



**U.S. Army Research Institute
for the Behavioral and Social Sciences**

Research Report 1927

**The Roles of Perseverance, Cognitive Ability, and
Physical Fitness in U.S. Army Special Forces
Assessment and Selection**

Scott A. Beal
U.S. Army Research Institute

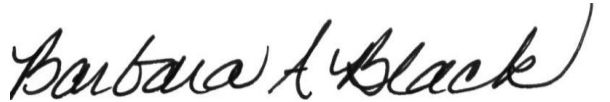
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THE ROLES OF PERSEVERANCE, COGNITIVE ABILITY, AND PHYSICAL FITNESS IN U.S. ARMY SPECIAL FORCES ASSESSMENT AND SELECTION

EXECUTIVE SUMMARY

Research Requirement:

Prior to September 11, 2001, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) completed more than a decade of research in support of the U.S. Army Special Operations Forces (ARSOF) at Fort Bragg, NC. From these years of research, ARI published reports on Special Forces manpower and personnel, assessment, selection, training, and Soldier development. Army Special Forces leaders and trainers have maintained interest in these specific areas of research since 9/11. However, sweeping changes at all levels of Special Forces necessitated updating the research to provide more relevant and timely results.

The leaders at the John F. Kennedy Special Warfare Center and School (SWCS), who are responsible for the growth and maintenance of Special Forces, were particularly interested in the extent to which the current tests and measures used for assessing and selecting Soldiers predicted their success. They recognized also the need for assessing perseverance as an individual Soldier characteristic that contributed to selection following the Special Forces Assessment and Selection (SFAS) process, and ultimately with completing the Special Forces Qualification Course (SFQC). This report documents one effort at updating this research. More specifically, it analyzes the extent to which Soldiers' cognitive ability, physical fitness, ability to complete difficult performance events, and perseverance contributed to valid and reliable predictions of SFAS selection.

Procedure:

Candidates admitted to SFAS (N=824) completed a battery of cognitive ability, physical fitness, and perseverance tests prior to attempting to complete a series of SFAS performance events. During the SFAS process, a proportion of the Candidates were withdrawn due to pre-existing or emerging physical injuries or medical problems. The data from these Candidates were removed from the analyses to eliminate their impact on the overall results. A larger proportion of Candidates withdrew from SFAS voluntarily, most citing insufficient physical fitness as the primary reason for their withdrawal. The Candidates who completed SFAS successfully were brought before a board of leaders who made the final selection decisions for admitting the Candidates to the subsequent SFQC. The ARI obtained and analyzed the data to determine the predictive strengths of the variables contributing to SFAS completion and selection for the SFQC. In addition, the data were used to analyze the potential impact of selected variables on Special Forces recruiting. Finally, ARI explored the extent to which a more efficient model of tests could be identified and used to predict success.

Findings:

The results showed that almost all of the current tests and measures used to assess SFAS Candidates were significant predictors of selection for training following the SFAS performance events, although the strength of their individual contributions varied. The SFAS performance event scores were strongest for predicting selection, followed by scores from cognitive ability tests, the Army Physical Fitness Test (APFT), and finally perseverance. Taken together, the current tests and events accounted for a robust amount of variance in our Soldier sample. The Special Forces recruiters could use the measures available to them to increase the stringency of current recruiting standards, which may increase the probability of choosing successful SFAS Candidates, but may also reduce the overall force structure. A more efficient model of five variables was derived from the analyses that accounted for slightly more variance than the current model of tests and measures. However, using the more efficient model would reduce the amount of information on which board leaders base their selection decisions.

Utilization and Dissemination of Findings:

This report represents an effort to update ARI's previous research in support of U.S. Army Special Forces, and supports the overall mission of the U.S. Army Special Operations Command (USASOC). The results of this research were briefed to members of the Directorate of Special Operations Proponency (DSOP) Command Group and continue to influence decisions made by leaders who are responsible for maintaining and increasing the force structure of U.S. Army Special Forces.

THE ROLES OF PERSEVERANCE, COGNITIVE ABILITY, AND PHYSICAL FITNESS IN U.S. ARMY SPECIAL FORCES ASSESSMENT AND SELECTION

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THE ROLES OF PERSEVERANCE, COGNITIVE ABILITY, AND PHYSICAL FITNESS IN U.S. ARMY SPECIAL FORCES ASSESSMENT AND SELECTION

Preface

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) conducted research for more than a decade in support of Army Special Operations Forces (ARSOF). The results of these research efforts were published in the following areas of interest: (a) supporting manpower and personnel, (b) improving selection, (c) developing tools for assessment, (d) enhancing training, and (e) Soldier and leader professional development (see Brooks & Zazanis, 1997 for a complete review). While these research areas continue to be relevant and of interest to ARSOF leaders, ARI's investigations were conducted prior to the events of September 11, 2001. Given the sweeping changes in Special Forces (SF) training and combat operations in response to these events, a need arose to replicate some of the earlier research conducted by ARI. This report presents the results of a systematic replication of ARI's earlier efforts to assist in developing a better understanding of the impact of cognitive ability and physical fitness on SF recruiting and selection. In addition, it summarizes the role of perseverance as a newly investigated individual characteristic in SF assessment and selection.

Background and Purpose

The U.S. Army John F. Kennedy Special Warfare Center and School (SWCS) at Fort Bragg, NC, forms and implements the standards for selecting Army Special Forces (SF) Soldiers. These standards ensure that the Soldiers entering SF can demonstrate physical toughness, mental sharpness, and enough operational readiness potential to meet the demands of current and future special operations. The SWCS meets their requirements for maintaining the overall SF force structure, in part, through a Special Forces Assessment and Selection (SFAS) process. This process includes recruiting Army Soldiers (and a limited number of civilians), assessing their cognitive and physical appropriateness for SF, testing their ability to complete a rigorous series of performance-driven events, and then selecting some of them for additional SF training.

Because the events during SFAS are difficult, as many as 40% of the recruited candidates in a given class will voluntarily withdraw (VW) during the process. The vast majority of the Soldiers who VW cite their inability to complete the events due to insufficient physical fitness. However, recent data analyses have shown that about 15% of the Soldiers who completed SFAS successfully and were selected for additional SF training had similar or even lower physical fitness and IQ scores than some of the Soldiers who VW during SFAS. These results suggest that there is an element of individual perseverance that reinforces a Soldier's willingness to stay the SFAS course, in spite of perceived or real limitations. It also suggests that, while mental and physical achievement and ability are important, the probability of success increases when a high level of performance is sustained over time and under increasingly difficult conditions; that is, when Soldiers persevere.

Leaders and trainers at SWCS, particularly those directly responsible for SFAS outcomes, wanted to explore the extent to which an individual characteristic like perseverance

contributed to Soldiers completing SFAS and being selected for SF training. In addition, SWCS wanted to better understand the potential consequences of modifying their recruiting practices if empirical evidence suggested that Soldiers with higher levels of reported perseverance had a greater tendency to complete the SFAS process successfully. The SWCS leaders asked ARI at Fort Bragg to identify a tool appropriate for measuring perseverance in a specialized military context, and then to validate the tool with SFAS candidates. In addition, leaders tasked ARI to develop a “most efficient predictive model” that combined existing SF cognitive ability tests and physical fitness test scores with the measure of perseverance to predict Soldiers who might VW from SFAS, versus those who would be selected for additional training. This report documents the results of this research effort. The findings suggest that a test of perseverance adds incremental strength to predict SFAS success when combined with existing cognitive ability tests, physical fitness tests, and SFAS performance event scores.

Identifying the Grit Scale as an Appropriate Measure of Perseverance

The belief that exceptional accomplishments can be produced by individuals that demonstrate something other than inherent ability is not new (see Terman & Oden, 1947). In large measure, SF operates, trains, and manages its expectations of current and future capabilities according to the widely held assumption that successes are obtained through consistent hard work and perseverance. Selection guidelines and training programs in support of SF are written from this vantage point. Yet, to date, military researchers have done little to establish an empirical basis for perseverance as a measurable, individual Soldier characteristic. The requirements to maintain the SF force structure and reduce the percentage of Soldiers who VW from SFAS provided the impetus for exploring the influence of perseverance in a SF context.

Duckworth, Peterson, Mathews and Kelly (2007) combined results from a series of studies that measured the extent to which the Grit Scale, a survey of perseverance, predicted educational attainment, grade point average, and military retention in adults. The Grit Scale includes five subscales that are each represented by a combination of items from the survey. The subscales (and the number of items that comprise them) are as follows: Grit Score (12 items), Consistency of Interest (six items), Perseverance of Effort (six items), Brief Grit (eight items), and Ambition (five items). The authors defined the construct “grit” as:

“...perseverance and passion for long-term goals. Grit entails working strenuously toward challenges, maintaining effort and interest over years despite failure, adversity, and plateaus in progress. The gritty individual approaches achievement as a marathon; his or her advantage is stamina...Disappointment or boredom signals to others that it is time to change trajectory and cut losses, [whereas] the gritty individual stays the course (p. 1087-1088).

The Army, to include SF, has relied heavily on indicators of cognitive ability (e.g., Armed Services Vocational Aptitude Battery – General Technical (ASVAB-GT) score) to inform decisions about selection, job assignment, and training. One finding discussed by Duckworth, et al., showed that grit was greater than IQ in predictive validity and magnitude when measuring achievement. In addition, the Grit Scale did not correlate with IQ. From these findings, three important conclusions can be drawn about perseverance and its potential

application to this research: (a) that it is a measurable predictor of accomplishment, (b) that it can account for more variance than IQ, and (c) that it can account for variance independent of IQ. It was for these reasons that we explored the efficacy of the Grit Scale, or perseverance, as a component of our predictive model for validation with SFAS Candidates.

Testing During SFAS

During the SFAS process, Soldiers complete a battery of tests that includes measures of language aptitude, general intelligence, and several other dimensions of cognitive ability, along with the Army Physical Fitness Test (APFT). In addition, multiple types of biographical data (e.g., age, years in active duty, education, etc.) are collected from each Soldier. Recruited Soldiers are admitted as candidates into an SFAS class when they meet or exceed established criteria for cognitive and physical fitness.

Following initial testing, the SFAS process requires that admitted candidates attempt to complete a series of difficult performance-based events. These events test the candidates' problem solving abilities, their physical strength and endurance, and their willingness to endure hardship under conditions that mirror the operational circumstances during SF combat missions. The SFAS Cadre collect and maintains the candidates' performance data. The candidates who complete the SFAS performance events successfully are presented before a board of trainers and leaders who make final selection decisions. The board members make selection decisions according to a general statement of risk that represents a composite of data and test scores for each candidate.

The ARI analyzed data from several previous SFAS classes to understand how the tests and events impacted selection. The results of statistical analyses (e.g., linear regression, binary logistic regression) showed that all the tests and events in current use had properties that contributed to predicting selection, though the results highlighted variations in the relative predictive strengths of each test and event. Table 1 shows the tests and events from which data were collected during the recruiting and SFAS processes, and then analyzed.¹

¹ Our intent was to publish this research report with unlimited distribution. As such, we omitted detailed results of these data analyses and the details of the SFAS events. We also omitted the specific procedures for collecting data.

Table 1

Cognitive Ability Tests, Physical Fitness Tests, and SFAS Events from which Data Were Collected for Preliminary Analyses

Cognitive Ability Tests	Physical Fitness	SFAS Event
Armed Services Vocational Aptitude Battery – General Technical score (ASVAB-GT)	Army Physical Fitness Test (APFT)	1 st Ruck March
Defense Language Aptitude Battery (D-Lab)	Number of Pull-ups	2 nd Ruck March
Test of Adult Basic Education (TABE)		1 st Run
Wonderlic Personnel Test		2 nd Run
General Ability Measure for Adults (GAMA)		Obstacle Course
Years of School Completed		

To meet the purposes of this research, all the tests and events shown in Table 1 were combined with the Grit Scale to determine their respective and collective roles in predicting selection for SF training. Another purpose was to understand better their potential impact on SF recruiting as if modifications to recruiting practices had already been implemented.

SFAS Data Collection

Candidates from four SFAS classes (N=824) participated in this research. The data were collected November 2008 through February 2009. The procedures for recruiting, testing, and performance events, and the selection standards and procedures, were held constant across the four classes to decrease the potential for confounding variables. The participating candidates completed all the cognitive ability and physical fitness tests that were required of previous SFAS classes. They completed the Grit Scale in conjunction with all other paper-and-pencil tests, which were administered at the beginning of each SFAS class. Following the testing, candidates began the process of completing the SFAS performance events in preparation for the selection board.

The data from previous SFAS classes showed that candidates experienced one of the following outcomes:

- Candidate VW from SFAS.
- Candidate was withdrawn during SFAS due to a pre-existing physical injury or medical condition.
- Candidate was withdrawn during SFAS due to a physical injury or medical condition that emerged during the process.
- Candidate completed the performance events, but was not selected by the SFAS board.
- Candidate completed the SFAS performance events and was selected for SF training.

Results

Biographical Data

The average age of the participating candidates was 26 years. Fifty-two percent of the candidates were high school graduates. Twenty-nine percent of the candidates had completed some college, 17% held Bachelor's degrees, and 2% had completed some post-graduate work. Seventy-two percent of the candidates reported that they had experienced combat during Operation Iraqi Freedom/Operation Enduring Freedom (OIF/OEF). Approximately 90% of the candidates were noncommissioned officers (NCO), and the remaining 10% were commissioned officers. Table 2 shows the distribution of ranks among the participating candidates.

Table 2

The Distribution of Ranks among the Participating Candidates

NCO Ranks	Frequency	Percentage (%) of Total Candidates
E1	3	<1
E2	3	<1
E3	86	10
E4	256	31
E5	239	29
E6	138	17
E7	18	2
Officer Ranks	Frequency	Percentage (%) of Total Candidates
O1	1	<1
O2	8	<1
O3	72	9

Grit Scale

From the four SFAS classes, we retained for analysis the data from the candidates (N=758) who VW (298/39%), as well as the data from those who completed the SFAS performance events but were not selected by the board (110/15%), and from those who completed SFAS and were selected by the board for SF training (350/46%). By doing so, we eliminated the potential impact of physical injuries and other medical conditions on our results and our ability to develop an efficient model to predict success. Therefore, 46% (350) of the candidates were selected, and 54% (408) were not selected.

Scale Reliability. Table 3 shows the reliability estimates for the Grit Scale subscales. These results show that the subscales have sufficient reliability for this Candidate sample.

Table 3

Grit Scale Subscale Reliabilities

Subscale	Reliability (Cronbach's α)
Grit	.81
Consistency of Interest	.81
Perseverance of Effort	.70
Brief Grit	.78
Ambition	.69

Predictive Strength of Grit Subscales. To examine the effects of the individual Grit subscales on SFAS selection, the scores were standardized for ease of interpretation. The SFAS selection variable was coded as a dichotomous variable where 1 = selected and 0 = not selected or VW. The results from binary logistic regression analyses, one analysis for each of the Grit subscales, are shown in Table 4.

Table 4

Binary Logistic Regression Analyses Using Individual Grit Subscales

Grit Subscale	N	B (beta)	p value	Nagelkerke R²	Odds Ratio
Grit Score	758	.198	.008	.013	1.22
Consistency of Interest	758	.115	.114	.004	1.12
Perseverance of Effort	758	.189	.010	.012	1.21
Brief Grit	758	.194	.009	.012	1.21
Ambition	758	.219	.003	.016	1.25

The values for beta (a change in the log odds of selection as a function of a one unit change in a subscale score) and the odds ratios (a change in the odds of selection as a function of a one unit change in a subscale score) are included in the table. A *p* value less than or equal to 0.05 suggests that the subscale is a significant predictor of SFAS selection. The Nagelkerke R² represents the variance accounted for by each subscale.

Based on these results, the Consistency of Interest subscale was not a significant predictor of SFAS selection and was removed from further analyses. The odds ratios for the remaining four subscales show that the candidates who scored a standard deviation above the subscale mean scores were 21% to 25% more likely to be selected. The amounts of variance accounted for by the four subscales were relatively small, which suggested that, though the subscales were significant predictors of SFAS selection, their contribution was slight.

Perseverance Model. The four Grit subscales retained for further analyses were included in a single binary logistic regression (with selected vs. not selected or VW as the dependent variable) to determine the effect of a "Perseverance" model for predicting selection. The results showed that the Perseverance model's effect on SFAS selection was significant, $\chi^2 (5, 758) =$

11.23, $p < .024$; -2 Log likelihood = 1035.140; Nagelkerke $R^2 = .020$. However, the amount of variance accounted for by this model was relatively small and should not be interpreted in isolation from additional tests reported below.

Cognitive Ability Tests

To determine and ease interpretation of the effects of individual cognitive ability tests on SFAS selection, test scores were standardized. The same dichotomous dependent variable (i.e., selected vs. not selected or VW) was used and binary logistic regressions were performed for each cognitive test. Table 5 shows the results of these analyses.

Table 5

Binary Logistic Regression Analyses Using Cognitive Ability Test Scores

Cognitive Ability Test	N	B (beta)	p value	Nagelkerke R^2	Odds Ratio
Entry GT	721	.620	<.001	.110	1.86
Wonderlic	758	.574	<.001	.097	1.78
GAMA	758	.455	<.001	.062	1.58
D-Lab	732	.631	<.001	.113	1.88
TABE	756	.872	<.001	.139	2.39
Years of school completed	754	.513	<.001	.076	1.67

All five cognitive ability tests and Years of school completed were significant predictors of SFAS selection and were retained for further analyses. The Candidates who scored one standard deviation above the mean for Entry GT were 86% more likely to be selected, whereas those who scored a standard deviation above the mean Wonderlic score were 78% more likely to be selected. Those who scored a standard deviation above the means for GAMA and D-Lab were 58% and 88% more likely to be selected, respectively. Those who scored a standard deviation above the TABE mean, and those who had one standard deviation above the mean for Years of school completed were 139% and 67% more likely to be selected, respectively.

Cognitive Ability Model. The standardized scores from the cognitive ability tests and Years of school completed shown in Table 5 were included in a single binary logistic regression (with selected vs. not selected or VW as the dependent variable) to determine the effect of a “Cognitive Ability” model for predicting SFAS selection. The results showed that this model’s effect on SFAS selection was significant, $\chi^2 (6, 691) = 105.45$, $p < .001$; -2 Log likelihood = 846.352; Nagelkerke $R^2 = .189$. The Cognitive Ability Model accounted for approximately 19% of the variance, which suggests that the predictive power of this model is relatively robust.

Physical Fitness and SFAS Performance Events

Binary logistic regressions were performed for each physical fitness measure and each SFAS performance event to establish the magnitude of their individual effects on selection. All test scores were standardized to ease interpretation of results. Because lower scores for the ruck marches, runs, and obstacle course misses represented better performance than higher scores, the

standardized scores were factored by -1.00 for ease of interpretation and to maintain consistency with results from the two models shown above. The dichotomous variable, selected vs. not selected or VW was used as the dependent variable. Table 6 shows the results of these analyses.

Table 6

Binary Logistic Regression Analyses Using Physical Fitness and SFAS Performance Event Scores

Physical Fitness	N	B (beta)	p value	Nagelkerke R²	Odds Ratio
APFT Score	758	.614	<.001	.107	1.85
Pull-ups	600	.438	<.001	.056	1.55
1 st ruck march	732	1.77	<.001	.326	5.85
2 nd ruck march	581	2.32	<.001	.199	10.15
1 st run	703	.639	<.001	.111	1.90
2 nd run	544	.453	<.001	.061	1.57
Obstacle Course	488	.375	<.001	.043	1.46

The results for these regressions showed that the two physical fitness variables (i.e., APFT score and number of pull-ups) and the five SFAS performance event variables were significant predictors of SFAS selection. As such, all seven variables were retained for additional analyses. The SFAS candidates whose APFT Scores and number of pull-ups were a standard deviation above the mean of these two variables were 85% and 55% more likely to be selected, respectively. Those whose 1st and 2nd run times were a standard deviation faster than the mean were 90% and 57% more likely to be selected, respectively. The candidates whose total number of misses on the Obstacle Course was a standard deviation below the mean were 46% more likely to be selected. Those whose 1st ruck times were one standard deviation faster than the mean had almost a five-fold greater likelihood of being selected. The candidates whose 2nd run times were one standard deviation faster than the mean had more than a nine-fold greater likelihood of being selected.

Physical Fitness Model. The standardized scores from the variables shown in Table 6 were included in a single binary logistic regression (with selected vs. not selected or VW as the dependent variable) to determine the effect of a “Physical Fitness” model on SFAS selection. This model’s effect was significant, $\chi^2 (7, 468) = 76.66, p < .001$; -2 Log likelihood = 464.511; Nagelkerke $R^2 = .220$. The Physical Fitness Model’s effect on selection was fairly robust, accounting for 22% of the variance.

An Efficient Overall Model for Predicting SFAS Selection

All 17 variables shown in Tables 4, 5, and 6 that were significant predictors of SFAS selection (only Consistency of effort was not) were included in a single binary logistic regression using the same dichotomous dependent variable. This inclusive model’s effect was significant and accounted for more than 39% of the variance, $\chi^2 (15, 421) = 132.46, p < .001$; -2 Log likelihood = 357.309; Nagelkerke $R^2 = .393$.

One purpose for this research was to determine, statistically, the most efficient combination of variables with the greatest magnitude of predictive strength, as indicated by the amount of variance accounted for. We entered every possible combination of variables that was conceptually meaningful into binary logistic regressions. The following combination of variables accounted for the most variance and is rank ordered, starting with the variable that produced the greatest predictive strength ($\chi^2 [5, 727] = 274.838, p < .001$; -2 Log likelihood = 731.675; Nagelkerke $R^2 = .420$):

- 1st ruck march
- TABE
- Ambition subscale
- Years of school
- APFT score

This particular model can be considered most efficient because it consists of just five variables that accounted for more variance than the regression model with all 17 variables.

Considerations for SF Recruiting

The Special Forces Recruiting Battalion (SORB) requires potential SFAS candidates to report their General Technical (GT) scores and their most recent APFT scores at the recruiting station. When Soldiers meet or exceed minimum GT and APFT scores, they are admitted as potential candidates into SFAS. Upon arriving at Fort Bragg, just prior to the beginning of a new SFAS class, Soldiers are required to complete another APFT. The Soldiers whose scores do not meet or exceed the minimum APFT score are not admitted as SFAS candidates, but can return at a later date to take the test again. Those who meet the APFT requirement, but whose GT scores are lower than the minimum cut-off can request a waiver to be admitted as candidates into SFAS.

The leaders at the SWCS and SORB wanted to understand better the potential impact of implementing more stringent requirements for SFAS admission, thus reducing the number of lower-scoring Soldiers who are admitted. Using the data from the four SFAS classes, we calculated the impact of cut-off thresholds on SFAS selection as if they had been enforced during the classes from which we collected data. The impact of these cut-off thresholds were analyzed using GT, APFT, and Grit Scale scores because these would be readily available to recruiters.

Based on conversations with SWCS and SORB leaders, the cut-off thresholds for the lowest scoring Soldiers were set at 10%, 15%, 20%, and 25%. The percentages of SFAS Candidates who were selected or who VW, along with the odds ratios, were calculated for each cut-off threshold. Table 7 shows the impact of implementing more stringent SFAS admission requirements.

Table 7

Potential Impact of Implementing More Stringent Requirements for SFAS Admission Using GT, APFT, and Grit Scale Scores

Measure	10% Cut-off	15% Cut-off	20% Cut-off	25% Cut-off
Entry GT	31 (47%)	50 (47%)	70 (47%)	79 (45%)
Score	Selected	Selected	Selected	Selected
	35 (53%) VW	57 (53%) VW	78 (53%) VW	92 (54%) VW
	*1.13	*1.13	*1.13	*1.20
APFT	12 (17%)	26 (24%)	35 (24%)	48 (27%)
Score	Selected	Selected	Selected	Selected
	58 (83%) VW	84 (76%) VW	112 (76%) VW	132 (73%) VW
	*4.88	*3.17	*3.17	*2.70
Grit	29 (45%)	45 (45%)	79 (47%)	120 (48%)
Scale	Selected	Selected	Selected	Selected
Score	36 (55%) VW	55 (55%) VW	88 (53%) VW	128 (52%) VW
	*1.22	*1.22	*1.13	*1.08

*Odds ratio for VW/Selected.

The results show that implementing more stringent requirements using GT and Grit Scale scores would have prohibited the recruiting of almost half the Candidates who completed SFAS successfully and were selected for SF training. By comparison, using APFT scores would have been far more beneficial than using GT and Grit Scale scores for eliminating Soldiers at the SORB who would have VW during the SFAS process. This is highlighted particularly at the 10% cut-off threshold for APFT scores where the odds ratio of VW/Selected is almost four times greater than for GT and Grit Scale scores. (The odds ratio is referring to the likelihood that Soldiers will VW rather than be selected, fail rather than pass).

Discussion

This research explored the strengths with which perseverance, (measured by the Grit Scale), cognitive ability tests, physical fitness, and SFAS performance events impacted selection of Soldiers for SF training following SFAS. Another purpose was to develop the most efficient, conceptually appropriate combination or model of these tests for predicting selection. Finally, we wanted to better understand the consequences of modifying SF recruiting criteria using the Grit Scale, GT, and APFT scores, all of which are readily available to the SORB.

Predictive Strength of Perseverance

We found that four of the five Grit Scale subscales predicted selection. Results showed also that perseverance, represented generally by a model comprised of the four subscales, was not significantly correlated with IQ scores. This suggested that the Grit Scale added unique value to the existing cognitive ability, physical fitness, and performance event measures in current use at SFAS. However, the strength of prediction for perseverance, though statistically significant, was relatively weak. As such, it would be unwise to use the Grit Scale in isolation from the other tests and measures that accounted for most of the variance in this Soldier sample.

A multisource approach to gaining information about Soldier performance to inform selection decisions is recommended.

Though the impact of perseverance on SF selection was slight, it is difficult to ignore the fact that about 15% of the Soldiers who completed SFAS scored lower on cognitive ability and physical fitness tests than a similar percentage of Soldiers who VW. This suggested that, at least for some Soldiers, the drive to finish SFAS in spite of limitations in cognitive and physical ability played a role in their eventual success. If perseverance paid off for these lower scoring Soldiers, then we can speculate that at least some of the Soldiers who VW might have been selected had they managed to remain firmer in their resolve to complete SFAS.

The SFAS performance events are difficult enough to tax even the fittest Soldiers. Those who complete the process can be confident in their mental and physical toughness, and in their ability to endure hardship. However, the toughness required of selected Soldiers to complete the SFQC successfully is even greater, by comparison. With regard to predicting SFQC success for our remaining sample of Soldiers, we believe that the Grit Scale will increase in predictive strength proportional to the increase in the mental and physical demands placed on the Soldiers who will endure the SFQC. Upon obtaining the SFQC data, we intend to test this hypothesis and publish an addendum to this report that describes the role of perseverance in SFQC success.

Predictive Strength of Cognitive Ability Tests

The Army relies heavily on cognitive ability tests to inform decisions about recruiting, selection, occupation, and training. The value of the cognitive ability tests used in this research was demonstrated in their ability to predict Soldier selection and to account for a substantial amount of the total variance in our Soldier sample. This suggested that a Soldier's cognitive ability to maintain awareness, to think, to judge, and to adapt, played a key role in completing SFAS and being selected for SF training.

The role of cognitive ability, though important during the SFAS process, tends to be even more important when Soldiers begin their advanced training following the completion of the SFQC. Leaders and trainers at SWCS report that the greatest mental challenges are presented to Soldiers during tactical training and language classes. The Soldiers who persevered and demonstrated physical toughness during SFAS and the SFQC, but who scored relatively low on cognitive ability tests, will be challenged most during language and other advanced training. Though they may attempt to persevere through these new mental challenges, it is not uncommon for Soldiers with less cognitive capacity to be withdrawn from SF training because of their inability to grasp knowledge, concepts, and skills that require higher levels of cognitive ability. This underscores the importance of the cognitive ability tests to help determine longitudinal success throughout the entire SF selection, training, and operational pipeline.

Predictive Strength of Physical Fitness Tests and SFAS Performance Events

Historically, physical fitness was thought to be among the most important factors for determining successful completion of SFAS events and the SFQC. Our data support this assertion. Soldiers who do not demonstrate physical toughness during the difficult SFAS process

simply will not prove themselves ready for subsequent SF training and military operations. It is for these reasons that Soldiers entering SF must meet or exceed minimum standard requirements for physical fitness.

Although all of the physical fitness and SFAS performance events in Table 6 were shown to predict selection, the majority of the variance in our Soldier sample was accounted for by the 1st ruck march. The SFAS cadre and leaders report that it is during this event, more than any other, that candidates VW from SFAS on account of insufficient physical fitness and preparation. Those candidates who do persevere and complete the 1st ruck march are soon faced with a 2nd ruck march, during which additional candidates VW for the same reported reason.

Unlike perseverance and cognitive ability, physical fitness can be improved rather quickly with the appropriate amount and frequency of work. Many of the candidates who VW during SFAS have the option of returning to a class after they have improved their physical conditioning. This is an option that allows returning Soldiers to complete SFAS and the SFQC, while supporting the growth of the overall SF force structure.

A More Efficient Model

The recruiters, trainers, and psychologists who support SF currently use all of the tests and measures that were included in this research. These tests and measures require substantial amounts of time and effort to administer and interpret, but ensure that a board of leaders is well informed before making selection and training decisions. One purpose of this research was to determine, statistically, if a more efficient model of tests would have a similar impact on SFAS selection compared to the current model of tests and measures. The amount of variance accounted for by all 17 of the tests and measures combined was fairly robust. However, the model that included the five variables discussed above (i.e., 1st ruck march, TABE, Ambition subscale, Years of school completed, APFT scores) accounted for slightly more variance.

To understand how this more efficient five-variable model would have affected selection, we calculated the impact of the four cut-off thresholds used above as if they had been enforced during the participating SFAS classes from which we collected data (see Table 7). The impact of these cut-off thresholds were analyzed using 1st Ruck March, TABE, and Ambition subscale scores. The impact of APFT scores is shown in Table 7 above. The Years of school completed variable was not reported because the cut-offs did not discriminate differences using the distribution of reported years of school completed (i.e., about 9% of participants reported 11 years of school completed, whereas 52% reported 12 years completed. No one reported between 11 and 12 years of school completed). The results of these calculations are shown in Table 8.

Table 8

Impact of Variables from Most Efficient Model on SFAS Selection

Measure	10% Cut-off	15% Cut-off	20% Cut-off	25% Cut-off
1 st Ruck	9 (12%)	15 (13%)	25 (15%)	35 (15%)
March	Selected	Selected	Selected	Selected
	69 (88%) VW	99 (87%) VW	143 (85%) VW	194 (85%) VW
TABE	8 (12%)	20 (19%)	29 (21%)	38 (22%)
	Selected	Selected	Selected	Selected
	59 (88%) VW	86 (81%) VW	108 (79%) VW	133 (78%) VW
Ambition	20 (31%)	38 (37%)	N/A	60 (35%)
subscale	Selected	Selected		Selected
	44 (69%) VW	64 (63%) VW		112 (65%) VW

In general, all three variables shown in Table 8 would have served recruiting and SFAS fairly well in discriminating selected candidates from those who VW. Relative to the Ambition subscale, the 1st Ruck March and TABE scores were slightly better in predictive accuracy. For all three measures, the 10% cut-off would have prohibited the least amount of recruited candidates who would have been selected otherwise.

From a purely statistical point of view, using the more efficient five-variable model to screen out Candidates at the SORB who are less likely to be selected following SFAS seems reasonable. Yet, in practice, it would be difficult for recruiters to require candidates to complete a ruck march, administer and score the TABE and the Grit Scale, and then combine and analyze all the scores before making final recruiting decisions. Though the 1st ruck march emerged as the variable with the greatest predictive strength, it would be among the most difficult events to execute at the SORB. On the other hand, including a ruck march at the SORB would greatly increase the model's overall efficacy to predict SFAS success.

The predictive strength of the remaining 12 variables that were excluded from the more efficient model may increase as a function of the SFQC. This has yet to be determined. Board leaders who make decisions about admitting SFAS Candidates into the SFQC would be better informed by the rich information represented by all 17 variables, as opposed to having their information limited to the reduced number of variables in the more efficient model, even though the latter accounts for slightly more variance. The costs of eliminating information should be weighed against the benefits of reducing the number of tests and measures by which data are collected, analyzed, and reported.

Conclusions and Recommendations

This updated analysis of the existing SF cognitive ability, physical fitness, and performance event measures provided empirical support for their use as valid and reliable sources of information upon which selection decisions can be based. In addition to the tests and measures used currently to support selection, perseverance emerged as a unique contributor, though the magnitude of its impact was incremental, at best. Based on the results of this research, we offer the following conclusions and recommendations:

Perseverance

- The Grit Scale is easy to administer and score.
- The Grit Scale provides an empirically-valid measure of perseverance that is independent from all other measures.
- The Grit Scale can be used for professional development as a marker of individual levels of perseverance.
- The Grit Scale can be combined with other tests and used to inform and support SF recruiting and selection decisions.
- It is expected that the value of the Grit Scale will increase when analyzed as a predictor of SFQC success, though this has yet to be determined, empirically.
- The Grit Scale should not be used in isolation from other tests and measures as a single criterion for decision making.

Cognitive Ability

- Assessed individually, the five existing cognitive ability tests and Years of school completed serve as empirically-sound predictors of SFAS selection.
- By comparison, the strength of the cognitive ability measures to predict SFAS success is far greater than perseverance.
- It is expected that the role of cognitive ability, in general, will increase during the SFQC and subsequent advanced and language training, though this has yet to be determined, empirically.
- The TABE (Test of Adult Basic Education) emerged with greater value in predicting SFAS success than the ASVAB-GT or Wonderlic, although greater emphasis is typically placed on the latter two measures.
- It is unlikely that the Wonderlic and Gama tests add value to predicting SFAS selection and SFQC success independent of the TABE, D-lab, and GT.
- Unless there are compelling reasons to use the Wonderlic and GAMA tests to provide information to selection boards, these tests could be eliminated without jeopardizing the overall contribution of cognitive ability measures.

Physical Fitness and SFAS Performance Events

- Physical fitness forms the primary basis upon which SFAS success rests.
- Compared to perseverance and cognitive ability, the SFAS performance events and the corresponding physical stamina required to complete them serve as the best predictors of SFAS selection and VW.
- It is expected that the SFAS candidates who are selected for the SFQC will be required to demonstrate higher levels of physical toughness to complete the latter course successfully. It is expected also that physical fitness will become less of an issue during advanced training subsequent to the SFQC. Both hypotheses remain to be supported, empirically.
- Physical fitness stands out as a measureable proficiency that can be improved rather quickly, compared to cognitive ability and perseverance, which cannot.

- Implementing a cut-off APFT score at the SORB can produce both positive and negative effects on the overall SF force structure. As a reliable standard for detection, it helps to eliminate Soldiers who are more prone to VW from SFAS. Yet, it also serves to eliminate some Soldiers who could improve their fitness fairly rapidly, and who demonstrate higher cognitive ability and perseverance, but who are not recruited because of immediate, insufficient levels of physical fitness.
- Though the data exist, an analysis has not been conducted to determine how many Soldiers fail the APFT, but then return later and pass it. Nor have we determined how many of these Soldiers who return and pass the APFT go on to complete SFAS and the SFQC successfully. Knowing these results would increase our understanding of the role of perseverance beyond what we gain using the Grit Scale.
- The results of this research support the current emphasis on SFAS candidates meeting or exceeding minimum levels of physical fitness. However, the number of potential candidates who are rejected because of not meeting the APFT standard, who do not return, yet who might have completed SFAS and the SFQC successfully had they received a waiver, remains unknown. Our analyses suggest that at least a small percentage of Soldiers would have completed SFAS successfully, in spite of beginning with lower than standard APFT scores.

A More Efficient Model

- The regression model that included the 1st Ruck March, TABE, Ambition subscale, Years of school completed, and APFT score accounted for more variance than the model of 17 variables in use, currently. Viewing this model from the vantage point of efficiency, it requires far less time and effort to utilize than the current model.
- If the primary purpose of a model of variables is to predict an outcome with the least amount of effort, then the more efficient five-variable model is superior. However, if the purpose of a model is to provide a selection board with as much information as can be made readily available, then the current model should be perceived as more appropriate.

Other Variables Impacting Selection

This research showed that the tests and measures currently in use accounted for a fairly robust amount of the variance in our Soldier sample. While commendable, from a practical viewpoint, more variance still remains unaccounted for. This begs for continued development of assessment techniques that do not restrict capable Soldiers from entering SFAS, but that restrict those who VW or who are not selected for SF training.

In an effort to gain a better understanding for the reasons why SFAS candidates VW, SWCS psychologists conducted exit interviews with all the candidates who VW from a recent SFAS class (SWCS Unpublished Manuscript, 2009). Excluding medical reasons, when asked why they VW, the vast majority stated that they were not physically prepared for the

performance events, which was consistent with the results reported in this paper. When asked if they would return if given the opportunity, the majority of the candidates stated that they would and that they believed their SFAS experience was a positive one. Additional reasons for VW that candidates listed included the following:

- Family reasons (e.g., wife not supportive, sudden illness in family, divorce, child custody issues).
- Decided not to enter SF after all.
- Mentally not prepared.
- Cannot gain proficiency with land navigation.
- Cadre did not meet expectations of what a SF Soldier should be.
- Choose an SFAS class when weather is not so hot.
- SF is too different from Branch or Career Management Field.
- Not sure I want to stay in Army.
- SFAS was much more difficult than I expected.

Though not an exhaustive list of additional variables affecting SFAS success, it represents a good starting point from which assessment tools can be developed and validated to improve the predictive accuracy with which Soldiers are recruited and selected for SF. In addition to these variables, researchers should continue to search for the determinants of SFAS success or VW that have not yet emerged.

References

- Brooks, J. E. & Zazanis M. M. (1997). *Enhancing U.S. Army Special Forces: Research and Applications*. (ARI Special Report 33). Alexandria, VA. U.S. Army Research Institute for the Behavioral and Social Sciences.
- Duckworth, A. L., Peterson, C., Mathews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology*, 92, 1087-1101.
- Terman, L. M., & Oden, M. H. (1947). *The gifted child grows up: Twenty-five years' follow-up of a superior group*. Oxford, England: Stanford University Press.
- The John F. Kennedy Special Warfare Center and School (JFKSWCS) (2009). Unpublished Manuscript. Psychological Applications Directorate, Fort Bragg, NC.