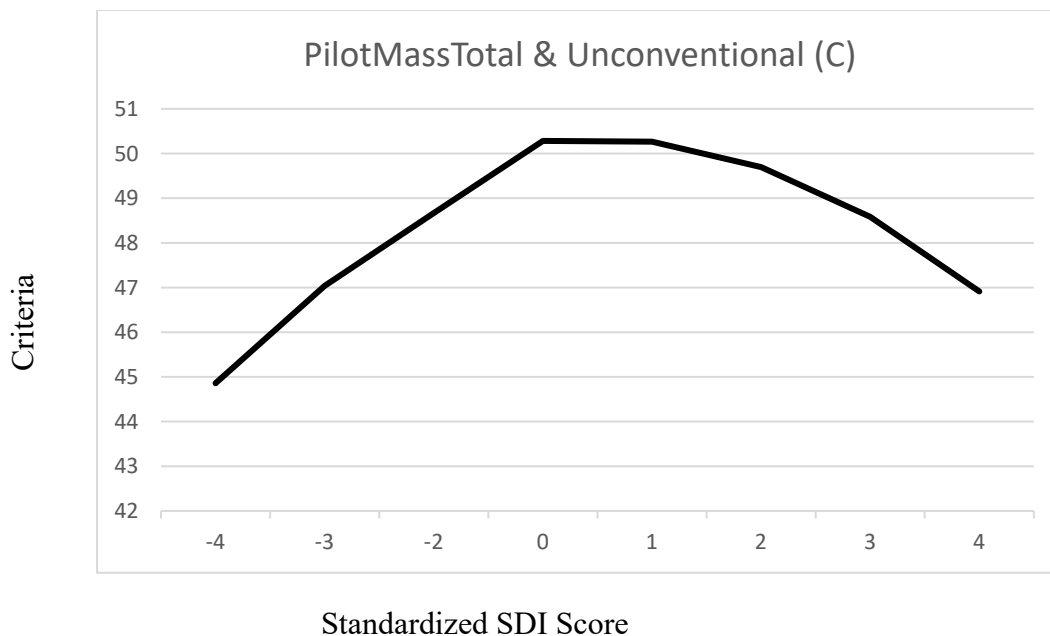


Figure 13. Non-Linear Relationship between SDI Unconventional and IFT Pilot MASS



Statistically significant non-linear relationships were found for 5 SDI facets in the prediction of CSO MASS. Results are summarized in the Table 111.

Table 111. Moderated Regression Results for SDI Facets Predicting CSO MASS

Model	Beta	t	Significance
Creative	-.12	-2.963*	.003
Creative ²	-.14	-3.316*	.001
Reflective	-.11	-2.843*	.005
Reflective ²	-.12	-3.129*	.002
Scientific Interest	-.03	-.753	.452
Scientific Interest ²	-.09	-2.287*	.022
Cultured	-.15	-4.252*	.000
Cultured ²	-.08	-2.387*	.012
Activity	-.03	-.670	.503
Activity ²	-.08	-2.122*	.034

Plots describing these relationships between the SDI facets are shown in Figures 14 through 18. In general, the plots showed modest inverted-U relationships, indicating that low and high SDI scores are associated with higher levels of CSO MASS.

Figure 14. Non-Linear Relationship between SDI Creative and CSO Pilot

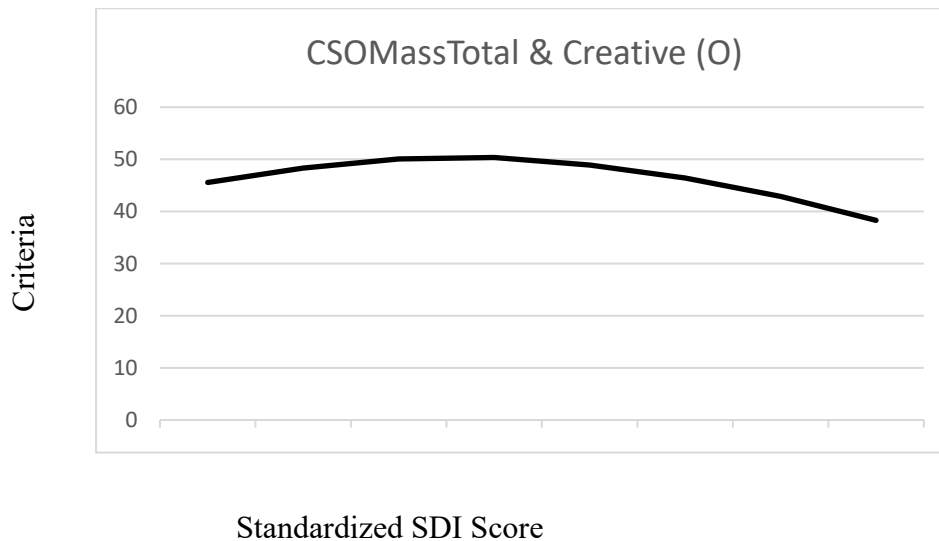


Figure 15. Non-Linear Relationship between SDI Reflective and CSO Pilot

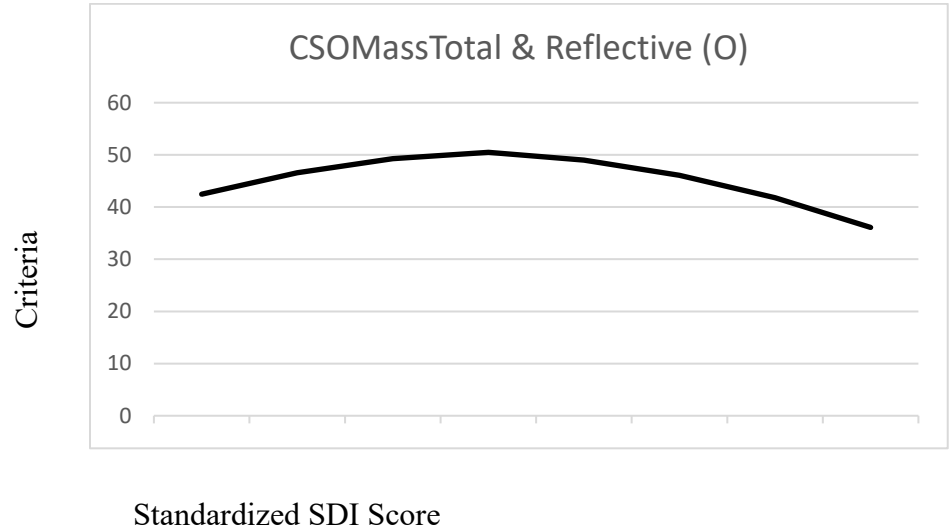


Figure 16. Non-Linear Relationship between SDI Scientific Interest and CSO Pilot

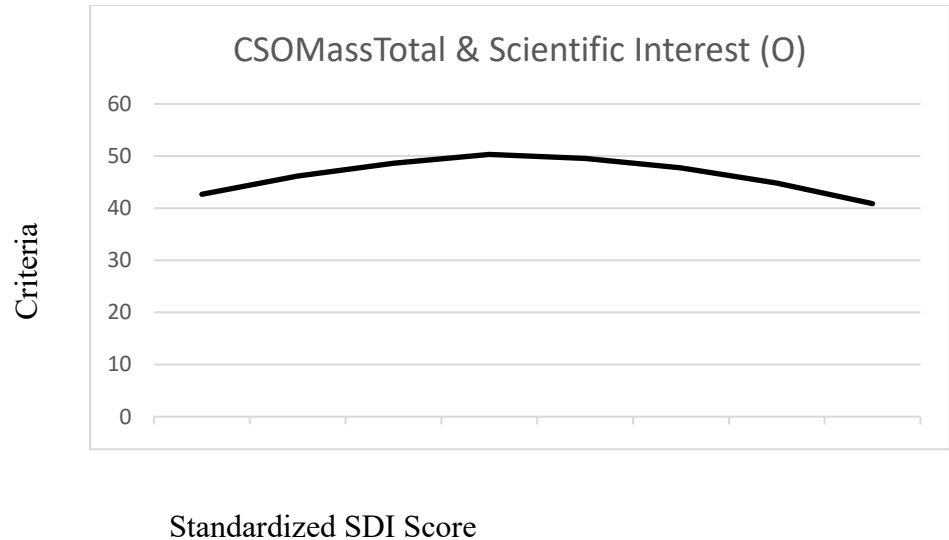


Figure 17. Non-Linear Relationship between SDI Cultured and CSO Pilot

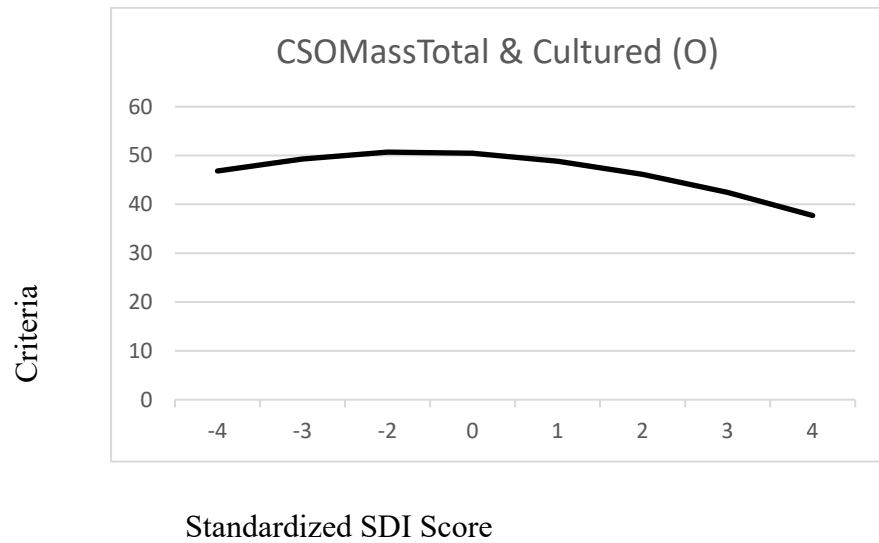
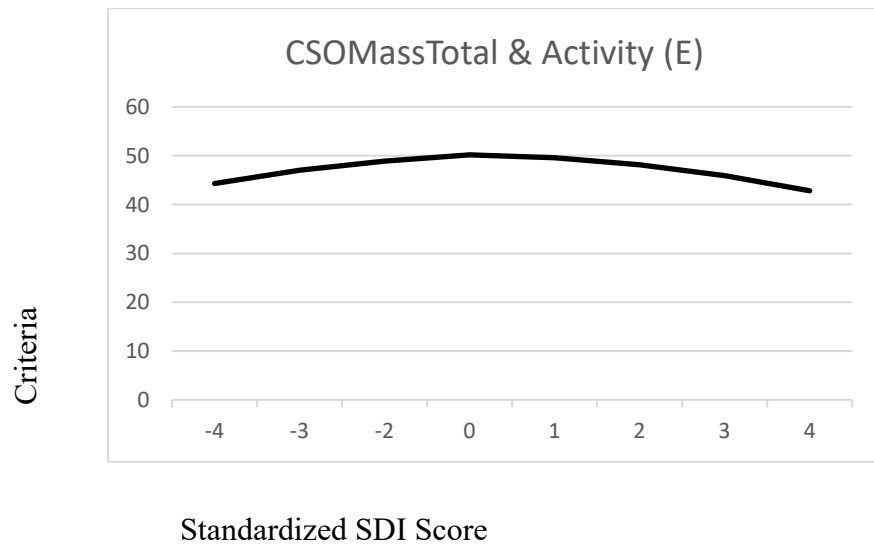


Figure 18. Non-Linear Relationship between SDI Activity and CSO Pilot



5.0 CONCLUSION

A comprehensive evaluation of the AFOQT Form T was conducted to evaluate its psychometric and validity characteristics and to evaluate the value of potential changes and revisions to the scoring of the test. The range of objectives performed included evaluation of: (1) the AFOQT operational composites, (2) the linkages between critical officer competencies and attributes with AFOQT subtests, (3) the validity, and subgroup differences, and potential for adverse impact for the current operational composites, and (4) alternative composites designed to maintain or increase validity while reducing levels of subgroup differences. Across the objectives, the results indicated the potential for alternative AFOQT composites to result in similar levels of validity, measure a broader range of job-related attributes and competencies for officer jobs, and reduce the potential for adverse impact through the inclusion of previously unscored, non-cognitive assessments compared with current operational composites. Tables 112 through 116 describe the validity and adverse impact results for the current and alternative composites for Officership (Table 112), Academic Aptitude (Table 113), Pilot (Table 114), CSO (Table 115), and ABM (Table 116). For the alternative composites, adverse impact ratios are presented for the restricted sample (validation study) and the unrestricted sample (applicant study).

Table 112. Composite Validity and Adverse Impact Ratios: General Officership

Validity	Adj R ² (ROTC ratings) = .08	
	Adj R ² (USAFA Order of Merit) = .03	
Subgroup	New Composite AIR (Restricted Sample)	New Composite AIR (Unrestricted Sample)
Black/African American	.75	.75
Hispanic/Latino	.85	.96
Asian	.79	.79
Female	.88	.88

Note. There is no corresponding current Officership composite.

Table 113. Composite Validity and Adverse Impact Ratios: Academic Aptitude

Validity	Adj R² (Verbal, SUPT MASS) = .00 Adj R² (Verbal, IFT Pilot MASS) = .04 Adj R² (Quant, SUPT MASS) = .00 Adj R² (Quant, IFT Pilot MASS) = .04		Adj R² (SUPT Academy) = .06 Adj R² (GPA) = .20	
Subgroup	Current Composite AIR (Restricted Sample)	Current Composite AIR (Unrestricted Sample)	New Composite AIR (Restricted Sample)	New Composite AIR (Unrestricted Sample)
Black/African American	.65	.60	.72	.72
Hispanic/Latino	.81	.85	.88	.93
Asian	.92	.89	.94	.94
Female	.81	.85	.80	.83

Table 114. Composite Validity and Adverse Impact Ratios: Pilot

Validity	Adj R² (IFT Pilot MASS) = .19		Adj R² (IFT Pilot MASS) = .17	
Subgroup	Current Composite AIR (Restricted Sample)	Current Composite AIR (Unrestricted Sample)	Alternative Composite AIR (Restricted Sample)	Alternative Composite AIR (Unrestricted Sample)
Black/African American	.45	.33	.65	.62
Hispanic/Latino	.75	.76	.90	.90
Asian	.90	.82	.87	.92
Female	.62	.62	.73	.77

Table 115. Composite Validity and Adverse Impact Ratios: CSO

Validity	Adj R² (CSO MASS) = .05		Adj R² (CSO MASS) = .11	
Subgroup	Current Composite AIR (Restricted Sample)	Current Composite AIR (Unrestricted Sample)	Alternative Composite AIR (Restricted Sample)	Alternative Composite AIR (Unrestricted Sample)
Black/African American	.54	.41	.69	.50
Hispanic/Latino	.79	.78	.91	.84
Asian	.92	.85	.95	.92
Female	.82	.78	.80	.66

Table 116. Composite Validity and Adverse Impact Ratios: ABM

Validity Subgroup	Adj R ² (ABM MASS) = .09		Adj R ² (ABM MASS) = .07	
	Current Composite AIR (Restricted Sample)	Current Composite AIR (Unrestricted Sample)	Alternative Composite AIR (Restricted Sample)	Alternative Composite AIR (Unrestricted Sample)
Black/African American	.47	.35	.72	.54
Hispanic/Latino	.76	.77	.91	.84
Asian	.93	.86	.99	.98
Female	.72	.71	.83	.72

The results of this project have implications for policy and process to select and classify prospective Air Force officers. There are also implications for ways of responding to the D&I strategic plan published in 2012, through the use of the AFOQT. The results point to several alternative AFOQT composites that can maintain the prediction of training and job performance while reducing systematic differences in scores across minority demographic groups such as race, ethnicity, and gender. The alternative composites were derived by combining selected legacy scored cognitive subtests with historically unscored subtests (Physical Science and the Self-Description Inventory). These composites were informed by a linking task that was designed and conducted to map attributes/competencies found to be important for officer roles to constructs measured in the AFOQT. This improves the theoretical and conceptual basis for including a broader range of content to increase the measurement of the AFOQT.

When compared to validity, subgroup difference, and adverse impact results for the current AFOQT Form T composites, it was found that the addition of multiple non-cognitive scales from the SDI along with cognitive subtests maintained validity and substantially improved adverse impact ratios (Uniform Guidelines; Equal Employment Opportunity Commission, 1978).

Going forward, we recommend the implementation of the alternative composites for selection and classification. Given the potential for faking when included as an operational assessment, we recommend that SDI scores be monitored in particular to evaluate whether it continues to support the validity of the alternative composites. We recommend periodic re-validation to ensure that the composites perform at the levels observed in this analysis. We also recommend that AFPC continue to pursue the research and development of alternative approaches and measures to further advance the D&I initiative. While the results presented in this report are positive and support improved D&I, some of the results continue to point to disparities in test scores for selected minority groups. As such, more work remains to continue to investigate alternative measurement methods that can help to more fully overcome the lingering group differences.

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APPENDIX A: JOB ANALYSIS LINKAGE TASK – COGNITIVE SUBTESTS

Job Analysis Linkage Task – Cognitive Subtests

Introduction:

AFOQT Rating Task Overview

In this rating task, we are asking industrial-organizational psychologists to provide judgments on Air Force attributes and competencies that are deemed important by instructors and supervisors for various officer roles. The judgment is to rate the extent Air Force Officer Qualifying Test (AFOQT) subtests measure these attributes and competencies. Your ratings will help confirm the existing mappings of AFOQT subtests to competencies and provide information about developing alternative composites.

Please complete your ratings by end of day Tuesday, February 1, 2021.

PDRI I/Os: Bill your time to 102528.001.00.

Materials and General Instructions

Materials:

- This workbook, which includes instructions and space to record your ratings.
- The document “**AFOQT Subtest Information**” which includes AFOQT subtest definitions and example items.

Complete the following steps:

1. Save a copy of this workbook, adding your name to the end of the file name.
2. Complete the "SME Background" tab.
3. Read and follow all instructions below regarding rating task instructions and AFOQT information.
4. Complete the "Attribute Ratings" and "Competency Ratings" tabs. You will provide 11 Subtest Relatedness ratings for attributes and competencies, following the instructions below.
5. Save this workbook as specified and email it back to eleanor.lovering@pdri.com by Tuesday, February 1, 2021.
6. Please destroy hard copies (if you print).

Instructions: In this rating task, you will rate the extent to which 11 AFOQT subtests measure 55 attributes, as noted in the "Attribute Ratings" tab. You will then rate the extent to which 11 AFOQT subtests measured 12 competencies. Please use the comments column to explain ratings, if necessary.

AFOQT Information: The AFOQT measures aptitudes used to select candidates for officer commissioning programs and specific commissioned officer training programs. The AFOQT consists of 12 subtests. You will receive a separate rating task for the last AFOQT subtest, the SDI, at a later time. Subtest scores are combined to generate composite scores used to help predict success in certain types of Air Force officer training programs.

1 Your name:

2 Your job title:

3 Your organization (Air Force or PDRI):

4 Your highest degree obtained, including field of study:

5 How long have you worked in the field of industrial/organizational psychology?

Years

Months

Attribute	To what extent does the Verbal Analogies subtest measure the attribute? <i>Verbal Analogies: Measures one's ability to reason and see relationships among words</i>	To what extent does the Arithmetic Reasoning subtest measure the attribute? <i>Arithmetic Reasoning: Measures one's ability to use arithmetic to solve problems</i>	To what extent does the Word Knowledge subtest measure the attribute? <i>Word Knowledge: Measures one's knowledge of words and their meanings</i>	To what extent does the Math Knowledge subtest measure the attribute? <i>Math Knowledge: Measures one's knowledge of mathematical terms and principles</i>	To what extent does the Reading Comprehension subtest measure the attribute? <i>Reading Comprehension: Measures one's ability to read and understand written material</i>	To what extent does the Physical Science subtest measure the attribute? <i>Physical Science: Measures one's knowledge in the area of science</i>
	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent
Achievement: To work hard; to show ambition, confidence, and resourcefulness						
Courage: To stand up to challenges and not be afraid to face dangerous situations						
Persistence: To persist in goal-directed behaviors in the face of obstacles; to focus on tasks until they are completed, and a need to see projects through to completion						
Responsibility: To be dependable, reliable, and make every effort to keep one's promises						
Curiosity: To be inquisitive and perceptive; to be interested in learning new information and attend courses and workshops whenever possible						
Attention to Detail: To pay close attention to the details of one's work; to ensure work is accurate and complete; to carefully review and scrutinize one's work						
Order: To organize tasks and activities; to maintain neat and clean surroundings						
Deliberation: To carefully think through details of a plan and consequences of behavior before acting						

Consideration: To be affectionate, compassionate, sensitive, and caring						
Humility: To have willingness to overcome one's own interests for the needs of others, and a willingness to subdue one's own individuality in order to be part of a group						
Cooperation: To be trusting, cordial, non- critical, and easy to get along with						
Selflessness: To be generous with one's time and resources						
Virtue: To strive to adhere to standards of honesty, morality, and "good Samaritan" behavior						
Moral Courage: To take action for moral reasons despite the risk of adverse consequences.						
Dominance: To readily take charge; to be domineering; to act as a "natural leader"						
Even-Tempered: To be calm and stable; to tend to avoid showing anger, hostility, or aggression						
Ingenuity: To be inventive and capable of thinking "outside of the box"						
Unconventional: Not strictly bound to following rules, especially if they do not make sense in a given situation						
Tolerance: To be interested in other cultures and opinions that differ from one's own						
Adjustment: To handle stress well; to avoid worry and apprehension						
Optimism: To have a positive outlook on life; to tend to experience joy and a sense of well-being						
Self-Control: To show patience and caution; to show ability to stay levelheaded and delay gratification						
Self-Discipline: To be focused and dedicated to working hard and completing the task at hand in a timely manner						

Depth: To be introspective in examining one's own life; to show behaviors associated with self-improvement						
Situational Awareness: To pay attention to surroundings and rarely get lost or surprised						
Team Orientation: To prefer to work in teams; to make people work together better						
Commitment to Serve: To identify with the military and have a strong desire to serve one's country						
Intellectual Efficiency: To process information quickly and make decisions quickly; to be knowledgeable, astute, and act as an intellectual						
Self-Efficacy: Belief in own ability to perform behaviors necessary to succeed in life						
Activity: To prefer to stay active much of the time, have a wide range of activities, and enjoy multitasking						
Physical Condition: To engage in activities to maintain physical fitness and to participate in vigorous exercise or sports						
Mental Rotation: To accurately rotate an object (for example, a map) in one's imagination while maintaining an accurate sense of direction						
Spatial Orientation: To know one's location in relation to the environment; to maintain directional orientation when navigating an unfamiliar area; to accurately estimate direction or location after traveling for a certain amount of time						
Instrument Comprehension: Ability to determine the position of an airplane in flight from reading instruments showing its compass direction heading, amount of climb or dive, and degree of bank to right or left.						
Rate Control: Ability to time the adjustments of a movement or equipment control in anticipation of changes in the speed or direction of a continuously moving object or scene.						

Auditory Attention: Ability to focus on a single source of auditory information in the presence of other distracting sounds.						
Control Precision: Ability to quickly and repeatedly make precise adjustments in moving the controls or vehicle to exact positions.						
Reaction Time: Ability to quickly respond to a signal when it appears.						
Multi-Limb Coordination: Ability to coordinate movements of two or more limbs together while sitting, standing, or lying down.						
Perceptual Speed and Accuracy: To perceive or compare information (for example, letters, numbers, symbols, or patterns) quickly and accurately; to notice or compare details about things quickly and accurately						
Flexibility of Closure: Ability to identify or detect a known pattern that (figure, object, word, or sound) that is hidden in other distracting material.						
Critical Thinking: To have ability to use logic and analysis to identify the strengths and weaknesses of different approaches, actions, or decisions.						
Reasoning: To apply rules to come up with logical answers to problems; to combine separate pieces of information to form general rules or conclusions; to recognize patterns or trends and anticipate outcomes						
Arithmetic Reasoning: To have ability to solve problems involving quantitative data						
Paragraph Comprehension: To have ability to read and understand written material, and obtain information from written passages						
Long-term Memory: To retain and recall information (for example, words, numbers, pictures, and procedures) after long time periods						
Working Memory: To have ability to hold information in memory while processing other information						

Time-Sharing: To have ability to shift back and forth between two or more sources of information						
Instructing: To be able to teach others how to do something						
Vigilance: To have ability to stay alert and attentive to one's surroundings over long periods of time, including small details, to recognize hazards and threats within one's environment						
Situational Judgment: Judgment in responding to interpersonal situations similar to those encountered in the Air Force.						
Aviation Knowledge: Knowledge of basic aviation concepts and principles.						
Mathematics Knowledge: To have knowledge of high school mathematics principles						
Mechanical Comprehension: To have knowledge of mechanical and physical principles						
Electronics Information: To have knowledge of electricity and electronics						

Attribute	To what extent does the Table Reading subtest measure the attribute? <i>Table Reading: Measures one's ability to read a table quickly and accurately</i>	To what extent does the Instrument Comprehension subtest measure the attribute? <i>Instrument Comprehension: Measures one's ability to determine the position of an airplane in flight from reading instruments showing its compass direction heading, amount of climb or dive, and degree of bank to right or left</i>	To what extent does the Block Counting subtest measure the attribute? <i>Block Counting: Measures one's ability to "see into" a 3-dimensional pile of blocks</i>	To what extent does the Aviation Information subtest measure the attribute? <i>Aviation Information: Measures one's knowledge of aviation</i>	To what extent does the Situational Judgment subtest measure the attribute? <i>Situational Judgment: Measures one's judgment in responding to interpersonal situations similar to those one may encounter as an officer</i>	Please note any comments you have regarding any of the subtests here.
	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	
Achievement: To work hard; to show ambition, confidence, and resourcefulness						
Courage: To stand up to challenges and not be afraid to face dangerous situations						
Persistence: To persist in goal-directed behaviors in the face of obstacles; to focus on tasks until they are completed, and a need to see projects through to completion						
Responsibility: To be dependable, reliable, and make every effort to keep one's promises						
Curiosity: To be inquisitive and perceptive; to be interested in learning new information and attend courses and workshops whenever possible						
Attention to Detail: To pay close attention to the details of one's work; to ensure work is						

accurate and complete; to carefully review and scrutinize one's work						
Order: To organize tasks and activities; to maintain neat and clean surroundings						
Deliberation: To carefully think through details of a plan and consequences of behavior before acting						
Consideration: To be affectionate, compassionate, sensitive, and caring						
Humility: To have willingness to overcome one's own interests for the needs of others, and a willingness to subdue one's own individuality in order to be part of a group						
Cooperation: To be trusting, cordial, non-critical, and easy to get along with						
Selflessness: To be generous with one's time and resources						
Virtue: To strive to adhere to standards of honesty, morality, and "good Samaritan" behavior						
Moral Courage: To take action for moral reasons despite the risk of adverse consequences.						
Dominance: To readily take charge; to be domineering; to act as a "natural leader"						
Even-Tempered: To be calm and stable; to tend to avoid showing anger, hostility, or aggression						
Ingenuity: To be inventive and capable of thinking "outside of the box"						
Unconventional: Not strictly bound to following rules, especially if they do not make sense in a given situation						
Tolerance: To be interested in other cultures and opinions that differ from one's own						
Adjustment: To handle stress well; to avoid worry and apprehension						

Optimism: To have a positive outlook on life; to tend to experience joy and a sense of well-being						
Self-Control: To show patience and caution; to show ability to stay levelheaded and delay gratification						
Self-Discipline: To be focused and dedicated to working hard and completing the task at hand in a timely manner						
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APPENDIX B: JOB ANALYSIS LINKAGE TASK - SDI

Job Analysis Linkage Task - SDI

AFOQT Rating Task

Overview

In this rating task, we are asking industrial-organizational psychologists to provide judgments on Air Force attributes and competencies that are deemed important by instructors and supervisors for various officer roles. The judgment is to rate the extent domains and facets of the Self-Description Inventory (SDI) measure these attributes and competencies. Your ratings will help confirm the existing mappings of the SDI to competencies and provide information about developing alternative composites.

Materials and General Instructions

Materials:

- This workbook, which includes instructions and space to record your ratings.

Complete the following steps:

1. Save a copy of this workbook, adding your name to the end of the file name.
2. Complete the "SME Background" tab.
3. Read and follow all instructions below regarding rating task instructions and the SDI Background tab.
4. Complete the "Attribute Ratings" and "Competency Ratings" tabs. You will provide 6 SDI domain Ratings and 30 SDI facet ratings for attributes and competencies, following the instructions below.
5. Save this workbook as specified and email it back to eleanor.lovering@pdri.com by February 9, 2021.
6. Please destroy hard copies (if you print).

Instructions: In this rating task, you will rate the extent to which 6 SDI domains and 30 SDI facets measure 55 attributes, as noted in the "Attribute Ratings" tab. You will then rate the extent to which 6 SDI domains and 30 SDI facets measure 12 competencies. Facets with "(R)" next to them indicate the facet is reverse-scored. If you believe a facet could measure a reverse-score of a attribute or competency, please indicate so by putting "*" next to your numerical rating. For example, the Temperamental facet may measure the Even-Tempered attribute, if reverse-scored. Please use the comments column to explain ratings, if necessary.

AFOQT Information: The AFOQT measures aptitudes used to select candidates for officer commissioning programs and specific commissioned officer training programs. The AFOQT consists of 12 subtests. Subtest scores are combined to generate composite scores used to help predict success in certain types of Air Force officer training programs. Contact Eleanor if you have any questions.

Self Description Inventory (SDI)

Overview

The SDI is an experimental test that measures non-cognitive attributes. The examinee is asked to use a five-point Likert Scale ranging from Strongly Disagree to Strongly Agree to rate 220 behavioral statements.

This inventory records one's personal style and attributes. The goal is to record one's first impressions and identify Air Force jobs in which similar people find the work satisfying. The inventory consists of a list of statements. Read each statement and, based on your first impression, record how well each one describes you.

Example Items

Look at the sample statement below:

S1. I enjoy reading poetry.

Indicate your agreement with the statement using the scale below.

A	B	C	D	E
Strongly Disagree	Moderately Disagree	Neither Agree nor Disagree	Moderately Agree	Strongly Agree

If you strongly agree that the statement describes you, select response E on the scale. If you strongly disagree, select response A on the scale. You would select B, C, or D to indicate other levels of agreement.

You should work quickly and reply to all statements. Give your first impression about how well each statement describes you. Don't spend a long time deciding what your answer should be. Answer all statements, even if you're not sure of your answer.

The 10 statements below are representative of the types of statements in the inventory.

1. I always try to finish what I start.
2. I generally get along well with most people.
3. I get nervous if I have to speak in public.
4. People often get upset with me for now showing up on time.
5. I like to listen to many different kinds of music.
6. Usually I let my work goals take priority over my personal interests.
7. I am not comfortable supervising others.
8. I am pleased when friends drop in to see me.
9. I don't like to be involved in group activities.
10. I have higher work standards than do most people.

1 Your name:

2 Your job title:

3 Your organization (Air Force or PDRI):

4 Your highest degree obtained, including field of study:

5 How long have you worked in the field of industrial/organizational psychology?

Years

Months

Attribute	To what extent does the <i>Agreeableness</i> domain measure the attribute? <i>Agreeableness: The kinds of interactions an individual prefers ranging from compassion to antagonism</i>	To what extent does the <i>Team Player</i> facet measure the attribute? <i>Team Player: Being a dependable and responsible team member</i>	To what extent does the <i>Pleasant</i> facet measure the attribute? <i>Pleasant: Tendency to be in a pleasant mood, act friendly and get along well with others</i>	To what extent does the <i>Helpful-Altruistic</i> facet measure the attribute? <i>Helpful-Altruistic: Tendency to be helpful and generous to others with time and effort</i>	To what extent does the <i>Optimist</i> facet measure the attribute? <i>Optimist: Having a happy, hopeful, and encouraging outlook on life and the future</i>	To what extent does the <i>Well-Adjusted</i> facet measure the attribute? <i>Well-Adjusted: Enjoy being around upbeat people while engaging in well-adjusted behavior with laughter, honesty, and dependability</i>
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Deliberation: To carefully think through details of a plan and consequences of behavior before acting						
Consideration: To be affectionate, compassionate, sensitive, and caring						
Humility: To have willingness to overcome one's own interests for the needs of others, and a willingness to subdue one's own individuality in order to be part of a group						
Cooperation: To be trusting, cordial, non-critical, and easy to get along with						
Selflessness: To be generous with one's time and resources						
Virtue: To strive to adhere to standards of honesty, morality, and "good Samaritan" behavior						
Moral Courage: To take action for moral reasons despite the risk of adverse consequences.						
Dominance: To readily take charge; to be domineering; to act as a "natural leader"						
Even-Tempered: To be calm and stable; to tend to avoid showing anger, hostility, or aggression						
Ingenuity: To be inventive and capable of thinking "outside of the box"						
Unconventional: Not strictly bound to following rules, especially if they do not make sense in a given situation						
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Reaction Time: Ability to quickly respond to a signal when it appears.						
Multi-Limb Coordination: Ability to coordinate movements of two or more limbs together while sitting, standing, or lying down.						
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Aviation Knowledge: Knowledge of basic aviation concepts and principles.						
Mathematics Knowledge: To have knowledge of high school mathematics principles						
Mechanical Comprehension: To have knowledge of mechanical and physical principles						
Electronics Information: To have knowledge of electricity and electronics						

Attribute	To what extent does the Neuroticism domain measure the attribute? <i>Neuroticism: The chronic level of emotional adjustment and instability</i>	To what extent does the Stress-Under-Pressure facet measure the attribute? <i>Stress-Under-Pressure: Tendency to experience stress and discouragement when</i>	To what extent does the Temperamental facet measure the attribute? <i>Temperamental: Gets easily upset over events; can be</i>	To what extent does the Worry facet measure the attribute? <i>Worry: Worry a great deal over many things, including what the future holds</i>	To what extent does the Angry-Hostility facet measure the attribute? <i>Angry-Hostility: React with anger and hostility to many stimuli, are easily</i>
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		<i>faced with high-pressure situations</i>	<i>irritable and sensitive to criticism</i>	<i>and how things might go wrong</i>	<i>upset and have short tempers</i>
	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent
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Humility: To have willingness to overcome one's own interests for the needs of others, and a willingness to subdue one's own individuality in order to be part of a group					

Cooperation: To be trusting, cordial, non-critical, and easy to get along with					
Selflessness: To be generous with one's time and resources					
Virtue: To strive to adhere to standards of honesty, morality, and "good Samaritan" behavior					
Moral Courage: To take action for moral reasons despite the risk of adverse consequences.					
Dominance: To readily take charge; to be domineering; to act as a "natural leader"					
Even-Tempered: To be calm and stable; to tend to avoid showing anger, hostility, or aggression					
Ingenuity: To be inventive and capable of thinking "outside of the box"					
Unconventional: Not strictly bound to following rules, especially if they do not make sense in a given situation					
Tolerance: To be interested in other cultures and opinions that differ from one's own					
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Attribute	To what extent does the Extraversion domain measure the attribute? <i>Extraversion: The quantity and intensity of preferred interpersonal interactions, activity level, need for stimulation, and capacity for joy</i>	To what extent does the Reserved facet measure the attribute? <i>Reserved (R): Are typically shy and reserved in social situations, often quiet and withdrawn</i>	To what extent does the Dominance-Leader facet measure the attribute? <i>Dominance-Leader: Tend to take charge in group settings, dominate conversations and viewed as a leader</i>	To what extent does the Excitement-Seeking facet measure the attribute? <i>Excitement-Seeking: Enjoy excitement and tend to seek out stimulating situations</i>	To what extent does the High-Intensity Pleasure facet measure the attribute? <i>High-Intensity Pleasure: Have a preference for environments with high intensity stimulation such as loud noises and bright lights</i>	To what extent does the Activity facet measure the attribute? <i>Activity: Prefer to stay active much of the time, have a wide range of activities and enjoy multitasking</i>	To what extent does the Spontaneous-Variety facet measure the attribute? <i>Spontaneous-Variety: Frequently engage in unplanned and spontaneous activities</i>
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Tolerance: To be interested in other cultures and opinions that differ from one's own							
Adjustment: To handle stress well; to avoid worry and apprehension							
Optimism: To have a positive outlook on life; to tend to experience joy and a sense of well-being							
Self-Control: To show patience and caution; to show ability to stay levelheaded and delay gratification							
Self-Discipline: To be focused and dedicated to working hard and completing the task at hand in a timely manner							
Depth: To be introspective in examining one's own life; to show behaviors associated with self- improvement							
Situational Awareness: To pay attention to surroundings and rarely get lost or surprised							
Team Orientation: To prefer to work in teams; to make people work together better							
Commitment to Serve: To identify with the military and							

have a strong desire to serve one's country							
Intellectual Efficiency: To process information quickly and make decisions quickly; to be knowledgeable, astute, and act as an intellectual							
Self-Efficacy: Belief in own ability to perform behaviors necessary to succeed in life							
Activity: To prefer to stay active much of the time, have a wide range of activities, and enjoy multitasking							
Physical Condition: To engage in activities to maintain physical fitness and to participate in vigorous exercise or sports							
Mental Rotation: To accurately rotate an object (for example, a map) in one's imagination while maintaining an accurate sense of direction							
Spatial Orientation: To know one's location in relation to the environment; to maintain directional orientation when navigating an unfamiliar area; to accurately estimate direction or location after traveling for a certain amount of time							
Instrument Comprehension: Ability to determine the position of an airplane in flight from reading instruments showing its compass direction heading, amount of climb or dive, and degree of bank to right or left.							

Rate Control: Ability to time the adjustments of a movement or equipment control in anticipation of changes in the speed or direction of a continuously moving object or scene.							
Auditory Attention: Ability to focus on a single source of auditory information in the presence of other distracting sounds.							
Control Precision: Ability to quickly and repeatedly make precise adjustments in moving the controls or vehicle to exact positions.							
Reaction Time: Ability to quickly respond to a signal when it appears.							
Multi-Limb Coordination: Ability to coordinate movements of two or more limbs together while sitting, standing, or lying down.							
Perceptual Speed and Accuracy: To perceive or compare information (for example, letters, numbers, symbols, or patterns) quickly and accurately; to notice or compare details about things quickly and accurately							
Flexibility of Closure: Ability to identify or detect a known pattern that (figure, object, word, or sound) that is hidden in other distracting material.							
Critical Thinking: To have ability to use logic and analysis to identify the strengths and weaknesses of							

different approaches, actions, or decisions.							
Reasoning: To apply rules to come up with logical answers to problems; to combine separate pieces of information to form general rules or conclusions; to recognize patterns or trends and anticipate outcomes							
Arithmetic Reasoning: To have ability to solve problems involving quantitative data							
Paragraph Comprehension: To have ability to read and understand written material, and obtain information from written passages							
Long-term Memory: To retain and recall information (for example, words, numbers, pictures, and procedures) after long time periods							
Working Memory: To have ability to hold information in memory while processing other information							
Time-Sharing: To have ability to shift back and forth between two or more sources of information							
Instructing: To be able to teach others how to do something							
Vigilance: To have ability to stay alert and attentive to one's surroundings over long periods of time, including small details, to recognize hazards and threats within one's environment							

Situational Judgment: Judgment in responding to interpersonal situations similar to those encountered in the Air Force.							
Aviation Knowledge: Knowledge of basic aviation concepts and principles.							
Mathematics Knowledge: To have knowledge of high school mathematics principles							
Mechanical Comprehension: To have knowledge of mechanical and physical principles							
Electronics Information: To have knowledge of electricity and electronics							

Attribute	To what extent does the Conscientiousness domain measure the attribute? <i>Conscientiousness: The degree of organization, persistence, control, and motivation in goal-directed behavior</i>	To what extent does the Achievement-Striving facet measure the attribute? <i>Achievement-Striving: Usually engaged in goal-directed behavior and striving to achieve</i>	To what extent does the Order facet measure the attribute? <i>Order: Are neat and organized with a strong preference for environments with orderly arrangement</i>	To what extent does the Self-Discipline facet measure the attribute? <i>Self-Discipline: Focused and dedicated to working hard and completing the task at hand in a timely manner</i>	To what extent does the Deliberation facet measure the attribute? <i>Deliberation: Carefully think through details of a plan and consequences of behavior before acting</i>	To what extent does the Unconventional facet measure the attribute? <i>Unconventional (R): Not strictly bound to following rules, especially if they do not make sense in a given situation</i>
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Achievement: To work hard; to show ambition, confidence, and resourcefulness						
Courage: To stand up to challenges and not be afraid to face dangerous situations						
Persistence: To persist in goal-directed behaviors in the face of obstacles; to focus on tasks until they are completed, and a need to see projects through to completion						
Responsibility: To be dependable, reliable, and make every effort to keep one's promises						
Curiosity: To be inquisitive and perceptive; to be interested in learning new information and attend courses and workshops whenever possible						
Attention to Detail: To pay close attention to the details of one's work; to ensure work is accurate and complete; to carefully review and scrutinize one's work						
Order: To organize tasks and activities; to maintain neat and clean surroundings						
Deliberation: To carefully think through details of a plan and consequences of behavior before acting						

Consideration: To be affectionate, compassionate, sensitive, and caring						
Humility: To have willingness to overcome one's own interests for the needs of others, and a willingness to subdue one's own individuality in order to be part of a group						
Cooperation: To be trusting, cordial, non-critical, and easy to get along with						
Selflessness: To be generous with one's time and resources						
Virtue: To strive to adhere to standards of honesty, morality, and "good Samaritan" behavior						
Moral Courage: To take action for moral reasons despite the risk of adverse consequences.						
Dominance: To readily take charge; to be domineering; to act as a "natural leader"						
Even-Tempered: To be calm and stable; to tend to avoid showing anger, hostility, or aggression						
Ingenuity: To be inventive and capable of thinking "outside of the box"						
Unconventional: Not strictly bound to following rules, especially if they do not make sense in a given situation						
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Depth: To be introspective in examining one's own life; to show behaviors associated with self- improvement						
Situational Awareness: To pay attention to surroundings and rarely get lost or surprised						
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Attribute	To what extent does the Openness domain measure the attribute? <i>Openness: The active seeking and appreciation of experiences for one's own sake</i>	To what extent does the Creative facet measure the attribute? <i>Creative: Having the ability to arrive at many novel and innovative solutions to ill-defined problems</i>	To what extent does the Reflective facet measure the attribute? <i>Reflective: Propensity to engage in deep reflective thought and meditation; in tune with inner feelings</i>	To what extent does the Scientific Interest facet measure the attribute? <i>Scientific Interest: Being highly interested in all topics of science and technology</i>	To what extent does the Cultured facet measure the attribute? <i>Cultured: Valuing artistic expression and performance such as art museums, theater, and dance</i>	To what extent does the Imagination facet measure the attribute? <i>Imagination: Having an active and vivid imagination, often resulting in daydreaming and fantasy</i>
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Attribute	To what extent does the Machiavellianism domain measure the attribute? <i>Machiavellianism: The level in which one engages in deceit, craftiness, and duplicity to expedited control</i>	To what extent does the Interpersonal Tactics facet measure the attribute? <i>Interpersonal Tactics: Employing manipulative and exploitive tactics with others as a means for achieving desired ends</i>	To what extent does the Cynical View facet measure the attribute? <i>Cynical View: Possessing a cynical and negative view of human nature, emphasized with lack of trust</i>	To what extent does the Envious facet measure the attribute? <i>Envious: Often experiences envious and resentful emotions concerning what others have</i>	To what extent does the Influence Tactics facet measure the attribute? <i>Influence Tactics: Employing charm and persuasive tactics with others to gain compliance</i>	To what extent does the Independent facet measure the attribute? <i>Independent: Having a preference to work alone on tasks and problems because others are seen as obstacles to accomplishment</i>
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Competency	To what extent does the Agreeableness domain measure the competency? <i>Agreeableness: The kinds of interactions an individual prefers ranging from compassion to antagonism</i>	To what extent does the Team Player facet measure the competency? <i>Team Player: Being a dependable and responsible team member</i>	To what extent does the Pleasant facet measure the competency? <i>Pleasant: Tendency to be in a pleasant mood, act friendly and get along well with others</i>	To what extent does the Helpful-Altruistic facet measure the competency? <i>Helpful-Altruistic: Tendency to be helpful and generous to others with time and effort</i>	To what extent does the Optimist facet measure the competency? <i>Optimist: Having a happy, hopeful, and encouraging outlook on life and the future</i>	To what extent does the Well-Adjusted facet measure the competency? <i>Well-Adjusted: Enjoy being around upbeat people while engaging in well-adjusted behavior with laughter, honesty, and dependability</i>
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Active Listening: Listens, giving full attention to the speaker. Seeks clarification when needed, synthesizes messages from others, and responds appropriately.						
Followership: Adopts the values and standards of the organization, recognizing one's responsibilities as a follower, and one's role within the organization. Adopts and supports organizational changes. Commits to the action plan of the organization and mission, and advocates for leader's point of view when a decision is established.						
Adaptability: Accepts change and maintains effectiveness when experiencing changes in new work structures, processes, requirements, or cultures. Responds in a pro-active manner to unexpected or ambiguous situations, opportunities, or risks.						

Learning Orientation: Applies newly acquired knowledge or skill to practical use (including further learning through trial and error). Seeks and capitalizes on new learning opportunities.						
Problem Solving: Evaluates options and selects appropriate actions, solutions, and resources when confronted with a problem or situation. Identifies and fills gaps in information required. Applies analytic methods in solving problems and developing alternatives.						
Decision Making: Makes effective, timely decisions informed by sound reasoning. Identifies, evaluates, and assimilates information from multiple sources and considers the consequences of potential actions to choose the most appropriate one.						
Integrity: Commits to and follows USAF accepted codes of conduct and ethical principles. Represents information and data accurately and completely.						
Professionalism: Maintains military bearing and professional etiquette at all times.						
Warrior Ethos: Exemplifies and models the warrior spirit. Maintains self physically, emotionally, spiritually, and socially. Exhibits moral and physical courage and a hardiness of spirit despite physical and mental hardships.						
Accepts Feedback: Accepts constructive feedback. Demonstrates a willingness to seriously consider feedback received and its implications for behavior.						

Self-Awareness: Acknowledges own interpersonal and technical strengths and weaknesses. Analyzes self-behavior and quickly and proactively modifies behavior to deal effectively with changes.						
Timeliness: Adheres to timelines and milestones set for mission accomplishment.						

Competency	To what extent does the Neuroticism domain measure the competency? <i>Neuroticism: The chronic level of emotional adjustment and instability</i>	To what extent does the Stress-Under-Pressure facet measure the competency? <i>Stress-Under-Pressure: Tendency to experience stress and discouragement when faced with high-pressure situations</i>	To what extent does the Temperamental facet measure the competency? <i>Temperamental: Gets easily upset over events; can be irritable and sensitive to criticism</i>	To what extent does the Worry facet measure the competency? <i>Worry: Worry a great deal over many things, including what the future holds and how things might go wrong</i>	To what extent does the Angry-Hostility facet measure the competency? <i>Angry-Hostility: React with anger and hostility to many stimuli, are easily upset and have short tempers</i>
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Self-Awareness: Acknowledges own interpersonal and technical strengths and weaknesses. Analyzes self-behavior and quickly and proactively modifies behavior to deal effectively with changes.					
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Competency	To what extent does the Extraversion domain measure the competency? <i>Extraversion: The quantity and intensity of preferred interpersonal interactions, activity level, need for stimulation, and capacity for joy</i>	To what extent does the Reserved facet measure the competency? <i>Reserved (R): Are typically shy and reserved in social situations, often quiet and withdrawn</i>	To what extent does the Dominance-Leader facet measure the competency? <i>Dominance-Leader: Tend to take charge in group settings, dominate conversations and viewed as a leader</i>	To what extent does the Excitement-Seeking facet measure the competency? <i>Excitement-Seeking: Enjoy excitement and tend to seek out stimulating situations</i>	To what extent does the High-Intensity Pleasure facet measure the competency? <i>High-Intensity Pleasure: Have a preference for environments with high intensity stimulation such as loud noises and bright lights</i>	To what extent does the Activity facet measure the competency? <i>Activity: Prefer to stay active much of the time, have a wide range of activities and enjoy multitasking</i>	To what extent does the Spontaneous-Variety facet measure the competency? <i>Spontaneous-Variety: Frequently engage in unplanned and spontaneous activities</i>
	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent
Active Listening: Listens, giving full attention to the speaker. Seeks clarification when needed, synthesizes messages from others, and responds appropriately.							
Followership: Adopts the values and standards of the organization, recognizing one's responsibilities as a follower, and one's role within the organization. Adopts and supports organizational changes. Commits to the action plan of the organization and mission, and advocates for leader's point of view when a decision is established.							

Adaptability: Accepts change and maintains effectiveness when experiencing changes in new work structures, processes, requirements, or cultures. Responds in a pro-active manner to unexpected or ambiguous situations, opportunities, or risks.							
Learning Orientation: Applies newly acquired knowledge or skill to practical use (including further learning through trial and error). Seeks and capitalizes on new learning opportunities.							
Problem Solving: Evaluates options and selects appropriate actions, solutions, and resources when confronted with a problem or situation. Identifies and fills gaps in information required. Applies analytic methods in solving problems and developing alternatives.							
Decision Making: Makes effective, timely decisions informed by sound reasoning. Identifies, evaluates, and assimilates information from multiple sources and considers the consequences of potential actions to choose the most appropriate one.							
Integrity: Commits to and follows USAF accepted codes of conduct and ethical principles. Represents							

information and data accurately and completely.							
Professionalism: Maintains military bearing and professional etiquette at all times.							
Warrior Ethos: Exemplifies and models the warrior spirit. Maintains self physically, emotionally, spiritually, and socially. Exhibits moral and physical courage and a hardiness of spirit despite physical and mental hardships.							
Accepts Feedback: Accepts constructive feedback. Demonstrates a willingness to seriously consider feedback received and its implications for behavior.							
Self-Awareness: Acknowledges own interpersonal and technical strengths and weaknesses. Analyzes self-behavior and quickly and proactively modifies behavior to deal effectively with changes.							
Timeliness: Adheres to timelines and milestones set for mission accomplishment.							

Competency	To what extent does the Conscientiousness domain measure the competency? <i>Conscientiousness: The degree of organization, persistence, control, and motivation in goal-directed behavior</i>	To what extent does the Achievement-Striving facet measure the competency? <i>Achievement-Striving: Usually engaged in goal-directed behavior and striving to achieve</i>	To what extent does the Order facet measure the competency? <i>Order: Are neat and organized with a strong preference for environments with orderly arrangement</i>	To what extent does the Self-Discipline facet measure the competency? <i>Self-Discipline: Focused and dedicated to working hard and completing the task at hand in a timely manner</i>	To what extent does the Deliberation facet measure the competency? <i>Deliberation: Carefully think through details of a plan and consequences of behavior before acting</i>	To what extent does the Unconventional facet measure the competency? <i>Unconventional (R): Not strictly bound to following rules, especially if they do not make sense in a given situation</i>
	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent
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Accepts Feedback: Accepts constructive feedback. Demonstrates a willingness to seriously consider feedback received and its implications for behavior.						

Self-Awareness: Acknowledges own interpersonal and technical strengths and weaknesses. Analyzes self-behavior and quickly and proactively modifies behavior to deal effectively with changes.						
Timeliness: Adheres to timelines and milestones set for mission accomplishment.						

Competency	To what extent does the Openness domain measure the competency? <i>Openness: The active seeking and appreciation of experiences for one's own sake</i>	To what extent does the Creative facet measure the competency? <i>Creative: Having the ability to arrive at many novel and innovative solutions to ill-defined problems</i>	To what extent does the Reflective facet measure the competency? <i>Reflective: Propensity to engage in deep reflective thought and meditation; in tune with inner feelings</i>	To what extent does the Scientific Interest facet measure the competency? <i>Scientific Interest: Being highly interested in all topics of science and technology</i>	To what extent does the Cultured facet measure the competency? <i>Cultured: Valuing artistic expression and performance such as art museums, theater, and dance</i>	To what extent does the Imagination facet measure the competency? <i>Imagination: Having an active and vivid imagination, often resulting in daydreaming and fantasy</i>
	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent
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Timeliness: Adheres to timelines and milestones set for mission accomplishment.						

Competency	To what extent does the <i>Machiavellianism</i> domain measure the competency? <i>Machiavellianism: The level in which one engages in deceit, craftiness, and duplicity to expedited control</i>	To what extent does the <i>Interpersonal Tactics</i> facet measure the competency? <i>Interpersonal Tactics: Employing manipulative and exploitive tactics with others as a means for achieving desired ends</i>	To what extent does the <i>Cynical View</i> facet measure the competency? <i>Cynical View: Possessing a cynical and negative view of human nature, emphasized with lack of trust</i>	To what extent does the <i>Envious</i> facet measure the competency? <i>Envious: Often experiences envious and resentful emotions concerning what others have</i>	To what extent does the <i>Influence Tactics</i> facet measure the competency? <i>Influence Tactics: Employing charm and persuasive tactics with others to gain compliance</i>	To what extent does the <i>Independent</i> facet measure the competency? <i>Independent: Having a preference to work alone on tasks and problems because others are seen as obstacles to accomplishment</i>
	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent	0 = Not at All 1 = To a Moderate Extent 2 = To a Great Extent
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Problem Solving: Evaluates options and selects appropriate actions, solutions, and resources when confronted with a problem or situation. Identifies and fills gaps in information required. Applies analytic methods in solving problems and developing alternatives.						
Decision Making: Makes effective, timely decisions informed by sound reasoning. Identifies, evaluates, and assimilates information from multiple sources						

and considers the consequences of potential actions to choose the most appropriate one.						
Integrity: Commits to and follows USAF accepted codes of conduct and ethical principles. Represents information and data accurately and completely.						
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Self-Awareness: Acknowledges own interpersonal and technical strengths and weaknesses. Analyzes self-behavior and quickly and proactively modifies behavior to deal effectively with changes.						
Timeliness: Adheres to timelines and milestones set for mission accomplishment.						

APPENDIX C: ALTERNATIVE MEASURES FOR UNMEASURED CONSTRUCTS

Construct	Reaction Time
Definition	Ability to quickly respond to a signal when it appears.
Search terms	"reaction time assessment tool" "reaction time measurement healthy subjects"

Construct Name	Construct Definition	Measurement tool	Measurement description	Sample items/Examples	Psychometrics and relationships	Source
Reaction Time	speed of information processing	open-source, open-access reaction time test (OORTT)	Rapid and easy administration, robust Italian normative data based on a wide age range, a simple scoring system, compatibility with all operating systems, no license or activation costs, and based on an open-source software platform.	The battery is composed of three tasks: simple reaction times (SRT), Go/No-Go (GNG) condition, and four-position reaction times (4PRT)	Note: can be used in the clinical environment for cases of different attentional deficits after focal or degenerative brain damage	Rigoli, M., Facchin, A., Cardile, D., Beschin, N., & Luzzatti, C. (2021). Open-source open-access reaction time test (OORTT): an easy tool to assess reaction times. <i>Neurological Sciences</i> , 42(6), 2461-2469.
Reaction Time	The interval of time in the perception and evaluation of a stimulus necessitating a response.	Reactor	The designed program, a diagnostic tool designated Reactor, was implemented into Microsoft Visual Basic for application on the basis of SQL database engine (Microsoft Access). The postulates of objectivity, reliability, importance, economics, use-fulness, resistance to counterfeit and impartiality were essential criteria taken into account when designing the tool.	N/A software application	Simple reaction time to acoustic stimuli has been found to be shorter as compared to visual stimuli equaling about 150 ms, whereas visual reaction time ranges from 220 to 250 ms.	Zajdel, R., & Nowak, D. (2007). Simple and complex reaction time measurement: a preliminary evaluation of new approach and diagnostic tool. <i>Computers in biology and medicine</i> , 37(12), 1724-1730.

Alertness	the condition of general wakefulness that enables a person to respond quickly and appropriately to any given demand	Test for Attentional Performance (TAP)	The "Alertness Test" is a simple visual reaction time (RT) task with and without an acoustic warning. In this test, reaction time is examined under two conditions. The first condition concerns simple reaction time measurements, in which a cross appears on the monitor at randomly varying intervals and to which the subject should respond as quickly as possible by pressing a key. Intrinsic alertness is measured in this condition. In a second condition, reaction time is measured in response to a critical stimulus preceded by a cue stimulus presented as warning tone ("phasic arousal", or temporal orientation of attentional focus). To compensate for effects of fatigue the test is constructed according to an ABBA design (A = without warning tone; B = with warning tone), that is, the examination comprises four blocks. Execution time: approx. 4,5 minutes (depends on reaction time)	Tone/Visual test		Zimmermann P, Fimm B (2004) A test battery for attentional performance. In: Leclercq M, Zimmermann P (eds) Applied neuropsychology of attention. Psychology Press, London, pp 124–165
Reaction Time		Flanker task	participants see a target stimulus within a set of other stimuli flanking it on either side and must press a button for the target; often the flankers are the same as the target (congruent) but on less frequent occasions, the flankers are different (incongruent)	see screen shot to the right	it has been recommended to use more elaborate statistical models such as ex-Gaussian- or Wald-distributions for reaction times	Eriksen, B.A.; Eriksen, C.W. Effects of noise letters upon the identification of a target letter in a nonsearch task. Percept. Psychophys. 1974, 16, 143–149. https://www.psychtoolkit.org/experiment-library/flanker.html
Selective Attention	the ability to respond to certain environmental stimuli while ignoring others	Stroop	In the original study by Stroop, people were shown a list of words printed in different colors. They were asked to name the ink color, and to ignore the meaning of the word.	Green (fast response) versus red (slow response)	the Stroop effect is the degree of difficulty people have with naming the color of the ink rather than the word itself. In Stroop's words, there is "interference" between the color of the ink and the word meaning.	Stroop, J.R. Studies of interference in serial verbal reactions. J. Exp. Psychol. 1935, 18, 643–662. MacLeod, C.M. (1991). Half a century of research on the Stroop effect: An integrative review. Psychological Bulletin, 109, 163-203.

Reaction Time				CRT 1: In this verbal classification task, single words were presented on the screen, and participants had to classify them into the categories of plant or animal. CRT 2: In the second verbal classification task, participants had to decide whether words had one or two syllables. The words were distinct from the words used in CRT 1. CRT 3: In this quantitative task, three-digit numbers were presented at the center of the screen. Participants had to classify them as odd or even. CRT 4: In the second quantitative task, again three-digit numbers were presented, and participants had to decide whether they were smaller or larger than 500. CRT 5: In this spatial task, participants had to decide whether an arrow displayed at the center of the screen was pointing upward or downward. Arrows were either pointing in a direction between 300° and 60° (upward) or in a direction between 120° and 240° (downward). CRT 6: In the second		Schmiedek, F.; Oberauer, K.; Wilhelm, O.; Süß, H.M.; Wittmann, W.W. Individual differences in components of reaction time distributions and their relations to working memory and intelligence. <i>J. Exp. Psychol. Gen.</i> 2007, 136, 414–429. Ratcliff, R.; Schmiedek, F.; McKoon, G. A diffusion model explanation of the worst performance rule for reaction time and IQ. <i>Intelligence</i> 2008, 36, 10–17. Ratcliff, R.; Tuerlinckx, F. Estimating parameters of the diffusion model: Approaches to dealing with contaminant reaction times and parameter variability. <i>Psychon. Bull. Rev.</i> 2002, 9, 438–481. Schulz-Zhecheva, Y.; Voelkle, M.C.; Beauducel, A.; Biscaldi, M.; Klein, C. Predicting Fluid Intelligence by Components of Reaction Time Distributions from Simple Choice Reaction Time Tasks. <i>J. Intell.</i> 2016, 4, 8
	worst performance rule: the slowest response times of individuals are more strongly related to general intelligence than faster ones	Choice reaction time tasks	Eight different CRTs were conducted. For each CRT, there were five blocks of 16 trials, resulting in a total of 80 RTs. Participants were instructed to decide about each stimulus as quickly as possible by pressing one of two keys on the left side and the right side of the computer keyboard, respectively. The assignment of stimulus categories to the response keys was displayed continuously in the upper third of the screen.			

				spatial task in which arrows were stimuli, participants had to decide whether arrows were displayed in the upper or lower half of the screen. The sequence of arrows was distinct from the sequence applied in CRT 5. CRT 7: In this spatial task, participants saw 3 in. grids with individual cells either filled or not filled. Participants had to decide whether the filled area was one coherent area or two areas. A pattern had to be classified as one area if each filled cell shared at least one side with another filled cell. CRT 8: In the second task with 3 in. grids, participants had to decide whether the patterns were symmetrical along a vertical or horizontal axis. The sequence of patterns was distinct from the sequence applied in CRT 7.		
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response time and motor agility	Response time is the ability to perceive and process a simple stimulus and respond to it, such as responding quickly and efficiently to a specific question. A loss of coordination could slow down our response time, so it is crucial to work on this cognitive ability.	Cognitive Assessment Battery for Coordination (CAB-CO) from CogniFit Speed Test REST-HECOOR	inspired by the classic Variables of Attention (TOVA) and the Hooper Visual Organization Task (VOT) by Hooper (1983) tests. The response time and motor agility make up the test, forming a test where skill and response speed are noted. With this test, you will be able to evaluate the user's ability to perceive and process a simple stimulus and respond to it. The less amount of time it takes to respond, the better the score.	A rectangle will appear on the screen. You must click on the rectangle as quickly as possible for 60-70 seconds. You will see how the balloon rises the faster that you click the button.		https://www.cognifit.com/cognitive-assessment/battery-of-tests/rest-hecoor-test/speed-test Hooper, E. H (1983). Hooper visual organization test (VOT). Greenberg, L. M., Kindschi, C. L., & Corman, C. L (1996). TOVA test of variables of attention: clinical guide. St. Paul, MN: TOVA Research Foundation.
Reaction time	used to judge how long it takes to process various things about external signals		The task was to lift one's finger in response to a tone as quickly as possible. There were two blocks of 50 trials that only differed in one respect: whether or not there was a straw above the finger that the subject should not hit. We will refer to the block with a straw as the con-strained block and to the block without a straw as the unconstrained block. The blocks were performed in a single session with a break of a few minutes between them. We blocked the conditions so that subjects could plan their response well in advance.	see screen shot to the right	The most reliable method is to use extrapolation of the change in the average force that the finger exerts on the surface to estimate the reaction time.	Brenner E. & Jeroen B. J. Smeets (2019) How Can You Best Measure Reaction Times?, Journal of Motor Behavior, 51:5, 486-495, DOI: 10.1080/00222895.2018.1518311

Appendix C – Alternative Measures for Unmeasured Constructs

Construct	Active Listening
Definition	Listens, giving full attention to the speaker. Seeks clarification when needed, synthesizes messages from others, and responds appropriately.
Search terms	"active listening measure" "active listening skill assessment" "active listening assessment tool" "workplace listening assessment tool"

Construct Name	Construct Definition	Measurement tool	Measurement description	Sample items/Examples	Psychometrics and relationships	Source
Active Listening	the practice of re-stating or paraphrasing a speaker's message in order to fully understand it without judgment	Index of Active Listening (IAL)	The IAL is a scale for assessing active listening behavior through professional observation. It consists of two subscales: behavior (5 items) and semantic differential (SD; 10 items). Evaluators completed both subscales of the IAL, which can each assess a different aspect of active listening	The behavior items included presence of direct gazes, nods, facial expressions, posture, and gestures (e.g., —Posture is suitable for listening); each item is rated on three-point scale, including 0 (—none), 1 (—little), and 2 (—often). The SD items include —serious, —communicate, —interested, —steady, —trustworthy, —sincere, —admissible, —conversable, —comfortable, and —amiable; this subscale is scored on a 5-point scale ranging from 1 (—not applicable) to 5 (—very much applicable). The total sum of each item score becomes the subscale scores. Higher scores indicate a higher level of active listening		Anme, T., Tokutake, K., Tanaka, E., Mochizuki, Y., Wu, B., Watanabe, T., & Sadato, N. (2013). Validity and reliability of the index of active listening (IAL). Journal of Applied Medical Sciences, 2(2), 21-29.

Active Listening	a communication strategy for recognizing and exploring patients' clues	Active Listening Observation Scale (ALOS-global)	Before the consultation, the patients reported how important they considered different aspects of communication for the forthcoming visit (1 = 'not important' to 4 = 'utmost important'). After the consultation, they rated whether the GP had performed these aspects (1 = 'not' to 4 = 'yes'). Factor analysis of both the pre-visit and post-visit lists of questions on preference and performance revealed two relevant sub-scales: an affect-oriented scale of 7 communication aspects and a task-oriented scale of 6 communication aspects (Cronbach's alpha between 0.74 and 0.89). In the affect-oriented performance scale, the patients rated after the visit to what extent they have perceived their GP to have given enough attention; listened well; taken enough time; been friendly; been frank; taken the problem seriously; and been empathic.	The GP... 1. Shows not to be distracted during the consultation 2. Is not off hand or hasty 3. Listens attentively 4. Gives patients time and space to present the problem 5. Uses exploring questionsx 6. Is good in leading the conversation 7. Expresses understanding non-verbally	The final 7-item ALOS-global had acceptable inter- and intra-observer agreement. Factor analysis revealed one homogeneous dimension. The scalescore was positively related to verbal attention measured by RIAS, to patients' perception of GPs' performance and to their pre-visit anxiety level. Female GPs received higher active listening scores.	Fassaert, T., van Dulmen, S., Schellevis, F., & Bensing, J. (2007). Active listening in medical consultations: Development of the Active Listening Observation Scale (ALOS-global). Patient education and counseling, 68(3), 258-264. https://postprint.nivel.nl/PPpp2926.pdf?
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Active empathetic listening	Sensing refers to a listener's ability to understand relational aspects of speech. Processing, the cognitive aspect of listening, involves attending to, comprehending, receiving, and interpreting messages. Responding measures the perception of behavioral output of listening including verbal and nonverbal feedback.	Active empathetic listening (AEL) scale	The AELS is an 11-item, three-factor scale measuring active-empathic listening across three dimensions: sensing (n = 4), processing (n = 3), and responding (n = 4).	Please indicate how frequently you perceive these statements to be true about yourself, using the following scale: 1 (Never or Almost never true) 2 3 4 5 6 7 (Always or Almost always true) Sensing 1) I am sensitive to what others are not saying. 2) I am aware of what others imply but do not say. 3) I understand how others feel. 4) I listen for more than just the spoken words. Processing 5) I assure others that I will remember what they say. 6) I summarize points of agreement and disagreement when appropriate. 7) I keep track of points others make. Responding 8) I assure others that I am listening by using verbal acknowledgements. 9) I assure others that I am receptive to their ideas. 10) I ask questions that show my understanding of others' positions. 11) I show others that I am listening by my body language (e.g., head nods).	All three subscales were related to a measure of empathy. Specifically, sensing ($r = .28$), processing ($r = .24$), and responding ($r = .17$) were associated with the Perspective Taking factor of the Interpersonal Reactivity Index (Davis, 1980, 1983); and sensing ($r = .18$) and processing ($r = .20$) were correlated with Empathic Concern (see Profile 28 for the IRI). Furthermore, the subscales of the AELS were related to a similar measure of active listening (Ramsey & Sohi, 1997): sensing ($r = .44$), processing ($r = .44$), and responding ($r = .57$).	Bodie, G. D. (2011). The Active-Empathic Listening Scale (AELS): Conceptualization and evidence of validity within the interpersonal domain. <i>Communication Quarterly</i>, 59, 277–295. doi:10.1080/01463373.2011.583495 Drollinger, T., Comer, L. B., & Warrington, P. T. (2006). Development and validation of the active empathetic listening scale. <i>Psychology & Marketing</i>, 23(2), 161-180.
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Active Listening Attitude	Active listening in the person-centered approach is grounded in the basic attitudes of the user and means effective and not passive listening to the other person. It has been described as a multi-step process, which includes techniques such as making comments, formulating appropriate questions, paraphrasing and summarizing, in order to express complete understanding and verify the things said. It also includes maintaining eye contact, using encouraging non-verbal gestures such as nodding or smiling, and not interrupting the speaker. The goal in active listening is to develop a clear understanding of the speaker's concern and also to clearly communicate the listener's interest	Active Listening Attitude Scale (ALAS)	The ALAS includes 31 items that are scored on a 4-point Likert scale, with response alternatives being 0 = Disagree, 1 = Rather Disagree, 2 = Rather Agree and 3 = Agree. The ALAS produces three subscales: (a) Listening Attitude (13 items, reverse scoring) which refers to "empathic understanding" or to "unconditional positive regard"; (b) Listening Skill (11 items) which describes more technical aspects of active listening and secondarily "empathic understanding", "congruence" or the utilization of active listening; and (c) Conversation Opportunity (7 items) which mainly measures the utilization of active listening. Respondents were instructed to choose the answer that best reflected their ordinary style of listening in the workplace (i.e., school). Every respondent received a score for each subscale, which was the sum of his/her responses to the respective items.	(a) Listening Attitude: "I hurry him/her into talking faster" (b) Listening Skill: "I pay attention to his/her unexpressed feelings" (c) Conversation Opportunity: "People feel easy to talk to me"	All corrected item-total correlations were high and internal consistency reliability was satisfactory for the three subscales, with Cronbach's alpha equal to 0.81 for Listening Attitude, 0.72 for Listening Skill and 0.73 for Conversation Opportunity.	Kourmoussi, N., Amanaki, E., Tzavara, C., & Koutras, V. (2017). Active Listening Attitude Scale (ALAS): Reliability and validity in a nationwide sample of Greek educators. <i>Social Sciences</i>, 6(1), 28. Norio Mishima, Shinya Kubota, and Shoji Nagata. "The development of a questionnaire to assess the attitude of active listening." <i>Journal of Occupational Health</i> 42 (2000): 111–18.
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	in the speaker's message”					
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Active listening skill		the Crisis Center Discrimination Index (CCDI)	Helpee: I'm so happy I just don't know what to do. I went out with this guy that I've had my eye on since high school. It was so neat! He acts absolutely in love with me. He didn't say anything about calling again, but I'm sure he will. Helper's Responses: 1. You sound as though you might be wondering if you're not reading too much into this one date 2. You sound like you had a really good time. It's a good feeling to know that one of your hopes might be realized. I'd like to hear more about how things went on the date. 3. Life can be exciting—full of unexpected happiness. How did this date come about? 4. You feel like a long hoped-for door has been opened, and that makes you very happy. It's really neat to feel that one of your dreams might be realized.		Paukert, A., Stagner, B., & Hope, K. (2004). The Assessment of Active Listening Skills in Helpline Volunteers. <i>Stress, Trauma and Crisis: An International Journal</i>, 7(1), 61–76. https://doi.org/10.1080/15434610490281075 The Index was developed by L.E. Peterson, Leigh W. Allen, Janet Taub, Marta L. Hedde, Janet E. Geis, and Kathleen Adams Springer (RoadHouse staff) working with Ursula Delworth. http://dustinkmacdonald.com/wp-content/uploads/2015/03/Crisis-Center-Discrimination-Index.pdf
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Appendix C – Alternative Measures for Unmeasured Constructs

Construct	Multi-Limb Coordination
Definition	Ability to coordinate movements of two or more limbs together while sitting, standing, or lying down.
Search terms	"multi limb coordination measure" "flight simulation" "physical test simulation" "motor coordination" "flight simulator task motor coordination assessment" "psychomotricity measurement tool"

Construct Name	Construct Definition	Measurement tool	Measurement description	Sample items/Examples	Psychometrics and relationships	Source
Physical Conditioning	High scoring individuals tend to engage in activities to maintain their physical fitness and are more likely participate in vigorous sports or exercise	TAILORED ADAPTIVE PERSONALITY ASSESSMENT SYSTEM (TAPAS)	Based on recent research on item response theory (IRT), computerized adaptive testing (CAT), and temperament/personality measurement, TAPAS provides a means for validly and efficiently assessing personality in a way that is fake resistant	I like to exercise. I don't consider myself to be an athletic person	The Physical Conditioning (Activity) facet predicted turnover: The uncorrected validity estimate was -.14. Physical Conditioning (Activity) scores had the highest uncorrected validity of .27 with Soldier's Fitness	Trent, J. D., Barron, L. G., Rose, M. R., & Carretta, T. R. (2020). Tailored Adaptive Personality Assessment System (TAPAS) as an indicator for counterproductive work behavior: Comparing validity in applicant, honest, and directed faking conditions. <i>Military Psychology</i> , 32(1), 51-59.
Psychomotricity/Coordination	the ability to move efficiently, carefully, quickly, and purposefully. In other words, it is what makes it possible to synchronize the muscles used in a certain action in order to carry out an action as appropriately as possible.	Coordination subprocesses test battery	Battery based on Wisconsin Card Sorting Test (WCST), the Stroop Test, the Test of Variables of Attention (TOVA), the Visual Organization Task (VOT), NEPSY (from Korkman, Kirk, and Kemp), the Continuous Performance Test (CPT), and the Test of Memory Malingering (TOMM). These tests, aside from measuring coordination, evaluate updating, cognitive flexibility, processing speed, divided attention, inhibition, visual perception, naming, visual scanning, focused attention, spatial perception, contextual memory, recognition, and working memory.	Synchronization Test UPDA-SHIF: For this task, a moving ball will appear on the screen. the goal is to use the cursor to follow the ball around the screen as carefully as possible - Coordination Test HECOOR: the user will have to use their cursor to follow the ball that moves across the screen, without leaving the circle. the user will have to manually and visually follow the ball. -Resolution Test REST-SPER: a number of moving stimuli will appear on the screen. the user will have to click on the target	currently in validation process	https://www.cognifit.com/coordination

				objects as quickly as possible, avoiding the distracting stimuli.		
Multi limb coordination		"Rock band"	Subjects played a video game which required the use of both arms and one leg to play a simplified electronic drum set with varying difficulty.	N/A		Mackenzie, S. J., Getchell, N., Deutsch, K., Wilms-Floet, A., Clark, J. E., & Whittall, J. (2008). Multi-limb coordination and rhythmic variability under varying sensory availability conditions in children with DCD. <i>Human Movement Science</i> , 27(2), 256-269.
Multi limb coordination		Dual motor task: rhythmic sensorimotor synchronization	Participants performed a dual motor task (simultaneously clapped while walking) in four different conditions: at a self-regulated pace with no coupling instructions defined among limbs, at a self-regulated pace with instructions to couple the clap and foot strike, at an externally-regulated pace provided by a metronome signal and set at the preferred single task clapping frequency, with instructions to couple the hands and feet to the metronome beat, and at an externally-regulated pace set at the preferred single task walking frequency with instructions to	N/A		Getchell, N. (2007). Developmental aspects of perception-action coupling in multi-limb coordination: rhythmic sensorimotor synchronization. <i>Motor control</i> , 11(1), 1.

			couple the hands and feet to the metronome beat.			
Motion analysis		real-time vehicle dynamic simulation	The driver's interaction with the system through the steering wheel and gas and brake pedals is captured by sensors and electronics. The signals are converted into inputs to the underlying vehicle dynamic model. The equations of motion of the vehicle dynamic model must be solved faster than in real time, so that the actuators underneath the Stewart platform can perform the pushes or pulls that mimic various driving conditions. In the meantime, the simulation results provide large excursions in longitudinal and lateral directions that are used to give acceleration and motion cues to the driver inside.	There are several notable driving simulators and associated research groups around the world, including those in the United Kingdom, France, Sweden, and the United States, in addition to the NADS in Iowa City (Figures 8.39(a) through (d)). Car manufacturers have built their own simulators in the past 20 years, among them the pioneering Daimler-Benz Driving Simulator that was put into operation in 1985 and which has been enhanced since that time in many details and has been used in many different applications.		Kuang-Hua Chang, "e-Design, Computer-Aided Engineering Design" Motion Analysis, Academic Press, Pages 391-462, 2015. [Chapter 8]. Available: ScienceDirect, http://www.sciencedirect.com/science/article/pii/B9780123820389000089 .
Body motion feedback/analysis		Flight simulators	a 6 dof parallel manipulator, also known as a hexapod, Stewart platform, motion platform, or motion bas	N/A	whole body motion is important when flight-naïve subjects need to learn helicopter maneuvering or disturbance tasks; motion might not be important for experts refreshing their maneuvering skills. More research is needed to investigate whether the skills obtained in the simulator	Robert T. Hays, John W. Jacobs, Carolyn Prince & Eduardo Salas (1992) Flight Simulator Training Effectiveness: A Meta-Analysis, Military Psychology, 4:2, 63-74, DOI: 10.1207/s15327876mp0402_1

					transfer to real aircraft, and to gain insight into the independent effects of experience and type of task	https://www.sciencedirect.com/topics/engineering/flight-simulators
Psychomotor		Complex Coordination and Two-Hand Coordination tests			These tests were significant predictors of Air Force and Navy pass-fail criteria in the past, and automated versions are similarly predictive today. The U.S. Army and Air Force are now using a combination of paper-and-pencil and automated psychomotor-cognitive tests for initial selection (Air Force) or helicopter assignment (Army). It appears that the Navy is considering the use of automated cognitive and psychomotor tests in a selection battery of the future.	Glenn R. Griffin & Jefferson M. Koonce (1996) Review of Psychomotor Skills in Pilot Selection Research of the U. S. Military Services, The International Journal of Aviation Psychology, 6:2, 125-147, DOI: 10.1207/s15327108ija.p0602_2
Psychomotor skills	cognitive, psychomotor and dexterity skills associated with performing clinical procedures and surgery.	Psychomotor skills in medical trainees	identify tools used to assess psychomotor skills in medical trainees through observation of the trainees with patients			Jelovsek, J. E., Kow, N., & Diwadkar, G. B. (2013). Tools for the direct observation and assessment of psychomotor skills in medical trainees: a systematic review. Medical education, 47(7), 650-673.

Appendix C – Alternative Measures for Unmeasured Constructs

Construct	Auditory Attention
Definition	The ability to rapidly and precisely direct our acoustic searchlight toward sounds of interest in our acoustic environment.
Search terms	Auditory Attention

Measurement tool	Measurement description	Psychometrics and relationships	Source	Products
Woodcock-Johnson III Test of Auditory Attention	The Test of Auditory Attention is part of a larger battery to assess Comprehensive Knowledge, Long-Term Retrieval, Visual-Spatial Thinking, Auditory Processing, Fluid Reasoning, Processing Speed, and Short-Term Memory. Auditory Attention measures speech-sound discrimination and resistance to auditory-stimulus distortion. Subjects are presented with a series of monosyllabic words with increasingly loud background noise. Subjects then had to point to pictures of the word they heard.	The full battery of tests is generally used for children to identify learning deficiencies or enhance learning environments but can be used for all ages. The Army Research Laboratory-Army Medical Department Field Element used the Auditory Attention test specifically when looking at ways to help military students learn more quickly. They found that gender and race were strong predictors of performance.	https://www.army.mil/article/43678/army_researchers_discover_auditory_processing_deficit_in_some_68d_students https://www.hmhco.com/~media/sites/home/hmh-assessments/clinical/woodcock-johnson/pdf/wjiii/wjiii_asb10.pdf%3F1a=en	https://riversideinsights.com/search.php?search_query=woodcock-johnson%20III&section=product

Selective Auditory Attention Test (SAAT)	The Selective Auditory Attention Test is a means to identify young children who might have attention deficits that could affect their academic performance. The test includes two sub tests: 1. monosyllabic words are presented to the subject without any distracting noise and is meant to measure the subject's auditory discrimination. 2. monosyllabic words are presented to the subject, but with distracting noises included. The competing noises consists of white noise, meaningful speech, and meaningless speech or speech ran backwards. The second test measures the subject's performance on selective auditory attention.	While this test is meant primarily for children and specifically for identifying attention deficits, it seems like a reasonable method for assessing auditory attention in the context of the Air Force if it could be validated for adult use.	file:///C:/Users/MARK~1.GOU/AppData/Local/Temp/83-manuscript-273-4-10-20170423.pdf	https://auditec.com/2015/08/04/selective-auditory-attention-test-saat/ https://www.oaktreeproducts.com/selective-auditory-attention-test-saat-c143
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Auditory Continuous Performance Test (ACPT)	a test that measures a child's ability to attend to auditory stimuli for an extended period. The test comprises six trial lists of one-syllable words. The words are presented at a rapid rate, and the child is instructed to indicate each time a target word occurs. The number of incorrect responses for the entire test provides a measure of overall attention ability; the number of incorrect responses for each of the six trial lists provides an indication of changes in attention during the task. [developed in 1994 by audiologist Robert W. Keith]	Also mostly used for children rather than adults, but the idea is more or less the same and should be adaptable to children	https://dictionary.apa.org/auditory-continuous-performance-test	https://www.oaktreeproducts.com/auditory-continuous-performance-test-acpt-c226 https://www.pearsonclinical.co.uk/Psychology/ChildMentalHealth/ChildAD/ADHDBehaviour/AuditoryContinuousPerformanceTest(ACPT)/AuditoryContinuousPerformanceTest(ACPT).aspx https://auditec.com/2015/10/26/auditory-continuous-performance-test-acpt/
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The Sustained Auditory Attention Ability Test	The SAAAT is an instrument used to verify the ability of the subject to hear words over a prolonged period of time (11 minutes). Subjects raise their hand to a specific stimulus (target word “no”). The test contains 21 monosyllabic words arranged in a 100-word list format that is repeated six times without interruption during the test at the rate of one word per second. During the list of 100 words, there is an incidence of the word “no” 20 times, requiring a task of hearing surveillance from the assessed subject.	The SAAAT is generally only administered to children up to age 11, however it has been found that adults tend to score lower on many measures compared to children. The source study adapted the test to be used with adults.	José, M. R., Mondelli, M., Correia, J. B., Bohn, V., Lauris, J., Zeigelboim, B. S., & Feniman, M. R. (2021). Adult Performance on the Sustained Auditory Attention Skill Test. <i>International archives of otorhinolaryngology</i>, 25(2), e249–e254. https://doi.org/10.1055/s-0040-1712481	
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Construct	Control Precision
Definition	Ability to quickly and repeatedly make precise adjustments in moving the controls or vehicle to exact positions.
Search terms	

Measurement tool	Measurement description	Sample items/Examples	Psychometrics and relationships	Source
FFS(Full Flight Simulator): in the study they used a FAA qualified Level C Simulator with six-degree-of-freedom synergistic motion and a wide angle high quality visual system	The experiment used an FAA qualified Level C flight simulator, which represents a 30 passenger, three crew, turboprop airplane with wing-mounted twin engines and counter-rotating propellers. The six degree-of-freedom synergistic motion system has hydraulically actuated legs capable of a 60 inch stroke. The high-quality visual system provides wide angle collimated cross-cockpit viewing with a 150-degree horizontal and 40-degree vertical field of view available to each pilot.	Pilots were taken through the simulator on two pilot tasks: Engine failures on take-off with either rejected take-off (RTO) or continued take-off. One group went through the simulation with the simulator platform's motion turned on and the other with it turned off.	The authors concluded that the simulator was an effective training method and that the motion didn't have any positive or negative effects on performance, though those that started with the motion control in the first evaluation did tend to do better than the no motion group in the second phase. Implication of this is that the Air Force might not necessarily need to test with a full motion simulation, which would save money and space. "The experimental sessions appeared to have been effective in simulating a real training session in that the crews' performance improved across the session. Specifically, combining the two motion groups (or looking at them individually), the grades for RTOs and V1 cuts improved across the training trials. This was even stronger for the V1 cuts, which elicited lower grades than the RTOs during First Look but caught up by Transfer."	https://arc.aiaa.org/doi/pdf/10.2514/6.2000-4296

FFT (Full Flight Trainer): The one in the study used a motion cued seat, but there are many types like this. They are usually considered FTD (flight training device) and are generally fully enclosed, but without the full motion capabilities of an FFS.	The FFT has a dynamic seat providing some vestibular, proprioceptive, and tactile motion stimulation from heave and vibration cues. Each pilot's seat is mounted on its own fixed platform which is moved vertically by actuators run by electrical rotary motors. A bass-speaker-shaker system underneath the cockpit provides additional vibration cues.		The Authors found that there were largely no differences between the transfer of skills when using FFS vs FFT, which again has implications for Air Force since I'd imagine the cost, size and upkeep of an FFS to FFT is much more onerous: "In conclusion, like our previous work, the current study does not seem to support an operational benefit of FFS motion. Not only did most group effects disappear in this and previous studies at transfer, but the effect sizes in the previous studies were determined by experts to be small and operationally irrelevant. We leave it up to the readers to interpret the effect sizes in the current study, but regardless of the sizes, the current results are mostly in-line with previous results in that there was a general trend for there to be no differences between the training success of FFS-trained and FFT-trained pilots. Most importantly, there were no group differences at transfer-testing in this and, for the most part, previous studies. Perhaps the most interesting motion-related difference between this study and previous studies, however, is the lack of a difference in pedal reaction time to the V1 cut in the current study. This indicates that the one-degree-freedom seat-motion system, although essentially different from the hexapod platform motion system of an FFS, may provide motion cues to the same qualitative level as an FFS, based on	https://arc.aiaa.org/doi/pdf/10.2514/6.2010-8218
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			the flight performance data presented here"	
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BATD/AATD/PCATD ([Basic or Advanced or Personal Computer] Aviation Training Device): training device other than an FFS or FTD that has been approved by the FAA for training. However, PCATD is no longer approved by the FAA for licensure, but it might still be applicable to control precision.	Essentially, it is any FAA approved training aid that isn't a fully enclosed like an FTD or with motion like FFS. Usually consisting of screens and high fidelity instruments, but can be lower fidelity in the case of PCATDs.		There was no evidence of a pre-test/post-test difference in VFR task performance between participants trained on the PCATD and the FTD, when post tested on the FTD. The use of both PCATD and FTD demonstrated significant improvements in VFR task performance compared to a control group that received no PCATD or FTD training. (Note: VFR is visual flight rules (VFR) which are a set of regulations under which a pilot operates an aircraft in weather conditions generally clear enough to allow the pilot to see where the aircraft is going. Specifically, the weather must be better than basic VFR weather minima, i.e. in visual meteorological conditions (VMC), as specified in the rules of the relevant aviation authority. The pilot must be able to operate the aircraft with visual reference to the ground, and by visually avoiding obstructions and other aircraft. The procedure in the study was an aircraft traffic pattern called Overhead Rejoin Procedure.	https://eric.ed.gov/?id=EJ1140175
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Construct	Situational Awareness					
Definition	To pay attention to surroundings and rarely get lost or surprised					
Search terms	situational awareness; situation awareness; shared situational awareness					
Note: Situational Awareness was tricky to find measures of. Many have been developed but are just mentioned in summary articles, which is why a lot of information is missing in this document. That being said, many situational awareness measures are intended for pilots. The Air Force most likely already has measures for this construct but it might be a simulation. Typically, most measures utilize the SAGAT (listed in Row 12) and tailor it to the intended context.						
Construct Name	Construct Definition	Measurement tool	Measurement description	Sample items/Examples	Psychometrics and relationships	Source
Situational Awareness		Situational Awareness Scale		I see myself as someone who is always aware of what is happening around me. I see myself as someone who likes to keep track of important factors and conditions in my work environment. I see myself as someone who makes decisions based upon what is going on around me on the worksite.		Whiteoak, John W., & Mohamed, Sherif. (2016). Employee engagement, boredom and frontline construction workers feeling safe in their workplace. Accident Analysis and Prevention, Vol 93, 291-298
Situation Awareness	The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future (Endsley, 1988)	Cranfield Situation Awareness Scale (Cranfield-SAS)	Flight instructors rate students in general aircraft handling, navigation, basic and airways instrument flying, night flying, and commercial airline flying Assess on pilot knowledge; understand and anticipate future events; management of stress, effort, and commitment; capacity to perceive, attend, assimilate, and assess; overall awareness	Relating each description to the flight task, how well does the pilot: know the aircraft's performance in regard to flight dynamics, weight, flaps, bank? Know and is aware of the immediate situation as it is occurring? Confidently and with commitment carry out the flight tasks? perceive information in the flight environment?		Dennehy, K. Cranfield – Situation Awareness Scale User’s Manual (COA Report Number 9702). Bedford, England: Applied Psychology Unit Cranfield University, 1997

Situation Awareness	The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future (Endsley, 1988)	Quantitative Analysis of Situation Awareness (QASA)	Freeze and query method			Edgar, G.K., and Edgar, H.E. Using signal detection theory to measure situation awareness. The technique, the tool, the test, the way forward. In J. Noyes and M. Cook (Eds.) Decision Making in Complex Environments (pp. 373–385). Aldershot, UK: Ashgate, 2007.
Situation Awareness	The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future (Endsley, 1988)	Quantitative Analysis of Situational Awareness (QUASA)	Combines true/false situational awareness probs with self-ratings of the confidence of the answer			McGinness, B. Quantitative Analysis of Situational Awareness (QUASA): Applying signal detection theory to true/false probes and self-ratings. 9th International Command and Control Research and Technology Symposium, 159–178, 2004.
Situation Awareness	The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future (Endsley, 1988)	Situation Awareness Global Assessment Technique (SAGAT)	A simulated exercise is halted at randomly selected times, information sources are blanked and the exercise is suspended while participants quickly answer questions about their current perceptions and understanding of the situation. Participant perceptions can then be compared to the real situation to provide an objective measure. Given 21 standard queries which assess perception,	Indicate the location(s) of each element on the map. Does the enemy know the location of your platoon? Who has the advantage in the current situation?	high reliability (test-retest scores of .98, .99, .99 and .92) of mean SAGAT scores for four fighter pilots who participated in two sets of simulation trials (Endsley & Bolstad, 1994) Analysis of variance was used to evaluate the effect of the test	Endsley, M.R. Situational awareness global assessment technique (SAGAT). Proceedings of the National Aerospace and Electronics Conference, 789–795, 1988.

			comprehension, and projection.		condition (no stop/not expected, no stop/stop expected, and stop/stop expected) on each of the two performance measures: aircraft kills and losses. The test condition had no significant impact on either performance measure, $F(2, 87) = .15$, $p = .861$, $F(2, 87) = 1.53$, $p = .223$	
Situation Awareness	The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future (Endsley, 1988)	Situation Awareness Behaviorally Anchored Rating Scale (SABARS)	27 behaviors and actions linked to SA in MOUT missions were identified. Observer/controllers (O/Cs) closely watched each platoon leader work through the four missions. The O/Cs then rated the platoon leaders on a five-point scale with respect to how well they performed these actions	Solicits information from squad leaders Communicates key information to commander Identifies mission critical tasks to squad leaders	SABARS data differentiated SA as a function of the experience level of the platoon leaders. Specifically, experienced platoon leaders were more likely to gather relevant information, follow procedures, and to focus on the big picture more than less experienced platoon leaders.	Strater, L. D., Endsley, M. R., Pleban, R. J., & Matthews, M. D. (2001). <u>Measures of Platoon Leader Situation Awareness in Virtual Decision-Making Exercises.</u> (ARI Research Report 1770). Alexandria, VA: U. S. Army Research Institute for the Behavioral and Social Sciences.

Situation Awareness	The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future (Endsley, 1988)	Post-Trial Participant Subjective Situation Awareness Questionnaire (PSAQ)	3 items designed to elicit the participant's subject ratings for: workload-how hard the officer worked during the scenario performance-how well the officer performed during the scenario self-perceived SA-how aware the officer was of the evolving situation Items are rated on a 5-point scale	Please circle the number below that best describes how hard/well you performed/aware of the evolving situation you were during the scenario	Did not have any significant effects	Strater, L. D., Endsley, M. R., Pleban, R. J., & Matthews, M. D. (2001). <u>Measures of Platoon Leader Situation Awareness in Virtual Decision-Making Exercises.</u> (ARI Research Report 1770). Alexandria, VA: U. S. Army Research Institute for the Behavioral and Social Sciences.
Situational Awareness		Situational Awareness Scale		I see myself as someone who is always aware of what is happening around me. I see myself as someone who likes to keep track of important factors and conditions in my work environment. I see myself as someone who makes decisions based upon what is going on around me on the worksite.		Whiteoak, John W., & Mohamed, Sherif. (2016). Employee engagement, boredom and frontline construction workers feeling safe in their workplace. Accident Analysis and Prevention, Vol 93, 291-298

Situational Awareness		WOMBAT	The WOMBAT arguably measures situational awareness and stress tolerance, both of which are important skills for pilots. Gaining measures of these abilities would be an advantage of administering the WOMBAT. However, a shortened version clearly would not measure stress tolerance as well as the original 90-minute version.		Study conducted at aviation dept. of US college. Subjects from all 4 years of program. Wombat scores related to flight hours ($r=.35$). Author believes WOMBAT can be used to measure SA and stress tolerance. Cain (2002) dissertation	Roscoe, S. N., Corl, L., & LaRoche, J. (2001). Predicting human performance (5.0 edition). Montreal, Quebec: Helio Press.
Situational Awareness	Accurately perceives self, others, and aircraft in relation to the environment; remains alert and attentive to surroundings, including relevant details; recognizes hazards, threats, and opportunities	SIFT	Supervisors evaluate student performance using a performance rating scale Rating Scale: Needs Improvement • Frequently overlooks small details. • Frequently overlooks subtle changes in a situation. • Unable to anticipate hazards, threats, and opportunities. Satisfactory • Usually alert to small details. • Usually alert to subtle changes in a situation. • Usually able to anticipate hazards, threats, and opportunities, though may get “behind the curve.” Outstanding			Paullin, C. J., Bruskiewicz, K. T., & Houston, J. S. (2005). DEVELOPMENT OF A SELECTION INSTRUMENT FOR ARMY FLIGHT TRAINING (SIFT): Volume 2, Appendices. PDRI Technical Report #493.

			• Always alert to small details. • Always alert to subtle changes in a situation. • Consistently able to anticipate hazards, threats, and opportunities.			
Situational Awareness					Includes nice summary of situational awareness construct and measures	Paullin, C., Ingerick, M., Trippe., D. M., Wasko, L. (2011). Identifying best bet entry-level selection measures for US Air Force remotely piloted aircraft (RPA) pilot and sensor operator (SO) occupations. "\\CTYITSSVRFS01\Projects\Air Force\AF - AFOQT --Form T Evaluation\Objective 4 - Job Analysis Information\Measures\Situational Awareness\Paullin et al (2011).pdf"

Construct	Commitment to Serve
Definition	To identify with the military and have a strong desire to serve one's country
Search terms	commitment to serve, commitment, affective commitment, Army identification
Note: There are have been a lot of measures developed and utilized in Army research. However, the majority of measures are tailored to those currently serving or in an organizing, not a pre-hire context. Kristen mentioned that for Project STAY and another project done for the Navy, PDRI developed Commitment to Serve items but for an in-service population.	

Construct Name	Construct Definition	Measurement tool	Measurement description	Sample items/Examples	Psychometrics and relationships	Source
Commitment to Serve	Identification with the military and commitment to a military lifestyle	TAPAS	High scoring individuals identify with the military and have a strong desire to serve their country		Kantrowitz, Kingry, Madaj, & Nye (2019) Meta-analysis results: Overall Peer Rating of Performance (.00) Grades/Job Knowledge Outcomes (-.06) Prediction of Fitness Outcomes (-.04) CWB (.03) Attrition (.03) 6 & 12-Month Attrition (.02) 24-Month Attrition (.04) Army Soldiers Sample - Retention Cognitions (.27) Navy Delayed Entry Program attrition (.13)	Drasgow, F., Stark, S., Chernyshenko, O. S., Nye, C. D., Hulin, C. L., & White, L. A. (2012). <u>Development of the Tailored Adaptive Personality Assessment System (TAPAS) to Support Army Selection and Classification Decisions.</u> (Research Report 1311). Alexandria, VA: U. S. Army Research Institute for the Behavioral and Social Sciences.
Organizational Identification	Perception of oneness with or belongingness to the organization	Mael Scale	Ten-item self-report measure	When I talk about this organization, I usually say "we" rather than "they" When someone praises this organization, it feels like a personal compliment	Internal consistency (.76) Riketta (2005) Meta-Analysis results: Job Satisfaction (.47) Job Involvement (.60) Intention to leave (-.48)	Mael, F. A., & Tetrick, L. E. (1992). Identifying organizational identification. Educational and Psychological Measurement, 52, 813–824.

				This organization's successes are my successes		
Commitment to the Navy	Is psychologically and emotionally attached to the Navy; identifies with, is involved in, and enjoys being in the Navy; views own values as congruent with Navy values; feels a sense of obligation toward the Navy and believes that staying in the Navy is the “right” thing to do.	Navy Career Assessment and Retention Tool (CARAT)	COM1: General commitment COM2: Affective commitment COM3: Normative commitment COM4: Value congruence COM5: Service to country	Items in TR #639		Horgen, K. E., Jackson, E. M., Bryant, R. H., Smith, T. N., Borman, W. C., & Riner, D. D. (2009) Development of an Adaptive Navy Career Assessment and Retention Tool (CARAT). (Research Report).

Service Orientation	likely to make the service a career (i.e. for long-term return on investment analyses)	SDI +			Self-Description Inventory Plus (SDI+). The SDI was developed by the USAF, and is currently considered an experimental subtest within Form S of the AFOQT. It was originally developed to measure the Big Five personality factors. In recent years, USAF researchers wrote two additional scales to measure Team Orientation and Commitment to Military Service (Service Orientation). It contains 220 items (see Christal, et al., 1997). According to USAF researchers, the value of the SDI is in generating profiles for people and ultimately profiles for organizations and job families to facilitate person-job match and strategic force development (J. Weissmuller, personal communication, February 28, 2005). It is not specifically intended for personnel selection. Nevertheless, validity data are currently being collected in a broad USAF sample, including some aviators.	Christal, R., Barucky, J.M., Driskill, W.E, & Collis, J.M. (1997). The Air Force Self Description Inventory (AFSDI): A summary of continuing research (Informal Technical Final Report F33615-91-D-0010). San Antonio, TX: Metrica, Inc. Could not find actual reference - found reference to it in PDRI SIFT report
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Affective Commitment		Army Life Questionnaire	Self-report measure	I feel a strong sense of belonging to the Army I feel personally attached to the Army I doubt I could become as attached to another organization as I am to the Army	Reliability: .91 (Nye, C. D., White, L. A., Drasgow, F., Chernyshenko, O. S., Stark, S., Graves, C. R., & Muhammad, R. S. (2020). Examining Enhanced Suitability Screening for Predicting Drill Sergeant Training and Job Outcomes (Technical Report XXXX). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences) .83 (Nye, C. D., Muhammad, R. S., Graves, C. R., Drasgow, F., Chernyshenko, O. S., Stark, S., & Butt, S. M. (2018). Examining Enhanced Suitability Screening for Predicting Performance in Recruiting Duty Assignments (Technical Report 1366). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences) .84 (3) Horgen, K., Nye, C. D., Drasgow, F., Chernyshenko, O. S., Stark, S., & Fletcher, K. (in press). Validation of the Noncommissioned Officer Special Assignment Battery (NSAB) for Army Instructor Assignment (Technical Report). Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.)	
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Construct	Rate Control
Definition	Ability to time the adjustments of a movement or equipment control in anticipation of changes in the speed or direction of a continuously moving object or scene.
Search terms	rate control, physical ability, psychomotor ability

Construct Name	Construct Definition	Measurement tool	Measurement description	Sample items/Examples	Psychometrics and relationships	Source
Rate control	Task that involves a significant perceptual and response load	Arc Pursuit	Stick's x-movement was speed mapped into a 140-degree arc-shaped window. Stick controls 2 yellow lines, connecting the inner and outer arcs. Participant moves the yellow lines to keep them as close to a single red line.		Formed a composite of these 4 tests (arc pursuit, wheel avoidance, circle pursuit, and lane tracking). Results showed evidence for a learning factor. Addition of the learning factor resulted in a modest increase in the goodness of fit ($\chi^2(18) = 130, p < .01$). significant predictors of general psychomotor ability are general cognitive ability ($r = .69, z = 8.3, p < .01$) and temporal processing ability ($r = .25, z = 2.7, p < .01$). The key predictors of the learning factor are processing speed ($r = -.49, z = -4.4, p < .01$), and general cognitive ability ($r = .41, z = 2.6, p < .01$).	Chaiken, S., Kylionen, P., & Tirre, W. (1999). <u>Organization and Components of Psychomotor Ability</u> . (Research Report 1999-0146). Brooks AFB, TX: U. S. Air Force Research Laboratory.
Rate control	Task that involves a significant perceptual and response load	Wheel Avoidance	2 versions: Simple version - single screen-centered rotating wheel with 3 gray and 3 black uniformly distributed segments. The wheel attained a target speed at a gradual rate then moved to the next target speed. Participants controlled the rotation rate of a green arrow to avoid the gray segments. Harder version (after Melton, 1947) - 2 wheels with alternating red and black segments, not uniformly distributed.		Formed a composite of these 4 tests (arc pursuit, wheel avoidance, circle pursuit, and lane tracking). Results showed evidence for a learning factor. Addition of the learning factor resulted in a modest increase in the goodness of fit ($\chi^2(18) = 130, p < .01$). significant predictors of general psychomotor ability are general cognitive ability ($r = .69, z = 8.3, p < .01$) and temporal processing ability ($r = .25, z = 2.7, p < .01$). The key predictors of the learning factor are processing speed ($r = -.49, z = -4.4, p < .01$), and general cognitive ability ($r = .41, z = 2.6, p < .01$).	Chaiken, S., Kylionen, P., & Tirre, W. (1999). <u>Organization and Components of Psychomotor Ability</u> . (Research Report 1999-0146). Brooks AFB, TX: U. S. Air Force Research Laboratory.

			Participants controlled the rotation rate to avoid the red segments.			
Rate control	Task that involves a significant perceptual and response load	Circle Pursuit	One half of a stick's y-movement was speed-mapped into a circular path. The stick controlled a sight's speed along the path in one direction. Participants kept the sight as close as possible to a red circle that traveled in one direction at varying speeds.		Formed a composite of these 4 tests (arc pursuit, wheel avoidance, circle pursuit, and lane tracking). Results showed evidence for a learning factor. Addition of the learning factor resulted in a modest increase in the goodness of fit ($\chi^2(18) = 130, p < .01$). significant predictors of general psychomotor ability are general cognitive ability ($r = .69, z = 8.3, p < .01$) and temporal processing ability ($r = .25, z = 2.7, p < .01$). The key predictors of the learning factor are processing speed ($r = -.49, z = -4.4, p < .01$), and general cognitive ability ($r = .41, z = 2.6, p < .01$).	Chaiken, S., Kylionen, P., & Tirre, W. (1999). <u>Organization and Components of Psychomotor Ability</u> . (Research Report 1999-0146). Brooks AFB, TX: U. S. Air Force Research Laboratory.

Rate control	Task that involves a significant perceptual and response load	Lane Tracking	Participants have a drivers-eye view of the front of a car heading down the right lane of a 2-lane highway, with high winds from the left or right, pushing the car off the road or into the opposing lane. Participants used the speed-mapped x-movement of the stick to compensate for wind and keep the car as close to the center of the lane.	Formed a composite of these 4 tests (arc pursuit, wheel avoidance, circle pursuit, and lane tracking). Results showed evidence for a learning factor. Addition of the learning factor resulted in a modest increase in the goodness of fit ($\chi^2(18) = 130, p < .01$). significant predictors of general psychomotor ability are general cognitive ability ($r = .69, z = 8.3, p < .01$) and temporal processing ability ($r = .25, z = 2.7, p < .01$). The key predictors of the learning factor are processing speed ($r = -.49, z = -4.4, p < .01$), and general cognitive ability ($r = .41, z = 2.6, p < .01$).	Chaiken, S., Kylionen, P., & Tirre, W. (1999). <u>Organization and Components of Psychomotor Ability</u> . (Research Report 1999-0146). Brooks AFB, TX: U. S. Air Force Research Laboratory.
Psychomotor Ability		Psychomotor Vigilance Test (PVT)	Computer simulation in which a tracking ball, operated by the joystick, moves randomly, and a second tracking ball, operated by the rudder pedals, moves horizontally. Participants try to keep both tracking balls centered. Helicopter-specific PVT.		McMahon, T. W., & Newman, D. G. (2016). Development of a field-deployable psychomotor vigilance test to monitor helicopter pilot performance. <i>Aerospace Medicine and Human Performance</i> , 87(4), 417-422.
Rate Control		Motor Judgment Test	2 adjacent disks rotating at a constant speed, with both disks having black and white sections. Between the disks is a pointer, controlled by the participant. The participant makes as many rotations as possible of the pointer without crossing the black areas on the disks.	$r_{xx} = .96$ and $.92$ (Melton, 1947); $r_{xx} = .76$ (Fleishman, 1958); Median $r_{xy} = -.02$ w/ several archival measures of driving performance using taxi cab drivers (Farr et al., 1971)	

Rate Control		Single Dimension Pursuit meter	Participant makes adjustments of a control wheel to keep a horizontal line in a null position as it deviates in an irregular fashion		$r_{xx} = .88$ and $.92$ for the timer and work-adder scores, respectively (Melton, 1947); $r_{xx} = .76$ for the timer score (Fleishman, 1958); Median $r_{xy} = .13$ and $.06$ for the timer and worker-adder scores, respectively, w/ graduation-elimination from pilot training (Melton, 1947)	
Tracking a Moving Target Ability		Test of Basic Aviation Skills (TBAS) - Airplane Tracking Test (ATT)	This compensatory tracking task measures the ability to track a moving target in two dimensions (horizontal and vertical). The image of an airplane and crosshairs appear on the computer screen. The examinee's task is to keep the crosshairs centered on the airplane.		Correlated $.12$ and $.14$ with SUPT T-37 pass/fail and total score performance criteria, respectively Change in R over and above AFOQT-P, AFOQT-Q, and flying experience = $.007$ (SUPT T-37 pass/fail criterion); $.009$ (SUPT T-37 total score criterion) Results of validation study created 3 composite scores: 1) AHTT_SR2: Airplane Tracking Test + Horizontal Tracking Test 2) AHTT_SR3: Airplane Tracking Test + Horizontal Tracking Test + Airplane and Horizontal Tracking Test 3) AHTT_SR5: Airplane Tracking Test + Horizontal Tracking Test + Airplane and Horizontal Tracking Test + Airplane Tracking, Horizontal Tracking, and Five Digit Listening Test (AHTT5) AHTT_SR2: Change in R over and above AFOQT-P, AFOQT-Q, and flying experience = $.015$ (SUPT T-37 pass/fail criterion); $.007$ (SUPT T-37 total score criterion) AHTT_SR3: Change in R over and above AFOQT-P, AFOQT-Q, and flying experience = $.014$ (SUPT T-37 pass/fail criterion); $.008$ (SUPT T-37 total score criterion) AHTT_SR5: Change in R over and above AFOQT-P, AFOQT-Q, and flying experience = $.017$ (SUPT T-37 pass/fail criterion); $.010$ (SUPT T-37 total score criterion)	Carretta, T. R. (2005). Development and validation of the Test of Basic Aviation Skills (TBAS). (Research Report 2006-0172). Wright-Patterson AFB, OH: U. S. Air Force Research Laboratory.

Tracking a Moving Target Ability		Test of Basic Aviation Skills (TBAS) - Horizontal Tracking Test (HTT)	This compensatory tracking task measures the ability to track a moving target on a horizontal axis. The image of an airplane and a box appear on the computer screen. The airplane moves left and right across the screen at various speeds that the examinee cannot control. Examinees are instructed to use rudder pedals to keep the airplane inside the box for as long as possible	Correlated .13 and .10 with SUPT T-37 pass/fail and total score performance criteria, respectively Change in R over and above AFOQT-P, AFOQT-Q, and flying experience = .011 (SUPT T-37 pass/fail criterion); .002 (SUPT T-37 total score criterion) Results of validation study created 3 composite scores: 1) AHTT_SR2: Airplane Tracking Test + Horizontal Tracking Test 2) AHTT_SR3: Airplane Tracking Test + Horizontal Tracking Test + Airplane and Horizontal Tracking Test 3) AHTT_SR5: Airplane Tracking Test + Horizontal Tracking Test + Airplane and Horizontal Tracking Test + Airplane Tracking, Horizontal Tracking, and Five Digit Listening Test (AHTT5) AHTT_SR2: Change in R over and above AFOQT-P, AFOQT-Q, and flying experience = .015 (SUPT T-37 pass/fail criterion); .007 (SUPT T-37 total score criterion) AHTT_SR3: Change in R over and above AFOQT-P, AFOQT-Q, and flying experience = .014 (SUPT T-37 pass/fail criterion); .008 (SUPT T-37 total score criterion) AHTT_SR5: Change in R over and above AFOQT-P, AFOQT-Q, and flying experience = .017 (SUPT T-37 pass/fail criterion); .010 (SUPT T-37 total score criterion)	Carretta, T. R. (2005). Development and validation of the Test of Basic Aviation Skills (TBAS)₂ (Research Report 2006-0172). Wright-Patterson AFB, OH: U. S. Air Force Research Laboratory.
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Tracking a Moving Target Ability		Test of Basic Aviation Skills (TBAS) - Airplane and Horizontal Tracking Test (AHTT)	This test requires examinees to simultaneously perform the ATT and HTT tracking tasks. Examinees manipulate the control stick to target an airplane moving in two dimensions while simultaneously manipulating the rudder pedals to target an airplane moving along a horizontal axis. Performance is based on how accurately both airplanes (targets) are tracked.	Correlated .09 with SUPT T-37 pass/fail and total score criteria Change in R over and above AFOQT-P, AFOQT-Q, and flying experience = .005 (SUPT T-37 pass/fail criterion); .005 (SUPT T-37 total score criterion) Results of validation study created 3 composite scores: 1) AHTT_SR2: Airplane Tracking Test + Horizontal Tracking Test 2) AHTT_SR3: Airplane Tracking Test + Horizontal Tracking Test + Airplane and Horizontal Tracking Test 3) AHTT_SR5: Airplane Tracking Test + Horizontal Tracking Test + Airplane and Horizontal Tracking Test + Airplane Tracking, Horizontal Tracking, and Five Digit Listening Test (AHTT5) AHTT_SR2: Change in R over and above AFOQT-P, AFOQT-Q, and flying experience = .015 (SUPT T-37 pass/fail criterion); .007 (SUPT T-37 total score criterion) AHTT_SR3: Change in R over and above AFOQT-P, AFOQT-Q, and flying experience = .014 (SUPT T-37 pass/fail criterion); .008 (SUPT T-37 total score criterion) AHTT_SR5: Change in R over and above AFOQT-P, AFOQT-Q, and flying experience = .017 (SUPT T-37 pass/fail criterion); .010 (SUPT T-37 total score criterion)	Carretta, T. R. (2005). Development and validation of the Test of Basic Aviation Skills (TBAS), (Research Report 2006-0172). Wright-Patterson AFB, OH: U. S. Air Force Research Laboratory.
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LIST OF SYMBOLS, ABBREVIATIONS AND ACRONYMS

%	percent
AA	academic average
ABM	Air Battle Manager
AEF	Air Expeditionary Force
AEFComp	Air Expeditionary Force Composite
AFOQT	Air Force Officer Qualifying Test
AFPC	Air Force Personnel Center
AI	Aviation Information
AIR	Adverse Impact Ratios
AR	Arithmetic Reasoning
BC	Block Counting
CFA	check flight average
CFA	confirmatory factor analysis
CSO	Combat Systems Officer
d	Cohen's d (standardized mean score difference)
D&I	Diversity and Inclusion
DFA	daily flying average
FCR	flight commander's ranking
GPA	grade point average
IC	Instrument Comprehension
I-O	Industrial-Organizational
IFT	initial flight training
MASS	merit assignment selection system score
ME/I	measurement equivalence and invariance

MPA	Military Performance Assessment
O_MERIT	Order of Merit
OTS	Officer Training School
PS	Physical Science
RawAcademic	OTS raw academic average
RC	Reading Comprehension
ROTC	Reserve Officers' Training Corp
RPA	Remotely Piloted Aircraft
rwg	Within-group rater agreement
SDI	Self-Description Inventory
SJT	Situational Judgement Test
SME	subject matter expert
SUPT	Specialized Undergraduate Pilot Training
SUPTAcad	SUPT Academic Average
TR	Table Reading
URT	Undergraduate Remotely Pilots Aircraft (RPA) Training
USAF	United States Air Force
USAFA	United States Air Force Academy
VA	Verbal Analogies
WK	Word Knowledge